

CONFERENCE
ON WATER OBSERVATION AND INFORMATION SYSTEM
FOR DECISION SUPPORT

BALWOIS

2006

ABSTRACTS

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Institut de Recherche pour le Développement, France
Hydrometeorological Service of Republic of Macedonia
Hydrobiological Institute of Ohrid

**Conference on
Water Observation and Information System
For Decision Support**

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BALWOIS

WELCOME TO BALWOIS 2006 !

In the Balkan Peninsula, three key issues related to the water resources management can be underlined:

- the climate changes leading to important modifications in the water cycle terms,
- the increasing discharge of pollutants worsening water resources quality and affecting the biodiversity of most of the rivers, lakes and wetlands of the area, and
- the transboundary shared waters accounting for more than 95 % of the resources of the area.

In this context and in the perspective of the enforcement of the EC Water Framework Directive, the main objectives of BALWOIS project are:

- to improve the scientific knowledge and the networking between the scientists,
- to favor a multidisciplinary approach, and
- to disseminate reliable and suitable information products to the end-users.

The achievements of BALWOIS project during the period 2003-2006 are:

- an active network of more than 500 scientists of whom 3/4 are from more than 80 Balkan research institutions, and
- an Information system permanently updated which provides more than 1500 references (proceedings, reports, maps, web sites, news, etc.) and the access to a set of hydro-meteorological data using the newest client-server technologies.

The enhancement of BALWOIS as network and the improvement of the BALWOIS Information system should be supported by significant events giving to experts the opportunity to meet each other.

BALWOIS 2004 conference (Ohrid, Republic of Macedonia – 25, 29 May 2004) mainly funded by the European Commission brought together 300 scientists coming from 35

different countries including all Balkan. The 249 papers presented for BALWOIS 2004 are published in free access on the BALWOIS web site www.balwois.net .

The international scientific conference BALWOIS 2006 is being held in Ohrid, Republic of Macedonia, 23, 26 May 2006.

The objectives of BALWOIS 2006 are to provide more specifically at Balkan scale:

- a meeting that will further the progress of the knowledge in the fields of Scientific research, Education, Policy and Development Activities and on all the Water related issues related to climate changes, hazards mitigation and water resources assessment, management and protection,
- an atmosphere to enhance the links between the providers and the end users of water related knowledge,
- a forum for free discussion of new ideas , research, development and applications, including techniques and methods to stimulate future works,
- an exhibition of current hardware and/or software in the field of water,
- opportunities for students and young researchers and engineers to meet their experienced peers and to stimulate them to join BALWOIS activities, and
- new knowledge through the publishing of high quality papers on BALWOIS web site and through DVD bundle, books edition, etc.

BALWOIS 2006 is organized by l'Institut de Recherche pour le Développement (IRD - France), Hydrometeorological Service of Republic of Macedonia and Hydrobiological Institute of Ohrid, patronized by the Macedonian government represented by Ministry of Environment and Physical planning, Ministry of Agriculture and Ministry of Education and Sciences (Republic of Macedonia), supported by French Ministry of Ecology and Sustainable Development, World Meteorological Organization (WMO) and International Association of Hydrological Sciences (IAHS).

The topics of the sessions of BALWOIS 2006 are:

- 1 - Climate and Environment
- 2 - Hydrological regimes and water balances
- 3 - Droughts and Floods
- 4 - Integrated Water Resources Management
- 5 - Water bodies protection and Ecohydrology
- 6 - Lakes and wetlands
- 7 - Hydrological modeling
- 8 - Information systems

It will be organized a scientific symposium on "Numerical Weather Prediction as Powerful Tools for Meteorological and Hydrological Disasters Prevention and Mitigation ".

More than 400 abstracts have been collected from scientists from 50 different countries. 300 full papers have been accepted by the Scientific Committee. These publications are in free access on www.balwois.net.

Ohrid is one of the most welcoming towns of Republic of Macedonia with a very significant cultural heritage. The location of the conference on the shore of Ohrid Lake-358 km², several millions years old and surmounted by splendid Macedonian and Albanian mountains - is particularly well chosen.

WELCOME TO BALWOIS 2006 !

WELCOME TO OHRID !

Marc Morell, IRD¹, BALWOIS Coordinator

Vlado Spiridonov, HMS² Director

Goce Kostoski, HIO³ Director

All information related to
BALWOIS Project is on www.balwois.net
BALWOIS 2006 conference is on www.balwois.org

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² *Hydrometeorological Service*

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3TOPIC 1: CLIMATE AND ENVIRONMENT

**DROUGHT PREDICTION OVER NORTH-EAST OF IRAN BY USING
DOWNSCALING TECHNIQUE DIRECT ON GCMS OUTPUT**

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The North-East of Iran rainfall regime is characterized by a strong seasonal cycle and large inter annual variability. Typically, frequency distributions of monthly precipitation present a large spread of values, implying frequent episodes of very wet or very dry years. Unfortunately, the most recent generation of general circulation models (GCMs) still has serious problems when modeling monthly precipitation over Iran. However, these models are able to reproduce the main patterns of atmospheric circulation, such as those derived from a principal component analysis of the sea level pressure anomaly field. GCMs Models are benefit for using in long terms forecasts. Even if global climate models in the future are run at high resolution there will remain the need to 'downscale' the results from such models to individual sites or localities for impact studies. General Circulation Models (GCMs) indicate that rising concentrations of greenhouse gases will have significant implications for climate at global and regional scales. Less certain is the extent to which meteorological processes at individual sites will be affected.

So-called "downscaling" techniques are used to bridge the spatial and temporal resolution gaps between what climate modelers are currently able to provide and what impact assessors require. Many downscaling techniques have been developed in recent years, all having in common the need to establish statistical links between the large-scale circulation and the observed data at a local or regional scale. We know several centers in the world are producing climate data in deferent scenarios. So, choose the best one that is suitable in selection area and then use them for giving forecast on Drought is the main propose of this paper. One of the natural phenomenon which occur in some areas (regions) of the earth is drought, although this phenomenon, drought, has very bad and harmful effects on water resources, agriculture, environment and etc., In this paper, we try to find correlation between observed data and models outputs to find the best one for downscale monthly precipitation over the Khorasan province in North-East of Iran. It was found that between seven climate Data centers, Australian Center is benefit and suitable for use in this region.

GCM data from control integration scenario, run from the Australian Climate Model were used to reproduce present-day precipitation over Khorasan province. It was found that the precipitation characteristics (mean, variance,

and empirical distribution) were better reproduced by the downscaled results than by the GCM direct output. With using Precipitation parameter constructed for the future (2005–2010) in SPI (Standard Precipitation Index) we could predict drought disaster in this region and it will improve drought risk management. Such scenarios are in good agreement with those obtained by other researchers using different downscaling techniques with other scenarios data for using them in management systems.

NORTH ATLANTIC OSCILLATION (NAO) AND IT'S EFFECTS ON TEMPERATURE AND PRECIPITATION OVER NORTHWEST OF IRAN

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Atmospheric systems affecting on northwest of Iran are mostly Mediterranean. Intensifying and weakeing of Azores high pressure and Islandic low pressure have mark effects on Mediterranean systems. NAO oscillation index defines the pressure gradient between polar cyclone (Island low pressure) and subtropical anticyclone (Azores high pressure). In this research the wet and dry periods over northwest of Iran including Western Azarbaijan, Eastern Azarbaijan and Kordistan provinces are investigated using SIAP index, then positive and negative phases of NAO is studied. Comprehensive correlation is observed between wet (dry) years over the region with mark negative (mark positive) phase of NAO index. Also it is proved that the positive (negative) phase of NAO is accompanied with colder (warmer) winters. Since majority of climatic models predict the positive trending of NAO index in future seasons; regarding the correlation between this index and prevailing weather of northwest of Iran, more frequent droughts and colder weather is expected for this region.

THE EFFECT OF MICRO IRRIGATION REGIMES ON GLADIOLUS CORM PRODUCTION

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For determining the suitable regime for Gladiolus corm production an experimental research was conducted in Varamin of Iran. An experimental statistical design with 6 irrigation treatments in split plot design wan applied.

Irrigation treatments included, 1- irrigation interval (as 2 days) with irrigation depth based on 50 percent of pan evaporation, 2- irrigation interval (as 2 days) with irrigation depth based on 75 percent of pan evaporation, 3- irrigation interval (as 2 days) with irrigation depth based on 100 percent of pan evaporation, 4- irrigation interval (as 4 days) with 50 percent of pan evaporation as irrigation depth, 5- irrigation interval (as 4 days) with 75% pan evaporation as irrigation depth and 6- irrigation interval (as 4 days) with 100% pan evaporation as irrigation depth. For maximum *Gladiolus* corm production, irrigation interval as 4 days with 50% evaporation from pan evaporation is recommended.

THE INVESTIGATION OF WATER UNIFORMITY DISTRIBUTION AND IRRIGATION EFFICIENCY ON SOME IRRIGATED FARMS IN IRAN

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This study was conducted to evaluate present management of border irrigation system in wheat, sugarbeet, alfalfa and bean farm which irrigated by this system in Lorestan, Iran. Experimental farms included, 5 wheat farm, 4 alfalfa farm, 4 bean farm and 3 sugar-beet farm. This experiment was conducted in traditional borders with specific criteria and management practices. The relationships between maximum allowable deficit (MAD), soil moisture deficit before irrigation (SMD) and infiltrated depth, showed that in most cases, deficit irrigation (stress condition) has been occurred. The rate of application efficiency were varied from 10.5 to 95.5 percent. Also deeperculation and tail water efficiencies were varied from 0.6 to 83.5 and 0 to 42.9 respectively. In spite of water losses, due to deeperculation and runoff, deficit irrigation was observed in 82 percent of farms. Results showed that in Lorestan, irrigation time for wetting root zone is insufficient. The lack of farmer knowledge about soil moisture condition for correcting irrigation time is the main cause for reducing yield and yield component in this province.

IRRIGATION MANAGEMENT OF MAIZE AFFECTED BY MANURE APPLICATION

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This experiment was conducted in Khorramabad of Iran in 2 years to study the effects of manure application and irrigation interval on growth properties and water use efficiency of maize. A complete block design using split plot with 16 treatments in 3 replication were used. Irrigation treatments including, traditional irrigation, 50, 75 and 100 mm evaporation from pan evaporation. Also subplots including 4 levels of manure as 0, 20, 40 and 60 t/h. The depth of irrigation was calculated as water consumption from field capacity. Results showed that irrigation treatments had a significant effect on grain yield and dry matter while manure application treatments had no effect on grain yield and other components. Maximum grain yield as 9 t/h was achieved from 50 mm evaporation from pan evaporation. Also irrigation treatment as 100 mm evaporation from pan evaporation, produced low grain yield (5 t/h). Also water use efficiency for 50 mm pan evaporation was highest (0.6 kg/m³). Our experiment showed that the minimum water use efficiency was occurred is 100 mm evaporation from pan. For achieving maximum yield, water use efficiency and water management, 50 mm evaporation from pan evaporation is recommended.

IRRIGATION SCHEDULE FOR SOYBEAN USING PLANT CANOPY AND AIR TEMPERATURE DIFFERENCE

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This experiment was conducted in Soil and Water Research station in Karaj, Iran to determine irrigation schedule for soybean using plant canopy and air temperature difference in 2 years. The statistical design was randomized complete block with 4 irrigation treatments in 3 replications. Irrigation treatments were as 30, 50, 70 and 90 percent of total soil available water depletion. The neutron meter was used for measuring soil water content in all treatments. Two linear regressions were obtained between plant canopy-air temperature and vapor pressure deficit for wettest (maximum transpiration) and driest (minimum transpiration) treatment ($(T_c - T_a) = 0.837 - 0.137 (VPD)$, $r = -0.74$, $(T_c - T_a) = 5.2$). The stress day index (SDI) and stress degree day (SDD) were used for showing the plant sensitivity to water stress due to soil

moisture deficit, especially in pod development stage, which is the most sensitive stage in moisture deficit. SDD were calculated for different treatment. The allowable S.SDS were 4, 8, 13 and 21 oC for wettest to driest treatments respectively. The linear regression for yield and allowable SDD and sum of SDD (during the period of measurments) were:

$$Y = 5.50 - 0.114 \text{ SDD} \quad r = 0.994$$

$$Y = 4.075 - 0.008 \text{ S.SDD} \quad r = 0.99$$

Temperature stress day (TSD) at 30% of soil moisture deficit was introduced as irrigation reference treatment. It means that, when the difference of temperature between canopy in 50, 70 and 90 percent soil moisture deficit treatments were 4, 6 and 10 oC more than reference treatment, irrigation is needed. Temperature difference between canopy and air (Tc-Ta) introduced as dependent variable and available water (Aw), relative Humidity (RH) and Net radiation (Rn) as independent variable. By the use of linear multiple variable regression it is possible to introduce the following relationship for irrigation schedule (Geiser Model).((Tc-Ta) = -21.0109 + 0.18068 RH + 0.026089 Rn - 0.042585 Aw r = 0.495)

DETERMINATION OF SPATIAL DISTRIBUTION MAP OF EVAPOTRANSPIRATION BY GEOSTATISTICAL INTERPOLATION METHODS IN TEHRAN PROVINCE

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The concept of the reference evapotranspiration was introduced to study the evaporative demand of the atmosphere independently of crop type, crop development and management practices, consequently, reference evapotranspiration is a climatic parameter and can be computed from weather data. Estimation spatial distribution map of reference evapotranspiration is essential in irrigation scheduling and hydrologic studies. At regions which are served by weather station networks, reference evapotranspiration at points located some distance from weather station can be estimated by using interpolation methods.

In this paper annual reference evapotranspiration were computed from recorded meteorological parameter at 38 weather stations using the Hargreaves-Samani method and spatial distribution map of long-term mean annual reference evapotranspiration in Tehran province were provided using three interpolation methods (kriging, cokriging and inverse distance weighed). Based on mean squared error which was computed by cross-validation, maps of cokriging, kriging and inverse distance weighed ranked

clearly above for estimation. Spatial distribution map of long-term mean annual reference evapotranspiration were provided and reported by cokriging and kriging method.

INNOVATIONS FOR SUSTAINABLE AGRICULTURE

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There is always a particular interest to plan modernization of agro, food and water economy, and to have development plan.. In this paper are presented issues related to water management, structures within the frames of the Vardar Valley Programme (development plan, agriculture, basic characteristics of the water economy, irrigation possibilities, technical basis of water economy structures according to the programme, protection against floods and erosion), environmental protection and improvement, water protection and the best management practices (integrated cropland cultural practices, nitrogen fertilizer management, best management practices for nitrogen fertilization, phosphorus management, manure and organic waste utilization), main strategic and reform objectives, and consortium building for research in innovations for sustainable development (specific objectives, project objectives information events related to the research project).

CLIMATOLOGICAL ANALYSIS OF THE SYNOPTIC SITUATIONS CAUSING DRY WIND AND DROUGHTY SPELLS IN BULGARIA

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The weather conditions with simultaneously registered air temperature above 25°C, relative humidity under 30% and wind velocity higher than 5 m/s (at least registered in three consecutive days) are used as a criterion for dry wind in the paper. The mentioned dry wind definition without wind velocity requirement is used as a quantitative criterion for drought spell as far as the extreme prolonged periods with the shown air temperature-humidity combination result evidently from prolonged foregoing rainless period.

The information of all available stations in the national meteorological network for the period 1961-2000 is analyzed for the investigation on dry winds and droughty spells on the territory of Bulgaria. The coastal and mountain stations and the stations with closure or crucial shifts, frequent interruptions, short available data periods, frequent although partial lacks of data during the warm half-year are eliminated from the basic list. The total number of 249 stations is reduced to 150 stations all of them with high quality data. The results are compared for the periods 1961-1990, 1991-2000 and 1961-2000

The NIMH historical archive of synoptic maps and NCEP/NCAR Reanalysis data files are used for analysis and classification of synoptic situations causing dry wind and droughty spells in the country. The fields of air pressure and wind velocity are considered also. Classification of the typical synoptic situations leading extreme dry wind and droughty spells is carried out.

SEASONAL RAINFALL TREND IN ARID AND SEMI-ARID REGIONS OF IRAN

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Climate variability acts as the main origin of drought and water scarcity. Seasonal rainfall trend was investigated in arid and semi-arid regions of Iran using 79 climatological stations with 36 years of data record. Monthly and annual precipitation data were studied from homogeneity and randomness point of view. A number of homogeneity tests were applied and discontinuities were adjusted in no-homogeneous stations. Seasonal (Spring, Summer, Autumn and Winter) precipitation time series from 1965 to 2000 were checked for climate variability and possible trend using nonparametric Mann-Kendal statistic test. The results showed that there is no evidence of any noticeable and significant changes in the seasonal time series across the study area. Although many stations showed negative trends indicating the decrease in precipitation, this trend was not statistically significant at 95 percent significant level. Meanwhile, the winter precipitation decreased significantly in some parts of study area, while no trend was detected for spring, summer and autumn precipitation.

Based on application of SPI index on precipitation time series, we also concluded that the study area was always almost in normal state and there is no tendency to dry or wet periods. Mapping trend statistics did not show any geographical orientation. The results indicated that southeast corner of Iran has experienced climate change in the form of negative precipitation trend. Considering the global warming and increase in temperature, which is obvious

and evident in the study area, the adverse effects of decreasing precipitation in conjunction with significant positive trends in temperature may lead to severe ecological and economical problems in the study area. The frequently occurring droughts in this region can be due to increasing temperature and decreasing precipitation.

INDICATORS OF DESERTIFICATION IN SERBIA

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The Republic of Serbia, as one of the members of the State Union of Serbia and Montenegro, is situated in Southeast Europe (West Balkan). In this area, during the past decades the recorded climate changes have been reflected in the decrease of rainfall and increase of air temperature. This results in the higher degradation of natural resources, primarily soil and water, which then leads to the desertification process. Areas threatened by desertification include land degradation in arid, semi-arid and dry sub-humid areas (in which the ratio of annual precipitation – R to potential evapotranspiration – PET is 0.05–0.65), resulting from various factors – from climatic variations to human activities.

This paper presents the main indicators of desertification in Serbia. Land degradation factors in Serbia include: water erosion, wind erosion, soil salinisation, loss of trace elements, chemical contamination by bio-industrial sources, mechanical soil compaction resulting from heavy machinery, waterlogging, floods, loss of fertility, etc. A special type of land degradation occurred in 1999 during NATO air raids: mechanical damage of the soil, contamination by depleted uranium, soil contamination by oil spills and oil derivatives, etc.

Taking into account the area covered by the above types of land degradation, the most significant degradation factors are water erosion and wind erosion.

The study period (1992-2002) is relatively short for this type of research. Still, some conclusions can be made:

1. The study period can be divided into three periods, i.e.:

period 1992–1994 when the territory of Serbia, without West Serbia, was threatened by desertification;

period 1995–1999, when only individual regions were threatened by desertification (1995 and 1997), and 1996, 1998 and 1999 when the entire

territory of Serbia was in the group of wet regions, without desertification hazard;

period 2000–2002, when the entire Serbia was threatened by desertification (2000), and 2001 and 2002 only individual regions were threatened;

2. The region most affected by desertification, during the study period, is East Serbia (six years), then Vojvodina and South Serbia (five years each), Central Serbia (three years) and the least threatened West Serbia (one year);

3. Although this is a short study period, it can be concluded that practically the entire territory of Serbia, except West Serbia, is threatened by desertification.

SECULAR CHANGES IN THE ANNUAL EXTREME RAINFALLS OVER INDIA

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The problem of secular changes in rainfall has received much attention from meteorologists and hydrologists world over during the past several years because of its relevance to climate and environmental change. As a result, several studies relating to changes in either the annual or seasonal rainfall for individual stations in India as well as for the country as a whole have been made. It should be noted that the seasonal and annual rainfalls are made up of rainfalls totaled from daily observations and at many places in India, the proportion of rain occurring during the maximum 1 to 3 days constitutes about 30 to 50 % and sometimes over 100 % of their total seasonal or annual rainfalls. There is an impression that climate change would bring more intense and more frequent extreme rainfalls. In this connection, for India there have been no systematic attempts to study the changes in the extreme rainfall events although several studies treat the problem of changes in the monthly, the seasonal and the annual rainfall over India, It is therefore, worthwhile to investigate whether year to year variations in the annual extreme rainfalls over India are entirely random and if they are not, what type of systematic behavior is involved. In this paper, secular changes in the annual extreme rainfall amounts in the time scale of 1 to 3 days are examined at more than 300 stations in India whose data are available from 1901 onwards.

The following conclusions have been obtained:

The annual extreme rainfall amounts at most stations have shown no trend and persistence.

The spatial variation of trends showed that there is little large-scale spatial coherence in the trends of extreme rainfalls.

The stations over the West Coast north of 120 N and some stations to the eastern side of the Western Ghats over the central part of peninsula showed an upward trend in extreme rainfalls.

The stations over the southern India and over the lower Ganga valley region showed a downward trend in extreme rainfalls.

The upward and downward trend in the extreme rainfalls at a few stations will have implications in the hydrological and dam design studies.

CHANGES IN THE CLIMATIC REGIME ON THE CASPIAN SEA REGIONS OVER THE PAST CENTURY

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A unique database of the Hydrometcentr of Russia is used to determine characteristic periods of changes in the air temperature, annual sums of precipitation, and cloudiness over the Caspian Sea region. The analysis of the above data series using the integrated difference curves showed good agreement between fluctuations of meteorological elements and the atmospheric circulation epochs. It is shown that the correlation between these epochs and the Earth rotation regimes may be used for the assessment of the state and tendencies of change in the climatic regime in the Caspian Sea basin.

A STUDY OF SOIL MOISTURE RELATIONSHIPS AT THE AREA OF RADMILOVAC EXPERIMENTAL FIELD NEAR BELGRADE

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The Western Balkan region in general is suffering from drought, especially during the main growing season. Consequently drought is a major limitation to agricultural production, at least as much as in Serbia . In order to contribute to development in the Western Balkans by introducing strategic water management for drought alleviation and sustainable agricultural practices, four EU and three WB partners conceived the WATERWEB (Water resources strategies and drought allevation in We stern B alkan agriculture) p roject. The aim of the project is to establish and reinforce research expertise in the WB in a range of technologies for water and crop management through technology

transfer. To achieve the strategic objectives, procedures for strategic management of water will be developed in parts of three contrasting river basins, two areas in Serbia and one in Macedonia. Radmilovac experimental field, located near Belgrade, was selected as representative for the study of water balance in typical Serbian small catchments. Detailed field measurements were performed in order to define the characteristics of water balance relationships. The measurements of climatic and meteorological parameters, as well as the measurements of soil moisture content, surface water and groundwater characteristics are included in hydrologic study at the area of Radmilovac experimental field. The results of soil moisture measurements, during the growing season of 2005, are analyzed in this paper. The soil moisture data sets cover a range of techniques for acquiring and compiling information about soil moisture over the Radmilovac site. The measurements here include ground based measurements (gravimetric, the profile probes and Theta probes). About 30 access tubes for profile probe, and three Thetaprobes were installed at the Radmilovac site. The spatial and time characteristics of soil moisture content were obtained.

PHENOLOGY – INDICATOR OF PLANT RESPONSE TO CLIMATE REGIME

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Phenology models are useful tools for various sectors of human activity, particularly for all environmental studies. An historical, 46-year phenological record, and meteorological dataset for period 1955-2000, were used to analyse the abilities of the statistical models to predict flowering and leaf unfolding time for a set of wild and cultivated plants in Slovenia. With single phenological model we have predicted timing of phenophase for particular plant on the base of previous phenological data of the same plant or on the base of previous phenological data of the other plants. The most frequently included independent variables in such models were common silver birch, dandelion and horse-chestnut. It was stated that these plants may be used as phenological indicators in given conditions. Correlation analysis and linear multiple regression were applied to establish the relationship among phenological development and climatic variables (temperature, rainfall, North Atlantic Oscillation, day length). Different thresholds temperatures have been selected for 8 different locations with the smallest standard deviation in growing degree day's method to calculate thermal time. Various plant species responded differently to the same climatic factors and were best fitted to certain geographic region. The timings of spring phenophases strongly

correlated with temperature of the precedent months, on the other hand rainfall and North Atlantic Oscillation explained smaller part of phenological variability. Photothermal time significantly improved results of phenoclimatic models when taken into account instead of thermal time. The validity of the results was tested with cross validation method and using independent data set for the year 2000 respectively. Considering the high year-to-year variability of phenological events, the models presented provide satisfactory estimations of the leaf unfolding and flowering dates. Formal equations presented in this study could be powerfully extended and applied to other sites and plants, provided that a sufficiently long time series of phenological and meteorological data were available.

SPATIAL AND TEMPORAL VARIABILITY OF ROMANIAN PRECIPITATION AND RIVER FLOWS ON WINTER PERIOD IN CONNECTION WITH THE NORTH ATLANTIC OSCILLATION

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The main characteristics of spatial and temporal variability of the precipitation and streamflow on winter season were determined by analyzing the precipitation quantities and the monthly average discharges series from 15 meteorological stations and 39 hydrometric stations (December-February, 1950-2003).

The local significance of trends has been analysed with the nonparametric Mann-Kendall (MK) test for the winter streamflow. The values of the statistics are negative in almost entire region, excepting north-eastern part.

The dominant mode of precipitation and flow variability was determined using the Empirical Orthogonal Function (EOF) technique. The first EOF pattern of precipitation, that explains 74% of the total variance, is characterised by the same sign in the entire region, with higher values (that means higher variability) in the region situated in the southern and eastern part of region. The second EOF, that explains 11% of total variance, presents a dipolar structure with one pole situated in the intra-Carpathian region and the other in the extra-Carpathian region.

The first EOF pattern of discharges explains 53% of the total variance and it is characterised by the same sign in the entire region, with higher values in the intra-Carpathian region. The second EOF, that explains 20% of total variance, presents a dipolar structure with one pole situated in the southern region and the other in the northern region.

The first patterns suggest that in spite of the highly irregular topography of the region, there is a common physical dominating the winter precipitation and streamflow variability and this process could be linked to large-scale process. The second patterns suggest the influence of the Carpathian Mountain on the winter precipitation and streamflow variability.

The time series of expansion coefficients (PCs) associated with the first three EOFs corresponding to winter precipitation and flow on 1950-2003 period were tested regarding the trend and change points. Significant results were revealed by the first PC. The PC1 of precipitation evidences a negative trend and a significant downward shift in the winter 1969/1970. The PC1 of streamflow evidences a significant negative trend too and a significant downward shift in the winter 1981/1982.

There is an out-of-phase relationship between the Romanian precipitation and river flows and NAO index.

ASPECTS REGARDING WATER SURFACE EVAPORATION IN ROMANIA

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The study of water surface evaporation is very important in the calculation of the hydrological balance of natural and artificial basins.

Romanian territory is characterized by a diversified relief and climate, which gives a territorial repartition to evaporation, with sensible differences from one region to another.

In this paper I try to present an as clear as possible image of spatial and temporal repartition of the water surface evaporation through the realization of maps and charts, and at the same time, I try to identify the areas with high vulnerability to drought.

Data resulted from surveys made on a period of 40 years at a series of evaporimetric stations was used, but also the graphical and analytical relations established among evaporation and determinant factors.

The present paper is accompanied by the map of multiannual mean values of water surface evaporation and by maps of monthly values (May, July and October) characteristic to the following seasons: spring, summer and autumn.

**WARM AND COLD WAVES AND PRECIPITATION VARIABILITY ON
TERRITORY BIH IN LAST TEN YEARS COMPARATIVE WITH ROW 1961-
1990**

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Bosnia and Herzegovina stands at the junction of three main climatic zones, the Mediterranean, mountain and the moderate continental. Periodically, air breaks through mountain barriers to the north and south, bringing dramatically contrasting weather patterns.

Especially caused of global warming in the last ten years we was observing colds and warm waves different period's duration and precipitation variability too. That impact to waves has been shown as follow:

-Decade 1996-2005 is warmest in last 110 years.

-Six years in period is beatween warmest of 1888. year.

-Average monthly values in more incidence surpassing equivalent maximum values of referable period (1960-1990).

-Absolute maximum and minimum temperature in more incidence surpassing extreme values of referable period (1960-1990).

However researches with monthly and decade values hadn't give adequate results, because extremely warm and extremely cold periods are of short duration. So, we desided to do our researches by pentade's values (periods of five days) and compare it with adequate values in respective order 19661-1990 year.

This metod were enough sensitive to indicate existence of very warm and very cold short periods, as also their consecutive fast exchanges, which have the opposite effect on humans health.

SEASONAL RAINFALL INTENSITY AND FREQUENCY IN TURKEY

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There are great seasonal differences in total rainfall among the regions in Turkey . The North-South directed polar front oscillation and topographic features of the country play important roles as dominant factors on these differences. Turkey also has differences in rainfall intensity and frequency between seasons. In some regions, 100mm of daily total rainfall occurs in all seasons although for another regions 50mm of daily total rainfall occurs just in some seasons only.

In this study, daily total rainfall data for the period of 1960-1995 for 77 cities in Turkey were used. Seasonal analyses for these data were done by classifying them as in five intensity thresholds and five frequency thresholds. A great difference between the seasons in rainfall intensity and frequency was observed in Turkey . It is also observed that rainfalls in certain intensities accumulate in only one season. In the regions affected by sea, rainfall intensity and frequency are higher than the inland regions where 80% of rainfall occurred has less than 10,0 mm in daily total.

In Turkey , it is determined that, although there is a great difference between the rainfall intensity frequencies among the seasons, their rational value has no important change.

EFFECTS OF NORTH ATLANTIC OSCILLATION ON P^RECIPITATION AND STREAM FLOW AT BUYUK MENDERES BASIN

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In this study, relations between the North Atlantic Oscillation (NAO) and precipitation and stream flow in Büyük Menderes Basin, in the period of 1968-1999. Monthly total precipitation data is obtained from Aydın Meteorology

station, and flow data is obtained from a flow station located near Koçarlı bridge and operated by the State Water Works (DSY). To determine the variations in the precipitation and stream flow data both on the seasonal and annual basis, Mann-Kendall line correlation method was used. The relation between NAO and precipitation and stream flow was investigated using Pearson correlation. The level of this relation was determined applying the student t-test. At winter and spring, the relations between NAO index and the stream flow with 0.05 significancy level were obtained. It was observed that after the first half of 1980, meaningful decrease in the seasonal and annual stream flow values is related to the positive NAO index. In general, a negative relation exists between precipitation and the annual and seasonal NAO index. This relation is also more apparent in winter and spring.

**THE SPECTRAL ANALYSIS METHOD FOR THE EVIDENCE OF THE
TELECONNECTION OF PHREATIC LEVELS WITH THE NORTH
ATLANTIC OSCILLATION IN THE FRAME OF NATURAL VARIABILITY
REGIONAL IMPACT IN THE NORTH-WESTERN PART OF ROMANIA**

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The main natural variability mode for Romania is the well-known NAO mode, and in this paper the presence of the NAO oscillation peak in the extended winter season phreatic spectra for the NW part of Romania is emphasized.

Some numeric evidences like serial correlations between the NAO index of the positive phase and the phreatic levels during the cold season, the increasing depth of the phreatic level and the presence of the ~8 year peak on the winter phreatic spectra are the main support for the teleconnection of the phreatic levels and NAO.

The spectral analysis method is important and widely used for the determination of the main periodicities of the natural systems and for this purpose there was used: the spectral power, the spectral amplitude and the spectral coherence estimates. Before the spectral computations, the data set was filtered by the PCA-Principal Analysis Method-in order to capture the main variability due to the NAO mode in one component used further on and correlation analyses (autocorrelation, partial autocorrelation) were applied.

When the index of NAO phase is high (the NAO positive phase), the main regional characteristics are the drought conditions, the winter is warm as usual, the phreatic depth is high, and the evolution of the phreatic system is under (drought) the risk conditions.

Some important consequences are resulting, like the ability to estimate the trend of the evolution of the phreatic levels during winter, the periods and characteristic years when the evolution is at risk, the return period of extreme drought events.

PRODUCING CLIMATE INDICES AND CLIMATE CHANGE MONITORING IN THE MIDDLE EAST

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Climate change is brought about by the complicated interactions among the atmosphere, the oceans, the cryosphere, the surface lithosphere and the biosphere, which comprise the climate system. Climate change being extremely complex and totally global in its nature, cooperative activities with international and interdisciplinary programs are indispensable for monitoring and predicting climate change and disseminating reliable information on it.

Extreme climate events often have the most impact on nature and society. It is essential that all parts of the world are examined for evidence of changes in extremes. It was clear that nearly half of the global land surface was not going to be represented in the "Global" analyses of changes in extremes used in the IPCC TAR. A joint WMO CCI/CLIVAR Expert Team on Climate Change Detection, Monitoring and Indices is trying to address questions such as: What observational data are needed and what analyses of these data can provide information useful for climate change detection and monitoring? They have put particular emphasis on indices derived from daily data for analyses of extremes. It is using daily data because monthly mean can filter out important information. The information provided by the indices See Zwiers et al. (2003) and <http://www.ncdc.noaa.gov/oa/wmo/ccl/> for more information. Xuebin Zhang of Environment Canada; prepared a very user-friendly software package to calculate the indices was developed. This software package, called RCLimDex, uses the free software R (see <http://www.r-project.org> for more information). The complete list of the 27 indices, software and users guide of RCLimDex are available from <http://cccma.seos.uvic.ca/ETCCDMI> .

This initiative started in 1999 and up to now the ETCCDMI had implemented six regional workshops, which were held in Jamaica , Morocco , South Africa , Brazil , India and Turkey . A workshop to address some of the issues of data availability and data analysis in Middle East was held in Alanya , Turkey , from 4 to 9 October 2004. Hosted by TSMS, the workshop brought together 12 scientists from 11 countries. Data from 75 stations were utilized, primarily on Middle East region. By setting an exact formula for 27 climate indices, analyses done in different countries or different regions can fit together seamlessly. RCLimDex loads the data and has several QC checks and after

that creates 27 core indices. Indices has some advantages versus data. The information provided by the indices not only includes how the mean values have changed over time but how the statistical distribution of the data changed. Also results give us very important information about the increasing or decreasing trends which will be held in 100 years. Turkey workshop results have already been published at <http://www.clivar.org/organization/etccd/docs/SWAsiaWorkshopRep.pdf> (Sensoy et al., 2005)

After the workshop, we keep on running RClimdex for 215 remaining climate stations in Turkey which they have at least 30 years daily records.

EARLY THUNDERSTORMS AT BLAJ

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The paper having the theme "Early thunderstorms at Blaj" highlights the synoptic situation in whose context the phenomenon occurred, as well as its consequences.

The thunderstorm phenomenon occurred at a much earlier date against the mean multiannual date of thunderstorm first occurrence in the central part of Transylvania . For the mentioned area (at Blaj), specialized papers in the domain place the multiannual date of thunderstorm first occurrence on 18 April.

In 2005, the first thunderstorms occurred on 29 March, around 3 P.M GMT (6 P.M. local time) triggering severe consequences on certain important units in Blaj municipal town, with effects on the social life, through the complete destruction of the local radio equipments, as well as of the methane gas pipeline supplying Blaj municipal town, which left the population without natural gas almost 24 hours after the thunderstorm.

The particularly heavy thunderstorms were caused by the contact between two air masses along the ground cold front line, which enhanced the atmospheric unsettlement. The thermo-baric contrast added between the ground advection cold air mass and the warm air mass in the altitude.

We may say, as a conclusion, that thunderstorms occurring long before the normal date of occurrence can be even stronger and trigger consequences of the most severe, as happened in the case displayed above.

THE USE OF SRTM DIGITAL TERRAIN MODEL FOR THE SPATIAL REPRESENTATION OF LIQUID AND SOLID RUNOFF – ALTITUDE LINKS

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Mean specific liquid runoff ($l/s/km^2$) and mean specific solid runoff ($t/ha/year$) is the best indicator of physical – geographical conditions and their contribution to the formation of runoff. Taking into account that the factors that determine runoff values vary, first of all from the point of view of the altitude, the correlation $q-H_b$ and $r-H_b$ is the most appropriate.

The decrease in mean altitude causes a decrease in precipitation quantities, an increase in evaporation, reduction in slopes and forestation, thus, whatever the area, liquid runoff decreases with the altitude. Although this correlation is generally valuable, there is though numerous territorial particularities which determine a weak correlation coefficient on the whole analyzed area. That is why, the regionalization of these correlations is necessary.

As the wash load runoff is concerned, it very much depends on lithology, generally having two tendencies in the Carpathian area: at altitudes higher than 300-400 m, it decreases with the increase in altitude, in the Sub-Carpathian area it has the largest values, and at lower altitudes, it decreases proportionally to the altitude.

The SRTM (NASA Shuttle Radar Topographic Mission) digital terrain model corrected and re-interpolated in order to provide a 30 meter resolution, allows a very good spatial representation of these links. Based on these spatial representations, a series of analyses can be made: evaluation of water resources, the repartition of mean specific runoff on different classes of values, the repartition of water volumes on altitude thresholds, the way in which the alluvia budget is formed, etc. For these analyses the ArcView software was used, which has a series of tools that serve the rapid processing of large volumes of data.

CHANGES OF CLIMATE AND RISK OF CLIMATIC DISASTERS (EXAMPLE FOR REPUBLIC OF MOLDOVA)

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Growth of the population and industry, modern agricultural technology, transport and consumption of energy have caused such problems of planetary

scale, as change of a climate, exhaustion of water resources, more often and dangerous of nature disasters about 90% of which have a Hydrometeorological origin. The global economy becomes sensitive to weather and climate, and for Republic of Moldova their negative consequences per separate years can be considered as the really socio economic and ecological disaster.

For the best understanding of interrelation between changes of a climate and risk of climatic disasters three types the most widespread over the territory of Moldova of climatic disasters - windstorms, flood and drought were studied. The estimation of risk of each type of the climatic disasters was carried out. With use of the data of the Centre of Research of the Epidimiology of Disasters (Institute de Iouvan, Belgium) is carried out the comparative analysis of risk of climatic disasters for Moldova and other regions. For each type of the specified climatic disasters the number of the inhabitants affected and relative vulnerability of the country were estimated as well. Is established, that these three kinds of natural phenomena cause up to 90 % of the registered fatal cases. The results of estimations of parameters of risk in connection with changes of climate in region specify the amplification of frequency and intensity of the studied disasters.

The fluctuations of weather and climate are and will stay by the source of the uncertainty in many spheres of activity of the man. At the same time, when nobody can operate weather, efforts directed to maintenance the preparedness for disasters, in particular creation of systems of the prevention can reduce human victims and material losses. The results of the given research could be useful in development of similar systems .

TIME VARIATION OF DUST CONCENTRATION AND DEPOSITION IN SOFIA DURING THE PERIOD 1981 - 2002

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In the present study are presented the long term data records of dust concentration and deposition in the region of Sofia , obtained in the frame of the atmospheric radioactivity monitoring program of NIMH.

Dust, or total suspended particle concentration is estimated by weighting of daily air filters (paper, FPP, Synpor), placed at 2m high above the ground surface. Daily dust deposition is based on the samples collected in open standard vessel for the atmospheric radioactive fallout with a bottom covered by distilled water at 1m high above the ground surface. The aliquot of 0.5l of the liquid total daily deposition is evaporated and the dry residue is measured by weight. The samples are changed every day at 06 UTC (8:00 LST).

The statistical evaluation of the time series show distinguished trend for decrease of both mean yearly concentration and deposition in 90's compare to 80's years of XX century. Seasonal variation is observed and discussed. The attempt to evaluate the influence of the precipitation is made. The variation of dry deposition velocity during the days without precipitation event is reported.

FOG AND DEW COLLECTION PROJECTS

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The present paper discusses the fog and dew water collection in Croatia. Fogwater collection by a standard fog collector (SFC) started at the meteorological station Zavižan (1594m above the sea) in summer 2000. The highest daily collection rate was 27.8 l / m². The collected fog water in days without rain has been analysed separately.

Dew is also a noticeable source of water, especially during the drier, summer season. Dew condenser in Croatia have been installed on the Adriatic coast (Zadar) and islands Vis and Biševo together with OPUR (www.opur.u-bordeaux.fr). In the Biševo island, a special roof has been designed to improve the formation and collection of dew on a house. Data from April 2005 will be presented.

CLIMATIC AND ANTHROPOGENIC IMPACTS ON THE HYDROECOLOGICAL REGIME OF A LARGE FRESHWATER BODY

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In the past four decades, wetlands have undergone devastating stresses as a result of significant hydrologic changes. The latter are primarily caused by the increase in water irrigation demands and the climate change phenomenon. This study attempted to analyze the past climatic and water management alterations in Trichonis Lake , located in W. Greece , to quantify the exact impacts on the surrounding wetlands that belong to the NATURA 2000 protection network. Statistical elaboration of rainfall and water level time

series have been applied, including regression analysis and Cumulative Sum method, to identify relevant past trends while remote sensing and GIS techniques have been used to map and illustrate the past and present morphological conditions of the riparian area. The temporal changes in the regional water management scheme such as the alterations in irrigation demands during the last 40 years have been also taken into consideration. Thus, a comparative assessment occurred between the estimated alterations in rainfall and anthropogenic water abstractions to identify the contribution of each one of these factors on the measured water level fluctuations in the lake and the associated wetlands extent changes during the study period. The results indicated that the observed decrease in the wetland area depends mainly in human activities such as the expansion of agricultural land in the catchment, the development of a large scale irrigational network to meet the increasing water demands and the unsustainable water management strategies. The climate change patterns that have been identified in the area concern a slight decrease in rainfall, which indicated relatively lower impacts on the wetlands since the associated hydrologic transitions are relatively limited in temporal and spatial basis.

THE WARM SEASON RUNOFF DEPENDENCE ON THE DROUGHT INDICES IN LITHUANIA

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Many drought indices are based on meteorological or hydrological variables. Most of them can not precisely detect the onset and end of the drought as well as its magnitude. On the other hand these indices better represent periods with surplus water resources than ones with the water deficit.

The main task of present research was to distinguish the long term fluctuations of water deficiency and sufficiency periods from hydrological point of view. Four different rivers catchments were involved to the analysis. Every of those catchments is situated in the different physic-geographical areas and belong to different climatic sub-regions of Lithuania . Also all analyzed rivers have different feeding conditions.

Effective drought index (EDI) - computed with Daily Water Resource Assessment Model and Hydrothermal Coefficient (HTC) was applied to different catchments areas for detection of the water deficiency and sufficiency periods in the warm half of the year. The resultant indices timeseries were applied to the run-off dynamics in the analyzed rivers. Extracted periods appear to belong to the different timescales which could be

classified as inter-seasonal and intra-seasonal. However they differently manifest in particular catchments. Intra-seasonal variation is more evident in the catchments where the groundwater feeding prevails and also runoff is regulated by lakes. The short range river runoff fluctuations better reflect the intra-seasonal variation of indices calculated for the catchments with the largest surface runoff contribution. Dry periods are represented well in all analyzed objects when the drought conditions matched both indices i. e. " no precipitation " is accompanied by hot weather spells.

EFFECT OF WEATHER VARIATIONS ON AGRICULTURAL PRODUCTION

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Climate elements, especially rainfall and air temperature, have varied significantly in recent years in relation to their long-term average varieties. It happened that two consecutive years were diametrically opposite regarding their weather conditions, affecting to a large measure the yield and quality of agricultural crops, environment and, indirectly, numerous segments of the overall economy.

Within a short period of only five years, from 2000 to 2004, the most arid year (2000), the most humid year (2001) and the warmest year (2003) were registered for the Vojvodina Province (the northern, agricultural part of Serbia and Montenegro) in the recorded history of this region.

A five-year study was organized in which we analyzed the effect of weather variations on the yield and adaptability of NS corn hybrids from different maturity groups. The study included also the effect of irrigation practice in the mitigation of drought impact.

In the extremely arid year of 2000, the average effect of irrigation was 6.02 t/ha or 72.88% (ranging from 54.17 to 108.81% among the hybrids). In the extremel humid year of 2001, yields were similar in irrigated and non-irrigated variants. In the dry years (2002 and 2003), irrigation effects were similar, 3.47 t/ha (32.34%) and 3.34 t/ha (36.26%), respectively. In a moderately humid, favorable year of 2004, the effect of irrigation was 0.9 t/ha (7.87%).

THE MAIN CHARACTERISTICS OF SOIL TEMPERATURE REGIME IN OHRID- PRESPA ZONE

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In this paper, the main characteristics of soil thermal regime over the Ohrid-Prespa zone have been evidenced.

This has been realized studying annual course of soil temperature as well as their changes in time and different depths based on the mean annual and experimental data which coincident with the other theoretical studies.

The relationship between the average air temperature at 2 meter height and the soil temperature in the different depths, using the simple equation of linear regression $y=ax+b$ has been found.

Also, the data of occurrences of extreme temperature go down to the depth as well as the coefficients of the heat conductivity of soil temperature $K= \lambda/c_p$ around this zone has been evaluated.

Based on the formula and well-known methods the generalized equations are found out which express the changes of extreme temperature to the different depths.

The aim of this study is evidencing the biggest potential possibility according to climatic conditions is exist in this part of the country. In this way we want to emphasize this possibility and to produce the opinion, how to manage that in optimal mode in order to serve better the diurnal agriculture practices.

CLIMATE AND ITS IMPACT ON THE EROSION PROCESS IN OHRID- PRESPA ZONE OF ALBANIA

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The soil degradation is a common phenomenon in that part of Albania .

The value varies from 20 up to 80 ton/hectare per year or in some time up to 100 ton/hectare per year.

This paper presents some results of the study of the erosion caused by meteorological elements especially heavy rain, temperature, drought and strong winds, which are the main contributors in this phenomenon.

Also, there are the pale ontological specifics and the type of soil which are more likely to affect.

Referring to the scenarios of the expected climate change for Albania, an annual increase in temperature up to 1.8°C and to 3.6°C and the decrease in precipitation up to -6% and -12.5% respectively by 2050 and 2100 related to 1990 are expected. These changes are likely to cause increase in drought frequency. It may intensify the soil erosion, especially in the coastal zone.

According to the existing problems, the potential impacts of expected climate change on erosion process, are analyzing in this study.

SNOWFALL TIME SERIES COMPARISON BETWEEN APPENNINES AN BALKAN PENINSULAS - A CLIMATE CHANGE CHALLENGE

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Precipitation long-term time series represent an important source for the climate variability evaluation. In this work snowfall records for Apennines Peninsula sites of Modena (34 m asl, since 1830 till 2005) and Abetone (1390 m asl, since 1969 till 2005) together to Balkans Peninsula sites of Sarajevo (630 m asl, since 1888 till 2005) and Mount Bjelasnica (2067 m asl, since 1950 till 2005) are examined. Total annually (seasonally) snowfall amounts are discussed using a moving average over 30 years. From the moving averages it can be noted a quasi-linear downward trend for the recent period (from 1960 till 2000), but seemingly interrupted in the last several years.

Moreover, in order to obtain smooth signal and more clear indications of possible climate oscillations, the snow precipitation signal has been filtered with one of the known wavelet transforms (the discrete Meyer wavelet is applied). Apparently, from the 3-level and especially from the 4-level approximations of the wavelet transform, oscillatory thirty/forty year's snowfalls periods can be distinguished also in the past 150 years. The coincidence of snowfalls series either at Apennines Peninsula or at Balkans Peninsula with the North Atlantic Oscillation (NAO) is found.

ASSESSMENT AND MAPPING OF SOIL ERODIBILITY AND RAINFALL EROSION IN BULGARIA

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Soil erosion by water is the major soil degradation threat for the territory of Bulgaria. Assessment of land susceptibility to erosion is a basis for effective conservation planning. Information on rainfall erosivity and soil erodibility is essential for soil erosion risk assessments. This paper aims at presenting assessments of soil erodibility and rainfall erosivity for the territory of Bulgaria at a scale of 1: 100, 000.

Rainfall erosivity and soil erodibility were assessed using the respective factors defined in the Universal soil Loss Equation (USLE). Data collected in a databank on the results from soil erosion experiments using field plots were used to evaluate rainfall erosivity and soil erodibility factors for the soil and climate conditions in the experimental sites and to test suitability of models for estimating these factors.

The general equation for estimating the erosivity term from daily rainfall data, proposed by Richardson et al., has been found to be suitable for evaluating the rainfall erosivity factor from the routine outputs of the national meteorological survey. The model was parameterised for 9 sites with long-term daily rainfall data to evaluate the site-specific parameter, which values were then graphically interpolated using a DEM for 84 hydro-meteorological stations across the country's territory with long-term observations. Each of those 84 weather stations was then characterized with an average annual value with respective standard deviation of the rainfall erosivity factor using the respective site-specific parameters. The values of the rainfall erosivity factor were then categorized in 10 classes, namely: 0-50, 51-100, 101-200, 201-400, 401-600, 601-800, 801-1000, 1001-1500, 1500-2000 and > 2000 MJ mm/ha h, and mapped using ArcView 3.1. The results showed that 65 % of the country's territory were characterized by rainfall erosivity higher than 800 MJ mm/ ha h.

Using the data from the databank on the field plots for soil erosion studies, the soil erodibility nomograph (Wishmeier et al.) has been adapted to evaluate the soil erodibility of Bulgarian soils using the routine outputs of the national soil survey. Values of the soil erodibility factor (K-factor) were calculated for each of 67 soil mapping units defined by the soil map of Bulgaria at a scale of 1: 400,000. Data for soil texture, organic matter content, soil structure class and profile permeability class for more than 1,800 soil profiles were used to evaluate the K-factor. The obtained values were then categorized in 6 classes, namely 0-0.01, 0.01-0.02, 0.02-0.02, 0.03-0.04, 0.04-0.05 and >0.05

t ha h/ha MJ mm, and mapped using ArcView 3.1. The results showed that the soil erodibility was higher than 0.03 t ha h/ha MJ mm for 61.5 % of the territory.

SOIL EROSION RISK ASSESSMENTS IN BULGARIA

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Soil erosion is recognized as one of the most serious soil degradation processes on the territory of Bulgaria . This paper aims at presenting a brief review of work done on soil erosion assessment in Bulgaria and it will focus on the main results from a recently developed geographic database for soil erosion risk assessment.

For the time being, soil erosion assessments in Bulgaria have been based mostly on the USLE approach. It was used in the 1970-ies for developing a National Long-term Program to combat soil erosion. Much work has been done on evaluation of the USLE factors for diverse climate, soil and management conditions and empirical equations for soil erosion assessments have been developed.

Geographic database for soil erosion risk assessment on the country's territory was developed recently at a scale of 1: 100, 000 using the USLE approach integrated with GIS (ArcView 3.1.). The inputs included maps of (i) rainfall erosivity; (ii) soil erodibility; (iii) agro-ecologica regions; (iv) soils; (v) topography and (vi) permanent land cover, and values of the C-factor of the main agricultural crops and vegetation cover, and the soil loss tolerance.

The topography maps were used to develop a map of the slope-length factor. The map of rainfall erosivity was developed on the basis of data from 84 weather stations across the country's territory with long-term observations. The soil erodibility map was based on the soil maps of Bulgaria at scales of 1: 400, 000 and 1: 25, 000 and soil survey data on soil texture , organic matter content, soil structural class and profile permeability class for about 1, 800 soil profiles. Values of mean monthly canopy cover, effective plant height, average acute angle of leaves and/or branches to the plant stem, maximum volume of the interception store, fall velocity of the drops dripping from the vegetation on the ground were set for wheat, maize, sunflower, potatoes, tobacco, beats, alfalfa, vineyards and orchards in accordance with data from measurements presented in different literature sources. Rspective C-factor values were then calculated with respect to rainfall erosivity monthly distributions for each of the 47 agro-ecological regions distinguished on the

country's territory using a quasi-deterministic approach (model) for estimating the cover and management factor.

The system enables either graphical or tabular outputs for the potential and the actual soil erosion risk. The graphical outputs can be thematic maps or layers and the tabular outputs can contain 29 fields with the whole available information or be more generalized. The results showed that the potential erosion risk for 61.6 % of the country's territory exceeded 10 t/ ha/ y and for 29.9 % it was higher than 40t/ ha/y.

THE EXTREME PRECIPITATION EVENTS OVER SOUTH ADRIATIC PART OF CROATIA

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During the rainy episodes the extreme amounts of precipitation were recorded in Komiža (239 mm on 30 th of August 2002) and Hvar (334 mm on 3rd and 4 th of October 2005) on the islands of south Adriatic over only a few hours.

Such unusually amounts of precipitation have not been registered in long period of measurements, which in Hvar started on 1858.

The synoptic situations causing such precipitation conditions were analysed by means of standard synoptic and upper data over the observed area and wider.

The characteristic of the mean monthly circulation patterns over the Northern Hemisphere is analysed in order to find their connection with extreme meteorological conditions in Croatia .

HOMOGENEITY TESTING OF PRECIPITATION TIME SERIES IN CROATIA

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All studies concerning climate variability reveal the necessity of the homogeneity testing of data as the first step in further research. Inhomogeneities caused by station relocation, installation of new instruments, etc. can be the cause of misleading conclusions that do not correspond to real changes. It is quite obvious that data must be tested in order to locate possible inhomogeneities/discontinuities.

This paper describes the homogeneity testing of the mean monthly and annual precipitation amount in Croatia. Several precipitation time series during the period from 1952 to 2001 were tested using the Standard Normal Homogeneity Test (SNHT). The exact cause of discontinuities was searched from the meta data.

STANDARDIZED PRECIPITATION INDEX: MONITORING TOOL FOR METEOROLOGICAL DROUGHT

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In this work, the 1973-1974 meteorological drought in Croatia will be analyzed by using Standardized Precipitation Index (SPI) at four time scales (1, 3, 6 and 12 months). The spatial distribution of SPI at different time scales for meteorological drought 1973-1974 will be presented. Also time series of SPI for period 1961-1990 for several climatological stations across Croatia will be shown.

HYDROLOGICAL IMPACTS OF THINNING IN A DECIDUOUS FOREST ECOSYSTEM

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The hydrological impacts of 11 percent thinning in a deciduous forest ecosystem is investigated with a paired watershed study. The treatment was a regular selective cutting according to the management plan of the forestry district and was performed on February 1986. The result was an unexpectedly high 79.28 mm of additional water in the following year. The timber transportation was performed with horse dragging and residues were left on site. Regression equations were computed for calibration period (1980-85) and calculated values for the first year of post treatment period was compared with the observed ones. The hydrologic systems of the experimental watersheds were also presented thoroughly as part of this paper. The region had a Mediterranean climate but more rainy (1050 mm) and moist, typical with dry summer periods causing water deficit in soil. Most of the water surplus was maintained in the following winter months as soil reached to a certain saturation level.

SOIL BUFFERING SYSTEM AGAINST ACID DEPOSITION IN BELGRAD FOREST ECOSYSTEMS

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More than 20 years of observations of rainwater chemistry shows the exposure of Belgrad Forest ecosystems to the acid deposition. Between 1999 and 2001 very low precipitation pH values down to 3.3 were measured in winter months. The total hydrogen deposition in 1999-00 water year (october-september) was 4.72 kmole ha⁻¹. However, stream water pH value did not decrease under 6.5 even in the winter season.

To investigate this situation a lysimeter, a litter layer removal and a cation retention study was employed. Ceramic cup lysimeters were installed to various soil depths and the soil water ionic composition was monitored to determine the main buffering zones among the horizons. The upper 20 cm including the litter layer and Ah horizon had the main exchange mechanism, decreasing the hydrogen ion activity from 22.82 m eq L⁻¹ to 0.56 m eq L⁻¹. To identify the role of litter layer another experiment was conducted which was basically composed of a litter layer removal parcel study. Litter layer was removed from nine blocks and another nine blocks were remained as control. After the removal, soil samples were taken periodically from two depths (0-12 and 12-20) to monitor the changes in soil properties. The pH and organic matter content was slightly higher in the first 12 cm soil depth. Finally, the exchange capacities of two major cations, sodium and potassium were compared taking the soil horizons into account with a totally controlled laboratory experiment. The cation retention capacities of the soil samples rich in organic matter were slightly lower than the ones with less organic matter.

The three experiments showed that even though the upper soil horizons were responsible of hydrogen buffering in the region, the litter layer or humus layer did not have a particular role.

EXTREME HOT SPELLS AND HEAT WAVES ON THE TERRITORY OF BULGARIA

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All available meteorological stations (249 in number) on the territory of Bulgaria are thoroughly examined for gaps (crucial interruptions, short data periods, numerous lacks of measurements, etc.) in the air temperature records during the warm half-year, for the period 1961 - 2000. The inappropriate stations as well as the costal and mountain ones are eliminated from the basic list so that the finally used meteorological stations with high quality data are reduced to 150 in number (after the year 1990).

The distributions of maximum daily air temperatures are investigated for determination of the corresponding "rare" values (percentiles) by stations and regions. These values are used for gathering the data about the prolonged hot spells (and heat waves) on the territory of the country. The so obtained data series are used for analysis of the investigate phenomena by frequency, duration and intensity. The results for different periods (1961 – 1990; 1991 – 2000; 1961 – 2000) are compared and commented in the light of climate variability problem.

A quantitative analysis for assessment of the extreme hot spells and heat waves as anti-resources is carried out and schematic mapping (by administrative districts) is implemented. The probable extreme hot spells and heat waves possible at least once in 10, 20, 50 and 100 years are assessed on the basis of the return period concept (by regions and selected stations. The cases of prolonged and intensive hot spells (and heat waves) are also analysed looking for the corresponding typical synoptic situations and especially these ones affecting the regions most in danger.

MEETING THE INCREASED IRRIGATION DEMAND AS A RESULT OF CLIMATE CHANGE

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Water is basic element in agriculture, and along with the soil characteristics, it remains the essential for the growth and evolution of plants. Trends of air temperature and precipitation for Slovenia indicate the increase of the air temperature and reduction of precipitation during the vegetation period, which will have a substantial impact on rural economy in Slovenia. The impact of climate change will be substantial for soil the water balance. Climate change will most probably also result in drought in soils which otherwise provide optimal water supply for plants.

Climate scenarios for the estimation of the impact of climate change based on the general circulation models showed that in Slovenia temperature would increase at min. by 2.3°C, by 5.6°C at max and by 4.5°C in average. Due to the climate change, variation of precipitation amount and pattern as well as change in evaporation, runoff, and soil moisture storage are expected. That will consequently lead to increased water demand for irrigation in agricultural sector. Increased water consumption could cause increased competition between agriculture, which is already the considerable consumer of water resources and urban as well as industrial users. Falling water tables and the resulting increase in the energy needed to pump water will make the practice of irrigation more expensive. This may be the situation particularly when with drier conditions more water will be required per hectare which may lead to some land be taken out of irrigation. Peak irrigation demands are also predicted to rise due to more severe heat waves. All things considered it is imperative to assess the potential impacts of climate change, primarily increase of air temperature and change of precipitation amount on irrigation demand.

A wide variety of adaptive actions may be taken to lessen or overcome adverse effects of climate change on agriculture. At the level of farms, adjustments may include the introduction of later-maturing crop varieties or species, switching cropping sequences, sowing earlier, adjusting timing of field operations, conserving soil moisture through appropriate tillage methods, and improving irrigation efficiency. Adaptation cannot be taken for granted:

improvements in agriculture have always depended upon on the investment that is made in agricultural research and infrastructure. It would help to identify, through research, the specific ways that farmers already use to adapt to present variations in climate as well as potential new methods. Some options such as switching crop varieties may be inexpensive while others, such as introducing irrigation, especially high-efficiency methods and water-conserving technologies, involve major investments.

Prospects for agricultural adaptation to climate change appear favorable, assuming water is available. Considerable investments may be needed, however, to utilize soil and water resources more efficiently in a changed climate therefore some regions may not be well provisioned with respect to both the research base and the availability of investment capital. For establishing adaptive actions that might be taken to ameliorate the negative effects of climate change first the possible anticipated responses of agroecosystems to the specific environmental changes as a result of climate change must be determined. In the frame of the project we will estimate the impact of increased air temperature and changed precipitation amount on the irrigation demand. The aim of the project is to assemble and assess the necessary adjustments with regard to soil water status, such as substituting crops, introducing or intensifying irrigation, and modifying field operations.

GPS, NCEP DATA AND METEOSAT PRECIPITABLE WATER COMPARISONS FOR BALKAN AREA

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Integrated Precipitable Water Vapor (IPWV) studies are an important mode for the hydrological regime evaluation with respect to the vertical structure of the atmosphere.

The aim of this work is to integrate different observation systems (for instance Global Positioning System and METEOSAT-8) and data sources in order to study IPWV spatial and temporal distribution for Balkans region, sparsely covered with atmospheric vertical observations, as the helpful aid in the analysis of weather and synoptic processes.

Global Positioning System (GPS) represents an enormous ongoing three-dimensional atmospheric observation system since the wet component of the tropospheric delay in GPS signals is nearly proportional to the quantity of integrated precipitable water vapor (IPWV). Tropospheric solutions for

Balkans GPS sites of Sarajevo, Osjek, Dubrovnik and Ohrid are studied and presented in comparison to METEOSAT-8 and NCEP data.

Tropospheric humidity product derived from the two water vapor channels of meteorological satellite METEOSAT-8 provides a layer-mean relative humidity for two tropospheric layers (between about 500 and 200hPa and between 850 and 300 hPa) with the resolution of 3 km, subsequently a biased estimation of IPWV can be obtained.

Daily global analysis precipitable water data since 1980 available at 2.5 degrees resolution from the National Centres for Environmental Prediction (NCEP) is a helpful climate data source to evaluate humidity observations.

MAPPING PRECIPITATION VARIABILITY USING DIFFERENT INTERPOLATION METHODS

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Precipitation data are available from recording stations that present point samples. Spatial interpolation may be used to estimate precipitation at unsampled sites.

The present analysis is based on the monthly precipitation totals observed at Danube Plain, Bulgaria. Precipitation variability is presented by deviation of monthly precipitation totals. The investigated period is 2000 - 2004 and the reference period is 1961-1990. The paper demonstrates the implementation of different interpolation methods into meteorological data analysis. Inverse distance, kriging and minimum curvature interpolations are used for mapping precipitation variability.

DEFINITION OF RAINFALL EROSION IN THE AREA OF EXPERIMENTAL STATION SNAGOVO

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Rainfall erosivity was defined by the computation of the values of rain erosivity factors based on the analysis of pluviographic tapes of rainfall events recorded at the experimental station Snagovo over the period 1973-1990.

Average annual factors of rain erosivity (R) for the region of experimental station Snagovo is 147.23 MJ ha⁻¹ cm h⁻¹ with the occurrence of the maximal values in June.

The analysis of rainfall seasonal distribution showed that the most intensive erosion processes in the area of experimental station Snagovo can be expected in June, especially on the areas that are not protected by vegetation cover.

OZONOSPHERE AND CLIMATE – SATELLITE RESEARCH

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During the last years, there has been a great interest in the problems of changing the climate as a result of the increased carbon dioxide and ozone presence in the atmosphere. These gases are not in big quantities in the atmosphere and that is why they refer to the minor components. The role of these gases is undoubted and exceptional concerning the thermal regime of the atmosphere, circulation and evolution of the climate and the biosphere.

A comparison of the atmosphere research of Mars, Venus and the Earth give unexpected conclusions. The greenhouse effect on Mars is not more than 6 °C because the gas carbon is in small quantities there and it is very cold on the planet surface. The atmosphere of Venus contains a lot of carbon and the temperature is very high. In the progress of the planet evolution, the water disappeared and it is impossible for a biosphere to exist there. In the low and middle layers of the Earth stratosphere, starting from 15-20 km, the air temperature rises gradually with the altitude, and as a result the water vapours are concentrated in the troposphere.

The maximum content of ozone is at 25-28 km – in the stratosphere. The ozone absorbs about 3 % from the ultraviolet radiation from the Sun and its influence on the stratospheric temperature regime is determinant. The ozone refers to the greenhouse gases because its molecule has an absorbing ability in the longwave specter range and therefore it returns part of the heat radiation towards the Earth surface. Its share in the greenhouse effect, according to the specialists, is 9 %.

In the Space Research Institute at the Bulgarian Academy of Sciences, special attention is paid to the satellite research in the field of ecology and atmosphere observation. In connection with the research of the ozonosphere

and its influence on the Earth climate, the Impulse photometric appliance Terma and the Laboratory Satellite Ozonometer have been developed.

METEOROLOGICAL DROUGHT MONITORING BY USING SPI MODEL AND GIS IN ISFAHAN PROVINCE

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One of the natural hazards is drought, which causes by shortage of raining and humidity deficit. When a drought occurs dramatic social, economic and environmental effects are inevitable. Because of the vast impact of drought, it is essential to be monitored timely and spatially. In order to evaluation and mapping of drought severity in Azerbaijan province, it used the SPI (standard precipitation index) model and GIS. It used GIS as a tool for mapping of the area in relation to SPI amount. It studied drought periods in Isfahan using 20 years climatic data (1985- 2005). Nearly 95.5% and 3.2 % of the province climate is dry and semi-dry respectively and only 1.3% of province has Mediterranean Climate. According to analyzing of the long time period of SPI value, the dry and wet periods were replicated. Two dry periods are happened in 1989-1990 and 1995 to 2000. The most dry year has been happened in 1990 in all stations of the Isfahan province. In 2000, nearly 23 % of the total area was affected by severe, 35 % by moderate drought, 32% are Normal and the other area (9%) of province had a wet year. It concludes that drought is a natural climatic feature of the regions and occurs time by time in specific periods. The study shows that the duration and severity of drought is more in the eastern than in the central and western parts of the province.

LANDSCAPE-GEOCHEMICAL APPROACH FOR EVALUATION OF THE ISKAR RIVER BASIN STATE IN THE WESTERN BALKAN MOUNTAIN (BULGARIA)

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The landscape-geochemical variety of each territory is determined by many factors. The basic ones among them are athmo-, litho-, hydro-, pedo-, phyto-, and technogeochemical factors. The last group plays a leading role in the occurrence of the geochemical processes and the differentiation of the chemical elements at the contemporary stage of nature complexes' development. In order to evaluate the impact of these factors, each landscape component should be researched in detail, and the internal and external relations within the borders of the whole landscape-geochemical system should be analyzed.

The channel sediments are an element of the complex system of aqua landscapes. They are characterized by varied lithological, grain-size and geochemical content and possess the highest degree of information about polluting substances in the water of rivers, lakes, artificial lakes, seas, etc. The main reason for that is the subordinate position of the aqua landscapes in the landscape-geochemical structure of each territory with regard to the main migration flows of the chemical elements and their compounds.

The channel sediments formed as a result of the mechanical and chemical sedimentation of the soluble and insoluble particles contained in the water represent natural environment for the accumulation of heavy metals as well. The different migration capability of the latter, which also depends on the physicochemical properties of the water, leads to significant differences in the degree of their accumulation in the channel sediments in each particular part of the river course.

This paper aims at representing the pollution with heavy metals (Cu , Pb , Zn , Cd , Mn , Ni , Cr , Co) of the channel sediments of the Iskar River basin and its tributaries within the borders of the Balkan Mountain. Part of the river course after the no-longer functioning metallurgical factory has several times higher concentrations of Cu , Zn , P b , C u and Mn than the permissible concentration levels (PCL) for river waters. Due to the lack of PCL for the channel sediments, they are compared with the PCL of the soils, as well as with the average values of the content of researched microelements from other river basins in the country.

FLOOD EVENT IN BULGARIA IN AUGUST 2005 (THE ICHTIMAN CYCLONE)

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From 4 to 6 August 2005 there was flood event in West and South Bulgaria.

The synoptic situation that caused the excessive precipitations has been presented and analyzed. There is a Mediterranean cyclone (we call it Ichtiman Cyclone) that moves slowly through the Balkans from 4 to 6 August. There are two distinguished parts of the weather process in Bulgaria: On 4 and 5 August there is a stationary cold front associated with the Ichtiman Cyclone that causes abundant rain in a relatively narrow band in the mountainous West Bulgaria. The conclusion of our analysis is that the reason for that first flood episode is the stationary track of the convective systems associated with the cold front. On 5 and 6 August the Ichtiman Cyclone moves through the Balkans towards the Black Sea. The core vortex of the Ichtiman cyclone moves through North Greece. There is severe flash rain in the Rodopi Mountain which is associated in our analysis to the core vortex of the Ichtiman Cyclone.

Composite charts of precipitation data has been compared to NWP model forecast as well.

AN INVESTIGATION OF THE OPEN WATER SURFACE EVAPORATION VARIATION OVER THE TERRITORY OF BULGARIA

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A basic moment in the management of the agricultural crops irrigation scheduling is the evaluation of the evapotranspiration. Its rate depends as on the crops specific biological features, their growth and development, and the applied production technology, so on the agrometeorological conditions of each particular year.

Evapotranspiration could be estimated by different methods. The most accurate results come when as a basis for its estimation the directly measured open water surface evaporation is used. In Bulgaria and abroad, the measurements from an evaporating pond 20 m² are considered an etalon of this index (indicator).

The goal of this investigation is to establish the relation between the open water surface evaporation, measured in the widely spread evaporation pans GGI 3000 cm², and the etalon evaporation from the evaporating ponds 20 m² for the potential vegetation period (April – October). Data from a 30-year period (1971-2000) covering the "contemporary climate" from 16 representative stations are processed. Their representativeness is examined

closely. Zoning of the open water surface evaporation for the territory of our country's agricultural production is accomplished.

SOUTH EUROPEAN RAIN RATE MODULATION BY NAO AND ATMOSPHERIC CIRCULATION REGIMES

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Changes in stream flow patterns over Europe have serious consequences for a wide range of human activities in this densely populated region. An appearance of the extreme events such as floods or droughts is caused in many cases by persistence of some circulation type(s). The aim of this study is to classify circulation patterns in Atlantic-European sector and to reveal linkages between anomalies in pressure field over North Atlantic (e.g. NAO) and respective circulation pattern occurrence over continent on one hand and rain fields on other hand. Changes in atmospheric circulation over Europe during the past 50 years were examined using both objective (modes of low-frequency variability - EOF and objective cluster classification of circulation types – fuzzy logic) and subjective (Hess-Brezowsky classification of weather types) methods. The grid monthly geopotential H700, wind zonal and meridional velocity components U850 and V850 as well as the sea-level pressure (SLP) and precipitation fields acquired from NCEP/NCAR reanalysis dataset (for 1948-1998) were employed in this study. The EOF analysis of SLP and H700 revealed the major circulation regimes over eastern North Atlantic and Europe to be the central tendency of pressure (EOF (empirical orthogonal function) 1 accounting for 41-47% of the total variability in various seasons), zonal flow (EOF 2 – north-south dipole pattern accounting for 19-26%) and blocking/cyclonic flow in the eastern Atlantic and western Europe (EOF 3 – west-east dipole pattern accounting for 9-13%). It was shown that NAO (North Atlantic Oscillation) index is not a good measure of zonal flow over the Europe because of considerably low correlation between the NAO and PC 2 (PC – principal (time) component related to corresponding EOF) outside the winter seasons, although above correlation in winter seasons is a reasonable high. In contrast PC 3 has highest correlation with the NAO, especially outside winter months. EOF 3 has a spatial pattern, which suggests increased cyclonic activity in the eastern North Atlantic in its negative phase and anticyclonic (blocking) activity in the positive phase. Therefore, the NAO index is a good indicator of western European/eastern Atlantic blocking or cyclonicity outside winter months. We (Pokrovsky, et al., Computer and Geoscience, 2002) carried out an objective classification applying fuzzy logic rules on normalized velocity components U850 and V850, air humidity Q850 and rain fields. These rules were defined based on cluster classification in

multidimensional grid space for composite fields. We showed that the fuzzy rule algorithm was able to reproduce the same circulation types as the Hess-Brezowsky catalogue, but reveal vorticity polar locations in more accurate manner. The fuzzy set analysis of these fields revealed the major circulation regimes over eastern North Atlantic and Europe to be determined in summer by three vorticity polar: 1) North-Western (Scandinavia), 2) Western Mediterranean and 3) Caucasian. It is necessary to note that anticyclone was found in western part of North Atlantic for both seasons. Scandinavia cyclone area explains rain rate maximums located in 50 o -60 o latitude European area and lower rain rate in Southern Europe because of hot and dry African air inflow. In late fall and winter we revealed a vorticity system comprised by three other polar: 1) North-Western, 2) Northern Africa and 3) Northern Russia (Cara Sea). The zonal circulation type dominates in this case and more precipitations are delivered from Atlantic . Rain rate in this case is more uniformly distributed in various latitude belts across Europe than in summer, but more intensive precipitations are occurred in Southern Europe because of moisture transport strengthening to this area from Atlantic . NAO as well as AO (arctic oscillation) indexes substantially increased their magnitudes in late eighties and nineties during global warming. Atmospheric circulation patterns have been shifting northward during this time. As a consequence, the climate in Southern Europe has been becoming drier and respective rain amounts reducing primary in warm part of year. In contrast, the rain rate has been increasing here in cold part of the year. It leads to more wet climate in autumn and winter.

CLIMATE VARIABILITY OF THE DISCHARGE LEVEL IN THE LOWER DANUBE BASIN AND TELECONNECTION WITH NAO

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First of all, the internal structure of monthly time series of the discharge level at Orsova situated in the Danube inferior Basin for 164 years (1840-2003) has been analysed. Statistical non-parametric tests (Pettitt and Mann-Kendall) have been applied for the emphasis the climate change points. Also, the signal-to-noise ratio has been estimated for testing the statistical significance of change points. The extreme events were rendered evident by the percentiles (10 th and 90 th) from a division in 10 equally probable classes. By means of power spectra the periodicities from 2 to 40 years have been found. Signal of Quasi-Biennial Oscillation - QBO (about 26 .months) is present in the discharge level during the spring and summer time, while periodicity of 40 years appears in autumn months.

North Atlantic Oscillation (NAO) is the dominant mode of the winter climate variability in the North Atlantic region. The corresponding index varies from year to year, but also exhibits a tendency to remain in a positive or negative phase for intervals lasting several years.

Teleconnections between North Atlantic Oscillation values , and time series of the discharge level at Orsova for the period 1840-2003 were performed. For this period the most significant result is obtained for the NAO index in February and discharge level in April. A positive phase of NAO in February leads to low discharge level in Danube inferior Basin in April and a negative phase in February favours a high level in April.

Because a change was occurred in the beginning of the 1970s in the North Atlantic Oscillation index, the teleconnection analysis has also been achieved in two separated periods, 1840-1970 and 1971-2003. Taking into account discharge level at Orsova in September as predictand, for the first period NAO in January is a good predictor and for the second period the best predictor is NAO in March.

FACTORS GENERATING THE WINDBREAKS OF 5-6 NOVEMBER 1995 IN MURES, HARGHITA, BISTRITA NASAUD AND COVASNA COUNTIES

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In this paper we analyze the synoptic conditions which generated strong wind intensities on the night of 5-6 November 1995, generating windbreaks which covered a large forest area in the Eastern Carpathians, in the following regions: Mures, Bistrita Nasaud, Harghita and Covasna. The paper analyzes this situation from the synoptic point of view, and also of the climate hazard.

The causes of the windbreaks were the following: abundant rainfalls, which reduced the resistance of the roots in the soil, the snow that produced the overloading of the tree tops and a very strong wind from the north-east with speeds over 160 km/h. The catastrophic windbreaks caused serious damages, on a surface of 416,000 ha and the windbreaks affected area exceeded 7,8 million m³. In order to avert those calamities, the Sylvical Agencies affected acted with energy for evacuating the wood mass and also for applying the silvicultural and phytosanitary measures necessary.

SIMULATION OF PRECIPITATION OVER THE BALKANS USING ERA40 DATA FOR CLIMATE ADAPTATION

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The climatic version of the regional model ALADIN (based on ARPEGE-CLIMATE) was used for downscaling of ERA40 re-analyses. We call this 'climate adaptation' what here means continuous run over several years period using the low resolution lateral boundary conditions from ERA40 data set and modeling the precipitation over 10 times finer resolution grid. The simulated precipitation is compared with the measurements at the synop stations. In this way we evaluate the reliability of this method.

CHANGES IN EVAPORATION, TEMPERATURE AND PRECIPITATION DATA DURING THE MEASUREMENT SEASON OF EVAPORIMETER CLASS A PAN IN CROATIA

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Evaporation is one of the processes developing in the atmospheric water cycle and it is important for the meteorology and hydrology as well as for the other related sciences. Quantity of evaporated water is determined using different measuring instruments - evaporimeters - or calculated from the other meteorological elements. The standard type of evaporimeter in Croatia is Class A pan. Evaporation measurements are made by hook gauge, twice a day (at 7 a.m. and 7 p.m. Mean European Time - MET). Measurement of evaporation from the free water surface in Croatia started during the sixties so currently there are several stations with thirty-year data series of continuous measurements. The existing data as well as network of evaporation measurement stations are analysed, along with advantages and disadvantages of the official instrument - Class A pan.

Based on long - term meteorological data series (period 1971- 2000) from the ten stations where evaporation measurements exist the data of mean monthly and seasonal values of temperature, precipitation and evaporation during the measurement season of evaporimeter class A pan (from April to October) are determined and analysed.

Mean monthly temperature and evaporation values show the similar seasonal course, i.e. their values are increasing from April till the maximum values in

July and then they are decreasing till the end of the season in October. Seasonal precipitation course is not so simple and depend on stations positions i. e. in which part of country stations are situated. In the continental part of the country the maximum of precipitation is in June, and in the part near the Adriatic Sea the maximum precipitation is mainly in November. According to data in July and August mean monthly evaporation is greater than mean monthly precipitation value.

There are some indications that in the past ten years temperature values are decreasing and the precipitation amounts are decreasing. So in the paper the trend of mean seasonal temperature values and seasonal amounts of evaporation and precipitation are determined. The analysis shows that there are increasing in seasonal values of temperature and evaporation, and decreasing in precipitation values.

The analysis has revealed that the existing network does not ensure satisfactory of the entire Croatian territory. The stations are missing in the entire coastal region and on the islands, and the numbers of the instruments in the mountain regions are also insufficient. Increase in number of instruments is proposed, and comparison of results obtained by Class A pan and the ones obtained by thermo-insulated GGI 3000 TM pan, which would give more reliable coefficients for the official instrument and the whole region.

THE STATISTICAL ANALYSIS OF WET AND DRY DAYS BY NINARY DARMA (1.1) MODEL IN SPLIT

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The study of the floods and draughts requires the investigation of the characteristics of wet and dry day sequences. Relying on empirical relative frequencies of sequence length only, may create completely wrong idea about probability of very long sequences, having more practical importance than short sequences. Various statistical models give more reliable estimates. Dryness or wetness of a time period (month) can be determined using daily precipitation data. Nevertheless, in some cases these estimates may also give wrong impression, so monitoring the number of wet and dry days is also important. In this work the Discrete Autoregressive Moving Average model (DARMA(1,1)) is used to describe the wet-dry day sequences in Split, south Adriatic coast of Croatia. The daily precipitation data from the gauging station Split-Marjan during the 1948-2000. period is used. Since the year 2003 is marked as very dry and in the year 2005 there where many floods at the Croatian coast, those two years are analysed as particular cases.

STUDY ON CLIMATOLOGICAL VARIABILITY IN THE REGION OF NATURAL PARK "SINI KAMENT"

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The natural park "Sini Kameni" is situated in the Balkan Mountain of Bulgaria and covers an area of 11380 ha. The relief is mountainous. The main land cover types are deciduous (88%) and mixed forest. The species that predominate are *Fagus sylvatica*, *Carpinus betulus*, *Quercus ceris*, *Acer pseudoplatanus* and others. The significant diversity in the climatic conditions in the park is due to the big difference of altitude. The park is not rich in water resources.

On the basis of meteorological data for the period 1961-2002 an analysis of the warm and humid conditions in the studied park was made. The sum of precipitation and the sum of efficient temperatures during the growing period were calculated, as well as the sum of Autumn-Winter precipitation. The negative trend of precipitation was determined.

LONG-TERM IN TEMPERATURE, PRECIPITATION AND RUN-OFF AT THE CROATIAN EASTERN ADRIATIC COAST

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The observed warming as well as the precipitation anomalies are not uniform on the globe. Regional differences make it reasonable to consider climatic variability in particular long-term series of meteorological variables in regions with different climatic conditions in order to detect their impact on hydrological parameters.

The paper aims to present variations and trends in annual and seasonal series of temperature, precipitation and runoff at two locations at the eastern Adriatic coast: Crikvenica (2 m a.s.l., 45°10'N, 14°42'E) located in the Kvarner Bay characterised by the maritime climate of the northern Adriatic under the strong influence of the mountainous hinterland with high annual amounts (1243 mm) and equal totals in the warm and cold half-year, and Hvar (20 m a.s.l., 43°10'N, 16°26'E) at the middle Adriatic island of Hvar characterized by rainy cold half-year (474 mm - 65% of annual value) and dry warm half-year (259 mm - 35% of annual value).

Data series for the period 1901-2004 are analysed for trend that is tested by means of nonparametric Mann-Kendall rank statistics. For the series, which showed the significant trend identified by the Mann-Kendall coefficient t , a progressive analysis of the time series by means of the statistic $u(t)$ was performed in order to determine the beginning of this phenomenon. Fluctuations have been considered by means of the 11-year binomial filtered series. Runoff values for each year have been calculated by means of the Palmer's procedure for calculation of water balance components on monthly basis.

During the 20th century significant trend in mean annual temperature is present at both locations, more expressed at northern Adriatic than at the middle Dalmatian islands. The main contribution to these increases is due to the temperatures in the warm part of the year, summer in Crikvenica and autumn in Hvar. The increasing trends in temperature were even strengthened at the beginning of the 21st century more at the northern coast than over the middle Adriatic. Like on the global scale, 1990's in Croatia have been the warmest decade of the 20th century. Similar values appeared also for the decade 1941-1950, which was even warmer than the end of the century at the northern Adriatic coast (Crikvenica).

During the last century there is a tendency for precipitation decrease. It is more noticeable, and statistically significant, at northern coast (Crikvenica: 18%/100yrs) than over the middle Adriatic islands (Hvar: 12%/100yrs). Such annual trends are resulting from precipitation decreases in all seasons except for summer at Hvar.

The annual anomalies show very large variability since 1901 and continue also at the beginning of the 21st century.

Due to the positive trends in air temperature and negative trends in precipitation, the runoff shows the significant decreasing trends at both stations. In Crikvenica the trends in warm and cold half - year are almost equal. On the contrary, as the runoff in Hvar appears only occasionally in the warm half - year, the negative annual trend of runoff is mainly the consequence of the trends in the cold rainy season.

BACKGROUND LEVELS OF PRECIPITATION CHEMICAL COMPOSITION AND THE IMPACT OF SOFIA

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Synchronized measurements and analysis of the chemical composition (NO_3^- , SO_4^{2-} , pH) of the rainfall throughout the warm half of the year have been conducted in the synoptic stations on Cherni Vruh mount (Vitosha Mountain) and in the city of Sofia . The station on Mount Cherni Vruh (2290 m) has been used as background, e.g. the chemical composition of the rainfall there is considered to bear the characteristics of the regions over which the cyclone's frontline has formed and passed. The investigation suggests that the background concentrations are significantly lower in the rain systems formed and passed over the Mediterranean, rather than over West and Central Europe . There are exceptions which might be explained with significant regional sources of pollution, for example - a Mediterranean cloud system with exceptionally high level of sulfates in the precipitation over Mount Cherni Vruh, could be explained with the working of ' Maritsa ' power complex. The average concentration of SO_4^{2-} in Sofia is approximately two times higher than that on Mount Cherni Vruh and this of NO_3^- - 5 times. The average value of pH for Mount Cherni Vruh (5.2) is in the norm for a clean precipitation, but the value for Sofia (7.1) suggests being alkaline.

PRECIPITATION CHEMISTRY - RAPID INFORMATION SYSTEM

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The rainfall chemistry network of NIMH (National Institute of Meteorology and Hydrology) consists of 45 stations. In 41 of them the samples are obtained at main synoptical hours 00, 06, 12 and 18 UTC as well as the 6-hourly precipitation amount . In the other 4 stations the samples are taken in 06 UTC - the hour of daily precipitation amount for climatological stations . The methods of sampling and pH - measurement are empirically established and applied in the synoptical network and in part of the climatological network in Mars 2002. The precipitation acidity (in pH -units) is measured with portable pH-metre on-site immediately after sample taking and the data are transmitted in a special group by the code synop . This method allows for an express acquisition of primordial information about the chemical composition of the rainfall immediately after or during it. In case of emergency, the sample is due to transportation to the laboratory for a more thorough and specific analysis. Typically all samples are transported monthly to the laboratories for nitrates (NO_3^-), sulfates (SO_4^{2-}) and conductivity analysis.

STATISTICS OF ENERGY POTENTIAL FROM HYDROPOWER PLANTS IN MACEDONIA

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Hydropower plants (HPP) are energy capacities which have negligible operation costs comparing with the high investments because of the water as natural and sustainable energy resource. The energy generation from hydropower plants cover a small part of total energy potential, mainly because of limited water inflow and because of high investments comparing with others generation capacities as coal or gas fired power plants. On the other side comparing with the fossil fired power plants, the hydropower plants are environmentally friendly and sustainable resource of energy.

The electricity generation in Macedonia is strongly dependant on lignite thermal power plants (TPP) which can cover 70-80 % of electricity needs in Macedonia, and the rest is covered from hydropower and electricity import. The hydropower potential in existing HPP is between 800 GWh and 1500 GWh of electricity generation in a year depends on hydrology. In the average hydrology the total electricity generation from HPP in Macedonia is approximately 1200 GWh.

The main HPP in Macedonia are Vrutok, Vrben and Raven in Mavrovo basin, Globocica and Spilje on Crn Drim basin, Tikves on Crna reka basin, and Kozjak, Sv. Petka and Matka on Treska basin.

This paper gives the overall of technical characteristics of existing HPP units in Macedonia , as well as economical and technical parameters for new candidates. On the basis of natural water inflow by month, it will be calculated the monthly electricity generation, water discharge, spillway, energy losses and others. On the other side the paper will give some statistical points of natural water inflow and energy generation of the HPP taking into account the hydrology conditions for wet, average or dry season.

A CASE STUDY ON UTILIZATION OF PRECIPITATION INDICES IN BULGARIA

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Various climate indices are widely used across the world in order to assess climate as well as its variability and change in a given location, region, etc. Many climate indices including precipitation ones have been already applied in Bulgaria. This case study also aimed to explore some precipitation indices throughout the country. Several precipitation indices were selected, calculated and analysed for different weather stations in Bulgaria. The selected precipitation indices are based on the STARDEX project.

SYNTHETIC DATA-BASED METEOROLOGICAL DROUGHT MODELING

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Being a global phenomenon the drought is defined as the dry period when the shortage of water becomes evident in a particular region. As a clearer definition, drought occurs when the water supply is less than the demand, and continues as long as there is a water deficit. Drought is classified as meteorological, hydrological or agricultural drought based on the aim of the study. Among these meteorological drought is defined as the time period when the observed precipitation is less than a predefined threshold value of precipitation. Observing one of these droughts does not necessarily mean that the other two, or one of them at least, will also be observed. For instance; having enough water for agriculture but not for population there to use cause a hydrological drought while nothing happens to the agriculture in the region. However, a meteorological drought (not enough rainfall or snowmelt) generally causes both agricultural and hydrological drought if another water resources such as groundwater is not available in the region.

Results obtained through existing climate change scenarios for different regions all over the world state that temperature increases and precipitation decreases. This is mainly connected to the climate change or variability issue, which is still a questionable one.

In this study, meteorological drought forecast is aimed. For this not only observed data but also their synthetic counterparts were used. Therefore, the forecasting algorithm is based on generated data sets statistically similar to the observation in a particular site. The method to be used can be explained as follows.

Length and severity of cases of droughts for a predefined threshold can be counted from the observed time series in hand. These two characteristics are random and hence have their own probability distribution functions. However, precipitation observations are usually too short for determination of the empirical probability distribution functions of these two variables. Because of that it is not possible to extract the probability distribution functions properly. It is thought in this study that a synthetic data set statistically similar to the observation can be helpful to make the series longer so that the probability distribution functions of the length and severity of drought can be extracted. Knowing the probability distribution functions and also the state of the precipitation (i.e. wet/dry) in the previous time step, forecasting of drought can be performed by choosing random numbers from the determined probability distribution functions above. This clearly assumes that both variables are random and have neither serial nor cross correlation.

The precipitation can be generated by selecting a model from literature such as ARMA type models or any other specific model. In this study annual total precipitation data from the Thrace region, the European part of Turkey, will be used.

Let now us assume that it is known from the observation that the previous year is the last year of a wet (above threshold) period. Then the length of the dry period can be generated by choosing randomly from the probability distribution function of the drought length (duration). Secondly, the severity of the drought is generated among the random numbers from the probability distribution function of the drought severity. The precipitation deficit during the drought period is averaged by dividing the random number generated for severity to that for the duration. The performance of the forecasting is decided based on the error between observed and forecasted length and severity of drought.

VERTICAL WATER CONTENT DISTRIBUTION IN THE UNSATURATED SOIL BY TDR MEASUREMENTS AT SHALLOW DEPTH: MASS BALANCE AND ANALYTICAL SOLUTIONS OF THE LINEARIZED RICHARDS EQUATION

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The water content in the surface soil is a key factor in soil physics, meteorology, agronomy, and of course hydrology and environmental water management. Nowadays the soil water content can be measured using Time Domain Reflectometry (TDR) technique. We used the TDR technique to collect long series of data in different soils: fine sand at the Lido beach (Venice, Italy), silty loam at an alpine valley (Val d'Ossola) between Switzerland and Lago Maggiore (Italy), loam at a suburban area close to Milan (Italy), silty clay loam at the campus of the University of Modena (Italy). An algorithm based on the mass balance equation has been derived, and used with soil moisture readings, to compute the loss or gain of water of a soil column (unitary cross section and known height). So, the soil water content (in the first 1-2 m) and the rain gauge data allow estimating evaporation or infiltration according to atmospheric conditions. The measured water content vertical profiles are compared with the analytical solutions of the linearized Richards equation. A new theoretical procedure to solve the linearized Richards equation for arbitrary initial and boundary conditions has been developed.

ESTIMATION OF THE CLIMATE CHANGE OF EVAPORATION IN STRUMA RIVER BASIN IN BULGARIA

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Water is essential for life and water problems are strictly related to the present and future living conditions in the world. One of the principal aspects of present and future water problems is the rational utilization of the existing surface and underground resources, in order to satisfy the demand that is strictly connected to all the intrinsic aspects of human living and civilization.

Climate changes are directly related to water resources, which are of high socio-economic and environmental significance. The aim of presented work is to analyze the trends in the evapotranspiration time series. The data from four meteorological stations in Struma river basin are used. The Spearman and

Man-Kendall tests are applied. In the paper also are given the expected values of actual evapotranspiration for the years 2025, 2050 and 2100, obtained by V. Alexandrov on the basis of the results from HaDCM3 and ECHAM4 climate change scenarios .

CLIMATE CONDITIONS IN THE BIOSPHERE RESERVE "SREBARNA" REGION

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The separate components of the environment as climate conditions surface and ground water regime, air and water quality and quantity and others form the living space of the reserve. The close connection between the biotic and abiotic factors necessitates working out a plan for governing of the reserve region to pay serious attention to abiotic conditions in the examined region.

In the presented paper the local climate regime in "Srebarna" reserve is described. Continental character of the climate here is well expressed with cold winter and hot summer. In winter the weather is formed mainly under the influence of continental air masses from southern latitudes or is formed here under the influence of the strong summer solar radiation in conditions of slow movable anticyclones. For the confined space we give a short description of the climate by seasons .

INVESTIGATION OF THE EVAPOTRANSPIRATION REGIME IN REGION OF TOWN ROUSE

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The water resources planning, management for water supply and irrigation of agricultural areas required mathematical models for simulation the evapotranspiration processes. Evapotranspiration is one of the most important processes in the land phase of the hydrological cycle. The success of water management policies in our country is linked to the accuracy with which variations (temporal and special) in available water resources.

The aim of the presented paper is to estimate and describe the regime of the evapotranspiration – potential and actual in the region of town Ruse situated in the central Bulgarian part of Danube on the territory of Bulgaria . The data from two meteorological stations in Ruse and Obrazcov Chisflik are used. The mean monthly potential evapotranspiration is calculated according Thornthwaite and Eagleman methods. The Turc's empirical equations for

mean monthly value of actual evapotranspiration is also applied. The long-term variability of evapotranspiration is analyzed.

POTENTIAL EVAPORATION AND EVAPOTRANSPIRATION IN REPUBLIC OF MACEDONIA FOR THE PERIOD 2001-2005

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Values of potential evaporation and evapotranspiration, precipitation, maximal temperatures, average diurnal temperatures and relative air humidity are the main indicators for drought phenomena.

Concerning that, this paper examines potential evaporation data obtained by Garnie's evaporator from three measurement points in Republic of Macedonia (Bitola , Gevgelija and Skopje) in vegetation seasons for the period 2001-2005.

Applying indirect Thornthwaite's and Penman's methods for potential evaporation and direct measurements by Garnie' evaporator for the same period, comparison of direct and indirect measurements results are carried out..

WATERSHED CONSERVATION AND MANAGEMENT OF GLACIAL LAKE OUTBURST FLOOD; COMBATING CLIMATE CHANGE IN HIMALAYAN ENVIRONMENT

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High vulnerability of inhabitants of Hindukush Himalayas to natural hazards has made poverty alleviation in the region very difficult. Among all, risk potential of Glacial Lake Outburst Flood (GLOF) remains the most threatening. Global climatic change has had significant impact on the glacial ecology and satellite images have reported more than 4000 such glaciers that spawned perilous moraine-dammed glacial lakes in Nepal and Bhutan. The high rate of movement of the retreating glaciers and also an alarming rise in temperature in these areas renders it imperative to monitor the ecosystem and assess the environmental risk. The paper presents risk assessment studies based on glacial morphometry, ecological thresholds of flash flood, agro-environmental parameters including vegetation patterns and slope

gradients. Implications of remote sensed monitoring, risk mapping and traditional ecological knowledge for community based watershed conservation has been evaluated towards hazard mitigation.

DROUGHT AND FOREST DECLINE IN REGION VULNERABLE TO DESERTIFICATION IN THE REPUBLIC OF MACEDONIA

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In this paper are presented results related to forest decline as a consequence of climate changes in last decade of the XX th century.

Some regions in RM are assigned as vulnerable to desertification so the analyzes were related to conditions in these regions.

Meteorological data from 32 stations was analyzed. Comparison between data for the period from 1951 to 1990 and period 1991-2000 was made. According to the analyzes, there is considerable increase of the temperature from one hand and decrease of the precipitation from the other hand.

Meteorological conditions are considerable factors in the region vulnerable to desertification in Macedonia . According to the result there are 4 regions with arid climate and 10 regions with semi-arid climate which is quite considerable. As a result of the climate changes there are some regions with very large amplitude of changes as in the case of Valandovo and Kocani. In Valandovo there is increasing of the temperature for 8,45% or 1,2 o C and decreasing of the precipitation for 20,33% or 124,2 mm and in Kocani the increasing of the temperature is for 10% or 1,3 o C and the decreasing of the precipitation for 7,18% or 37,5 mm.

Some investigations related to forest decline are carried out in 3 localities in the period from 1991 to 2003. Target of the investigations are oak forests. One of the localities is situated in the region vulnerable to desertification. The oak forest health condition was done by visual estimation. According to the methodology classification there are 5 categories of the forest health condition (I- health trees, V-dead trees). In the first year of observation there were 80% health trees, but in the next two years there was drastic decrease of tree health (32% in 1993 up to 27.9% in 1999). Percent of dead trees increased from 0.9% (1991) up to 5,4% in 1999.

Forests in some regions were considerable affected by dry period in Republic of Macedonia .

**PRELIMINARY IMPACT ASSESSMENT OF NUCLEAR POWER PLANT
"BELENE"**

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In the region of Belene town it is planned to build a Nuclear Power Plant (NPP) "Belene" and by this reason since five years the meteorological monitoring system is in operation. The data collected give the opportunity to simulate the possible impact of the NPP on the environment.

In the present work are given the results from the numerical simulations of the ground level concentration and deposition of the long living aerosols LLAs. The real meteorological data and the emissions from a hypothetic reactor 1000 MW are used as input information.

As a result of the model study it was ascertained that the operation of the " Belene " Nuclear Power Station does not result in the formation of radioactive pollutants with concentration greater than allowed by the sanitary-hygienic norms.

**COMPARISON BETWEEN SYNOPTIC AND STATISTICAL METHODS FOR
ESTIMATION OF PMP IN SOUTHWEST BASIN OF IRAN**

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The probable maximum precipitation (PMP) is the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of the year. Hydrologists use a PMP magnitude together with its spatial and temporal distributions for the catchments of a dam to calculate the probable maximum flood (PMF). In this study the synoptic (physical) method has been compared with statistical method (e. g. the Hershfield's) for calculate PMP in southwest regions of Iran . In order to estimate of probable maximum precipitation first collection meteorological data including precipitation; dew point temperature; wind speed were collected. In this connection synoptic maps at appropriate time scales at meteorological stations in southwest catchments and neighboring basins were study. Then major storms (extreme) including last year storms of various durations were selected and Depth-Area-Duration (DAD) curves for all selected storms extracted. By using synoptic Method, PMP estimations were obtained at different locations. These estimations PMP values can be applied to 1000, 5000 and 10,000 km² areas. In this study also PMP estimations were obtained by statistical analysis (Hershfield's Methods) of the series of annual maximum 24h precipitation amounts. The results of

statistical method show a correlation between the point PMP and the mean annual precipitation which is significant. We found that PMP estimates by statistical method are well comparable with values of obtained by the synoptic (physical) method for different durations. Results also shows that limited transposition of statistical methods gives higher estimates, in comparisons with synoptic method.

THE ESTIMATION OF CLIMATE CHANGE IMPACTS ON WATER RESOURCES IN AZERBAIJAN

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Climate influences to security, food and water reserves, property of people, generally to all fields of the world and as well as to durable development as a factor defining existence of life in the globe. Climate changing is one of the difficult problems of the mankind recently repeating of external cases and increasing of intensity and increase of negative influences to the different sectors of, economy is expected in connection with it in the result of global heating. Speedy development, achievements of scientific technical progress not only isolated people from present and future influences of the climate, but also was at the bottom of increasing this dependence more. Although thousands of researches were conducted in the world on the indicators such as how the climate changing on the regions in future, increasing and reducing the rainfalls, dynamics of distribution, forecasting about future changing of the climate is one of the difficult issues. So, serious losses are expected to happen, such as in economical, ecological, as well as in all, fields of the social life.

In Azerbaijan have sat are most typical for the rivers of southern and northeast slopes of the Big Caucasus, southwest and northeast slopes of Small Caucasus

In 1994-2003 have sat observed on the rivers Kishchaj, SHinchay, Qà l à chay, Kurmukchay have put a significant loss to economy of republic. Were observed have sat on the rivers Nahichivan

The annual loss from these phenomena makes 70-80 million dollars.

Catastrophic increase of a water level on the river the Kura and other rivers in 2003 has put a significant loss to economy of republic to an agriculture, a fish facilities, 50 hectares of the sowing grounds have been flooded.

From 1978 to 1995 the level of the Caspian sea is raised on 2,4 m , as result 485 km 2 of coast zone was flooded that was 2 milliard \$ detriment for country.

As a result of flooding coastal territories there is a pollution exhausting with harmful elements, heavy metals.

There are forecasts, that by 2040 at increase of a level of Caspian sea on 150 sm of 87,7 thousand hectare of a coastal zone of Azerbaijan will be are flooded.

Increase of a level of Caspian sea will lead to to additional pollution by mineral oil that will adversely affect biological resources.

Hydrological mode and fluctuations of a sea level are major factors influencing on increase in food fishes.

Expected consequences:

- Flooding of coastal territories, occurrence of threat for rare and valuable coastal a biodiversity.
- Degradation of the grounds.
- Negative influence on health.
- Negative impacts on ecological systems and biodiversity.
- Reduction of water resources.
- Negative influence on a forestry.
- Influence on an agriculture.

COMPARATIVE ASSESSMENT OF THE ATMOSPHERIC BETA RADIOACTIVITY IN FINLAND AND BULGARIA

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Studying and monitoring of the atmospheric radioactivity has been well recognized in the fifties of XX century when the nuclear tests in the atmosphere lead to contamination of the global fallout with the radioactive decay products. The networks of atmospheric radioactivity monitoring have been developed in different countries. During and after the Chernobyl accidents such networks proved their capabilities and necessity successfully estimating the level of radioactive pollution. The radioactive substances from natural and man-made origin continue to be used as tracers for studying of the atmospheric processes.

In Bulgaria and Finland the national networks for air radioactivity monitoring were developed in the frame of Meteorological Institutes, NIMH and FMI, giving the opportunity to take into account the influence of the atmospheric processes and parameters on the radioactive substances concentration and

deposition. Some of the approaches and methods in the measurements of the atmospheric radioactivity are common. There are data records available for many years, since 1959 for Sofia and since 1960 for Finnish stations for beta radioactivity of the air particulate and deposition measured 120 hours after sampling. The contamination due to the global fallout from the nuclear tests depends both on site specific meteorological conditions, like precipitation, and on site latitude.

In the present paper high correlation between Finnish stations and Sofia for mean monthly values of the 120h aerosol beta is shown and discussed. The deposition of beta emitting radionuclides measured 5 days after sampling in Bulgarian and Finnish station is compared and the role of the precipitation in total deposition is distinguished. The work performed was done under the common project of NIMH and FMI in the frame of bilateral co-operation between Academy of Finland and Bulgarian Academy of Sciences.

EXCESSIVE AND ABUNDANT RAINS IN THE REGION OF SOFIA AND ITS SURROUNDINGS

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Besides the abundant continued rainfalls (including the bigger part of +añò of the twenty-four-hour period , and, at times more) , of practical interest are also the excessive (vigorous) , but short (of short duration) rainfalls , which often last a few minutes only or a small part of the hour . Abundant are the rainfalls of twenty-four-hour amounts higher than 30 mm.

Generally, we mean by excessive (heavy or torrential) rain a relatively short , but plentiful rain . These rains are distinguished from the abundant ones, which are also characterized by huge amounts of rain , but achieved in a longer time interval and with relatively lower rainfall rate . The pouring rains are usually local; characteristic for them is their high, but varying in time and place, rainfall rate, as well as the relatively small area they affect.

In our country as excessive rains are considered the ones of rates higher than 0.18 mm/min or over 30 l / (s.ha) , irrespective of rain duration . Excessive rains are measured from the pluviograph with the method of the maximum intensity. Basic parameters for characterizing the excessive rains are the rainfall amount, the time duration (continuation) of the rain, and its rainfall rate evaluated by the amount of rainfall in a unit of time.

Following basic statistical characteristics for the excessive and abundant rains have been considered : average and maximum amount , frequency and repeatability in the region of Sofia and its surroundings.

A STUDY ON PRECIPITATION VARIABILITY AT ISKAR AND MESTA RIVER BASINS

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Precipitation is a key element of the hydrological cycle and climate as well as for productivity of agricultural plants. Recently an increasing interest to precipitation is observed for more frequent draughts recorded in South East Europe during the 20 th century that are a part of the climate cycle on the Balkan Peninsula. An investigation on variations of the annual and seasonal precipitation over the period 1931-2000 at sixteen meteorological stations located at the upper Iskar and Mesta river basins is carried out. For assessing climate variations and trend statistical techniques such as moving averages and non-parametric test are applied. With exception of spring precipitation, analysis revealed a noticeable reduction in annual and seasonal precipitation on Iskar and Mesta river basins during the investigated period and an overall decrease over the warm and dry period 1982-1994.

COMPARISON OF THE CBL MODEL YORCON WITH EXPERIMENTAL AND CLIMATE DATA FROM SOFIA

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The aim of the present work is to determine the vertical profiles of the wind velocity and temperature using radio-sounding data from Sofia and applying the convective ABL model YORCON. The simulated with YORCON profiles are compared with the measured profiles under convective conditions from regular and experimental radio-sounding at Sofia Aerological Observatory. Thus climatological CBL height values for Sofia are obtained.

The regular soundings data were taken from NIMH Aeroclimatological Atlas for a 10-year period before 1985 and from noon radio-sounding data for a period 2001 - 2004 when a Waisala radio-soundings system was introduced at NIMH. Aerological data were also available from several experimental campaigns in Sofia . The last one in September-October 2003 (The Sofia Boundary-Layer Experiment) comprised high resolution boundary layer radio

soundings and sonic anemometer measurements at two heights on the research tower of NIMH .

Applying the CBL model YORCON and input data taken from the radio-soundings some turbulent characteristics such as friction velocity and turbulent fluxes were estimated in addition to the CBL height. The measured and simulated parameters were compared on the basis of the experimental data.

The Convective Boundary Layer (CBL) model YORCON is developed in accordance with the Monin-Obukhov similarity theory. Applying the similarity theory and resistance laws, the internal parameters as Monin-Obukhov length scale, friction velocity, and cross isobaric angle are determined from the external parameters as geostrophic wind and the difference between the potential temperature at CBL height and at the ground. The external parameters can be determined from the numerical weather prediction or from radio sounding data. In the present study different radio-sounding data are used.

The results from the comparison between the modeled and measured (Sofia Experiment 2003) turbulent characteristics as the surface heat flux, the friction velocity and the evolution of CBL height during chosen experimental days characterized with convective conditions are discussed.

The CPBL model YORCON simulates reasonably well the basic ABL characteristics under convective conditions as the surface turbulent fluxes for heat and momentum, and the velocity and temperature profiles in ABL as well as the CBL height . The dynamic of the mixing layer height is an ABL characteristic important for the distribution of pollutants and aerosols in meso and micro scale tasks. The CBL model YORCON can be used for determining the height of the mixing layer applying regular and readily accessible information for the external ABL parameters taken from aeroclimatological data or directly from radio-soundings studying individual and average for a given time interval realization of convective conditions.

ABOUT THE INPUT DATA IN CLIMATE MODELS - AGGREGATION OF TURBULENT FLUXES OVER HETEROGENEOUS SURFACES

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A single grid in climate models covers different land-use patches and thus different surface exchange parameters. A key topic in climate modeling is therefore the generation of input data for the surface exchange from one side

and the way model output is compared to point measurements. A method to assess the aggregated values of surface turbulent fluxes is presented here along with comparisons with data from different field campaigns.

The height of the atmospheric boundary layer is of key importance for the exchange of energy between surface and atmosphere and thus is essential for the air humidity and precipitation formation.

The assumption we propose is that the convective boundary layer over a non-homogeneous area develops as a result of aggregated turbulent forcing. In climate modelling usually information on the character and size of different land cover patches (forest, agriculture land, urban area, lakes) is available within each grid square. The question is how to assess one grid value for each forcing parameter (surface turbulent sensible or latent heat flux and friction velocity). A method to derive aggregated fluxes is described by Gryning and Batchvarova, (1999) and Batchvarova et al. (2001). It is validated with measurements from the NOPEX and WINTEX (two northern climate experimental studies performed under Nordic and European projects). The concept was suggested to be used over urban areas as well (Gryning and Batchvarova, 2002). Further it was validated with data from the Sofia Boundary-layer experiment in 2003 (Batchvarova et al, 2004).

The mixed layer overlooks a very large area or in other words has a large footprint. In this study the aggregated fluxes that control the development of the mixed layer height are determined by inverting a model for the growth of the mixed layer. Knowing from measurements the development of the mixed layer height, the aggregated heat flux of the upwind area can be estimated. The required information for use of the method can be derived from wind speed and temperature profiles obtained by radio soundings when performed frequently enough to provide a reasonably detailed structure of the mixed-layer development. Alternatively data from remote sensing techniques like combined wind profiler and radio acoustic sounding systems can be used.

The emphasis is made on the need to consider the upwind fetch and thus to derive climatological values from observations.

ANALYSIS MEDITERRANEAN PRECIPITATION ASSOCIATED WITH THE NORTH ATLANTIC OSCILLATION (NAO) INDEX VIA HILBERT-HUANG TRANSFORMATION

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The state of the atmosphere is governed by the classical laws of fluid motion and exhibits a great deal of correlations in various spatial and temporal scales. The correlations are crucial to understand the short and long-term trends in climate. The most significant correlations are recognized as teleconnection patterns. One of those connections is the North Atlantic Oscillation (NAO) refers the exchange of the atmospheric pressure systems between the Greenland/Iceland region and regions of near the Azores. It is known that the NAO is associated with anomalous weather patterns of which are the main sources of the water-based systems in eastern United States, Western Europe and Mediterranean. In this study, Empirical Mode Decomposition (EMD) method of Huang is employed to cut up the NAO index data into different narrow-band frequency components, and then studying each of components with a resolution harmonized to its scale of which are called Intrinsic Mode Functions (IMFs) of the underlying physical dynamics have advantages over traditional Fourier analysis in analyzing physical situations where the signal contains discontinuities and sharp spikes in a domain of non-linear and non-stationary space case. The EMD method is performed to extract oscillatory modes in the NAO index in order to reduce the relationship between the each of the IMFs and the large-scale precipitation comparing with the embedding method of nonlinear dynamical systems approach. The results show that NAO index exhibits substantial organized and correlated structures with the large-scale precipitation over Mediterranean.

THE QUANTITATIVE ANALYSIS OF CLIMATE CHANGES BY USING FROM PRECIPITATION OF IRAN SELECTIVE STATIONS

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The advanced statistics application have too importance in the atmospheric science especially climatology. The climatic conditions analysis of every zone especially it"s variations have too importance time series models application. Therefore can be used random changes , trend, seasonal changes, cyclical variations and monitoring forecast models. Random variations models usable in climatic changes as single forecast models are: zero average error, equal frequency, minmax, minMAD and least squares. This models are analysed and reviewed by moving average, exponential smoothing and etc. The study of trend models are linear trend, curvilinear trend, quadratic models, modified exponential trend models, logistic and gompertz trend models, regressive models and etc. Everyone of models are analysed and forecasted by various methods . For example trend models are analysed and forecasted by simple mean, selective points, semiaverages, least squares, double moving

average, Brown and Holt smoothing and etc. The analysis and forecasting models of seasonal variations are general seasonal models (additive and multiplicative), additive and multiplicative Holt and Winters models and etc. The analysis and forecast models of cyclical changes are additive and multiplicative models from classically. The climatic changes are analysed and explanation by using Box – Jenkins models (ARIMA). The monitoring models are other models of analysis and study climatic condition analysis of every zone in standard limit. Therefore tracking signals as can be used for example smoothed absolute error, Trigg and Brown signals smoothing schemes and adaptive response rate exponential smoothing. It is considerable that mentioned models must be used in the three form measurement, analysis and forecast. The measurement stage defines confidence and reliability of models that can be used from statistical tests suitable with their condition. For application of mentioned models is used precipitation of the Iran selective stations. For application of this models is necessary advertisement from Spss, Minitab, Splus softwares and etc. This models is used to precipitation Iran stations.

ANALYZING THE NUMBER OF EVENTS ABOVE THRESHOLD FOR RAINFALL IN MASHHAD SYNOPTIC STATION, I.R OF IRAN

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Designing and programming in water projects need for a deep understanding of probabilities concepts. For analyzing extreme values of rainfall two series of annual maximum and partial duration are used. To define a threshold is necessary for analyzing on partial duration series which is access by climatological or statistical methods. According to χ^2 test the statistical model ruling on the number of annual events above threshold is recognized. The model is one of the Poisson, binomial or negative binomial generally.

In this paper at first we defined a statistical threshold and then determined prevailing model on the number of annual occurrences so, in this study 44 years daily rainfall data of Mashhad synoptic station in north east of Iran were considered.

VARIATIONS OF PH VALUES OF STREAM WATER IN MATURE OAK-BEECH FOREST ECOSYSTEMS IN BELGRAD FOREST NEAR ISTANBUL TURKEY

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The streamflow has been recorded for more than fifteen years by automatic water level recorders established in two experimental watersheds in Belgrad Forest. Some physical and chemical properties of stream water were also weekly determined during this period. An attempt was made to show variations of pH values of stream water in terms of seasons and throughout the observation period.

Statistical analyses indicated that the pH values were significantly different from each other according to climatical seasons, and growing vs dormant periods although they seemed to be very similar.

**CLIMATE CHANGE IMPACT ON WATER RESOURCES OF ARMENIA -
EXAMPLE OF RIVER DEBED**

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Water resources of Armenia are in direct relation to meteorological conditions and climate variability, and the only source for their updating is atmosphere precipitations.

According to scientific research of Armstatehydromet, using the observational data for the period 1935-1995, the average amount of precipitations as a whole over republic has decreased on 6% in relation to the norm (592 mms), and the air temperature has increased by 0,4 grades (norm 5,50 °C). The means for 1961-1990 are taken as the norm. On the basis of IS92 scenario is estimated, that at the end of 21 century in Armenia is expected an increase of mean air temperature by 1,70 °C, and the amount of precipitation will be decrease by 10 %. As a result of a precipitation deficit and air temperature rise estimated by this scenario, the annual fluvial sink will be diminished by 15 %. As the large irregularity on a sink territory over time in a perennial cut and in many basins the sink's high responsivity even to minor changes of climate characterise Armenian rivers, the analysis of climate change impact on water resources is being done by Armstatehydromet in all comparative large drainage basins.

Here, by way of an example, the results of complex research for the river Debed are discussed, which is the largest liquid water content river of Armenia, the annual consumption of which is 33,5 km^3 /sec., volume is 1200 million m^3 . Major factors determining a sink in a month and annual cut for the period 1955-2001 are studied separately: precipitations, temperature, air humidity, vaporization, humidity of soil, the snow coverage, and an objective data analysis of these factors is also conducted.

For the forecast of a month sink the multifactor connections (asynchronous and synchronic) between a sink and meteorologic members are established, using also methods of pattern recognition and Markovian process. The asynchronous relations are used for the sink forecast, and synchronic - for the estimation of fluvial sink vulnerability under climate change impact. The forecast methodology was inserted in Armstatehydromet practice for the period 2002-2005., justification of which was 85%. Diagnostic methodology was used for the calculation of vulnerability of Debed river's sink. Taking into account the fact, that in this basin precipitation decreases on 15 % and air temperature rise is expected by 0,5 $^{\circ}\text{C}$, annual sink will decrease by 23 % thus in interannual cut its increase is expected in spring - maximum in April and decrease in the summer - maximum in July. Such kind of complex researches are carried out for other basins as well.

MULTIDISCIPLINARY PLANNING OF WATERS IN REGION KATLANOVO-SOLUNSKA GLAVA

Dimitar Velev, Janevski Jordan

The region Solunska glava- Kadina Reka-Katlanovska Banja is situated south-east of the city Skopje and it is principally mountainous region with exception of south-east part of the plain Skopsko Pole. Namely it consists of five microregions : Mokra, alias Jakupica with Solunska Glava, Kadina Reka Taorska Klisura, Katlanovsko Blato and Katlanovska Banja.

In this region flow the follow rivers: Vardar, Kadina Reka and the following two recreational and navigable channels, Taor- Katlanovo and one great swamp(Katlanovsko Blato). Herein enter also the the termal springs Katlanovska Banja and many natural springs on the mountains Kitka , Karadjica and Golešnica .

For every microregion it is necessary to be elaborated many projects for the development and the improvement of the nature and other characteristics of the microregion .

Before the manufacturing of the projects it is ought to be made the promotion of this proposal.

The promotion must be effectuated in two stadiae; at first by the total Public and at second by the institutions whoses are responsible for this action .

The elaboration of the projects must be constantly every year, even then to the ending of the last.

THE APPLICATION OF VARIATIONS RANDOM MODELS IN ISFAHAN PROVINCE PRECIPITATION FORECASTING AND ANALYSIS

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The classical time series models have four components trend (T), seasonal variations (S) , cyclical changes (C) and irregular changes (I) . These components are used as single or combined in the climatic changes. In order to study these components , first should measure them in one of the additive and multiplicative models and then analyze an forecast them . To analysis of climatic temporal variations calculating different components of the time series accomplishes by different ways , least squares is the most important of these ways . For accomplish this process paying attention to these case is important : selecting a suitable model before the final selecting by the use of accuracy indexes , determining the changing limits of the time series component as random , and studying the condition and quality of the variations (determining the maximum and minimum of the variation limit of the series). The present research is compiled in direction of the rainfall random changes rate in Esfahan Province . To achieve the above goal , the average of monthly rainfall per thirty years (1971 _ 2000) eighteen stations of synoptic and climatology are chosen and they have studied . and the normal amount of any station is compared by Anderson _ darling method and tests other . And in the next period the several methods as Thumb method are used to ascertain the amount of seasonal changes in any station. To appoint the rain fall chronological changes, the multiple method in the from of movable average is used . The results of this resarch show that the most amount of random changes in rainfall are in the beginning of fall and then winter. the spring and the summer are in the next array . It is determined the winter season of Esfahan with decrease of rain average from west to east, the amount of variations of random rain is increased. the autumn and spring seasons of Esfahan with decrease the amount of rain from west to east the amount of variations in random rain is decreased and summer the irrregular of random rain variations from west to east are increased.

THE VARIATIONS MODELING OF IRAN TEMPERATURE BY USING FROM SEASONAL MODELS OF TIME SERIES

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The seasonal component is concerned with the periodic fluctuations in the series within each year. Such fluctuations form a relatively fixed pattern that tends to repeat year after year. The seasonal variations modeling are complex method in its mathematics. There are several methods for seasonal variations modeling. Three different methods the seasonal variations modeling is: simple averaging, moving average and least squares. In the seasonal variations analysis is so important updating. There are the several methods for updating. Therefore, it can be used from exponential smoothing with seasonal models or simple seasonal exponential smoothing (SSES) models. To modeling of seasonal variations must do processes of filtering, modeling, seasonal adjustment and seasonalization. These stages were considerate in the Iran temperature .For application simple seasonal exponential smoothing models temperature of Iran stations was studied. According to the seasonal changes all the temperature series of these stations and, also the seasonal variations of the temperature series of these stations was modeled.

AN APPROACH TO MAPPING SOIL EROSION BY WATER WITH APPLICATION TO ALBANIA

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The combination of the mountainous terrain of Albania and a seasonally wet Mediterranean climate has led to some of the most extreme erosion in Europe . New methodology is used in this work to estimate soil erosion risk and provide a framework for soil conservation that can effectively and economically control soil loss. A one-dimensional hydrology, vegetation and erosion model (RDI/CSEP) is used to calculate accumulative soil erosion. This model provides an integrating the climatic, topography and associated vegetation components into soil erosion modeling. The forecast runoff, accumulated across the frequency distribution of storms, is used to give a climatic potential, which is then appropriately combined with measures of topography and soil erodibility to estimate the expected rate of soil erosion at a resolution of 1 km .

Annual and monthly soil erosion maps of Albania are also developed in this research. The proposed approach for evolution and mapping soil erosion by

water uses existing soil maps, land use maps, a digital elevation model (1km), and interpolated climate data. The erosion maps clearly show that Albania is a country where erosion is a potentially severe. The annual erosion rates are estimated at 10 t ha⁻¹ y⁻¹ or more, especially in the south and center part of the country. In three areas (two in Gjirokastrë, and one in Sarandë) the annual erosion rate is more than 100 t ha⁻¹ y⁻¹. Erosion rates are highest in October, November, February and December and lowest in June and July.

ENVIRONMENTAL EFFECTS OF ENERGY USE AND CLIMATE CHANGE IN ALBANIA AND PUBLIC AWARENESS, EDUCATION AND TRAINING ON THESE ISSUES

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Most important environmental impacts caused by energy sources in Albania are climate change and acid rain – both of which have the origin in the combustion of fossil fuels and lead to global or trans-boundary effects.

The emission data for the national greenhouse gases represents that Albania has a relatively low level of CO₂ emissions per capita and high CO₂ emissions per GDP. The main source of CO₂ is energy sector with 69.95%. The main source of CH₄ emissions for Albania is agriculture sector with 77.74%. Moreover agriculture is the main source of N₂O emissions with 69.45%.

The climate change scenarios for Albania leads to an annual increase in temperature up to 1.0 °C, 1.8 °C and 3.6 °C respectively by 2025, 2050 and 2100 and a decrease in precipitation up to -3.8%, -6.1% and -12.5% by the same time horizons. Cloudiness would decrease from -2.6% up to -4.6% related to the 1990 year by 2050 and 2100 respectively. Wind speed is expected to increase up to 1.3 to 2.3% by 2050 and 2100 respectively related to the period 1961-1990, especially during summer because of the increase in the land-sea temperature contrast.

Another side effect of fossil fuels combustion and resulting emissions of pollutants is acid rain (or acid deposition). In Albania it effects forests as well as lakes and rivers, soil, buildings, human health. There are also some cases where acid rain may be produced naturally, which is also bad for the environment but occurs in much lower amounts and quantities than that of those found in urban areas. One of the major problems with acid rain is that it gets carried from a mass acid rain producing area to areas that are usually not as badly affected.

Beside greenhouse gases, SO₂ and NO_x emissions that cause acid rain, emissions of particulate matter contribute to bad air quality in Albania. Fuel combustion is the most important source of anthropogenic nitrogen oxides, while fuel combustion and evaporative emissions from motor vehicles are the main sources of anthropogenic volatile organic compounds (VOCs).

Despite the increasing public awareness regarding environmental issues in general, the issue of climate change in Albania is still relatively dormant, even the policy makers do not have a very good understanding of the climate changes, of the implications of expected climate changes, of the potential benefits of the response measures for mitigation and adaptation to climate change.

A similar situation relates to education and training on climate changes. The level of education is low for environmental education in general. The recent tendencies aim at including the environmental education into school curricula. Some progress has been achieved but to a very low extent and nothing is explicitly referred to climate change. Different projects run in Albania are steps forward in the process of building the institutional capacity for climate change issues.

PRECIPITATION AND POTENTIAL EVAPOTRANSPIRATION IN REPUBLIC OF MACEDONIA IN THE 21 ST CENTURY, AS A RESULT OF CLIMATE CHANGES

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The purposes of this paper are to describe predictions on the precipitation and potential evapotranspiration (such as water balance basic components which affect total water needs, soil moisture, surface and ground water, plants etc. and they are important components of climate changes during the 21 st century), for the following characteristic years: 2010, 2025, 2050, 2075 and 2100.

Investigations are performed for three sensitivities of climate changes: small, medium and great. The performed analyses refer to 6 climatic models of common atmospheric circulation as follows: HadCM2- scenario used by Hadley Center of the United Kingdom, UKTR-scenario and UKHI-EQ scenario which are used by the Meteorological Service of the United Kingdom, CSIRO1-EQ scenario and CSIRO2-EQ scenario which are used by Australian Scientific Investigation Institute, and CCC-EQ scenario which is used by Canadian Climatic Center.

Climate change predictions in the 21 st century are investigated for the following emission scenarios IS92a and IS92c (IPCC 1995).

During the investigation of climate changes in the 21 st century the climate models are used according to software package MAGICC SCENGEN (Hulme at all. 1995) as well as CD-MAGICC (version 2.4 dated 2000) published by IPCC (Second Assessment, 1996), by which precipitation and other parameters are analysed which are important for assessment of potential evapotranspiration e.g. mean monthly, annual, seasonal cloudiness mean maximum and minimum air temperatures, wind and air relative humidity. On the basis of the above-mentioned climatic elements, the values of potential evapotranspiration are assessed according to Penman-Monteith (FAO 56) method (Allen R. and all. 1998 and Smith 1996) which is combination of Penman's formula (1948) and modified formula by Monteith (1965). Index R/PET is defined according to the values of precipitation and potential evapotranspiration.

This index is applied and analysed for the first time for the territory of Republic of Macedonia and appropriate climatic and agroclimatic districting is made. The R/PET index is analysed using UNESCO classification, (Lozanovski P. and all. 2004) and the values interpreted by De Pauw et all.1999 are used.

The results of the investigation show that during the 21 st century in Republic of Macedonia significance changes of precipitation and potential evapotranspiration will happen which will reflect on climate aridity, droughts and desertification, surface and ground water, total water needs and all fields of human life (agriculture, forestry and biodiversity).

STOCHASTIC MODELING OF DYNAMICS OF DROUGHTS FOR THE PURPOSES OF LONG-TERM FORECASTING AND PREVENTION

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The drought represents the natural complex phenomenon described, first of all, by an extreme condition of a complex of meteorological parameters, resulting to significant ecological and economic losses. The alternation of these conditions in time has a random nature, as in their occurrence turbulent motion of various scale play a significant role. The reliable ways of the forecasts of droughts, as well as other meteorological phenomena, random image repeating in time, do not exist yet. Therefore study of legislation of their dynamics has the important scientific and practical interest.

By the purpose of work was the research of an opportunity to use a series of rules of the theory of random processes for the description of dynamics of regional droughts in Southeast region of Europe . Is established, that is not

observed of any steady tendency of natural character showing that in the neighborhood of region. On the basis of generalization of data droughty years for the period from 1891 to 2004 is shown, that the sequence of droughts in region can be described by Poisson distribution with the steady characteristics. It is marked, that the similar sequence of droughts in region results in a rather rigid mode of their influence, when the droughts follow one after another is most probable.

To estimate a degree of risk of manifestation of droughts, the system of parameters is developed and the system of estimations of risk is established. In particular, the time interval (t) is established, within the framework of which is guaranteed ($F(t)=0,95$) manifestation of a drought. Already within the limits of this interval of time of drought manifestation, the estimations of entropy were calculated. They have allowed to determine on which piece of the given time interval it is necessary to expect manifestation of drought. It has allowed essentially to narrow frameworks of uncertainty peculiar to the probable forecasts. The system of estimations of risk allows also to estimate probability of amplification of a drought, or its transition in qualitatively other conditions of humidifying (for example, drought in abnormal - damp conditions for the given region).

The similar estimations are used for the forecast of drought approach. Having the necessary information on scales of a loss, given by a drought, it is possible also to calculate scales of economic losses. The developed system of quantitative estimations of risk has as object a more effective utilization of the available information about droughts in the decision of a wide number of practical tasks, and also realization of the program of researches on creation of preliminary systems of the forecast and prevention of droughts.

CHARACTERISTIC OF RAIN AND RUNOFF IN THE EXPERIMENTAL HYDROLOGIC STATION " GAVANESHTIZA" FOR THE PERIOD 2002- 2004

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Climatic factors impact on the surface yield significantly. The impact of precipitation is the most tangible. In order to perform monitoring of the impact a hydrologic station was established in the scientific experimental hydrologic station "Gavaneshtiza". An on-going monitoring process started in 2002. The results of precipitations and surface yield measurement over the period 2002-2004 are presented in the article. The results are tentative due to the short term period of monitoring.

IMPACT OF CLIMATE CHANGE ON THE WATER LEVEL OF A SHALLOW LAKE IN EASTERN AUSTRIA

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In a project the impact of downscaled climate change scenarios on the water level regime of the Lake "Neusiedler See" in eastern Austria was investigated. The lake with a maximum water depth of 2 m and 360 km² area plays an important role for the tourism and microclimate of the vine region in the region east of Vienna and border region of Hungary. As the lake suffered from low water levels during the past decade, a plan for a channel from the Danube river will be evaluated.

The lake's water balance is dominated by precipitation by about 80% and therefore strongly dependent on precipitation and water evaporation in the coming decades. Climate scenarios for the 2020's and 2040's for the region show an increase of the temperature of 1.9 and 2.5 °C compared to the base period of 1961-1990, respectively. For precipitation a sensitivity analysis was carried out using slight increased and decreased levels, as the related uncertainty in the scenarios is relatively high. For the calculation of the water balance of the lake the hydrological regime was considered including water temperature and evaporation and transpiration of reed. The developed method was calibrated with measured water levels during the past 30 years. Using a weather generator, 500 years of daily weather data were generated for each scenario and statistics on water level changes were calculated finally.

The results show that the lake is very sensitive to changes in precipitation. A decrease of mean precipitation of 5-10 % will increase the probability of low water levels significantly under current temperature regime. Under the warmer climate of the 2020's and 2040's the probability of low water levels would increase significantly under unchanged precipitation regime due to an increase of potential evaporation of 15% and 23%, respectively. For example, the extreme case of a „drying out" of the lake would not happen under the climate of 1991-2004, although the lake was dried out several times already during the past centuries due to periodical decrease of precipitation. By a reduction of precipitation in the 2020's the lake would dry out in an statistical frequency of 71 years and in the 2040's of 25 years. A decreasing trend of precipitation is measured already during the past decades in the region. A potential increase of precipitation, however show reverse results.

COMPARISON OF SIMPLIFIED METHODS FOR DROUGHT YIELD LOSS DETECTION ON CROPS AND GRASSLAND IN AUSTRIA

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Precise recognizing of the direct and indirect effects of environmental constraints (as for example extreme temperatures or water shortage) plays an important role in agricultural production, particularly in plant production, and for optimising the efficiency of production techniques. Therefore, a lot of efforts are undertaken to develop practicable methods and techniques to optimise growth conditions and avoid any constraints such as drought stress in an early stage. In this context, agrometeorological models and operational advising plays an important role, where actual and representative information and measured data is an important basis. Field based methods or techniques can be used for scheduling and optimisation of production techniques such as irrigation on field scale. Only field based methods can estimate the specific local conditions with the necessary resolution in time and space for using the gathered information in adaptation measures for optimising growing conditions of crops. For the above mentioned reasons our project compares various drought estimation methods and their relation to crop yields (wheat, barley and maize) and permanent grassland biomass yield at the field scale at selected agricultural regions in Austria. The tested methods contain meteorological drought indices (Discrete and Cumulative Precipitation Anomalies (Foley, 1957), Rainfall Deciles (Gibbs and Maher, 1967), Rainfall Anomaly Index (Van Rooy, 1965), Standardized Precipitation Index (SPI), (McKee et al., 1993, 1995), Hydro-thermal indices (TI, KI), (Harlfinger and Kees (1999)), agrometeorological drought indices (Palmer Moisture Anomaly Index (Z index) and Palmer Drought Severity Index (PDSI), (Karl, 1986; Palmer, 1965), Crop Moisture Index (CMI), (Palmer, 1968), Crop Specific Drought Index (CSDI), (Meyer, 1993a,b)), a simple water balance model (FAO Method, (Allen et al., 1998)), remote sensing indices (Normalized Difference Vegetation Index (NDVI), (Kogan, 1995; Peters et al., 2002)). For grassland, a combination of the FAO model with a statistical yield model was tested on several sites and implemented in a GIS.

Meteorological indices, based mainly on only precipitation or temperature and precipitation did not correlate well ($R^2 < 0.30$) to yield depression of the investigated crops by drought when they were applied only for the main

growing period (3 month) of the crops. Through the application of agrometeorological methods or indices the correlation could be improved significantly ($R^2 > 0.30$), because they consider information about soil water storage capacity and crop status. The best correlation of $R^2 = 0.67$ (based on the year 2003 only) was found by using a relative available soil water depletion value from the simplified soil water balance model (FAO model), related to a 3 month main growing period. These results also disclose a high spatial variability of actual drought stress levels due to the high spatial variability of soil conditions, which are not considered by meteorological indices. Remote sensing indices showed a very good relationship to crop yield depression in 2003 at the field scale ($R^2 = 0.82$), whereby the adaptation to the most sensitive crop specific phenological phases is important. A combination of methods could further improve the results at the field scale, and improve the interpretation about the reasons of yield depressions (especially in distinguishing between the effects of high temperatures and drought stress). This was shown in the case of grassland, where the FAO model was combined with a statistical yield model.

ESTIMATION OF TOTAL SOLAR RADIATION RECEIVED ON HORIZONTAL SURFACE IN BULGARIA

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A review of the studies on total solar radiation incident on horizontal surface carried out in Bulgaria and abroad are done. Five methods for estimating daily sum of global radiation are re tested in the case study area (lowlands of Bulgaria). Applying the methods in the investigation, the results of total solar radiation estimations are compared to experimental measured data. The correlation coefficient and chi squared distribution χ^2 between measured data and estimated data indicate that the highest precision could be expected when sunshine duration is used as a predictor. The method generally known as the Angström –Prescott is found to be ultimately the best of all tested methods. Empirical coefficients "a" and "b" required by the selected Angström –Prescott formula are developed for the specifically climate conditions in Bulgaria. There are reliable estimates of the empirical coefficients "a" and "b" necessary for this equation, on the base of least squares method. The method is found to perform satisfactory for whole the year. The results developed in this paper will be used to estimate global solar radiation for locations where only sunshine records data are available.

The formulae which include cloud term and daily temperature range, yield not sufficiently precise estimates.

The most appropriate methods estimating the daily sum of total solar radiation received on horizontal surface in Sofia is selected.

The results of estimations are compared with the experimental data observed in the NIMH's observing system.

WEATHER NETWORK IN BULGARIA

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A weather network - its history, density, development, current status, problems, etc. – is an important classical basis for many researches and operational service in many sectors and fields such as weather forecast, climatology, hydrology, agriculture, transport, tourism, etc. The quality of weather data and their appropriate transmission from the weather stations to the data users are among the significant factors of first importance. For example, most long-term weather time series have been affected worldwide by a number of non-climatic factors that make these data unrepresentative of the actual climate variation occurring over time. These factors include changes in: instruments, observing practices, station locations, formulae used to calculate means and station environment.

This paper presents an overview of the structure and current status of the national weather network in Bulgaria maintained by the National Institute of Meteorology and Hydrology (NIMH). Nowadays, the NIMH weather network consists of: 41 synoptic stations working at a 24-hours regime; 102 climatic stations, where the observations are taken 3 times daily; 295 rain-gauge stations with a priority for measuring the precipitation total and type. At the synoptic stations the observations are consistent with the WMO (World Meteorological Organization) rules and recommendations. The climatic stations are using a Russian methodology. The rain-gauge stations collect also some important weather events such as storms, hail, frosts, etc.

Some problems which are facing the weather network in Bulgaria are also considered into the paper. Problems such as interruptions in weather data series due to various circumstances (e.g., changing the place of meteorological parks, difficulties in communications) are discussed. The decrease of the problems will provide better weather information for future research and operational weather service.

AN INTEGRATED APPROACH FOR EUROPEAN AIR POLLUTION ASSESSMENT

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The integrated approach for multi-pollutant multi-effect assessment of the European air quality is developed as a result of the project from the 5-th framework program of the EC, named MERLIN. For this purpose databases for different pollutants and measures for emissions restriction were created for different economic sectors of the European countries. Generation of these data for Bulgaria was the Bulgarian contribution to the project. A model system to determine the bundle of air pollution control measures, that is capable of achieving compliance with air quality limit and target values (for emission, concentrations and deposition) for specific pollutants at least-costs, was further created. Cost-benefit analysis is applied, taking into account macroeconomic effects and distributional impacts of pollution control strategies. As results, in support of decision making policy of the EC, are developed tools and methods to assess European air pollution control strategies and their efficiency to achieve air quality targets and impacts on economic indicators. In this work a brief description of the methodology used as well as some of the results, obtained during realization of a combined health and climate scenario, are presented.

PHENOLOGICAL DEVELOPMENT AS INDICATOR OF METEOROLOGICAL CONDITIONS

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Development of agricultural crops and forest trees depends from meteorological and agrometeorological conditions and dynamics of basic weather elements subject of daily observations. In the same time phenological phenomena of the mentioned types of agroecosystems depends from meteorological conditions and follow their motion.

On the base of phenological and meteorological elements observations authors provide investigations and find dependence between transitions of temperatures across 0, 5 and 10°C during spring and autumn seasons and connected with this zoning of temperatures and phenological development.

Some dependencies between termal conditions and stages of development are present.

WASTEWATER REUSE FOR IRRIGATION: AN ACCEPTABLE SOIL CONDITIONER?

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Drought climatic conditions occurring around the Mediterranean region and the Balkans, suggest serious consideration as to the reuse of treated effluents resulting from treatment of domestic effluents. Taking into account that about 70% of the total water resources are used for agricultural purposes and mainly irrigation, then a tremendous conservation of hydrological resources can occur. Using however non-conventional quality water for irrigation, presents a number of ecological and health risks and poses problems connected with soil and ground water contamination. This paper concentrates in the general evaluation of the effects of these effluents on soils and investigates their consequent organic enrichment.

IRRIGATION EFFECTS IN PLANT PRODUCTION IN SERBIA AND MONTENEGRO

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Irrigation contributes to increased agricultural yields and production volume and intensified agricultural production. Field crops double their yields in irrigation. Production value of irrigated field crops is increased 2.06 times compared with dry farming. Profit per hectare of irrigated field crops is increased 2.01 times. The economy of field crop production increases from 1.03 in dry farming to 1.18 in irrigation. Profitability of field crop production increases from 3% in dry farming to 18.4% in irrigation.

Productivity of production of irrigated field crops increases 1.6 times for wheat, 2.4 times for corn, 1.9 times for sugarbeet, 2.4 times for sunflower and 2.7 times for soybean (yield/work hour).

High economy of production is achieved in vegetable production, amounting to 2. Profitability is increased by 75%. Profit per hectare of irrigated vegetable crops exceeds that of irrigated field crops.

Investments in irrigation result in higher volume and quality of food production, more economic and profitable production, and higher incomes and profits.

Irrigation has a decisive impact on yield performance, production and economic results and further development of market-oriented, certified organic production of high quality produce.

CLIMATE AND AIR POLLUTION MONITORING IN TWO FOREST ECOSYSTEMS IN BULGARIA

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The relationship between month and daily mean concentrations of ozone and NO_x were established. Month values of ozone dose (AOT40 values) for the vegetation period as well as the short-term ozone episodes and some climatic factors (air temperature and humidity, global radiation) and NO_x concentrations is established with direct reference to ICP-forest data. The monitoring of air pollution is carried out in two forest ecosystems: Vitinia and Jundola. The values of the correlation coefficients in Pearson correlation matrixes are used as the basis of an estimation of the variability in these relations. There was not clear trend between month mean ozone concentrations and global radiation. The coefficient values for the air temperature increased along with the month means of these parameters. Daily means of the temperature and NO_x concentrations are in a good correlation with the short-term ozone means during the summer months. The tendencies established are explained in relation to climate peculiarities in two forest ecosystems during the different parts of the vegetation season.

PLANKTON COMPOSITION OF PALICS AND LUDAS ALKALINE LAKES IN SERBIA AND MONTENEGRO

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The research of plankton in waters of two alkaline lakes Palics and Ludas has been carried out in the course of 2003 and 2005. The blooming of toxic cyanobacteria *Microcystis aeruginosa* was prominent in both lakes, causing an impact on plankton composition and ecosystem functioning. According to the number of heterotrophic bacteria and phosphatase enzyme activity of water, natural remediation of lakes was observed. However, the results pointed out bad ecological status of Palics and Ludas lakes.

TOPIC 2: HYDROLOGICAL REGIMES AND WATER BALANCES

WATER BALANCE AND HYDROLOGICAL REGIMES IN THE CENTRAL PART OF THE BALKAN PENINSULA

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Hydrological knowledge about the Balkan Peninsula have been achieved with regard to the types of considered parameters and the periods of study in varying levels. For the central part of the Balkan Peninsula, for purpose of preparation, water resource master plans and hydrological studies, were done. This plans were done with applying common methodology for period of 1946-1991. This paper will present results from these studies in sense of water balance and interpretation of the hydrological regimes of major rivers.

Special reference will be made to the study of the forming rivers flows and the identification of areas with different values of water availability in the considered territory. Basic regional dependence will be established for basic characteristics of average flow, low flow and high flow regimes.

A STUDY OF WATER BALANCES OVER TIGRIS-EUPHRATES WATERSHED

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In order to establish a basin-wide water management plan for the Tigris-Euphrates (TE) watershed, which covers 967,000 sqkm area, it is necessary to perform rigorous water balance studies of the whole watershed at least for critical historical drought and flood conditions, and under various water resources development scenarios. Performance of such water balance studies over the watershed requires climatic and hydrologic data sets, corresponding to historical critical dry and wet periods, at fine time and spatial grid resolutions. In the accompanying paper (Kavvas et al, "A regional hydroclimate model for Tigris-Euphrates watershed, RegHCM-TE: Reconstruction of historical hydroclimatic data over the watershed"), the reconstruction of the historical climatic and hydrologic datasets over the Tigris-Euphrates watershed by means of a Regional Hydroclimate model, RegHCM-TE, is described. Besides the climatic and hydrologic data sets, for the performance of water balance studies over this watershed, the irrigation

water demands (by far the most significant consumer of water resources in this watershed is irrigation activities) under various water resources development scenarios need to be estimated. Then, corresponding to each specified water resources development scenario, the water resources system of the watershed needs to be operated in order to quantify the dynamical water balances under the hydroclimatic conditions of the historical critical dry and wet periods.

Within this framework, the irrigation water demands under various water resources development scenarios were estimated by means of the vegetation patterns that correspond to specific water resources development scenarios, and of the hydroclimatic conditions that correspond to the historical dry and wet critical periods. In order to compute the dynamical water balances within the watershed under various water resources development scenarios, a computer model for the operation of the system of reservoirs within the watershed was developed and utilized (along with the streamflow routing model, described in the accompanying paper). Within this dynamical water balance modeling framework, it is possible to assess and quantify the effect of sequential river flows on the chronologically sequential water balances over the whole Tigris-Euphrates watershed.

In the paper, the irrigation water demand computations, the water resources system reservoir operation model, and the water balance studies under various water resources development and hydroclimatic conditions will be presented.

IDENTIFICATION OF THE QUANTITY IMPACT OF THE PRECIPITATION AND WATER LEVEL IN THE KARSTIC POLJES ON THE BREGAVA RIVER FLOW REGIME IN HERZEGOVINA

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The Bregava River drains the catchments area part of East Herzegovina, from Mt. Ćemerno to Neretva River basin. In essence, the water originating from precipitation flows through the karst polje, via a system of karst plains (Gatačko, Lukavsko, Dabarsko and Fatničko), to the Bregava karstic springs and the channel of the Bregava River. The paper presents the assesment of the quantity impact of the precipitation and water level in the karstic poljes on the Bregava river flow regime in Herzegovina.

TUNDJA RIVER BASIN – HYDROLOGICAL ASSESSMENT FOR THE 1961-2002 STUDY PERIOD

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The evaluation of the water resources in Tundja river basin is performed. The Tundja River is located in Central South part of Bulgaria. The 1961-2002 study period is executed. Data from the existing river stations along the main river body and its main tributaries are evaluated. Selected rain-gaining stations in the drainage area are taken into consideration during the analysis. The main river is characterized with disturbances from anthropogeneous characters – reservoirs (Konrinka and Jrebchevo Reservoirs) and irrigation works. The water resources for natural or near to natural conditions are estimated and natural flow generation was performed. The objects of assessment are time series with multi-annual, minimum monthly and annual maximum river discharges. The theoretical approximation of the empirical distribution functions for multi-annual, minimum monthly and annual maximum flow is performed. Some obtained results will be presented and discussed.

LONG-TERM VARIATIONS OF PALMER'S WATER BALANCE COMPONENTS OVER CROATIA

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In Palmer's water balance equation following variables: precipitation amount (p), real and potential evapotranspiration (E and PET respectively), recharge into the soil (f), loss of wetness from the soil, content of the moisture in the soil (S) and finally runoff (RO), are considered. Monthly values of all components have been calculated for 24 weather stations of Croatia for period 1951-2000. Twenty-five moving averages have been applied on time series obtained as well as principal component analysis. Finally, time-space variations of Palmer's calculated water balance components have been compared with variations of observed river discharge for a number of locations.

MORPHOLOGICAL VARIATIONS OF A TIGRIS RIVER REACH FOR DIFFERENT PERIODS IN IRAQ

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Many morphological variations occurs in the rivers paths due to many reasons such as the hydraulic changes in the natural flow regime of rivers in-addition to the human activities on rivers such as dams constructions on rivers. Many morphological variations created on Tigris river reach within Mosul city, north Iraq for different periods between 1956 to 2002 had been studied such as observation the changes on the river width specially near the bridges sites and also the development of the dimensions of the sediment islands within the river reach. The available topographic maps and an aerial photographs were depended in the data analysis with some field reconnaissance .

The research work concluded that one of the main reasons for the development of the Islands is the flow regime variation of Tigris river as a result of the Mosul dam operation which in-turn leded to a reduction in the transported sediment load in the reach due to the released water discharges from Mosul dam clear of sediment having high stream power. The second reason was the reduction in the water level which in-turn developed the middle and side islands in the river with the growing vegetation cover such as trees and weeds specially in the sites downstream the meander of Al-Rashidia Village and downstream Al-Shuhadaa bridge and upstream Ninevah bridge and finally upstream the fourth bridge in Mosul city.

IMPACTS OF FORESTATION AND LAND USE ON WATER BALANCE AND LOW FLOWS IN NORTHWEST GERMANY

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The extensive transformation of North Germany's heath into forests and agricultural lands since 1860 had a strong influence on the water balance of the Lunenburg Heath (Lüneburger Heide). Within a hundred years, forest areas, mostly planted with pine trees, increased from about 15 to more than 30 percent of the total area. Due to interception and transpiration by trees, the water consumption of forests is significantly higher than that of cultivated and fallow lands, causing a reduction of groundwater recharge and runoff formation. Time series analysis of water levels recorded since 1888 at the gauging station of Bienenbüttel, Ilmenau River, revealed a decreasing

tendency of discharges since the beginning of the 20th century, significantly correlated with the growth of forest areas. Particular impact was found on low flows and flows during the summer season.

Since about 1960 forest areas remained practically unchanged. However, a further reduction of baseflow and low flows continued due to increasing groundwater abstractions mainly for sprinkler irrigation purposes.

The analysis of the historical time series of water level records allowed the identification of changes in the water balance. While the average annual precipitation of about 700 mm remained unchanged, average annual runoff height of the Ilmenau basin decreased from about 260 mm to less than 190 mm within a hundred years. About 40 mm of this reduction were caused by forest development while 30 mm were due to groundwater abstraction. Groundwater recharge and runoff of forest areas with about 75 % of conifers was determined to 60 to 100 mm while non-forested areas yielded about 300 mm. The effective water consumption of forests was even significantly higher than that of sprinkler irrigated fields. A further forestation would thus reduce groundwater recharge and low flows in the rivers. A change from pines and spruces to deciduous trees would moderate this effect.

WATER BALANCE IN SLOVENIA 1971 – 2000

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The water is becoming more and more valuable natural resource. Also in the regions of Slovenia . The increasing water demand and climate changes are making water a precious and not always available resource. For the purpose of knowing more about water cycle in Slovenia , about hydrological characteristics of drainage basins, precipitation and evaporation, the water balance is the most appropriate way to make a full overview. The article presents the methodology and the results of the Water balance project of Slovenia .

The geographical position of Slovenia is the juncture of 4 main European georegions: The Alps, the Panonian Basin , the Mediteranean and the Dinaric Mountains , and this is what makes the territory very diverse also from a hydrological point of view. Our major watershed divides the precipitation runoff into two watershed areas – the Adriatic Sea and the Black Sea . Due to this watershed almost all the Slovenia 's rivers have headwaters in our territory.

The first water balance for the area of Slovenia was published in 1998 for the period 1961 – 1990. The project based on traditional research methods, with

less accurate data and subjective interpretations by the authors of water balance. Therefore, in the Environmental agency of the Republic of Slovenia , we continue the water cycle research. Our goal is to improve the methodology of previous water balance, to support it with GIS and statistical tools and to make more objective, unbiased, complex and detailed research in all the main fields relating the elements of the water balance.

The project Water balance of Slovenia was started in 2004 and is our attempt of creating an integrated set of data files and models in GIS format that can be used to characterize the water balance of the Slovenia and its major water balance elements. The basic elements of the water balance include all the inflows and outflows for a given basin and serve for the computation of the water regime of a catchment area. It is defined by the parameters precipitation (P), evaporation (E), discharge (Q) and the change of the water reserves (ΔS). The long-term (1971-2000) water balance will serve as a model for building more sophisticated GIS and relational database (RDB) based yearly water balances that are required for yearly evaluations of water deficit or deficit on national level, for refining the (regional) hydrogeographical knowledge and also for the reporting purposes to EEA and EU Commission.

The results of the Water Balance project can be, due to the complexity of the project, divided into two major parts. The methodological part is presenting the acquired methodology and the solutions of the specific hydrogeographical problems (precipitation, land cover, watersheds, etc). The second, the content part, is presenting the research results for the new period 1971-2000, ending with the main explanations and cartographic presentations of the water balance (precipitation, evaporation, discharge) of Slovenia .

VARIABILITY OF EXTREMES OF ANNUAL RUN OFF OF THE SMALL RIVERS IN THE TERRITORY OF MOLDOVA

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The problem of rational use of water resources is the extremely important for all countries of the world. In the long term, in process of the further development of a human community, the actuality of this problem will grow and, moreover, get global character. As to Republic of Moldova , this problem is incomparable more significant. Comparative limitation of water resources, fast growth of need in water make the given problem especially urgent for Moldova . In this connection researches according to regularities of dynamics of a river run off and the development on this basis of models for their description can play certain effect for its forecast and can play the important

role in a prediction of a complete picture of functioning of all system in the future.

On the basis of the statistical analysis given about extremes of run off of the small rivers of Moldova , represented as a sequence of events, is experimentally shown, that dynamics of extremes of annual run off can be considered as random processe. The distribution of Poisson with the λ parameter was used as the main model 1 to descript their dynamic. The system of statistical parameters and their stability in time is appreciated. Some change of average number (λ 1/year) of run off extremes of the small rivers is marked in connection with observable changes of a climate, and also anthropogenous regulation of a run off and use of water for economic needs. However as a first approximation sequence of exstremes of a run off the small rivers can be examined as stationary. This that allows to use the estimated parameters of models for forecast. The attempt of developement of the forecast of extremes of rivers run off based on a hypothesis of the greenhouse.effect is also undertaken. The forecasts, on the basis of two modelling experiments (HadCM2 and HadCM3), have shown, that up to middle 21 centuries the expected changes of a regional climate will not entail essential changes a mode of small rivers run off.

It is considered, that the developed models and their numerical characteristics can find application as in forecasting dynamics of run off in the territory of Moldova , but also to develop of the plans of complex use both protection of water resources and development of methods of accounts of a river run off for the various economic purposes.

PROBABILITY ESTIMATION OF WATER SUPPLY RELIABILITY ASSESSMENTS

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Water resource balances (WRB) are a basic tool, used for technical and economical feasibility estimation of the water resource systems and for assessment of their adequacy to meet the demands. Particularly they are used in run-off regulation methods, reservoirs water release planning and supply reliability assessments.

The main problem with WRB is the irregularity and time variation of the run-off. They have seasonal and in great measure random character. In addition irregular cyclic variation is typical for the yearly run-off volumes with succession of dry and wet periods.

In calculation of WRB with PC and imitation models the run-off is represented by long enough multi-annual time series of its monthly volumes at the water intake points. These time series are composed of their measured in a past

period or modeled values. In the latter case the modeling is done on the basis of the measured series. Using modeled series could be considered as a more adequate assumption of the run off as a stochastic phenomenon, because the totality of the variations is greater and richer.

The WRB calculation releases the necessary volume of a designed reservoir for meeting the demand with the required normative reliability, the actual percentage of the supply reliability from existing water systems, and other assessments. All these are mean statistic values and are valid for the whole range of the run-off variations, taken into account in the WRB calculation. But the water resource system will be functioning in much shorter period than the used time series, especially when they are very long, obtained by models. The mean hydrological values for that period could be rather different than the ones related to the general representation of the run-off.

It is then important to estimate the probability of accomplishment of the value of full supply reliability, assessed by WRB on the basis of the run-off general representation, during the limited period of the facility functioning. Also it could be calculated the expected demand satisfaction (full supply) reliability during the same period. Depending on the occurred in the period run-off character that reliability could vary between some minimal percentage and 100%.

In the paper it is shown a method, developed for estimation of the following probability characteristics, related to that limited period:

probability of accomplishment of the supply reliability, assessed by WRB over the represented by time series general run-off;

the maximum probability of exceedance of maximum (100%) full supply reliability;

the minimum full supply reliability with maximum (100%) probability.

All these values have practical importance for decision making when planning and governing water resource systems.

INVESTIGATION OF CHANGES IN THE BACKGROUND FACTORS OF RIVER INFLUENCED SUBSURFACE WATERS

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Located in the northwestern region of Hungary and also stretching into Slovakia, Kisalföld is split into two by the river Danube that marks the boundary between the two countries. Along the river Danube there are two smaller landscapes with specific features – Szigetköz on the right bank in Hungary and Csallóköz on the left bank in Slovakia. The diversion of the river Danube in 1992 had an effect on both subsurface waters and overland flow.

The diversion of the river Danube brought about changes in the conditions of surface runoff. It also considerably altered the relations between surface and subsurface waters. The natural and annually recurring flooding of the areas along the river Danube (former floodplains and active floodplains) has ceased and is now confined to periods of significant flood waves or artificially generated surges. Indubitably, these changes have also affected local biocoenoses.

These interventions, of course, had an influence on subsurface waters as well, especially in terms of ground-water levels. Due to the modifications in the former course of recharge, the ground-water levels in the Szigetköz area have become a function of not only the amount of water entering the river Danube but also precipitation. Thus, the background factors that influence the ground-water regime have seriously altered. To identify these background factors and their roles we consider the application of mathematical methods essential.

It is not evident how the effect of water extraction – which, in our case, is the diversion of the river Danube – can be determined, especially if the randomly varying nature of water supply from precipitation is taken into account. It is water-level fluctuations that make the identification of latent background factors possible. The traditionally applied statistical tool for this is factor analysis. Since factor analysis is a method designed for independent observations we have to apply dynamic factor analysis instead as the dynamic structure of water-level time series has to be taken into consideration.

In the area of investigation, in Szigetköz, the diversion of the river Danube and infiltration are the background factors that control water-level time series. These factors are definable and their weight coefficients represent intensities. The strength of the effect can be calculated for the observation points and thus its spatial distribution can also be determined.

BUILDING BASIC CONCLUSIONS USING DATA DISTRIBUTION OF MEASURED AND FORECASTED ELEMENTS, RELATED TO WATER STAGE OVER THE AREA OF THE RIVER VARDAR BASIN

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We choose to examine the region of the river Vardar basin, according to the importance of water resources and the fact that it is the biggest basin in our country.

These are the results of the space distributions analysis in intention to estimate the interdependence between: measured precipitation real data, forecasted precipitation data from the global numerical model (or data from our meso-scale prognostic model), content of the moisture in the soil and measured water stage.

Keeping things together we can organise a large number of conclusions to:

- Inform the target groups, through building and resending automatically generated text, graphical and multimedia outputs.
- Define thresholds in different seasons, or different synoptic or hydrologic situations.

A created set of procedures should be added as one everyday activity in our service, in intention to improve informing activities (printed and electronic media).

Data obtained from the global prognostic model are not so reliable (the resolution of the model is not enough for such small region), but we hope that the method will be reusable for data with better quality in a near future.

In this moment we use daily data from the hydrological reporting stations network of our hydro-meteorological service. The big step forward is to use near real-time data from one or more automatic water stations.

DEVELOPMENT OF WATER BALANCES OF A BULGARIAN RIVER BASIN WITH VARIOUS MATHEMATICAL MODELS

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Results of studies on water balances of a Bulgarian river basin carried out within the framework of the project "Nutrient Management in the Danube Basin and its Impact on the Black Sea " (daNUbs), funded under the 5 th EU Framework Programme for research and technological development are considered. The objective of this paper is to present results for the runoff constituent distributions of the Lesnovska River basin developed through four mathematical models and to make comparison between these distributions. Two watershed scale models were applied, the physically based dynamic model with distributed parameters SWAT 2000 and the static model MONERIS as well as two runoff separation models, the DIFGA 2000 model and a model based on a filter technique used in signal analysis and processing.

The first two models are based on GIS. The total area of the Lesnovska River watershed is 1100 km² . The Lesnovska River is a third order Danubian tributary – it mouths into the Iskar River and the Iskar River discharges its waters into the Danube River . The watershed under consideration is characterized with territorial heterogeneity, consisting in extended plain and slanting and steep slopes with elevations varying between 509.5 m and 1685.7 m above sea level. The land cover of this watershed is dominated by agricultural area (52.5 %), followed by forest (38.5 %), grassland (6.2 %), urban (2.4 %) and water area (0.4 %), including a reservoir with storage of water amounts up to 35.4 Million m³ .

The direct comparison between the individual components of the runoff obtained by the four models was not possible because of the different conceptualization of the streamflow, different ways for modeling of its components and their different physical meaning and for this reason a method for such comparing was developed. The results of the comparison are presented in the paper.

LOW FLOW ESTIMATION FOR SEVERAL DURATIONS AND RETURN DURATIONS AND RETURN PERIODS USING MEAN ANNUAL FLOW DISTRIBUTION

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The characteristics of low flow, in Timis-Bega hydrographic area, are presented in this paper.

The low flow analysis will be done using the flow-duration-frequency (QdF) modeling, establishing for each analyzed sub-basin a local modeling associated to a Weibull Law with two parameters.

Local modeling requires the knowledge of two local descriptors: the characteristic duration of the low flow D_e and the median value of annual daily minima quantile .

Based on these models, a dimensionless regional model for low flow was established.

On other hand, the theoretical distribution of mean annual discharges was drawn for each hydrographic basin analyzed using Weibull Law with two parameters, too.

Theoretical distribution comparison of dimensionless regional models corresponding to low and mean flow shows that these are almost identical.

Thus a low flow estimation for several durations and mean return periods was tested, based on mean flow characteristics.

The utilization of this method to the ungauged sites supposes the knowledge of two parameters of Weibull regional distribution corresponding to annual mean discharges, as well as an estimation of two local descriptors of low flow based on the river basin characteristics.

TOPIC 3: DROUGHTS AND FLOODS

**CONSTRUCTION OF DROUGHT EARLY DETECTION SYSTEM IN I.R.OF
IRAN USING NDVI FROM NOAA/AVHRR DATA**

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In This paper we use the changes of up-to-date and normal Normalized Deference of Vegetation Index (NDVI) from NOAA satellite's images in AVHRR format for detecting and monitoring drought effects on agriculture. Ideally, for detecting and monitoring drought, cloud-free satellite data are required. Therefore, to minimize the cloud effect, the largest NDVI value of every pixel is used for the daily, weekly and 10-day images. However, even using this method, we found that there are too many cloudy cover areas in the daily and weekly images, which makes it difficult to detect drought effects on agriculture using these data. On the other hand, monthly data are averaged over a period that is too long to describe the development of vegetation because morphological changes and leaf appearances occur in a shorter period. Therefore, in this work, the detection and monitoring of drought effects on each 10-day interval are discussed. The standard NDVI images are created first. Then, the up-to-date NDVI is calculated just after the 10 days and cloud pixels are masked for elimination. And then, the difference NDVI images between the standard and up-to-date NDVI images are calculated. Lastly, using the difference NDVI image, it is possible to detect the area and intensity of drought damage on agriculture. The bigger negative difference pixels are listed as drought areas, and the values of difference NDVI show the intensities of the drought damages.

In this research, using the changes of up-to-date and normal NDVI from NOAA/AVHRR data, an early detection system for drought is developed. The standard NDVI images are created using NOAA/AVHRR data in 1997–99. The drought risk maps are created. The drought risk maps in I.R. of Iran in 2000 are discussed as the example. Compiling the analyses of characteristics of NDVI graph and meteorological precipitation data, the drought effects on agriculture in 2000 are detected and monitored successful. It is shown that this system is possible and useful to detect the drought area and intensity on agriculture.

**CONSTRUCTION OF A FLOOD RISK MANAGEMENT SYSTEM IN A
WATERSHED BY USING STATISTICAL MODELS(CASE STUDY :
KARDEH WATERSHED)**

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By occurrence of climate change phenomenon and increasing of human's interference on global climate, two natural disasters such as drought and flood have effected on different parts of the earth. In the recent years, our country was alternatively witness in occurring of floods and sever droughts in most of places, specially twice occurring of these natural disasters, improve each other as because of severe droughts, vegetative coverage and humidity of soil are spoiled that is facilitation agent for flowing destructive floods. On the other hand, occurring of severe floods have caused destroyed of agricultural lands and lynching fertile soils and has amplified the effective of drought in these places. In a watershed which has high submergible potential, with a alternative and correct management, we can reduce the effects and damages of flood and use of it for increasing of water potential in this place, for example increasing of soil moisture and discharging of aquifer and increasing of water resources of lake of dams. For succession in these actions, an alternative and optimum flood risk management in that watershed is necessary. Kardeh watershed is located near of Mashhad, and it is considered as a case study. The risk of flown floods in this basin is modulated with three flowing types of statistical models: 1) probability Distribution Function, 2) Linear Regressive Model, 3) Auto Regressive Independent moving Average (ARIMA) Models.

According the results of models testing, Probability Distribution Function couldn't be able to model the floods risk in basin. Regressive Model doesn't offer acceptable responses because it obeys from one general trend. ARIMA Time Series Models are tested in difference stages and finally, ARIMA (1,2,3) Model offer the best statistical fitness. According the conclusion from this research, by using of three statistical models, we can get a fit model for flood risk management for (Kardeh) basin, that It is usable into practical and conclusion of this research is expansible and usable for the other similar watershed basin.

ASSESSMENT OF DRYLANDS OF THE REPUBLIC OF MOLDOVA

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The most part of the territory of Moldova is situated in semi-arid zone with a frequent drought phenomenon. The national economy suffers from the droughts which affect the agricultural production activity, water supplies and biodiversity. In some years droughts provides a catastrophic consequences and economical loses.

The analysis of multiannual data of the Hidrometeo Services regarding drought phenomena for the period of 1890-2004 demonstrates that frequency of drought periods of different intensity have been observed during the 16 years of the 110 years period (1 per 6-7 years). The hydrotemic coefficient (by T. Seleaninov) for vegetation period 0,6 and less, have been used during the determination of the intensity of droughts. During the assessed period there was observed a 20 years period with conditions that are similar to droughts. A total period of drought effects consist 36 years (1/per 3 years). In the last 10years period droughts phenomena were observed more frequent at the territory of Moldova, and droughts demonstrate a more intensive character. In the period from 1990 to 2004 the territory of the country were affected by droughts in 10 years with different intensity.

In accordance with the international classification (UNEP), arid zones are determined by the proportion between the sums of precipitations amounts and the potential of evapo-transpiration. Using this indicator, we provided an assessment of intensity of dryland capacity of the territory of the Republic of Moldova. It is known that the information about transpiration could be obtained by direct measurements methods as well as accounting methods. To be mentioned that there are a lot of accounting methods which determines the veracity of the land dryness capacity indicators. Our data demonstrate that the most veridical data were obtained by accounting methods by E. Olidecop, M. Budirco, I. Ivanov, and were used by us in the dryland assessment of the territory.

According to the calculations made the three zones of aridity with different level of land dryness in the country were identified. The most arid conditions were observed in the South part of the country (semi-arid and dry-subhumid lands). The most favorable conditions of humidity were observed in the Northern part of the country and in the Codru zone – the territory with the humid-subhumid and humid lands. It is considered necessary to take into consideration these differences of conditions of dryness's capacity of the

territory of Moldova when applying methods for combating droughts and land degradation processes (desertification).

In this context we consider important developing the following activities:

- Establishment of the Drought Monitoring Center;
- Elaboration of unified methods and criteria for an assessment of atmospheric and soil dryness and their early diagnostic (intensity, duration, area of extension etc.);
- Ensuring with necessary information of consumers of the operative and regular information at different levels (maps, tables, graphics etc.);
- Determination of droughts development regularity in the region in conditions of global climate changes on the base of accumulation of new experimental data;
- Assessment of climate dryness and determination of areas of drylands in the countries-participants;
- Elaboration of recommendations for the adaptation of economics of countries from Region as well as the public vital activities to droughts and drought phenomena;
- Identification of criteria and ways for early warning (forecast) of drought phenomena and droughts;
- Elaboration of annual analytic overview of drought effects and droughts with assessment of consequences and damages for countries-participants.

FLOODS IN UPPER VARDAR RIVER BASIN

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Major watersheds in the Republic of Macedonia are Vardar (Aegean Sea), Crn Drim (Adriatic Sea) and Strumica (Black sea). The largest one is Vardar River basin that occupies over 80% of the total area of the country. This river basin is divided into the following sub-basins: Upper Vardar, Treska, Crna, Middle Vardar, Pchinja, Bregalnica and Lower Vardar. The Upper Vardar river basin covers the area of 1489 km². Monitoring of the hydrological parameters in this watershed is performed with the stations: Radusa (1949), Jegunovce

(1969), Sarakinci (1938), Balin Dol and Vrutok (1945). For monitoring of climatic meteorological parameters have been established one climatic station at Popova Sapka, and two regular meteorological stations at Tetovo and Gostivar. Besides this there are 13 rain gages located on elevation 380-1500 m a.s.l.

Recently the lower part of this watershed (villages Tudence, Kopance, Jegunovce) had been flooded frequently. Because of this a technical documentation of river channel regulation has started to evaluate. As a basic data of this documentation are the results from hydrological analysis. The catchment characteristics have been obtained by DTM (Digital Terrain Model). This paper will present the characteristic discharges that have been obtained within this analysis, as well as the calibration results of the hydraulic model for steady and unsteady flow simulation in the natural river channel. The focus will be paid to the estimated floods with different return period on the basis of historical data on monthly discharges for the period of 50 years.

TOWARDS LONG RANGE FORECAST OF THE NILE FLOOD

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Investigations have been made to correlate Sea Surface Temperature (SST) fields over Indian, Pacific and Atlantic oceans with the total Natural flow of the river Nile at Aswan. Sea surface Temperature (SST) over six different regions have been found to be correlated with the total natural flow of Nile at Aswan throughout the years . Also, a multiple regression model has been developed to forecast the total natural flow of the river at Aswan. The coefficient of correlation between actual and estimated values of natural flow has been found as 0.87. The validity of the prediction using statistical model has been done using two different methods. The results were statistically significant at 95%.

WATER INDUCED HAZARDS VULNERABILITY AND MITIGATION: TOWARDS PROMOTING PREVENTION CULTURE

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Hazards are extreme events. But disasters pose potential risks to damage . Despite the progress made by global communities in reducing the impacts of and deaths caused by natural disasters, damage continues towards not only the hazard potential but also the vulnerability of societies. Human and material losses from natural disasters are on the increase worldwide: since the 1960s the global economic cost of disasters has increased by more than 800 %. Given the growing long-term vulnerability of people living in high-risk regions like India, rising prosperity and the cumulative effects, this trend is expected to continue.

Environmental change and natural disasters are linked. Climatic variability and related extreme weather events having particularly severe impacts on India are likely to increase. At the same time economic marginalization and population shifts towards more risk prone zones will increase people's vulnerability to extreme events such as cyclones, coastline flooding, droughts and river floods together with earthquake vulnerability. Poor people tend to live in high-risk zones and large cities are often not adequately prepared to deal with such events. Increasing attention therefore needs to be given to the vulnerability of metropolitan cities and their infrastructure. A concept is promoted that makes disaster reduction an integral part of sustainable development and links efforts to reduce poor community vulnerability and promote local resilience with efforts to manage natural resources.

Improve the capacity of the social and physical sciences to undertake regional monitoring of the human aspects of disaster reduction. Integrating a Prediction of Ungauged Basins (PUB) monitoring system with the well-established observation systems in the Himalayan region will generate a new dimension of predictive data giving input to decision-makers in reducing vulnerability. There is need to promote the development of satellite technology applications and ground-based observation, with special emphasis on incorporating such data more effectively into mapping and geographic information systems. Disaster prevention could be achieved by encouraging greater awareness and networking through capacity-building and strengthening networks of stakeholders together with improving government policies and programmes for disaster reduction on short and long term basis.

THE CODING OF RIVER SYSTEMS AND BASIN MANAGEMENT HYDROLOGICAL RISKS IN SIBERIA

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As a result of thirty-years research a theoretical basis of basin approach to the study of interaction processes between the environment and society and to nature use and to water use first of all has been established. The basis uses the hydro-geomorphological, eco-biospheric, historical-ethnical, socio-economical and geopolitical approach. A method of basin division into districts and cartography has been developed.

An important advantage of the basin method is an opportunity to use structural parameters of different systems, determined according to Horton-Staler diagram. On this basis a system of rivers and basins encoding, including 13 classes (ocean, parts of the world, sea, country, basins of nine grades) has been developed. Encoding of the whole territory of all planet has been carried out.

Considering the basin management in national and international basins the nature and water resources management scheme improvement implying the basin principle has been developed. Some practical recommendations for a number of Ost Siberian basins are given (Ob-Irtysh, Angara, Lake Baikal). Basin conception plays important role in hydrological risks management. There was drew up an inventory of 15 basic hydrological risks in 17 macrobasins in Siberian area and valuation of every risk and their total combination. Risk was estimated with 5 point scale by following indicators: prevalence, recurrence, predictability, damage value, possibility of protection. The districts-basins with greatest risks and the risk priority in every basin were revealed.

PREVENTION OF DISASTERS RELATED TO WATER IN JAPAN

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Generally speaking, water is rich in Japan . Sometimes excessive water, that is to say a flood, washes away many houses and infrastructures . On the contrary, shortage of water appears somewhere in Japan , then damages agriculture and population. In the full text, water-related disaster occurring in Japan , namely a flood, storm surges, tsunami, droughts, pollution and excessive withdrawal of groundwater will be discussed in the historical viewpoint.

Japan islands are located at the east of Asia , clinging to the continent like a festoon. The tectonics around Japan is very complicated with dense swarms of conspicuous earthquakes and violent volcanoes. Mountains are high, and the land is narrow, then all rivers are steep. Precipitation is much all over Japan . There are three rainy seasons in a year. The annual average precipitation is about 1800mm. Debris flows and heavy sediment transports usually occur from high lands during the period of heavy rainfall.

Consequently alluvial fans and alluvial plains have quickly grown up by floods and sediment transports. In old days people lived on natural levees in alluvial plains and made rice fields in back marshes. But such cultivation was fragile. High continuous levees were completed only in recent years by the government. It also has constructed diversions and cut-off channels to reduce water levels during the periods of floods. Therefore flood risk is much reduced and quality of rice is remarkably upgraded.

Recently, weakness of urban life is pointed out due to quick and wide spread of inundation water in city areas. It is stressed that increase of runoff due to urbanization should be minimized. Japan suffers from huge typhoons every year. They bring strong wind and heavy rainfall. Strong wind not only damages structures on the ground but also produces storm surges at the coastal areas. The author developed the method to estimate the height of storm surges in Tokyo Bay . In this case the main elements of storm surges were wind driven force and suction of atmospheric pressure. But other elements must be considered to make clear the reasons of recent unexpected storm surges.

THE CAUSES OF FLOODS IN THE WESTERN BLACKSEA REGION, TURKEY

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In Turkey, floods are one of the most common natural disasters. Torrents and floods are widespread in Blacksea region of Turkey causing significant social and economical damages almost every year. Knowing flood phenomena causes is very important to improve flood defence strategies. To determine the causes of floods in this region, Bartın Iskalan Creek Watershed typical for Western Blacksea region is selected as the study area. To reach the objectives of the study soil sampling was done at different sampling points that will represent the study area and some physical and chemical soil properties were determined with standard soil laboratory analysis methods. Rainfall-runoff data were evaluated using appropriate time series analysis techniques. Furthermore some physiographic features of the study area have been computed and land capability classification have been done. The results of the study showed that in this region, the main causes of floods were some soil properties, topographic characteristics, long system memory, inappropriate land use.

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A ROBUST STATISTICAL METHOD FOR HYDROLOGICAL EXTREMES FREQUENCY ANALYSIS

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In flood prevention and hydraulic engineering design, hydrologists and engineers are often required to estimate magnitude and frequency of hydrological extremes such as flood extremes at a specific site or in a region by records of historical observations. The currently widely adopted procedure to provide the designed values or frequency analysis follows two steps, the first is the assumption that on an annual basis, floods are independently and identically distributed (iid) from a given probability distribution with unknown parameters; and the second is the estimation of the unknown parameters by application of statistical estimation approaches. Under such a framework, many probability distributions and parameter estimation methods have been developed and applied in hydrological activities. But the iid assumption is sometimes challenged because it is difficult to verify whether samples observed in different historical periods are identically distributed with the specified probability distribution, in fact for most cases they are not. Practically, It is more reasonable to recognize that data collected from observation are from a 'contaminated' probability distribution, i.e. a distribution (F) with the form as $F = (1-H)G + H$, Where G is the assumed specific distribution, H is a distribution different from G, is termed the percentage of 'contamination'. It means that percent of data are from the assumed distribution G and the left are from a different distribution H. It has shown that some of the parameter estimation methods, under the 'contaminated' model, may decrease their statistical advantages, some may become worse. Which means the methods are liable to be influenced by data, i.e. lack of robustness. Accordingly, robustness of a method for parameter estimation has so far been an interesting topic to hydrologists.

Therefore the objective of this study is to develop a statistical method which provides robust quantile estimates for the 'contaminated' probability distribution. The method is constructed by combining Huber's M-Estimator (M-E) and Minimum Distance Estimator (MD-E). It has been shown that M-E is capable of obtaining a robust estimation of the location parameter of a distribution, while MD-E is able to achieve the robust estimations of its scale and shape parameters. Statistical properties of the proposed method were verified using Monte-Carlo simulation to the Person type III distribution (P-III). Results show that the method presented is robust and has advantages in preserving good statistical properties.

**TURKISH EMERGENCY FLOOD AND EARTQUAKE RECOVERY
PROJECT (TEFER)**

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Natural disasters induced by severe weather accompanied by micro-climatological and topographical variations cause millions of dollars of property damages and human life loss every year in Turkey. Especially heavy rainfalls which causes flash floods along the coastal parts of Turkey have become one of the most hazardous phenomenon.

Mainland of Turkey is located in Mediterranean macroclimatic region of subtropical zone. She has a mean elevation of 1100 meters and is surrounded by sea on three sides. Due to its complex topographic features, its proximity to water, being in a transition zone for different large scale weather circulations systems, spatially variable climatic features appear to be dominant over the country. Total amount and distribution of rainfall in the coastal parts are influenced by troughs and frontal type mid latitude cyclones that are associated with the prevailing upper level westerly flows.

During the period of 19 to 22 May 1998 several heavy rainfall occurred in the north-western coastal regions of Turkey . As a result the Government of Turkey with assistance from the World Bank has carried out a rapid work program for reconstruction of existing damaged infrastructure and to develop early warning systems in order to reduce risk of future floods by improving meteorological and hydrological infrastructure and data processing systems.

The project area and field equipments which consists of 3 Doppler Radars, 100 Hydrometric Stations (HS), 206 Automatic Weather Observations Stations (AWOS) and VSAT (Very Small Aperture Terminals) communication system.

Intended purpose of this article is to show TEFER Project and its component as well as flood early warning system.

**DYNAMIC-STATISTICAL MODEL FOR THE DETERMINATION OF
PROBABLE MAXIMUM FLOOD**

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Extreme floods are, for the national economy, both a useful and a damage source. Therefore, knowing the statistical elements regarding various aspects of floods (occurrence frequency, maximum discharges and volumes with different insurances, the shape of the hydrograph, etc.), being useful for the stipulation of solutions regarding the use or avoidance of their destructive effects (for example creating reservoirs, dykes, etc.)

This paper presents a dynamic-statistical model of determining the Probable Maximum Flood (PMF), which requires a more detailed study and the use of "Probable Maximum Rainfall" (PMR) and its transforming into a runoff hydrograph.

In order to calculate the PMF in the deterministic way several stages have to be covered:

Choosing the PMR model;

The calculation of PMR histogram;

The transformation of gross rain into net rain using a production function;

The transformation of net precipitation into runoff hydrograph using a transfer function.

A PMR statistical determination procedure is presented, which supposes a spatial statistical analysis of the available observations at meteorological stations and pluviometric stations, based on general formulas of analysis of the hydrological sizes frequency proposed by Chow (1961) and later modified by Hershfield (1973);

$$X_t = X_n + K S_n$$

where: X_t is the rainfall with the return period t

X_n and S_n are the mean and the variation of the series of the n annual maximums, respectively.

K is the variable statistical coefficient.

The determination of the PMR structure in time was made through the "Common Hydrograph" method which makes the analysis of the temporal distribution of rainfall on non-dimensional values, building non-dimensional histograms having on the x axis, precipitations in percent from the maximum precipitation, and on the y axis percent from the total duration of precipitation.

The calculation of maximum probable flood is based on the integration of probable maximum precipitation previously obtained with the help of a rainfall-runoff deterministic model in which the basin is treated as a system that has as input the rain histogram and as output the flash flood hydrograph.

The transformation of net rainfall into the discharge hydrograph on every basin (tributary) is based on the unitary hydrograph method which is one of

the most important investigation instruments of the rainfall-runoff process and the propagation of the flood through the riverbed and the mixing with the floods on the main tributaries based on the Muskingum model, one of the most representative cinematic hydrological models.

The presented methodology was applied for the Tazlau Rivers hydrographic basins in the Helegiu sections.

ON FREQUENCY DISTRIBUTION AND INSENSITY OF SEVERE CONVECTIVE STORMS OVER BULGARIA

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The subject of the present research is a severe convective storms (SCS) from the Small-scale Weather Phenomena (SCSWP). Such SCSWP events are spars in space and time but cause significant property damages and losses of life with considerable impact on the economics and society in small countries. The problem concerning the climate variability and change impact on frequency, intensity and scope of SCS phenomena especially heavy rain, thunderstorms, and hailfall, is actual and discussible.

In this work a set of severe storms over Bulgaria are selected on the basis of defined criteria for extreme values and space-dissemination of complex meteorological records for the cases of heavy rain, thunders and hail during the warm half of the year (April , September) in period 1961-2005.

The time-space variation of the thunderstorm days (as well as the ratio to hail days) is investigated. It was obtained an increase of the mean annual thunderstorm day's frequency for the period 1981-2005 versus those for 1961-1980. The regime of potential dangerous heavy rain events (totals over 30 mm/day is considered as a risky for floods) is compared with thunderstorms variation for the two periods: 1961-1980 and 1981-2005 (period of significant global warming).

An attempt for classification of extreme SCS phenomena according to synoptic and upper-air sounding characteristics of environment and the available data for damages is made.

The obtained results are the attempt in the knowledge of SCS variation and prediction.

DROUGHT VULNERABILITY OF RUNOFF IN THE CONTEXT OF CLIMATE CHANGE - CASE STUDY ON BULGARIAN RIVERS

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The two models HadCM2 and ECHAM4 GCMs, applied to Balkan Peninsula data, both expose an increase of annual temperature and a decrease of precipitations. Great changes are expected during the summer months, from 1.1 to 1.3 °C in the 2020s, 1.6-1.8 ° (HadCM2) to 2.1-2.2 ° C (ECHAM4) in the 2050s and 3.3-3.5 ° (HadCM2) to 4.2-4.3 ° C (ECHAM4) in the 2100s. Monthly precipitation in the weather stations will have minimum values in August and September – about 20 mm in the 2100s. (V.Alexsandrov). Because of the fact that river basins integrate meteorological variability, i.e. “filtered” climatic data, river flow is strongly influenced by climatic variations. Climate change similarly adversely affects natural and human systems and undermines long-term economic development prospects.

The central objective of this paper is to find out whether climate changes at the time level of 2025 and 2050 will cause a risk of hydrological drought. The difficulties ensue from the fact that the meteorological drought will not necessarily lead to hydrological or agricultural drought.

Two rivers generating their flow in different climate conditions are used as a case study. The basin of the Osam River, situated in North Bulgaria, is part of the Moderate-Continental climatic sub-region. Climate conditions in the second one- the Struma River basin are rapidly changing: from Moderate-Continental climate to the north, High-Mountain climate of the tributaries along the river and Continental-Mediterranean to the south. The quantification of the impact of climate changes on runoff has been achieved by applying the Water Balance Model (WBM) and the HBV model - Norwegian version of the model (Bergstrom, 1976) developed for the project “Climate Change and Energy Production”. The data used in the analysis include historical monthly and seasonal values as well as those obtained by the above mentioned models. Comparative analyses by the criteria of hydrological drought have been made. Whether the expected hydrological drought for the time level of 2025 and 2050 may be accepted as hazardous will be assessed by the Drought Risk Index.

ASPECTS REGARDING FLASH FLOODS AND FLOODS IN THE TROTUS RIVER HYDROGRAPHIC BASIN

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This paper presents the global and local causes that lead to the formation and evolution of the main flash floods in the Trotus River hydrographic basin (with a surface of 4349 sq kms, situated in the Central-Eastern part of Romania).

At the level of the entire basin, extreme floods took place during 1960, 1970, 1975, 1991, 2004 and 2005 especially due to the intensity, duration and quantity of precipitations (very large quantities in a very short time), to which recent and massive deforestation added.

Flash floods that occurred are characterized and analyzed from the point of view of their genesis, area of occurrence, and in the case of large ones, the main elements of the singular type flood waves and the realization of the map with the isolines of the drainage layer are also presented.

Almost all analyzed floods caused extremely large economic damage, fatalities, ecological accidents and diseases. The effects of floods are illustrated by certain relevant pictures.

The paper ends with a series of conclusions and proposals meant to lead to the reduction of flood occurrence risk.

EXTREME HYDROLOGICAL PHENOMENA IN THE BARLAD RIVER HYDROGRAPHIC BASIN

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During the last decades extreme meteorological and hydrological phenomena became more frequent and more destructive in our country too.

Among them, the ones that affect goods and human lives the most are: excessive rainfall that generate floods, and droughts (meteorological and hydrological).

This paper presents special situations encountered in the evolution of water runoff in the Barlad River hydrographic basin (the largest tributary of the Siret River from the point of view of basin surface and length), situated in the Eastern part of Romania. Here, water courses with semi-permanent and

temporary flow regime are predominant, and even the main drainage artery of the plateau, the Barlad River, has a semi-permanent flow regime due to small quantities of rainfall.

On the other hand, the torrential regime of the Barlad River hydrographic basin, small longitudinal slopes, riverbed which is silted in many sectors, contributes to the flooding of large surfaces from its basin.

Beside the knowledge of maximum and minimum runoff characteristics depending on the causal factors, the paper also pursues the discovery and pointing out the modification tendencies of river behavior in this hydrographic space, determined either by natural causes (general changes in climate and microclimate) or anthropic (deforestation, forestation, irrigation and drainage, damming of valleys and forming of reservoirs, dyke building and water transfer etc.).

COMPLEX APPROACH FOR ASSESSMENT OF DRY WIND AND DROUGHTY SPELLS IN BULGARIA

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The results for extreme dry winds and droughty spells in Bulgaria assessed on the basis of data for air temperature, relative humidity and wind velocity complex ($t - f - v$) are compared with the newly obtained similar results based on data for the extreme rainless (wr) periods. For this purpose, all available meteorological stations situated in the non-mountain (up to 1000 m) part of the country are thoroughly checked for crucial gaps in the series of simultaneously registered ($t - f - v - wr$) data in the warm half - year of the period 1961 – 2000.

The extreme rainless periods are estimated (by stations and regions) using their statistical distributions for analysis by frequency, duration and intensity, and for determination of the corresponding "rare" values (following the return periods concept). They are also quantitatively assessed as "anti-resources" (by administrative districts) and the results are compared with those obtained on ($t - f - v$) basis. Comparisons for the periods (1961 - 1990, 1991 – 2000, 1961 – 2000) and appropriate trend analyses are carried out for comments in the light of climate variability problem.

The meteorological conditions accompanying the mentioned spells are investigated through analysis of the data for atmospheric pressure, air temperature and humidity, wind direction and velocity, and appropriate synoptic and satellite data are additionally examined in order to support and

enrich the climatological analysis in looking for typical synoptic situations. An attempt is also made for classification of the results (on the basis of atmospheric pressure and its complexes) and development of an useful criterion characterizing the extreme dry wind and droughty spells in Bulgaria .

METEOROLOGICAL CONDITIONS DURING DRY WIND AND DROUGHTY SPELLS IN BULGARIA

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The well known definition for dry wind described by the complex of simultaneously registered wind velocity higher than 5 m/s, air temperature above 25 ° C and relative humidity under 30% (at least in three consecutive days) is used as a basis for assessment of the meteorological conditions during dry wind and droughty spells (without the requirement for wind velocity) in Bulgaria .

The information of all available meteorological stations (249 in number) for the warm half-year of the period 1961 – 2000 is thoroughly analyzed for crucial interruptions, short available data periods, numerous (although partial) lacks of measurements, closure, etc. The corresponding stations are eliminated from the basic list (together with the costal and mountain ones) and the total number of used sources of meteorological measurements is reduced to 150 stations with high quality data.

The meteorological conditions during the mentioned spells are investigated through a climatological analysis of the data for atmospheric pressure, air temperature and humidity characteristics, wind direction and velocity. The differential distributions of the examined meteorological elements are used for analyses of the investigated meteorological conditions by frequency, duration and intensity, and the integral distribution curves are used for determination of their probable expected extreme values.

An analysis is carried out by stations and regions of extreme manifestations of the examined events and the results are compared for the periods 1961 – 1990, 1991 – 2000 (when the number of available stations is significantly reduced) and 1961 – 2000. The differences by territory due to the specific climatic conditions in the different regions of the country are also commented.

**ON THE POSSIBLE CAUSES OF THE SEVERE DROUGHTS IN THE
INFERIOR DANUBE BASIN IN 2003**

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In September 2003, discharge level in the Danube inferior basin reached absolute minimum since 1840. This extreme event affected natural ecosystems, agriculture, water supply, energy demand, navigation, etc.

In this paper teleconnections were performed between the large-scale atmospheric circulations indices as the North Atlantic Oscillation (NAO), the blocking type atmospheric circulation indices, as well as SSTA in the tropical Atlantic and time series of the drought index or the discharge level in the Danube inferior Basin.

The following data are used:

Drought index (DI) time series were calculated by means of the standardized anomalies of temperature and precipitation. This index is very similar with the Palmer Drought Severity Index (PDSI). The DI time series were estimated both for four stations (Bucharest, Constanta, Timisoara and Sibiu) with long series of observations (over 100 years) and for the 33 stations in Romania for the period 1950-2003, filtered by the first principal components of empirical orthogonal functions (EOF) decomposition.

Monthly discharge level at one station (Orsova) situated in the Danube inferior basin (1840-2003).

The NAO values for 1840-2003 period are defined as the normalised pressure difference between Ponta Delgada (Azores) and Reykjavik (SW Iceland).

The blocking type atmospheric circulation indices (I B), at the 500 hPa height, 1950-2003 for the two regions: Atlantic (50° 0' W-0° 35' 0" N) and European (0° 0' E, 35° 0' – 65° 0' N). This index is calculated simply as a mean for λ longitudes of

$I B (\lambda) = \Phi (\lambda, 57.5^{\circ} 0' N) - \Phi (\lambda, 37.5^{\circ} 0' N)$, where Φ is the geopotential at 500 hPa.

Sea Surface Temperature Anomalies (SSTA) in the tropical Atlantic region (67.5° 0' W-12.5° 0' E; 22.5° 0' N-22.5° 0' S) in the period 1950-2003, using data provided by Hadley Centre. SSTA were analysed by means of significant principal components (PC) of EOF decomposition.

In order to find the most significant predictor, the teleconnections between DI or discharge level and NAO, I B and PC of SSTA with the lags from 1 to 12 months have been achieved.

The present study revealed that the most significant predictor for the discharge level in the Danube inferior basin in September is behaviour of SSTA in July from tropical Atlantic region.

A PROTOTYPE OF AN EARLY WARNING SYSTEM FOR SEVERE WEATHER AND FLOODS FOR DECISION SUPPORT IN BULGARIA

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The need of early warning system for severe weather and floods for decision support in Bulgaria has been explained and analyzed. A prototype of a web-based client-oriented warning system with four levels of vigilance has been developed and presented. The idea has been taken from a similar warning system which has already been operational and successful for a couple of years in Meteo-France.

The levels of risk are: Green – no significant weather; Yellow – there are significant but usual weather events; Orange – there is a risk for dangerous weather events and floods that could cause damage; Red – there is a risk for severe weather events and floods that could cause massive damage and put in risk human lives.

The administrative list of municipalities has been used as a basis for issuing the warnings although very often the dangerous weather patterns do not threat the entire territory of a single municipality or the warning is valid for a domain larger than a single municipality. This reflects the client-oriented feature of our prototype system.

The system should at first work in quasi-operational regime. Two warnings maps should be issued and updated twice a day in the morning and in the evening. The two maps contain warnings for every single municipality on the four levels scale in color. The first map is for the next 12 hours and the second map contains warnings for the time from 12h to 24h. They are based on considerations of the very short range weather forecast.

There is a special care to be taken in order to provide a reliable forecast for floods which takes into account the soil engorgement of water from previous precipitations.

The warning maps should be disseminated nationwide among the public, the municipality authorities, the national civil defense authorities, the government, and they should be freely available on internet as well.

FLOOD RISK ANALYSIS IN HYDRO PROJECT PLANNING

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Water resources projects are usually developed for multiple purposes, and flood control is often one of the primary objectives for hydro development. Some special issues have been raised in flood risk analysis for multi-objective hydro projects. First, when a dam and reservoir formed, the flooding frequency at the dam downstream certainly decreases, but the inundation scope and vulnerability of downstream floodplain would potentially increase should the designed capacity be exceeded. Moreover, possible sedimentation in reservoir and upstream river reach could reduce the storage capacity, raise the riverbed elevation, and thus increase the probability of flooding in the upstream region. Besides, during flooding seasons there are conflicts and constraints in reservoir operation to retain sufficient storage in advance for peak inflows while maximizing the electricity generation. Therefore, it is significant though challenging to develop a contemporary flood risk analysis framework, considering special issues of hydro projects, to complement the whole project evaluation and improve the project planning strategy

In this paper, based on case studies of a selected hydro dam, different types of uncertainties from variability of natural environment (climate change, precipitation, stream flow etc.), reliability of engineering systems (dam, gate), operation modes of systems, and economic value of floodplain property are identified. Then, the possible flooding patterns including overtopping, dam breach and dam failure are addressed. Finally, a comprehensive framework of flood risk analysis will be developed, in which the approach of scenario analysis and sensitivity analysis are implemented; the changes of expected annual damage are compared for different project alternatives (including no engineering scenario) to determine the most cost-effective solution to flood control.

CONSIDERATIONS REGARDING THE OCCURRENCE OF THE FLOOD WAVES FROM APRIL 2005 IN THE BANAT HYDROGRAPHICAL AREA

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The Banat hydrographical area, especially its Western part, has geological layers especially made of clay alluvia and sands, but also shallow impermeable ones. These ones, but also the fact that most of the rivers (Bega, Timis, Barzava, Caras) flow in the superior part of the plain, lead to the formation of very developed flood channels, which generated floods and created large wetlands.

Because of this, starting with the middle of the 19 th century most main rivers were dammed, and the water bodies in between were drained.

In April 2005, as a result of the precipitations that fell between April 14 and 28, hydrological situations similar to the ones that occurred in 1753, 1859, 1912, 1966 and 2000, repeated in the Banat hydrographical area, but at another spatial scale. This time, the flash flood overflowed the right bank dyke on the Timis River, in the Graniceri area, flooding a surface of about 21000 hectares

In this paper the causes of the April 2005 floods in the Banat area are analyzed and the runoff hydrological balance compared to other floods is made.

At the end of the paper some conclusions are emphasized, which resulted after the analysis of the characteristics of historic floods which occurred in the Banat hydrographic area and were similar to the one in April 2005.

THE INFLUENCE OF THE BASIN AREA ON THE MAIN ELEMENTS OF THE FLOOD WAVE

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In this paper, the dependence on the basin area of the following wave flood elements was studied: the maximum discharge, the increasing and decreasing of durations, the flown layer, but also the time concentration of the maximum flow.

In the first part of the study there were obtained the relations between the flood wave elements and the characteristics of the precipitations that generated them – quantity, duration and intensity for each analyzed hydrometrical station.

In the second part of the study the regionalization of the flood wave elements in the case of certain rain types was elaborated, differentiated from the quantity, duration and intensity point of view.

All the obtained regionalization had the variation range of the basin surface between 72 m² and 100 km².

The regionalization of the flood wave was obtained for various physical-geographical areas of the country, as a result of the diversification of natural factors: soil, relief, vegetation.

DEFINING RELEVANT FLOODS OF MT. MEDVEDNICA TORRENTIAL STREAMS

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Total of 31 brooks collectively referred to as "the Zagreb brooks" or "the City brooks" flow from the southern and south-eastern slopes of Mt. Medvednica. Most of them undergo a complete transformation on their course from springs at Mt. Medvednica slopes to mouths into the Sava River or the urban sewage system. The common characteristic of all brooks is their torrential water regime, so they should be expected to bring unpleasant surprises, such as catastrophic floods, in the lower catchment areas within the city, which has frequently happened in the past.

To defend the city from torrents generated by high-intensity rains, 19 retention basins were built in the upstream parts of the catchment. The paper elaborates problems encountered in the upstream part of the Bliznec Brook catchment up to the measuring section "Rebar". The analyzed data are stored in HIS200 - Hydrological database of the Hydrological and Meteorological Service. The conclusion is that relevant floods with different return periods from the Mt. Medvednica torrential catchments should not be determined by statistical analysis of multi-annual series of measured hydrological parameters, but rather by one of empirical methods (Ven Te Chow Method in case of Mt. Medvednica). However, this certainly does not mean that regular

hydrological observations and measurements on the Mt. Medvednica are not justified, rather that HIS2000 needs to contain all useful information on changes in gauging station and measuring section, as regards both geography and data acquisition method and their primary analysis, which should ensure homogeneity of time series . Need for upgrading and modernization of measuring devices (electronic devices for remote water level monitoring in real time and ultrasonic flow meters used by the Meteorological and Hydrological Service) is stressed, in order to encompass rapid and transient occurrence of floods and ensure quality flood control and protection against their disastrous consequences in the lower parts of the catchment.

EFFECTS OF URBANIZATION ON APPEARANCE OF FLOODS

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Process of urbanization decreases permeable surfaces in the catchment, and simultaneously increases impervious surfaces, with next consequences: faster forming of surface runoff, more frequent appearance of maximal discharges. Urbanization influences on development of erosion processes, land degradation with significant reduction of water capacity of soil. Problem was analyzed on small catchments on territory of Belgrade.

LOW FLOW ESTIMATION IN ALBANIA

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There is a wide variety of low flow measures which describe properties of the flow regime. These include the flow duration curve, flow frequency curve, low flow spells, deficiency volumes etc.

Where reliable river data are available at the site of interest these measures can be derived directly from the observed data. However, in many situations no flow data is available and, hence, techniques have been developed to estimate low flows at ungaged sites (Martin & Cunnane - 1976, Lundquist & Krokli - 1985 , Gustard et al. –1992, Demuth –1994, Lena M. Tallaksen and Henny A.J. Van Lanen - 2003 etc). At the same time, the regional studies

provide an useful techniques for the assessment of spatial variability of low flows.

The available freshwater resource is often represented in terms of the long-term average annual runoff and expressed as a uniform depth in units of millimeters over the area concerned. This statistic, though providing a measure of the average availability of the resource, gives no indication of seasonal variability of the water available under extreme dry conditions. An alternative to the runoff is the (or), a flow statistic representing the daily flow which is exceeded or equaled 90 (75) percent of the time. Expressed in millimeters or as a percentage of the mean flow, the can be used by planners and engineers to determine the resource available in periods of low flow or drought.

Using the time series of river flows and a computer program it was possible to calculate the for 42 catchments of Albania. They are expressed as a percentage of the mean flow, in order to remove the scale effect of different sized catchments with differing rainfall and evaporation characteristics. The surface of the catchments varie between 50 and 400 km².

A multivariate regression models was used to derive estimates of for the unged sites. The regression provide a relationship between in l/s, the surface of the catchment AREA, the average annual rainfall AAR and an index of the geology GEO expressed as the percentage of the rocs with high permeability in the classical for (see PDF Document) .

Using this equation the values of /Q_{mean} are estimated in 30 unged sites and a map is established for the Albanian territory.

ANALYSIS OF DRY PERIODS OF CORUH RIVER BASIN

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The concepts of global warming and climate change are among the topics of the current agenda. In different regions of the world flood and drought events are frequently met. Studies that accept not only floods but also droughts as natural disaster have gained acceleration in our country. Droughts have significant effect on economical and public dimensions. That is why analysis of flows in river basins, determination of dry periods are of great importance within the context of work done (planning, operation...) under the heading of " Water Resources Development " .

Run analysis is a method often used for the analysis of dry periods. In this study, the length and return period of dry periods of Coruh Basin have been determined via run analysis. With this purpose annual flow series of EIEI

stations numbers 2304, 2305, 2315, 2316 and 2323 have been used. For the $q=0.5$, $q=0.4$ and $q=0.3$ truncation levels of the flows, negative run lengths and return periods of the longest dry periods have been estimated.

Later, it has been investigated whether multi-site (two-five) stations are serially and mutually dependent. For these cases joint negative run lengths and the return periods of the maximum dry periods have been determined.

In Coruh Basin, situated in Eastern Anatolian Region of Turkey which receives high precipitation, long run droughts have been observed through single-site and two-site run analyses. Dry periods are existing in three-site and four-site cases which are serially and mutually dependent. When five stations are considered jointly, there has been no dry period detected.

THE FLOOD AND SOME PROBLEMS OF WATER RESOURCE SYSTEM INVESTIGATIONS

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In this report some aspects of waste of water from flooding (losses – direct and indirect, damages, social aspects) are given.

The investment effectiveness, aimed at the retaining works, is considered when the effectiveness is estimated by taking into account the discount of exploitation period.

Some ways are given for determination of:

The best variant of investments – the shortest investments return period;

The effect from real retaining work;

The mean annual waste of water avoided as a result of retaining works construction.

Nevertheless of experience, gained from many years of estimating the retaining works, the article recommends some improvements in the investigation of water resource systems planning and management in order to help the local authorities in their applying for financing.

INTEGRATED WATERSHED MANAGEMENT TO PREVENT FLOODS AND SUSTAIN WATER RESOURCES IN JAKARTA , INDONESIA

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There are nine major rivers flowing through Jakarta , the capital city of Indonesia . Total extent of the nine watersheds in Jakarta and its vicinity is about 106 000 ha . Average annual rainfall of 17 stations (1972-1999) throughout the watersheds is 2 973 mm. These make the total water resources throughout Jakarta is about 3.151 billion cubic meters per year (cmy).

Average water demand for evapotranspiration is about 4.5 mm perday or 1 643 mm per year or 1.742 billion cubic meters per year (cmy) throughout the watersheds. Therefore, the total annual available water for storage in the soils, ponds, lakes, reservoirs, vegetations, rivers, and for municipal use will be only 1 330 mm or 1.410 billion cmy.

Water consumption (municipal use) for 11 million people in the nine watersheds is about 1.205 billion cmy or 1 136 mm or 300 liter per capita per day. To meet these requirements the amount of water discharge in the rivers should not be greater than 194 mm or 0.206 billion cmy or 6.52 cubic meters per second (cms) in all nine major rivers. In another words, the runoff coefficient in the whole watersheds should not be greater than 6.5 %.

What is happening in Jakarta is extremely horrible in terms of water problem During rainy seasons maximum daily water discharge in Ciliwung alone (one of the nine rivers) at Rawajati Station is about 103 cms ranging from 20 – 231 cms but in dry seasons minimum daily discharge is only 4.5 cms. These data indicate that the water discharge particularly in rainy seasons is far above it should be, to meet the water requirement for municipal use sufficiently. Because the failure to keep the daily discharge quite low in rainy seasons, many people had been suffering from lacking of fresh water for domestic use. This is the reflection of high runoff coefficient in the watershed. Runoff coefficient in Ciliwung watershed is ranging from 38% to 54%; it is far above it should be. . This high runoff coefficient is the major cause of the very high water discharge or frequent floods in rainy seasons and lacking of fresh water in dry seasons in Jakarta .

It is clear from this analysis that the water problem in Jakarta is not only frequent and high floods in rainy seasons but also lacking of water for municipal use in dry seasons. These situations seem to be more horrryfyng in the future. Therefore, the water problem in Jakarta needs an extremely great

attention. The key to undertake these problems is a set of activities in an integrated and wholistic watershed management programs.

This paper will discuss analysis and recommendation of integrated watershed management in Ciliwung watershed.

REVIEW AND ANALYZE OF SOME MAXIMAL DISCHARGES IN EUROPE

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Some results from the analyzes of data for large water discharge in Europe are presented in this paper. There are 657 data in the database. Some statistical analyzes have been done. A few correlation functions are defined, correlation between maximal water discharge and catchment area $Q_{max} = f(F)$ and correlation between specific water discharge and catchment area $Q_{sp} = f(F)$.

Firstly, whole database was analyzed. Later, data were classified in classes by their catchment area. - 50 km² ; 50.1<F<100 km² ; 100 .1<F<200 km² ; 200 .1<F<500 km² ; 500.1<F<1000 km² ; 100 0.1<F<2000 km² ; 200 0.1<F<5000 km² ; 5 000.1<F<10000 km² ; 10000. 1<F<50000 km² and >50000.1 km².

The maximal discharge noted in these analyzes was Dounau in Wien happened in august 1501, when $Q = 14\ 000\ m^3/s$

The highest specific disharghes noted in the database happened in France on 18.10.1940, when river Canideil on the profile Prats de Molo ($F = 11,6\ km^2$) produced $400\ m^3/s$ or $34.48\ m^3/s.km^2$.

Also selected data about extreme values were analyzed separately.

There is great level of correlation between data from whole database. The determination quotient was $R^2 = 0.64$.

Analyzes of classified data don't show enough relationship. Extreme values show high level of correlation too.

HYDROMEMETEOROLOGICAL CHARACTERISATION OF THE FLOOD FROM THE PERIOD 14-30 APRIL 2005 IN THE TIMIS-BEGA RIVER BASIN

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The precipitation, which generates the 2005 flood in Timis-Bega River Basin, have been analyzed both as spatial distribution (total isohyets map) and as temporal one (time distribution at the meteorological stations). Further on, an analysis of the balance of the flood hydrographs volumes is made. Unusual values of the runoff coefficients have been resulted, as the duration and the quantity of the rainfalls were very high (over 200mm). A mathematical model has been applied aiming to the reconstitution of the flood hydrograph of Timis River at the border. Then the volumes of water penetrating the ruptures in the dikes downstream Sag station have been determined. Thus huge volume of the flood downstream Sag station (720.106 m³) explains the very large area that has been flooded. An analysis of the effects of the storages (permanent and non-permanent ones) led to the conclusion that they were less effective in mitigating the flood crest in the Timis-Bega River Basin. In continuation, an analysis of the hydrological and technical issues of the present embankments in Timis-Bega River Basin is made. Proposals for improving the defense system by gradually implementation of new structural measures deeming and keeping the principle "more space for rivers" as well as the improvement and diversifying the non-structural measures are presented in detail.

MODELING FLOODS RISK IN YANTRA RIVER BASIN

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During the last years Bulgaria suffered numerous devastating floods causing great damages in economy and infrastructure. Yantra was one of the rivers with highest floods during this time. The paper represents results from an investigation that explores relationship between landscapes in the basin and the river water quality and quantity as well as the risk of floods. The main tool used in the investigation was AGWA (Automated Geospatial Watershed Assessment). It provides the functionality to conduct all phases of a watershed assessment for two widely used watershed hydrologic models: SWAT (Soil Water Assessment Tool) and KINEROS (KINematic Runoff and EROsion mode). Changes of the land use during the last decade were investigated in order to find the main trend of development. Models of landscapes and water interaction were elaborated for 3 different scenarios of changes. The results show that particular changes of the land use in the basin could increase the floods risk in some areas. They could be used to make recommendation for management measures directed to reduce the damages caused by floods.

FLOODS IN BULGARIA

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- Characteristics of the floods in Bulgaria .

Although a relatively small European state, 111 thousand km² in area, Bulgaria has extremely diverse topography, weather, and river run-off formation.

Most of the river network is concentrated in the mountains and foothill areas. These are the most frequent flash-flood areas. The watercourses follow very steep inclinations there, and significant differences between the minimum and maximum flows occur during the different seasons. The average and the maximum annual run-offs differ by a factor of hundreds. One particular feature of floods in Bulgaria is that approximately 60% of the intensive precipitation transform into river run-off. Another typical feature is the flood-wave transition time, which is 3 to 6 hours in small watersheds. Life-saving measures and evacuation are difficult during this extremely short period. Such floods and the areas where they may occur can be difficult to predict and localized.

The above factors allow two possible courses of action:

- before the flash flood
- after the flash flood

Rivers in Bulgaria's flatland areas are managed and floods in urban areas are possible during extremely rare precipitation events.

- Overview of the flood events occurred in the 2005

Several serious floods occurred in 2005 in the Republic of Bulgaria taking human lives, causing serious damage to private and state property and to infrastructural sites and facilities, forcing many people out of their homes, and destroying thousands of houses.

There are various causes for its emergence and devastating consequences.

First is nature - Floods in the period between April and August in 2005 are the result of precipitation of extreme intensity. The frequency of this precipitation in the catchment's areas varies between 500 and 1000 years.

Poor maintenance during the recent years of the engineering facilities for protection against harmful impacts of water, inadequate cleaning of riverbeds, thoughtless activities in the riverbeds are among the other causes for the catastrophic consequences. It can be said that such a natural phenomenon had not been expected due to the 20-years of predominantly dry weather, with precipitation at the level of dry to average year.

- A look in the future.

Bulgaria, impersonated by the Ministry of Environment and Water - the main governmental body committed to integrated water management and implementation of the provisions of the European water directives is ready to participate in working groups on flood issues and preventive action, especially since it is our intention to give serious presence of such measures in our river basin management plans, including those for our transboundary water courses.

The European Flood Action Programme on flood risk management is in process of elaboration. Many activities should be undertaken in order to cover the requirements by means of establishment of early warning system, improvement of flood forecasting, flood mapping, preparation of flood risk management plans etc.

FLASH FLOODS IN BULGARIA

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We distinguish the torrent floods of rivers as short-termed phenomena, lasting generally for only several hours and in very rare cases – for up to several days. Appropriate scientific methods for their forecasting are lacking. The short duration of the torrent floods, including their formation, do not make possible the organization of effective protection and safety measures. In many cases the inhabitants does not possess the required training to take-in urgent evacuation or adequate reaction.

Torrential rainfalls of intensity up to 0.420-0.480 mm/min and duration of up to 15-29 min. predominate. The frequency of rainfalls above 0.300 mm/min accounts between 20-30 and 50-60 cases per year, while in the case of those with intensity above 0.600 mm/min the frequency diminishes to between 7-10 and 25-30 cases per year.

The available hydrological information reveals, that irrespective of the ascending drought the frequency and dimensions of the torrent floods remain unchanged.

The biggest flood, ever recorded in Bulgaria, was that of 31 st aug.-01 st sept.1858 along the Maritsa River in Bulgaria when the river banks in the town of Plovdiv have been flooded by 1-1.2 m. of water. The most ancient data for a devastating flood comes from the Turkish novelist Hadji Halfa. It concerns the Edirne (Odrin) flood in 1361.

Numerous digital parameters of the floods are used in hydrology, like for instance, time of rise and time of fall of the flood, achieved water level

maximum, average and maximum flow speed of the water current, size and duration of the flood, frequency and duration of the emergence, ingredient of the free water surface, time of concentration and time of travel (propagation) of the high flood wave, depth and intensity of the rainfall, state of the ground cover, preliminary moisture content of the watershed basin, etc.

SOME PRINCIPAL PROBLEMS IN FLOOD RISK ASSESSMENT

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The problems related to flood risks are still not well developed and understood in the engineering practice of many countries. The report considers some theoretical principal issues connected with the natural flood risk assessment for various sites of the territorial infrastructure.

Special attention is paid to the identification of the "probability of flood" concept. It is interpreted from the viewpoint of the complex "cause - flood - object" relationship, which is still not sufficiently well realized in the engineering practice.

An attempt has been made for comprehension of the diverse forms of floods in a methodologically well sustained classification by means of two hierarchical levels - "flood type" and "flood cause", which are differentiated at deeper inferior levels depending on the other systematization features. The obtained rich scheme of the different possible cases provides the possibilities of applying a systematic approach to flood risk assessment in the territorial structure of any country.

The specific peculiarities of the flood probability are discussed further on with critical remarks on its erroneous identification with the normative probability in the design of hydrotechnical construction.

The basic theoretical principles for the flood probability determination are presented briefly for different practical cases: in natural river sections, in corrected river sections, in river sections below dams, in settlement areas, in polders and wetlands, in sites of low-rise and underground construction.

Finally the importance of flood risk assessment in humanitarian, economic, ecological and administrative-legislative aspect is pointed out.

The study is directed towards the activities for creation of a methodologically sound scientific basis and well-grounded orientation of measures for population safety and reducing the harmful flood consequences.

GROUNDWATER LEVEL REGIME IN THE UPPER PART OF THE TORYSA RIVER CATCHMENT AND DETECTION OF OCCURRENCE HYDROLOGICAL DROUGHT

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The Slovak Republic (SK) is a landlocked nation-state in Central Europe. Torysa river is the biggest river in the area of Šarišská vrchovina. Studiedly area is situated according for geomorphological division (Mazúr, Lužniš 1980) in subprovince Vnútorne Západné Karpaty in Fatransko-Tatranskej area, unit Branisko and in subprovince Vonkajšie Západné Karpaty in Podhôrnomagurská area, on boundary between units Levočské vrchy, Bachureň and Spišsko - šarišské medzihorie.

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. It occurs in virtually all areas, whatever their normal climate may be, and the characteristics of a drought may be very different from one region to another. Technically, drought is a "temporary" condition, even though it may last for long periods of time.

In This paper we use the time series of climatic and hydrological data in monitoring network Slovak Hydrometeorological Institute (precipitation, discharges in surface water and condition of groundwater level), also abstraction data of ground water in individually water management sources. Influenced of surface water was evaluated on basic relation of discharges and abstraction in the area with circumspection development of climatic factors. Level changes of groundwater were evaluated in 3. observational objects. Natural regime of surface and groundwater in the upper part of the Torysa river catchment is influenced by long-term abstraction of groundwater. The results showed that as a whole, groundwater abstraction still negatively influences the groundwater regime, mainly in the lower part of the catchment, where the cumulative influence of all abstraction points was showed.

RISK ASSESSMENT FROM FLOODINGS IN THE RIVERS OF ALBANIA

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Flooding is a natural phenomenon in Albania. The floods are flashy and flood – waters occupy the floodplain; in the biggest rivers, close to the rivermouth area, these waters inundate the floodplain for several weeks.

Attempts have been made to alleviate flood situation in Albania by building protective dykes and creating upstream storage. Although many of these measures have been beneficial, they also served to encourage further encroachment upon river floodplains, thereby raising the potential for flood damage. Actually, more than half of the Albanian population lives very close to the rivermouth areas, where the risk of flooding is higher.

The structural solution is only a partial one; the only long-term solution consists of keeping flood-vulnerable development and uses out of the floodplain.

Non structural measures consist of measures undertaken for flood warning or flood forecasting or different studies like flood-mapping, estimation of inundation risk and inundation zones and possible damages etc

The purpose of floodplain mapping was to delineate the area affected by a 100-year flood. For the case study the maps of 1:5 000 scale has been used, and the contours of the inundations zones were delineated.

Applying AutoCAD software the digitizing maps were established for each river and the number of houses and habitants affected by floggings were calculated.

TOPIC 4: INTEGRATED WATER RESOURCES MANAGEMENT

A METHODOLOGY FOR DEVELOPING STRATEGIES OF SUSTAINABLE MANAGEMENT IN MARINE ECOSYSTEMS

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The suggested methodology can be considered as a support tool for developing of Strategic Plans of sustainable management of marine ecosystems. As a whole the task of developing of those Strategic Plans can be presented in the following view:

where S - set of alternative management's strategies;

S^* - "optimal" strategy;

$C(T)$ - the concept of long-term (T) management of marine ecosystem;

KS^* (B, E, F, P) - the generalized criterion of strategy efficiency, including biological (B) ecological (E), economical (F) and social (P) criteria;

R_0 - allowable risk-status of strategy S^* ;

L_0 - the vector of resource limitations (temporal, financial, legislative, technological and so on);

W - the set of measures of uncertainty, due to incompleteness of knowledge and forecasting difficulties

These kind of tasks are usually non formalized . The most of difficulties in solution of those tasks appear usually on the stage:

- Forming of alternative complex strategies of sustainable management;
- Multi-criteria analysis and choice of optimal strategy.

In the first case the difficulties are due to those circumstances that among identified sub strategies exist numerous and various relations (space-temporal, causal, organized-technical and so on), which are in competency of individual experts, but are hardly considered in forming of complex strategies.

In the second case the difficulties due to permanent-contradictory character of used criteria's of effectiveness, difficulty of their quantity estimation and difficulty of convolution different criteria's into some summarized global estimation of strategy effectiveness.

In the real projects these difficulties intensified by high level of uncertainty and risk, with which nowadays meet an ecological practice, experts and decision makers.

On the base of suggested methodology the conceptual scheme of "strategic planning", adopted to problems of sustainable management of marine ecosystems and realized in the form of knowledge-based technologies are lied.

In the report the technique of constructing of complex strategies , their multi criteria analysis and choice in condition of uncertainty and risk (the theory of Fuzzy set (L.Zadeh), the theory of hierarchy analysis (T.Saahti), the theory of determined analysis (K.Chestnyakov), the theory of structure analysis (V.Nechinorenko)), cognitive psychology (J. Kella, U.Velichkovskiy), knowledge engineering (D.Waterman), descriptive models of population dynamics (R. Karayev), knowledge-based EIA (R. Karayev)) are given in the sample of concrete marine ecosystem.

INTEGRATED WATER RESOURCES PLANNING AND MANAGEMENT OF NORTH CYPRUS: CASE STUDY ON WATER SUPPLY AND DEMAND INCLUDING DROUGHT CONDITIONS

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Water is vital for human being in order to survive. However, increase in population, contamination of the water resources, salinization of coastal aquifers and over-extraction of the water from the ground water resources due to poor management, reduced the quantity of water on the supply side and increased the water need at demand side. North Cyprus is one of the European countries suffering from limited water resources owing to depletion, salinization and contamination of available groundwater resources. The water scarcity started in 1960s and increased to the alarming level in 2000s and it is still increasing due to lack of any serious measurements. In 1980s, several dams have been constructed with the help of the government of Turkey for the purpose of agricultural irrigation and aquifer recharge. Inasmuch, the alternative water resources to reduce the scarce in the country are under investigation nowadays, like; transferring water from Turkey to North Cyprus through medusa bags and by tankers from nearby land Turkey . Recently, more determinate solutions like; construction of flexible pipes under the sea between two countries and searching the possible deeper aquifers in the island, are under investigation. In spite of this catastrophic situation, no reliable research is available identifying the water balance in the country. And so, a case study, Integrated Water Resources Planning and Management of North Cyprus on supply and demand quantities, will be introduced in order to clarify the present situation of the country. The study considers all the contributing units to the water budget as an input or exit including the drought

condition experiences in the country and its consequences. The analysis is performed through three main and seventeen sub-regions and given. The flexibility is considered to evaluate the effect of evaporation, rainfall, domestic use, irrigation use, effluent water reuse, water for animals, small industry and tourism sectors. Furthermore, the water withdrawals from the resources; groundwater, dams, springs, etc. are all studied to identify the deficiency in the groundwater resources. Irrigation need is evaluated considering the monthly and annual extractions for the whole sub-regions. In addition, irrigation techniques and their efficiencies and water losses in the pipeline systems are also accounted and presented.

FUTURE OF THE INTEGRATED WATER SUPPLY SYSTEM OF ISTANBUL

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Since being one of the most important metropolitan areas in the world, Istanbul has got an important and raising problem of domestic water. Governmental and municipal agencies such as DSI and ISKI are working very hard for supplying the future water demand of the city. These agencies are mainly focused on the overland water sources as a primary solution. For the purpose of water supply to the city, these two agencies has planned and constructed many water storage areas. They also developed several operation and management systems for the management of these storages around the city.

Istanbul is located on both Asia and Europe. There is the Bosphorus between the two continents that has a minimum width of one kilometer. The Asian part of the city has less population than the European side but it has got more water resources than the other side. The integrated domestic water system has been established at the beginning of 1970's. At the present, the projected amount of domestic water resources of Istanbul is approximately 1059 hm³ per year. The present system is good working at the moment and it is sufficient for the water demand of the present population but it was determined that this amount in the system will not be sufficient for the population in the future. The estimated population of Istanbul for the year 2030 is 18 millions. For this purpose in this paper the analysis of the alternative water resources and their possibility of integration with the present system is examined. Melen River that is in the 130 kilometers east of Istanbul is decided to be the best solution among a number of alternatives. This alternative was selected as the most favorable one because of its resource capacity, technical and economical appropriateness and longer service duration. Istanbul's water demand up to 2070 will be covered with this

resource. The drinking water problem of Istanbul will be exactly solved. For the years after 2070 new domestic water resources should be searched.

In this study the present integrated drinking water supply system is examined by means of population, supply and demand. The resources that can be encountered in the integrated system are investigated for the rapid population growth scenario. As a result the water supply of the city up to the year 2070 is decided.

BENEFITS OBTAINED FROM RENOVATION OF ÖMERLİ DAM

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Ömerli Dam, constructed in 1972, is one of the most important reservoirs for the water supply of Istanbul. There is a rising need to water in Istanbul due to rapid population growth. Because of this purpose an evaluation and re-planning of the present water resources of the city had become essential. As the first step a bathymetry study was held in the reservoir of Ömerli dam in the summer of 2004. It was also a sedimentation survey. According to this survey sediment transported into the reservoir during the last 30 years was found less than the amount estimated in the planning report that means the real dead storage of the dam is very smaller than the planned dead storage. Then a study carried out by DSI to search the modifications to increase the active storage capacity. Two main types of modifications were assigned. First of them was lowering the minimum water level that means taking water from the deeper parts. So some part of the dead volume will become part of the active volume. The second alternative was reconstructing the old free overfall spillway as a controlled type of spillway to raise the water head that means an extra volume of water in the reservoir.

As a result the first alternative, which was lowering the minimum water level, is found feasible. In the second alternative since the water level will be increased it will bring an extra cost of land purchasing because nearly 2.5 square kilometers of agricultural land will be under the water level of the reservoir. This has also a meaning of loss of agricultural land. This situation is neither economical nor environmental.

The results of this renovation planning show that the capacity of the dam can be increased from 188 hm³/year to 220 hm³/year. This means the storage capacity of the dam will increase approximately 17 percent. Such an amount of water is very important for the public. This new amount of water can be used for domestic water, irrigation or flood protection of the agricultural land at

the downstream of the dam. At the present extra reservoir storage gained from this study can be used for flood protection of the agricultural areas at the downstream of the dam. Because there is enough water resources for the present but it will be used as drinking water in the future.

At the end of this study it became obvious that a renovation in Ömerli Dam will be very beneficial. In this paper the results of several simulations of these modification studies were presented.

THE PROGRAM OF MONITORING, MEASUREMENTS AND ANALYSIS OF THE EFFECTS OF "DJERDAP I" AND "DJERDAP II" RESERVOIRS ON THE ENVIRONMENT FROM 1980 TO 2003 - GENERAL RESULTS

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The Djerdap I and Djerdap II Hydro Power and Navigation Systems (HPNS), also known as the Iron Gate HPNS, are among the largest in Europe. Their purpose was to utilize the considerable hydropower potential and improve the conditions for navigation in the formerly very dangerous section of the Danube. During the period of operation, the Iron Gate I and Iron Gate II HPNS confirmed their necessity. Without the output of this system, the energy supply of Serbia and Romania could not have been realized at all (until 2002, the total energy production on the SCG part of HPP was more than 200 000 GWh). The navigation conditions were fundamentally improved, since previous constraints and dangers were eliminated. The Iron Gate System generated considerable modifications of the natural river regime and raised a number of questions concerning water management decisions, such as: the reduced sediment transport capacity, followed by sediment deposition; the raising of the groundwater table, the endangerment of many communities and industrial, municipal and transportation facilities, as well as agricultural production in the riparian belt; the inadequacy of the existing flood control structures; the decrease of the ice transport capacity at the end of the backwater zone; etc.

Over the many years of system operation, most of the initially recognized water management problems were addressed by comprehensive protection works and measures. The environmental impacts and effects of the protection measures were investigated within the scope of a multidisciplinary and complex monitoring program. It is composed of 9 sub-programs, which thoroughly investigate all the possible river impoundment impacts and consequences for the social situation and the environment.

CONTAMINANT ORGANIC POLLUTANTS OF OHRID LAKE

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In those research letters are exposed same experimental data about the levels of Chlororganic Pesticides (known as POP-s) in the biota of Ohrid Lake. Interesting facts are exposed for the presence of PCB-s and OCP-s in endemic species of biota that live in this immense basin, with unique values for region and elsewhere. In this publication we take definition that levels of PCB-s and OCP-s are so considerable, but within EN levels. We determine another conclusion that the origin of those POP-s is both from human outputs of farmlands about the shore of the Lake and atmospheric factors. We suggest that if the levels of contaminant organic pollutants aren't in control, they risk so much the endemic biota of Ohrid Lake in the future.

WATER AND INTERNATIONAL LAW

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The inescapable marchandisation of water could perhaps help to define what is common for the international community. Because no one can live without this precious resource. Will water be then the leaven necessary to the construction of a universal conscience? And so bring humanity towards the wisdom to share out the riches produced by water.

It is now on largely admit that the installation of a sustainable development requires to put in equation social and economic concerns with environmental concerns by taking care about the essential and limited factor and namely water.

Water is a common patrimonial good of humanity. Individual and collective health depends on it, agriculture, industry and the life domesticates are dependent there.

There is no access to the production of the richness without access to water. This communication proposes to study the topic of water and the international law.

This subject is initially apprehended by its historical aspect for then starting an exploratory study on the implication of the marchandisation of water through the important place taken by the multinational firms helped in that by the international financial institutions (the IMF and the World Bank) and OMC.

The implications of these international agreements on the countries in the process of development can be dramatic for a majority of the population. Thus, the idea of an international law of water to the service of humanity can prove to be necessary because it's the only way to keep insane.

It is by the defense of the concept of a human right to water and while bringing to water the qualification of common inheritance of humanity that the concept of common Good could find a beginning of concretization. Because the principal goal of this century is to contribute to make effective the right to water and more particularly to drinking water as belonging to the right to the life (which is the first of the rights known as civil and political).

ESCAPES OF WATER IN "OUIZERT" DAM'S (ALGERIA)

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Algerian's dam confronted with the problem of escapes through banks and the foundations. The study of this phenomenon proves of very great importance, considering the risks generated on the stability of the work and the reduction in the useful capacity of the reservoir, of which paramount importance for the zones where this resource is done rare, following the example arid regions particularly in Algeria. This, one incited us, to study the water leakages in the dam Ouizert, known for these considerable water losses.

Located at approximately 35 km in the South - West of the place head of the Mascara, the dam Ouizert of a total capacity of 100 million m³ is intended to increase the degree of regularization of the Wadi El Hammam for the drinking water supply and industrial of Oran - Arzew, the irrigation of the perimeter of El Habra located at the North of Mohammadia and to feed the dam Bouhanifia by the lâchers. However, this dam is threatened by the leakages through banks in clear evolution in time. The dam never reached its maximum level, since lost volume generally borders the values of 1m³/s. We present in this communication a report on the problems and the mechanism of the escapes as well as the results of a physicochemical and piezometric study.

**ROLE OF HYDROSYSTEM DANUBE/TISZA/DANUBE IN WATER
MANAGEMENT IN THE VOJVODINA PROVINCE, SERBIA AND
MONTENEGRO**

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Before the construction of the hydrosystem of Danube-Tisza-Danube (DTD), floods caused by internal waters had brought enormous damages to agricultural land and plant production in the Vojvodina Province. In central Banat, the rivers Begej and Tamiš flooded close to 300.000 ha of land. Largest problems were large surfaces under ponds and marshes so that no successful agricultural production could be organized without land drainage.

After the World War II, particularly in the period from 1960 to 1977, a significant reconstruction of the old and construction of new drainage systems were carried out. The hydrosystem DTD was thus constructed which serves to perform the drainage, irrigation and other water management activities of significance for the Vojvodina Province. Since its completion in 1977 until the present day, the hydrosystem DTD has been continuously in operation, meeting successfully its basic functions,

The hydrosystem DTD has a total of 8,046 km of drainage canals, 93 pump stations and other accompanying structures and facilities. There are 14 main canals with the total length of 694.2 km, 600.6 km of which are navigable. The capacity of water intake from the Danube is 96 m³/s under conditions of gravity inflow and 27 m³/s by pumps. The discharge capacity amounts to 154 m³/s under conditions of gravity flow and 51 m³/s by pumps.

The drainage basin area of the hydrosystem DTD covers 1,085,000 ha, encompassing about 180 drainage systems. The hydrosystem receives up to 326 m³/s of water from these drainage systems and discharges them into the Danube and Tisza Rivers. The hydrosystem DTD also drains 159,000 ha in Hungary and 285,000 ha in Romania.

The hydrosystem DTD has been planned to provide irrigation water for the area of 510,000 ha. Unfortunately, the reality lagged behind the plans. So far, only about of 50,000 ha of irrigation systems have been constructed so far.

Apart from the 20 existing fishponds covering the area of 4,957 ha, new fishponds can be constructed on about 10.000 ha of land. Industrial facilities use relatively insignificant quantities of water from the canals, namely, there are 19 plants which draw about 9 million m³ of water per year.

The canal network receives annually about 20 million m³ of wastewater from 6 settlements and some 200 industrial and agricultural facilities disposed through 69 discharge points into the canal network.

IMPROVEMENT OF OPERATION OF ISTANBUL WATER SUPPLY SYSTEM DURING 1989-1994 DRY PERIOD

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In this study upon the investigation of present operation of Istanbul Water Supply System it has been detected that especially during the last dry period there has been no operational policy that has been followed. The system has been operated according to a certain operational policy and it has been observed that water deficiencies which were present in the past can be eliminated.

A previous work, Drought Impact on Water Supply System of Istanbul Metropolis (Onoz & Yegen, 2005) shows that Istanbul Water Supply System experiences a drought during 1988-1991 with a system drought intensity of 79.72 mm/year. Only one year later the system, without being able to recover, goes through another drought of three years between 1992-1994 with a system drought intensity of 145.60 mm/year; the latter being a more severe drought. The results are for a truncation level of 0.5 for the standard annual precipitation and for $A_c=0.5$. A_c is the ratio of the system suffering drought.

In this work this period is tried to be analysed in more detail in respect with the operational issues. The major reservoirs supplying water to the city and the characteristic precipitation gauges have been selected. A joint run analysis of the annual total precipitation record and of the operational data has been performed. This analysis shows that the period 1989-1994 is the period when a drought is experienced for the Istanbul Water Supply System. Here Omerli reservoir is accepted as the fundamental reservoir of the system since it is the largest.

City of Istanbul is situated on two continents, Europe and Asia. Terkos and Alibeykoy reservoirs are on the European side considered jointly. Omerli reservoir is on the Asian side.

The operational data of the reservoirs were divided into two parts; dry period part and the wet period part. For each month of the year the average of the amount of water given to the city during the wet period was found. Thus the monthly targets were determined. While doing this the dry period was excluded from the data, it was not considered.

The differences between the amount of water given to the city and the target have been found along the operational period. The deviations in the negative direction are called deficiencies. It has been observed that during some months in dry period the amount of water given to the city exceeds that during the wet period. There has been no policy noticed as to the operation of the reservoirs.

The standard operational policy is performed for the European and Asian reservoirs. It is observed that the deficiencies decrease. A further attempt is made to improve the operation of the reservoirs. This attempt is to integrate hedging to the operational policy of the reservoirs.

STRATEGY OF INTEGRATE MANAGEMENT OF WATER RESOURCES FOR TRANSBOUNDARY RIVER BASIN OF CENTRAL ASIA

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Strategy – a conception of integrated management of water resources must create reliable basis for providing rational and effective use of water resources with maximum possible profit to all consumers with minimum negative influence on environment. It must determine the main principles which are secured achievement of three purposes:

- economical development;
- social development;
- protection the environment.

It considers Sub-basin of Vakhsh River which despite of exclusive in national boundaries can take part in all international collaboration processes on united basin of transboundary Amudariya River and all Central Asia in general.

From this point of view strategy of integrated management of water resources of sub-basin Vakhsh River foresees:

Development of international collaboration, first of all with Central Asian countries on the basis of complex use of hydro resources;

Mutual co-ordinated interaction on regulating Amudariya River's basin source with certain reservoirs and creation water stock resources by the way of building a number of reservoirs for providing a necessity of all Amudariya River's basin region with water resources and for supporting the ecological balance of the Aral Sea.

**IMPROVING REGIONAL COOPERATION AND PUBLIC PARTICIPATION
FOR CONFLICT PREVENTION AND RESOLUTION IN INTERNATIONAL
RIVER COURSES: THE SENEGAL RIVER CASE**

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The Senegal River basin economic development and its transition towards sustainable development are strongly linked to the availability, fair management and distribution of its resources among all users. Water management forms the most critical process in such semi-arid areas, as it impacts livelihood, food security, land conservation and productivity and society in general. As is common in international river basins, integrated planning for efficient watershed management is hampered by the difficulties of coordinating between riparian countries with diverse and often conflicting needs. Though the Senegal River is noted generally for a successful and productive case, the cooperative nature of the basin management is being strained by the size and possible economic and environmental impacts of the second generations' infrastructures. Severe political instability and violent conflicts particularly between Senegal and Mauritania in the late 1980s, the scarcity of the resources, unilateral short term gains, the recent transformation of social institutions, and new economic conditions may raise old and new types of violence.

Indeed the first benefits taken from the hydroelectric plant have prompted new conflicting perspectives which may take toll in the upcoming inter-ministerial committee's work.

This paper a first step in what is hoped to be continued exploration of conflict and cooperation over the Senegal River resources seeks to identify the main constraints in implementing effectively preventive measures to mitigate the potentially driven social and environmental unrests. The current study offers the opportunity for institutional and administrative reform to acquaint local stakeholders with the background and the procedures related to ecologically sound management practices, integrated and cooperative management options to cope with the discontinuities, such as extreme climatic events or sudden institutional changes.

Although locally, and in some sectors tremendous progress have been achieved, several indicators point out that, to date, the majority of the stakeholders in the valley have not benefited yet from the output and, the entire management approach has been strictly sectoral without any constructive public deliberation in the decision making process.

CURRENT LEVEL OF WATER EROSION PROBLEM AND SEDIMENT CONTROL MEASURES IN TURKEY

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Turkey is a country located between Europe and Asia and has a surface area of 779 452 km² and a population of about 73 million. The Asian part; Anatolia is a plateau rising progressively towards the east. Turkey has a variety of climates, changing from the temperate climate of the Black Sea region, to the continental climate of the interior, then to the Mediterranean climate of the Aegean and Coastal Mediterranean regions. Annual rainfall in Turkey varies between 220 mm to 2500 mm with an average of 642.6 mm and this corresponds to an average annual rainfall of 501 km³. Approximately 186 km³ of this water flows in rivers as surface water. The reconnaissance studies made by Turkish State Hydraulics Works indicate that with the construction of 702 dams and 508 hydroelectric power plants it will be possible to regulate all the rivers of Turkey and make the maximum use of them. Turkey has been divided into 26 river drainage basins to study the water and land resources as extensively as possible. Out of 77 945 200 ha total surface area, 28 054 310 ha is agricultural land, 21 505 112 is pasture and grazing land, 1 159 161 ha is water surface, 23 228 060 ha is forest and 3 998 557 ha is classified as other lands etc.

In Anatolia erosion and sediment transport problem started in III.Century B.C. and most of the ancient harbors were filled with the sediments carried from the upper reaches of the watersheds. Although in the ancient periods about 72 % of Anatolia was covered by forests, now it is barely 26 %, and 35 % is defined as steppes. For example, due to the filling of the estuaries of the rivers Büyük Menderes, Küçük Menderes and Mersin harbor, the ruins of antique cities of Ephesus (at present Milet and Salinin antique towns) are now located many kilometers inland. During the Ottoman period, the erosion and sediment problems were less damaging because the people were not very much dependent on land. During the Turkish Republic period, the population increased from 13 millions in 1923 to 73 millions in 2005, therefore more agricultural land was needed. This caused forest damage, consequently erosion became a problem and sediment discharge of the watersheds increased. This is the most important reason for the sudden decrease in the active volumes of most reservoirs. While 13 small water supply dams built during Ottoman period; such as Topuzlu; are still active and supply water to Istanbul city, 46 % of total volume of Seyhan dam, 75 % of Çubuk I, 47 % of Kartalkaya, 40 % Yalvaç and Kesikköprü dams which were built quite recently, are already filled with sediments transported into the reservoirs.

The soil in the Anatolian peninsula is very susceptible to erosion, the average elevation of Anatolia is 1132 m above mean sea level, 45.7 % of the land is between 1000 to 2000 m high and 62.5 % of the land has slopes steeper than 15 %. At present, 65 million tons of soil from the river Kýzýlýrmak and 108 million tons from the Euphrates are carried to the sea. Every year 450-500 million tons top soil goes to the dams, lakes and sea.

To cope with the problem, reforestation at the upper reaches of the catchments, river training structures such as sediment traps, weirs and drop structures made of concrete, masonry, loose riprap and woods, on the torrential river beds, dams on the main rivers, and longitudinal structures along the river banks are applied by the responsible State Organizations (General Directorate of Reforestation and Erosion Control, Turkish State Hydraulics Works).

REVISED SEDIMENT YIELD ESTIMATIONS IN GREECE AND IMPLICATIONS ON INTEGRATED WATER RESOURCES MANAGEMENT

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Erosion and sediment yield form a crucial issue within the integrated water resources management context; however are often neglected during the design of major water systems. Mean annual sediment discharge of an upstream catchment is computed since the sediment discharge rating curves for a specific river cross section have been established. The least square regression of the log-transformed simultaneous measurements of river and sediment discharge is then backtransformed to produce a power function, namely the rating curve. Sediment yield estimations in Greece, during the development of major hydroelectric projects at the early 70's, have been computed generally using a unique power function for the whole set of measured discharges or ultimately separating the set of measurements according to the wet or dry season of the year. The least squares regression of the log-transformed variables is well known that generally underestimate the dependent variable because of the statistical bias that is introduced during the anti-logged regression. A number of correction factors have been proposed to remedy this effect but the unique expression of sediment discharge for the whole set of measured discharges has no basis on physical grounds.

It is evident at least for gravel-bed rivers that after a certain discharge, there is a well-defined threshold for sediment motion. Once the coarse armor layer fully breaks-up that exposes a great range of sediment sizes the transport rate increases. This effect is clearly illustrated in a number of rivers with a break point separating the rating curve into two segments, with the one corresponding to the higher discharges is much steeper. Using this technique, so-called the Broken Line Smoothing, the problem of heteroscedasticity and serially correlated error terms, which is prominent in single rating curve, is practically avoided.

Sediment yields in 14 river sites in Western Greece are computed with this type of rating curve and compared to the earlier estimations. It is shown that in certain locations there is a serious underestimation of the sediment yield and correspondingly of the designed reservoir's dead storage volume. This underestimation of dead storage has a potential impact on the economic life of the reservoir especially when the deposition of sediment occurs in the useful storage of the reservoir.

PRELIMINARY DESIGN OF THE STORAGE CAPACITY OF RESERVOIRS BASED ON A FLOW REGIONALIZATION PARAMETER

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Previous studies of the authors proved that the mean annual flow expressed as water depth over the watershed – mean annual flow depth, – is a powerful flow regionalization parameter able to describe the relative temporal variability (along the year and among years) of the flow regime in Portuguese rivers.

The relationships then established either between some statistical characteristics of the Portuguese annual flow series and the mean annual flow depth or allowing estimating the annual flow with a given probability as a function of the mean annual flow depth are presented.

Those studies also showed that the annual, monthly and daily flow series at watersheds with close enough mean annual flow depths are similar, provided those series are expressed in non-dimensional forms. Taking into account this fact, transposition procedures enabling to establish the annual, monthly and daily flow series at ungauged watersheds were developed. In this paper a brief overview of those transposition procedures as well as some application examples based on several study cases are presented.

Taking into account the previous results, it is shown that the storage capacity of reservoirs can also be related with the mean annual flow depth, according to the following general equation

where the variables have the following meanings:

- C net storage capacity of the reservoir (m³);
 mean annual flow expressed in volume (m³);
 specific storage capacity of the reservoir (-);
- V_f annual volume required by an uniform water demand (m³);
- G guaranty of the water supply (-);
 mean annual flow depth (mm).

For each pair of values of G and equations of the following type were obtained with significant correlation coefficients:

Though the results referred herein concern to Portugal, the authors believe that they can also be established for European countries or regions having climatic characteristics similar to those of Portugal, with emphasis to the South European zones.

WATER MANAGEMENT IN ALBANIA

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Albania is endowed with sufficient surface water and groundwater resources for its various needs, which is a real asset for a Mediterranean country. Moreover, the aquifers as well as the surface hydrographic network, including the artificial reservoirs, are evenly distributed throughout the country.

Water is a key resource for most economic and social activities. In Albania , surface waters are traditionally used for both non-consumption (as hydroelectricity, tourism) and consumption (irrigation, industry) and receive all the pollution generated and discharged by anthropogenic activities. The threat from industrial pollution has eased since the early 1990s, except in a few hotspots. Nowadays most of the pressure comes from domestic pollution in urban areas. Ultimately the polluted rivers contaminate the coastal areas:

If this situation continues, the human welfare could be badly affected in the long run as well. Therefore, in managing its water resources, the challenges for Albania is to keep the groundwater resources suitable for drinking, protect them from any contamination from the surface, ensure their sustainable

management for future generations and improve the management of effluents in order to better protect surface waters and the seashore. Further integration of water protection and sustainable water management into other policy areas such as agriculture, urban development, transport, tourism, fisheries and regional development is necessary.

Albania has not a comprehensive water monitoring at present, yet. However, data requirements on water resources, their quantity and quality, as well as the impact of discharges, should be selected and prioritized according to national strategic goals. How effective and demand driven water monitoring system is to provide the necessary information for effective decision making in water resource management and protection?

Which is the current legislation concerning the water resources management in Albania ?

How are the main principles of the EU water Directive integrated in the Albanian legislation for a long term management? Which are the responsible authorities for the water resources management in Albania ? Which are the economical instruments introduced for the water management? Which are the ongoing projects for water supply and water treatment and associated high investments?

These are some of the questions which find an answer in this paper to show the current water monitoring system, economical instruments, standards, institutions responsible for the management of the water resources, legislation (national and international), policies, strategies and framework management for water use and protection in Albania.

STUDY OF THE PROTECTION VOLUME TO CONTROL FLOOD IN RESERVOIR BY STOCHASTIC AND GENERALIZED EXTREME-VALUE DISTRIBUTION MODELS

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There is a clear conflict between the reservoir utilization for control and use multiple of the water mainly for electric power generation. In order to control the floods, it is necessary to predict the availability of empty reservoir volumes, capable of absorbing some inflow parcels, to avoid or reduce the damage caused to the downstream area. From an energy standpoint, it is desirable to allocate the smallest possible protection volume, while from a flood control standpoint, it is desirable to have a reliable estimate of the

possibility of the reservoir failing to control a flood when a given protection volume is allocated. Minimizing this conflict is tantamount to allocating the smallest possible protection volume, while minimizing the probability of the reservoir failing to control a flood. Among the methods used in the calculation of the protection volume and failure risk, the most traditional method is the Volume x Duration Curve (VDC) method. The application of this method presents some difficulties. The main difficulties are the sampling variations that cause the VDC to be non-concave, as required, and the choice of which probability distribution should be fitted to the data. This paper studies a stochastic model in conjunction with reliability analysis concepts to improve estimates for the protection volume that should be allocated in a reservoir to control a flood wave. In this approach, the inflow that reaches the reservoir during a flood is considered to be a load, and the reservoir capacity to control this flood is considered to be the resistance that the reservoir offers against the propagation of the flood. Here, the load and the resistance are modeled as a stochastic process using Bayesian approach by Monte Carlo Markov Chain Algorithms and VDC method is modeled by the generalized extreme-value (GEV) distribution using moments of linear combinations of higher order statistics (LH moments).

GROUND WATER MANAGEMENT RESOURCES IN SICILY (ITALY)

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We want to present in this context a synthesis about the problem of groundwater resources management in Sicily. Simultaneously, a studies have been carried out to characterize the qualitative and quantitative features of the aquifers and at the same a specific activity concerning the identification of the most important water bodies for abstraction of drinking water.

On the whole, the objectives are: define a general hydrogeological framework in Sicily, for the characterization of the principal water bodies, asses water resources for every hydrogeological structure, show the connection between management of the resources and his sustainability.

The hydrogeological features of Sicilian aquifers are mostly characterized by pelitics sediments and low permeability, consequently large areas are characterized by local and superficial aquifers of low extension and potentiality, therefore the carbonatic hydrogeological structures have a good potentiality.

On the basis of productivity, the following most important hydrogeological complexes (for porosity and fissuration) were identified:

Alluvional complex, Volcanic complex, Sandy calcarenitic complex, Carbonatic complex, Conglomeratic arenaceous complex, Arenaceous and clayey – arenaceous complex, Evaporitic complex, Metamorphic complex.

The total annual drawing are around $1163 \times 10^6 \text{ m}^3$ (535,27 among rising and 628,45 from wells) and divided in:

$559,39 \times 10^6 \text{ m}^3$ for agriculture use;

$109,47 \times 10^6 \text{ m}^3$ for industrial use;

$434,86 \times 10^6 \text{ m}^3$ for civil use.

The qualitative features, by biological chemical monitoring, have showed pollution phenomena in the coastal zone for sea water intrusion.

In particular the coast aquifers in Trapani, Augusta, Siracusa, Palermo and Ragusa zone are effected by increasing salinity and falling groundwater levels; civil pollution loads has identified in a wells and sources areas used for abstraction of drinking water.

RUN-OFF ASSESSMENT WITH WATER ECONOMY BALANCES

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The water economy balances (WEB) are the main tool used in run-off regulation methods, reservoirs water release planning and supply reliability assessment. The flow into water resource system intake points is a basic but very difficult for reliable consideration component of WEB. This comes from the run-off irregularity and time variation. In WEB multi-annual time series of its monthly volumes are mostly used. Their variation has seasonal and in great measure random character. In addition irregular cyclic variation is typical for the year run-off volumes with succession of dry and wet periods.

If we consider the run-off forming climatic factors as constant, it could be characterized as a stochastic phenomenon, which overall representation can be done by the totality of its variations. In fact, limited, but long enough, time series could be considered as sufficient for an adequate calculation of WEB. The run-off is estimated by its registered realizations in past periods. As the available series of such measured data are comparatively short for reliable calculation of WEB, an artificial run-off series, generated by mathematical models, could be used for improving the situation.

In the article two type of models – autoregression (AR) and autoregression moving average (ARMA), are discussed. Where as the goodness of fit of the

statistic characteristics of the modeled to the measured data series, used for their basis, are insured by the modeling methods, there is no mathematical criteria for equivalence in the character of the annual cyclic variations. The latter is very important with storage volume dimensioning and other assessments by WEB with multi-annual regulation. For main criteria, witnessing such equivalence, it is proposed and reported in the article a method using the results obtained by WEB, made up with modeled and measured time series in parallel.

The proposed criteria consists in the existence in the frame of the long generated series of at least one excerpt of successive run-off values, as long as the measured data series, with equal average value and close statistics, which brings to approximately the same results obtained by WEB.

To demonstrate the method a simple methodology has been developed for selection of the excerpts and series of numerical experiments have been carried out. They consist in calculation of the water supply reliability by modeled and measured hydrological series, respectively 1000 and 50 years long, with fixed storage volume, dimensioned as seasonal and multi-annual regulator. The analyses made on the results from these investigations bring to the following conclusions:

In relation to the character of the annual volumes variation the modeled by AR and ARMA hydrological series could be assumed from the viewpoint of WEB results as equivalent to the basic measured data series. It proves the possibility of their employment in WEB.

The investigations also proves the high relevance of using modeled run-off series with reservoir dimensioning, water release planning and supply reliability assessment by WEB calculations, regardless of the regulation type, as they show more stable and safer results.

SOUTHEASTERN ANATOLIA PROJECT (GAP) IN TURKEY AS A WATER RESOURCES MANAGEMENT

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The Southeastern Anatolia Project (GAP), one of the most important projects for develop remarkable natural resources of the world, is accepted as a change for getting benefit from rich water and agricultural resources of the Southeastern Anatolia Region.

The GAP Project has been considered as a regional development projects through years, but the dimensions of sustainability, protection of environment

and participatory have been attached to the master of the project in recent years.

When the GAP Project is completed, the Upper Mesopotamia, the centers of many civilisation, will re-gain its importance as it had in the ancient times, and will be alive a center of civilisation. Moreover, when the problem of water shortage and water supplies in the world for the future is kept in mind, the importance of Southeastern Anatolia's water supplies will be doubled. For this reason, the GAP Project, developed by depending on water and natural resources of the region, will have an important place in the world.

The aim of this study is to introduce the region with rich natural resources and the GAP Project. For this reason, firstly, the natural potential of the region will be introduced. Second, The GAP Project will be presented in details. In the third stage, the projects being processed for protecting the natural sources and environment will be analyzed. In the last stage, strategies and policies to develop and to protect the natural resources of the region in short, mid, and long terms will be proposed.

JEL Codes: Q2, Q3, N55, O53

IRRIGATION DEVELOPMENT IN SERBIA UNDER WATER FRAMEWORK DIRECTIVE

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Adoption of Water Framework Directive (WFD) is a turning point in development of European water resources. For the first time in the history of Europe, a unified and uniform strategy for the environment protection and water resources management was created. The goal of this paper is to point at some new events in the irrigation development in Serbia resulting from the application of the WFD. The application of the WFD can result in big changes in irrigation.

One of the goals of the WFD is rationalization of the water consumption, which in the countries with the developed irrigation means that the consumption of water in the irrigation systems ought to be decreased. The second goal is the decrease of the water resources pollution. The recent investigation has demonstrated that agriculture took over the ignominious leadership in the environment pollution. Industry, which was for decades the primary polluter, is now put under control by the introduction of the waste

water control and by the construction of waste water treatment facilities. In the intensive irrigation conditions, the artificial fertilizers and plants protection chemicals are washed off from the land into the recipients along with the excess water.

The WFD sees a solution in the introduction of the principle "user pays" and "polluter pays". So, the price of water is introduced as an instrument that should reduce the consumption and pollution of waters. From the irrigation aspect, it means the increase of the net water price, because, in the most of the countries, the end user pays only a portion of the real price of water. All the stated brings about the changes in this agricultural area. The choice of the irrigation method providing the rational water consumption and little water loss is emphasized. Also, the crop patterns with the plant sorts more resistant to water shortage will be an advantage.

The introduction of the principle "user pays" may provoke a certain resistance in the farmers who are the end users of the irrigation systems. Water, must become an economic category. This requirement should be fulfilled not because of the EU, but for our own sake.

Nevertheless, the level of understanding of water resources problems in Serbia is very low. The behavior of the previous regime which did not observe economic logic has resulted in the great deal of population thinking that the state is obliged to provide water for all the users at low, non-economic prices.

The authors surveyed the public (users of water) on the question of irrigation of the Leskovac field. This survey has demonstrated that the large majority of farmers (87%) understand the importance of irrigation, but a negligible part of the respondents accepts the fact that the construction of the system inevitably leads to the changes in the agricultural production (new, different sorts of crop, modern irrigation methods, and economic price of water).

The construction of the irrigation system effects the modernization of the complete agricultural production. However, the expressed attitudes demonstrate that there is a strong resistance of the potential users of water to any modernization. In this case, there are no realistic conditions for the successful operation of the irrigation system, so that the construction cannot be recommended in this region. The obtained result demonstrate that one of the reasons for degrading of a large number of the irrigation systems in Serbia lies perhaps in the fact that no public was consulted in the making of decision to build the systems.

**ANALYSIS OF PRESSURES AND IMPACTS ON THE WATERSHED OF
STUDENA RIVER ACCORDING TO THE WATER FRAMEWORK
DIRECTIVE**

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Serbia as a country attempting to become a member of the European Union is obliged to harmonize all national legislation with the European legislation. The Water Framework Directive (WFD) is the most important piece of water legislation in Europe for many years. The importance of this directive surpasses the boundaries of the European Union. By the force of its political and economic authority, the EU manages to enforce the directive not only in the candidate countries, but in all the countries which have the common large river basins with the EU. It is in the best interest of the Serbian water resources management to, irrespective whether Serbia will become a member of the EU or not, pay a due attention to the Water Framework Directive, and other water resources related EU directives.

The WFD aims at achieving good ecological status for all rivers exceeding a catchment area size of 10 km². One of the key actions that Member States need to take is to characterise river basin districts in terms of pressures and impacts. In the River Basin Management Plans required by this directive, all human impacts on the aquatic environment shall be quantified and evaluated.

The watershed of Studena River is located in the southeast surrounding of Nis, Serbia. One of the largest water supply sources is located in this basin. Also, a part of the basin (Jelasnica gorge) was put under protection as a special natural reservation. The basin is exposed to the anthropogenic influence by agriculture diffuse, waste water, bad waste management, channel modification and physical barriers.

The purpose of the study is to present the watershed status of Studena River through its biological, physico-chemical and hydromorphological conditions in the light of Water Framework Directive. The field research has already begun (spring 2005), but have not finished yet (expected to be by 2006 summer). This research includes biological quality elements (macrophytes and phytobenthos, benthic invertebrate fauna and fish fauna). Physical and chemical properties are to be used along with the hydromorphological situation of the river as supporting elements.

THE ANALYSIS OF THE PUMP STATION OPERATIONS ON THE DRAINAGE SYSTEMS IN VOJVODINA

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The present drainage concept is defined by the "Investment program of draining water districts of Backa and Banat " effective since 1967. This document represents platform for drainage area of about 1.730.000 ha, portion of it, circa 1.000.000 ha is making part of the hydro system Danube-Tisa-Danube.

As a result of the drainage-system development, additional areas were included and higher efficiency over the already reclaimed areas has been achieved. Up to date over 2.000.000 ha of land is controlled by drainage.

This paper analyses the operation of a pump-station controlling a particular drainage system. The results are compared with the surplus of water determined by the water-balance equation. The infiltration from the nearby Danube River has also been taken in consideration.

WATER CONSUMPTION FORECAST AND WATER DEMAND MANAGEMENT IN STREVEZO IRRIGATION SYSTEM

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The Irrigation System "Strezevo" - Bitola is situated on the south-western part of Republic of Macedonia, and can perform irrigation on 20200 ha net area. The irrigation system is demand oriented. The Main Supply Canal of the System (44 km) dominates over the irrigation area and provides natural pressure into underground pipeline network. It is covered concrete canal with open canal flow, with big slope and relatively small dimensions of the cross sections and with small own water reserves. The control of water flow is performed by remote control from the Command Computer Center, according to the French method of dynamic regulation, which is not completed in the part of forecasting of water consumption due to not completed part of the database, in which a primary place take the meteorological data and the registered flows through the Main Supply Canal and the main pipelines.

The available data - measured flows of the main pipelines and meteorological data from public meteorological station located in the geographical center of

the irrigated area are in the hard copy, and there is a running process of their digitalisation.

Because of design and practical inconsistencies in canal construction and organizational weaknesses in the work of water users associations and water supply agency, difficulties occur relating to water management in the Main Supply Canal .

Non-existing of prompt and confidential data concerning the agricultural crop pattern, the undeveloped system for irrigation water demand concerning delivery time and quantity of water, the practice for concentration of irrigation in certain periods of the day cause great difficulties in regular water supply.

The problem of sudden cancellation of water consumption because of the summer torrents followed by thunderstorm, particularly is complicated due to the power supply failure of the regulation structures and non-functioning of the larger part of the lateral safety spillways of the Main Supply Canal , and requires development of procedures for quick response in such cases.

The terrain configuration, which does not enable construction of larger basins for water reserves, in conditions of demand oriented water supply, requires to be worked out a model for water consumption forecast, appropriate to the available data, and in the same time, creation of measures to manage the water demand, because in certain periods of irrigation season, during the daily consumption peak, is overpassed the maximum flow canal capacity.

PUBLIC PARTICIPATION IN INTEGRATED WATER RESOURCE MANAGEMENT AT LAKE OHRID - OPPORTUNITIES AND CHALLENGES

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The capacity for the implementation of sustainable development in water resources management is ignited by strong civic participation. Such participation can create the foundation for using water resources efficiently and effectively by engaging social learning, building trust, and a forum for understanding possibilities and limits. The nature of civil society and its role in a given context, however, must be taken into consideration. In this paper, we explore the case of Lake Ohrid and conclude with some empirical insights into strengthening public participation as well as understanding the challenges of transboundary.

PROBABILISTIC ASSESSMENT OF OVERTOPPING RELIABILITY OF A DAM

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Probabilistic methods, which consider resistance and load parameters as random variables, are more realistic than conventional deterministic methods for determining the safety level of a dam. This study is based on a probabilistic assessment of overtopping reliability of a flood detention dam. In the analysis, the inflow hydrograph parameters and the initial reservoir level prior to the allocation of the flood in the reservoir are accepted as random variables. A bivariate flood frequency analysis is performed in which the annual maximum peak discharges and the surface runoff volumes of the floods are handled as the random variables, using bivariate gamma probability density function. This operation yielded a number of flood hydrographs having different peak discharges and runoff volumes under a particular return period. Using this information, family of return period curves relating the runoff volume to peak discharge are generated at the dam site. Maximum reservoir elevation is determined by performing reservoir routing based on Monte Carlo simulation. This calculation is repeated for various return periods and combination of possible flood hydrographs to observe the variation of overtopping reliability. It is, therefore, intended to find the most critical case that is likely to occur at the dam site. The findings of the present analysis may be used in decision-making for the crest elevation of the dam, which is safe against overtopping.

IMPLEMENTATION OF THE EU WATER FRAMEWORK DIRECTIVE IN THE BALKAN AND CENTRAL EUROPE

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It was only in December 2000 that the EU Member States adopted the Water Framework Directive (WFD). Since this endorsement of the WFD, all (future) member states are facing the challenge to meet the requirements as set by the Directive. The fulfillment of this new overarching and integral legal framework is very opportune, as Europe's water resources are under strong pressure. The Directive provides for sustainable and integrated management of surface waters and ground waters, transitional waters (zone between fresh

and salty waters), and coastal waters. Environmental considerations form the basis of the WFD, with the ultimate aim of achieving 'good ecological status' in all waters by 2015.

The WFD follows an integrated river basin approach in considering water management issues. Since river basins cut across municipal, provincial and in some cases national borders, the WFD aims to harmonize water policy and water management of the river basin as a whole, in close consultation with all stakeholders.

Practical implementation of the WFD is a complex process containing many institutional, political and technical elements. The development of River Basin Management Plans (RBMPs) is a central element within the WFD process. RBMPs are to provide a detailed account of how specific environmental objectives for the river basin (including groundwater) are to be achieved within a given time frame and should contain a.o:

an overall analysis of the river basin characteristics

a review of the impact of human activities on the status of waters (in terms of both quantity and quality) and ecosystems in the basin

an assessment of existing legislation and shortcomings in meeting the WFD objectives, including a set of measures to address these shortcomings

the perceived involvement of the public in an open planning process

a 'combined approach' of Emission Limit Values (e.g. discharge concentrations) and water quality standards (e.g. the quality of waters receiving effluents)

an economic analysis of water (use) within the river basin, identifying means of cost recovery

(biological) monitoring strategy and approach to be able to determine present ecological status and monitor if planned measures will have the expected impact on identified water bodies.

ARCADIS has been involved in WFD activities since its endorsement by assisting the Bulgarian, Romanian, Hungarian, Polish, and Dutch water management authorities with the implementation of the WFD. In most of the projects specific attention has been paid to "Integrated Water Resources Management" and "Water bodies protection and Ecohydrology".

This paper will provide results and lessons learned coming from practical implementation of the above indicated two BALWOIS Conference subjects. These results will be shared to enable Balkan Countries to apply methodologies and lessons learned in their own river basin management.

References: documents produced by the following projects:

Institutional Strengthening of the East Aegean Sea River Basin Directorate for the Implementation of the Water Framework Directive , Bulgaria (2005-2006)

Support to the Black Sea Basin Directorate for the Implementation of the Water Framework Directive concerning Coastal Water Monitoring, Bulgaria (2005-2006)

Implementation of the Water Framework Directive in two Pilot Basins in Romania (2003-2005)

Implementation of the Water Framework Directive in Romania (2002-2003)

Ecological Survey of Surface Waters in Hungary , (2004-2005)

Implementation of the EU Water Framework Directive in Poland (2004-2005)

A DATA MINING APPROACH FOR DERIVING IRRIGATION RESERVOIR OPERATING RULES

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Recent developments in the field of computational intelligence techniques are helping to solve various problems of water resource modelling and management. These techniques have also shown their potential as an alternative approach to conventional controllers. In this paper a Data Mining approach is applied to the derivation of the operating rules of an irrigation supply reservoir. Operating rules are determined as a two step process. First, a linear programming technique is used to determine the optimal release from the historical data. Then these optimisation results are used as input for the data mining process which gives the release from the reservoir as a decision tree or ruleset. The data mining tool used in this work is based on the induction tree technique, See5, reported by Quinlan in 1993. The decision tree is prepared using a long period, including several drought events, and operation rules so determined are validated on a different shorter period. The behaviour of the operating rules is assessed by simulating reservoir operation and by computing several performance indicators. The results show that the operating rules based on data mining approach are able to provide an effective control and function approximation.

INTEGRATED WATER RESOURCES MANAGEMENT IN OVCE POLE REGION

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Unequal water resource distribution is a global problem which not passes Republic of Macedonia . She belongs to countries, where is not water sufficient, and as results of the global climate changes, there is a water deficit in some regions, including Ovce Pole.

Ovce Pole region with total surface of 700 km² is classified as one of the most arid sites in Europe , based on rainfall patterns, temperatures, high wind speeds and evaporation demands. But, in the same time, Ovce Pole is agriculturally productive region, being the second largest region in Macedonia for small-grain cereals.

World practice shows to us that we should have a complex and integrated view to water management, if we want to achieve positive results in decreasing water deficit, especially in drought regions.

As a result of previous establishments, regards to solving problems with water deficit in dried regions in Macedonia , a project WATERWEB is running in Ovce Pole.

The idea of this project is to integrate the new technologies, from river basins to plant water usage, taking in account environment, socio-economic conditions and health implications from various types of water usage. As a result of application of the new technologies, we are expecting decreasing of water usage for agricultural production, and production of products with acceptable yield, as well as, good quality.

In this paper are presented collected results from the first year of the research, the importance of these results and explanation of other activities in progress, which will be done also in the rest time of the project.

INDUSTRIAL ENTERPRISES AND PUBLIC PARTICIPATION IN THE WFD IMPLEMENTATION IN BULGARIA

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The paper outlines some major aspects concerning the implementation of EU Water Framework Directive /WFD/ in Bulgaria . The importance the business sector as a partner in WFD implementation and the participatory decision-making is justified. The analysis is focused on the private sector role and the need of partnerships in WFD implementation.

The implementation of the WFD in Bulgaria requires for the first time full integration of stakeholders and civil society. It is necessary to raise the awareness of relevant sectors and to strengthen stakeholders' partnerships and networks so that they could efficiently participate in new public-private consulting bodies for development of river basin management plans. The review of initiatives, that have been implemented so far, shows that industrial enterprises do not participate actively in capacity building projects or their involvement is limited to informing them only about technical requirements concerning water resources quality and quantity. At the same time, these enterprises are an important sector in the partnership for integrated water resources management and the WFD implementation. That is why, it is necessary to improve their capacity for participation in decision-making processes.

The paper presents results of a survey of medium- and large-sized industrial companies from the Black Sea, East Aegean and West Aegean Sea Basin Districts, carried within the framework of a Phare project. The main topics of the survey are: awareness of the water protection Acquis, experience in implementing Bulgarian legislation for water protection, notions about participating in water resources management, attitude towards networking and partnerships, assessment of institutional capacity.

The paper outlines lessons learned in the WFD implementation. The experience of Bulgaria shows that the success of this new policy approach strongly depends on the efficient participation of all interested parties (stakeholders) and the synergy among different sectors, legislative acts and policy instruments.

THE KRAKOW 'S WATER SUPPLY SYSTEM OPERATION IN THE ASPECT OF WATER DISTRIBUTION SUBSYSTEM FAILURES

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Application of the reliability theory in engineer system evaluation in Poland and in the world is very common and contains different fields of economy as: military, transport or building. Using that theory for analysis of water supplying systems is already acknowledged as standard. Nevertheless it is still a field of science that is not fully recognized.

The inspection and reliability estimation of a distribution system is a complicated and difficult question. It requires considering a wide range of random events. First of all it results from multifunctionality of such system: supplying water to buyers in needed amount, quality, under proper pressure and at the any moment. Moreover structure of the system, multitude of different elements consisting of, is another aspect that influences a difficulty of estimating reliability. Nowadays, water demand in the system has considerably decreased, the reliability inspection are performed in particular to estimate weak points of the water supply system, where frequency of accidents and type of effect is the greatest. The above inspections gives in addition possibility of marking out such point of the system where exists a potential risk of secondary water contamination, caused by change of network running hydraulic parameters resulting from lack of water demand stability in the system. Small reliability and occurring damages may lead not only to disable operation of water supply system (WSS), but also can risk consumers health and lead to other damages of water-pipe enterprises. Qualitative and number estimation of negative events lets draw more precise conclusions and use an engineer performance having in view eliminating them to improve exploitation conditions of system functionality. Hence, reliability estimations of WSS, corresponding not only to engineer structure but also allowing for qualitative aspect of the product, determine essential information for effective management and exploitation of WSS.

This paper is a try of presenting reliability estimation of a water supply system. Analysis was performed for distribution systems of Krakow city. Basic of investigation was a wide base of information related with damages of the water distribution system in exploitation period 1996-2005. Reliability estimation has included determining basic parameters such as: parameter of failure flux, mean time of running without damage or mean time of repair. It was also analyzed different dependencies between possibility of pipe damage and their diameter, material and if their aim was supply water to a buyer.

INTEGRATED WATER RESOURCES MANAGEMENT OF PENINSULA INDIA – CHALLENGES IN CHANGING ENVIRONMENTS

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Globally, gap between demands and availability of water is widening, necessitating immediate measures for its sustainable utilisation and efficient management, especially in the developing world where economic crisis and population explosion are hazards in further development of water resources. This is especially true in regions like peninsular part of India with wide disparity in the distribution of rainfall and water resources. Topography of the Western Ghats Mountain that runs parallel to the Arabian Sea coast brings very heavy rainfall in the west coast, producing a number of rivers, most of them flowing fast westwards through the steep slopes to join the Sea. Some of major rivers flow east through the water starving Interior Peninsula, which is a rich agricultural land. Here, increasing demands associated with rising population exacerbate the existing conflicts over water. Management of these rivers and settling disputes over the water is a key factor determining the social and economic development of the region, as life of the majority is related to agriculture. Estimation of the water availability after two decades in a changing environment, using the water balance model shows considerable decrease in coming years. When the factors affecting water quality and quantity are considered, actual availability of safe water will be even less. Impact of extremes associated with global anomalies is another challenge in water resources management in this region. Existing disputes over water will definitely worsen and new disputes are likely to originate in near future. The new scheme of river linking may create unpredictable environmental issues in coming years. Though the pressure from the rising population outpaces all water development projects, there is still exploitable water in the Mountain region that can solve water crisis to a good extent. But, present methods of conservation and management of water resources are inadequate as a result of poor finance, corruption, slow government machinery, non-cooperation among different departments involved and vested political interests. The region needs an appropriate water policy and a strong political will to implement rules and regulations to protect resources from destruction. This paper is a comprehensive assessment of the various issues related to water resources management of Peninsular India.

PROBLEMS OF THE INTEGRATED WATER RESOURCES MANAGEMENT

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Bulgaria is poor of water resources and is in a very complicated situation, with small financial investments available to improve water quality. The interdependence between available water resources, sustainable environmental, and the development of human society is becoming more and more obvious.

According to the EU directives, within 5 years, members of the EU must prepare water management plans for integrated water resources management of each basin in the country. For Bulgaria, as an Eastern European country in a period of transition, this requirement is most urgent. The implementation of water management plans will increase the quantity of water available for water supply, and satisfy the other needs of water, while maintaining ecological equilibrium in the basin.

A water management plan by basin must include all measures for the improvement of water supply and water quality, while balancing the financial capabilities of the country and the invested funds by the EU.

Elaboration on these water management plans cannot be done without a comprehensive analysis of the actual situation of the water resources, economic conditions, and the environment. The Integrated Water Resources Management (IWRM) is an approach that gives us the possibility to integrate the needs of the two main operating systems in a given basin - nature and society.

Today many people speak about this approach, some stages of integrated water resources management procedure are prepared, but another stages are subject of determination and discussion. It is very important to emphasize the fact that water management plans are the final phase of IWRM. To create these plans it is necessary to pass through the profound analysis of the actual water resources, society and environmental development. All of this must be supported by a mine of information. In other words, we need Decision Support Systems (DSS's), in the area of the water resource management, in order to unify all these requirements.

From this point of view, the Bulgarian practice in water resources management will be presented in this paper. Water legislation and its conformity with the EU water directives will be discussed. For example, the

Geographical Water Resources Information and Assessment System "GeoWaterIAS" V.1, will be briefly demonstrated, and attempts to simulate different scenarios for water quality improvement by the DSS "REKA" will be described. Some problems related with the integrated water resources management will be presented and discussed. A review of the weak points in Bulgaria's water policy will also be made.

HYDROELECTRICITY AND OTHER USES - THE CASE OF HYDRO-QUEBEC

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Hydro-Québec is one of the main electricity producers in North America (33 616 MW). Hydro generating stations (more than 50) produce 97% of this output. Some are very powerful: for example, the installed capacity of the Robert-Bourassa generating station at La Grande II (16 units) is 5616 MW and its reservoir covers 2 815 km². Along the Saint-Maurice river (380 km) in Southern Québec, eight hydro stations generate a total of 9 TWh.

Amongst Hydro-Québec's main goals in managing rivers for hydroelectricity production are caring about water quality, preserving the diversity of species and taking efficient action on spills (including avoiding inundations and low waters). An important concern is conciliating the operation of its facilities with other uses of rivers and reservoirs: fishing, commercial and recreational navigation, industry, drinkable water, agriculture, tourism, etc.

FLOATING DEBRIS IN RIVERS AND LAKES IN SERBIA

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An analysis of floating debris is conducted. It was found that components of debris is similar to the municipal waste and consists of plastic bags, bottles and glasses, tires, dead branches and tree trunks, aluminium waste, mud, etc. Floating debris cause pollution of water bodies and disturb activities related to the use and regulation of water resources. It is suggested that a planned action needs to be organized and taken immediately.

EROSION POTENTIAL METHOD" AN IMPORTANT SUPPORT FOR INTEGRATED WATER RESOURCE MANAGEMENT

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"Erosion Potential Method (E.P.M.)" is a complex methodology designed for usage in the field of Integrated Water Resources Management. Its cover tasks from erosion mapping, sediment production and transport recalculating and as an important support for Water Master Plans and Integrated water Resource Management.

Up to date development of this method contributed to high degree of reliability of sediment production evaluation and sediment transport evaluation and reservoir sedimentation. Also very important field is planning optimal quantity of anti-erosion works and measures where E.P.M. is important input

Anti-erosion and torrent control works quantified trough E.P.M., carried out during the past fifty years, produced significant direct and indirect effects (decreased sediment production, reduced sediment transport in many rivers in Serbia , considerable enhancement of the state of ecosystem in eroded regions etc). Rough estimation reveals that the annual sediment discharge in the Velika Morava catchments was reduced to a half as compared with the previous period.

The paper presents obtained result during half-century permanents development and usage. Last floods improved its value.

CLIMATE CHANGE AND USING WATER RESOURCES MANAGEMENT IN TAJIKISTAN AND CENTRAL ASIA

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Global and regional climate change including connected with anthropogenesis factor in past decades are not practically disputed. Well known example is the Aral Sea catastrophe.

Unfortunately, sometimes these factors become pressure mean and even speculation instead of working out effective measures of adaptation to them. Appreciably it is connected with insufficient studied question. Characteristic

examples are river water resources. In last 15 years after breaking down of USSR and formation in Central Asia five new independent states climate changes its becoming warm are constantly used by all countries in their interests at upholding or, on the contrary, an interdiction of new development of water resources, especially at the expense of building dams and hydroelectric power stations, substantiation of quotas of water division establishment regime of regulation river flows and so forth. At that time according to accepted all over the world and including in the Central Asia norms, any use of river flow provides its natural hesitation and moreover very essential. For example minimal shallow consumption for the most mastered in Tajikistan Vakhsh river in leaf of building Roghun, s HPS with capacity of 360 MWt is $100 \text{ m}^3 / \text{sec}$ and maximum debit is $6000 \text{ m}^3 / \text{sec}$. The real observed climate changes of flow are several orders lower. From here it can be done a conclusion about very high adaptation of nowadays methods of development and using of river flow to its changes, including to climatically. Therefore now in Central Asia the serious problems of using flow connected with climate change are not existent. At the some time in perspective arising of such problems is possible. It is connected with melting of glaciers, irrigation of new lands etc. But in this case first of all the study of all these processes and mainly working and effective adaptation measure to them are required. Nowadays' problems in water facility sphere of Central Asia connects firstly with their exhausting in relation with social activities. It is at first the result of accepted now in all countries of region strategies giving unconditional priority to agriculture economical development in their countries.

The last, in its turn, can be explained as strategy of surviving, inevitable at arisen during USSR time demographic situation in countries of Central Asia-sharpen growing of population. For example in Tajikistan from 50s to 90s years the number of population increased 6 times and increasing did not stop after 1991. Thus, today a man simply shifts on climate his shortages on organization social activity. Differently from climate problems of water resources management are very important for Central Asia now, mostly having transboundary character. These problems:

-interrelation between hydropower located mainly in countries of upper flow and irrigation in countries of lower flow

-distribution of water resources between countries

-protection and provide of water quality and others acquired interstate character after 1991.

Unfortunately, today there are made approaches to their decision by old administrative or in better case political methods. Development new economical mechanisms for interrelation between countries based on market approaches are necessary. In relation to water resources it is very complex question. Now in Central Asia such mechanism worked out only for interrelation between two branches –hydropower and irrigation. But even here

this decides on bilateral base. Its extension on all countries-participants is necessary.

RECENT ENVIRONMENTAL PROBLEMS AND EDUCATION IN BULGARIA

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The world society is currently faced by many environmental questions and problems such as pollution, wildlife rescue, global warming, natural resources protection, etc. All these important issues should be transformed to the population, especially to the young generation. Bulgarian education is also part of the above process. The level of Bulgarian education has been decreased for the last 15 years, due to various subjective and objective reasons. Nevertheless, some efforts related to education of students in the environmental field are implemented by the Ministry of Education and Science as well as schools across the country. This study discusses various educational questions and problems related to the environment. A special attention is paid to the formation of knowledge and sense of water resources saving among the Bulgarian students.

INTEGRATED WATER RESOURCES MANAGEMENT

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One of the most important contributions to protecting the clean water resources, watertables, rivers, lakes and the coastal sea is scientific and engineering know how in integrated water resources management and its implementation.

Reduction of the daily drinking water consumption per person by half and reduction of sewage water production of human settlements to almost zero is possible.

These new technologies are less expensive than conventional systems, which cover all water needs by clean drinking water and send all polluted water in one single sewage pipe to a pit, to the sea, lakes and rivers or to an inadequate purification station. – The systems can be built up step by step in a decentralized way and do less depend on centralized planning.

=> The aims of sustainable water management:

- Reducing water pollution and sewage
- Saving of scarce and expensive drinking water
- Using grey- and rainwater for non-drinking purposes
- Cleaning wastewater by natural processes
- Recycling nutrients to agriculture for soil fertility
- Recycling nutrients to biomass and energy production

=> The technical tools of sustainable water management:

- Water saving devices for installed taps, showers and toilets
- Water saving household machines
- Rainwater collection, storage and use for non drinking water purposes
- Low flush, vacuum and urine separation toilets
- Separation of sewage streams and decentralised wastewater treatment
- Local "grey" water (used water without faeces and urine) treatment and reuse

Recycling systems for "brown water" (feces in low diluted wastewater) and "yellow water" (urine)

Biogas reactors (=> energy production) and sludge composting (=> soil nutrients for agricultural production)

Biomass production through water cleaning in open fields and ponds

The presentation will first introduce the new water and nutrient cycles and then give practical examples of small and medium sized projects of the above mentioned technologies.

WATER WOES IN SOUTH EAST ASIA: GEO-ECOLOGY OF TRANS-BORDER RIVER SYSTEMS AND DAMS BETWEEN INDIA AND NEPAL

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Floodplain along the border of India and Nepal located north of Gandak-Kosi interfluves of Middle Gangetic Plains, remains submerged under flood waters

from two rivers Kosi, the 'sorrow of Bihar' and Gandak The floodplains constitutes of a series of alluvial cones formed by master streams along with lower gradient slopes between them. The plain is absolutely featureless with tributaries constituting dendritic drainage that receives the floodwaters of the Gandak-Kosi systems converting 8000 sq. Km of arable land to waste wetlands.

The dams built upstream for flood mitigation have been sources of social and regional conflicts Ganges basin between India and Nepal. This paper figure out four types of prospective benefits from integrated management of Gariges basin, i.e. benefits to the river; benefits from the river; reducing costs because of the river; benefits beyond the river, which will create "win-win" situations that would be reasonable to be accepted by each country in the basin and which in turn promote regional co-operation, socio-economical, and environmental benefit for the people of Ganges basin and also provide as a good example to resolve the regional conflicts in various river basin's in the world.

WATER INTEGRATION: BANGLADESH PERSPECTIVE

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Bangladesh is deltaic land blessed with the Ganges-Brahmaputra-Meghna rivers systems. The problem is that Bangladesh has too much water in the monsoons and too little in the dry season. Unless the water is conserved when it is in excess for use when scarcity follows, the problems for flooding and drought will continue to plague the country. Besides, demands for freshwater are growing rapidly in the urban and industrial sectors, in agriculture, in fisheries, in inland navigation and for controlling salinity.

Simultaneously, agricultural water logging is degrading water resources and salinity are no longer problems of the coastal area alone but occur in and around embankments and dams. Construction of flood-control embankments and roads are impeding water flows and both the wetlands and their fishery resources are under threat.

Other pressure on the wetland are form desiccation and encroachment for Boro rice in the winter season, especially in the Haor regions in Sylhet and Mymensingh and from reduced dry seasons flows particularly in the South West in the Ganges system.

Callous interventions along the course of common rivers, at the cost of Bangladesh , are nothing new. The severe environmental disruptions in both

West Bengal in India and Bangladesh set in motion by the infamous Farakka barrage on the Ganges are a bitter testimony to how devastating the consequences can be for those whose livelihoods depend on the land and waters of the affected areas.

The much-hyped Ganges water-sharing treaty can scarcely undo the ecological damage triggered by excessive withdrawal of the waters during the dry season and veritable deluge during monsoon as the floodgates are opened to ease pressure. Unfortunately, being a lower riparian country, with some 93% of the catchments areas of the common rivers outside Bangladesh, this uncomfortable situation often finds itself at a great disadvantage with respect to both sharing common waters and riparian regions. This, despite the fact that there are international river-sharing norms and rules, which by their very definition, ought to exclude any injustice to the disadvantaged party.

Bangladesh has not been receiving the stipulated amount of waters under the terms of the so-called treaty. Agriculture, forestry, fisheries and the environment have suffered serious setbacks in large areas of Bangladesh as a result. Insufficiency of river waters have forced the farmers to go for lifting of underground water and this is posing a threat of land subsidence and creating the worse health threat to arsenic contamination.

The other countries of the world that have suffered from arsenic poisoning found remedy in stopping the use of ground water. Instead, they developed an efficient management of their surface water resources. Bangladesh also needs a proper watershed management plan immediately to combat the problems. Some multi-dimensional research should be addressed for further definition of environmental risk factors for major health problems and development of appropriate techniques, technology and methods of communication.

Besides, to address the overall problems of water management, water pollution and unilateral withdrawal of water in upper riparian zones an integrated national and regional water approaches and policies are needed to be worked out.

CONCRETE RESERVOIRS FOR POTABLE WATER : CHARACTERISTIC DAMAGE AND REPAIR METHODS

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Buried or partially exposed reservoirs for potable water are frequently constructed as reinforced concrete structures. The basic structural elements

of reservoir are: base slab, walls and top slab executed as flat slabs with capitals or two ways slabs.

During exploitation of such facilities, especially in large municipalities, situations when reservoirs are empty and when necessary repair works could be done, are rare. Namely, disregarding the recommendations of national and international associations, practice shows that reservoir RC structures were practically "neglected". This was mainly stipulated by function of water reservoirs in water supply system of urban towns. Significant repair measures are usually taken in cases when leaking from reservoir is notable or when sediment layers reach critical level.

Characteristic damage of reservoir structure elements are:

- fissures and cracks,
- reinforcement corrosion,
- dissolving and washing out of hydrated cement compounds,
- cracks in protective coat and its separation from concrete substrate.

The main causes that lead to occurrence of quoted damages are:

- design faults and defects, which are result of poor construction,
- frequent change of stress state in walls due to water level changing,
- differential settlement of ground under reservoir,
- "aging" of protective coatings,
- incidental actions (earthquakes, floods, impact actions, etc.).

Specific characteristics of survey process of buried water reservoirs, analysis and classification of causes of damage occurrence in reservoir RC structure elements, as well as case study of assessment and repair of one buried concrete reservoir for potable water, will be presented in the paper.

**WATER PRICES AND HOUSEHOLDS' AVAILABLE INCOME: KFY
INDICATORS FOR THE ASSESSMENT OF POTENTIAL
DISPROPORTIONATE COSTS - ILLUSTRATION FROM THE ARTOIS-
PICARDIE BASIN (FRANCE)**

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The WFD's implementation in the Artois-Picardie French basin is carried out by several working groups involving water stakeholders. One of these groups deals with "Economic" and "pressures & impacts" assessment. The main

objective of this group is to carry out the characterisation and the baseline scenario combining economic and Pressures and Impacts information i.e. identify the pressures caused by main uses and provide socio-economic indicators on these uses.

The investigations carried out for the characterisation have undertaken a specific analysis of the weight of the water services bill for the households of the Artois-Picardie. In this basin of 5 000 000 inhabitants, the mean price for a cubic meter of water is 3,28 euros in 2004 (inc. water distribution, collection and treatment of waste waters and environmental taxes) but this price can reach 5 euros and more in some specific areas of the basin. Unfortunately in some areas of the basin, these high prices can be combined with low mean available income per inhabitant (the ratio for artois-picardie basin is 20% lower than the national ratio).

This paper give a short presentation of the method used for collecting both water prices and indicators on mean available income at the municipality level (2 500 municipalities for the whole Artois-Picardie River basin).

Then it presents the main results from this study and for example that the ratio comparing the weight of the water invoice and the available income can overcome 2% in many municipalities.

The last part of the paper draws out some conclusions on ho, in the context of the implementation of the Water Framework Directive, these results can be used for developing a water pricing policy that will be both incentive and sustainable for households.

2% is generally considered as a guidance value in many documents (e.g. EÜ commission, OECD, Académie de l'eau).

APPROPRIATE MEAN OF ACCESS TO RURAL WATER SUPPLY IN GORANCI

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Goranci is located at a dry karstic valley at 650 m altitude. The area is settled from many centuries bacc. It is environmentally vulnerable enclave since the karstic formation are highly permeable and belongs to catchment area of springs in use for a grate water supply system of Mostar town and surroundings. In spite of relatively very high precipitation in Goranci, there are not available surface water, groundwater is not investigated yet, sources of potable water are limited and it's price during the summer season is high. This

paper gives an overview of traditional water sources and environmental sanitation then some of the possibilities to provide necessary quantity of potable water, improve the sanitation there and escape the contamination of water down streams.

NATIONAL WATER STRATEGY FOR ALBANIA

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National Water Strategy (NWS) for Albania is prepared, from BCEOM French Engineering Consultants and Albanian experts. The goals and objectives of NWS have been laid down in the Water Resources Law as follows: - The NWS is the definition of national objectives in the field of water resources and institutional structures for implementation of the strategy;

- ✓ It indicates the way how to fulfil the requirements of the different water uses;
- ✓ It identifies programmes and priority projects;
- ✓ It promotes water resources conservation and sustainable use of water resources.

From these objectives, the following functions of the strategy has been derived:

- To define objectives in the field of water resources management;
- To define institutional structures needed for the implementation of the strategy;
- To define the legal, regulatory and technical framework as well as co-ordination structures among the participants in its implementation;
- To indicate how to fulfill the requirements of each different water use, in agreement with the national and regional development and the individual sector policies;
- To identify programmes and priority projects to be included in the short-term, medium-term and long-term strategies;
- To promote water resources conservation and sustainable use of water resources in harmony with environmental and other natural resources.

TOPIC 5: WATER BODIES PROTECTION AND ECOHYDROLOGY

EFFECT OF DIFFERENT WATER QUALITIES ON SOIL PHYSICAL PROPERTIES

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The quality of irrigation water (Salinity & Sodicity) has the potential to significantly affect soil structural properties. While the effect of electrolyte concentration (as indicated by the electrical conductivity EC) and sodium adsorption ratio (SAR) have been studied under laboratory conditions, the effect on soil profile structural properties have not widely investigated under field conditions. In this paper, water with three different water levels of sodium (SAR = 0.9, 10, 30) was applied as alternative treatments to a clay loam soil in furrow irrigation. Soil physical properties as surface bulk density, subsurface bulk density and Mean Weight Diameter (MWD), which is a index of aggregate stability were measured.

The application of minimum to high SAR water was found to reduce aggregate stability, increase the bulk density of both the surface crust and underlying soil. MWD in the moderate and high saline-sodic treatments decreased respectively about 17% and 53% during the irrigation season compared to control. Also, bulk density in surface layer increased by about 4% and 7% respectively with using moderate and high sodic treatments than beginning. Both of these results indicate the impact of high SAR_{iw} on the collapse of soil structure and soil dispersion.

PASSIVE TREATMENT OF ACID MINE DRAINAGE

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The objective of the work (report) is to evaluate environmental contamination around the towns of Kizhnica and Gračanica in Kosovo and to make recommendations as to the means of eliminating or reducing contamination. The towns are located in east central Kosova approximately 10 km south of the capital city Prishtina. The primary industry is mining and processing (known as concentrating) of lead ore by the Trepca company.

Trepca owns four mines in this region- Kizhnica Mine, Novo Brdo, Badovci and Ajvalia.

The primary objective of the stage I assessment is to identify the principal causes of contamination and to define a programme of works to remove, or reduce these. Also included was a preliminary assessment of the stability of the paddock dam, sampling and analysis of soil, ground and surface water to determine zones of contamination within the vicinity.

Drainage flowing from or caused by surface mining , deep mining or coal refuse piles that is typically highly acidic with elevated levels of dissolved metals .

The formation of Acid Mine Drainage (AMD) is primarily a function of the geology, hydrology and mining technology employed for the mine site. AMD is formed by a series of complex geo – chemical and microbial reactions that occur when water comes in contact with pyrite (iron disulfide minerals) in coal, refuse or the overburden of a mine operation .

The resulting water is usually high in acidity and dissolved metals . The metals stay dissolved in solution until the pH raises to a level where precipitation occurs. Solubility charts for the various metals show the pH at which precipitation begins and the pH at which maximum insolubility occurs.

DISTRIBUTION OF ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS IN MUSSELS TISSUE FROM ALBANIA COAST

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Organochlorine compounds such as PCBs and DDTs are a class of widespread organic contaminants which are ubiquitous in the environment. They are stable lipophilic compounds which can be bioaccumulated (Lang, 1992) and have several toxic effects (Tanabe, 1988). PCBs are among the most widely known class of persistent organic pollutants (POPs) because of their ubiquity, potential for magnification in the food chain, and harmful effects on humans and wildlife (Mimmi, 1994; Loomis et al., 1997; Hansen, 1998; Cheek et al., 1999). Synthetic pesticides have been in use earlier to mid twentieth century. Although many public health benefits have been realized by the use of pesticides, but also their potential impact on the environment and public health is substantial. These kinds of persistent and bioaccumulative chemicals can be transported through the atmosphere and water far away from the pollution source (Blais et al., 1998).

In this paper, we present a review of existing analytical methodology for the biological monitoring of exposure to pesticides. The findings reported here are parts of a study to determine the concentration and distribution of OCPs and PCBs in mussel's *Mitilus Galloprovincialis* in two stations, Durrës and Vlora bay and to identify sources of this contamination. The use of sentinel organisms to measure the levels of bioavailability contaminants has been established by various pollution monitoring programs (Claisse et al., 1992; Baumard et al., 1998a, b). Mussels, which are water altering bivalves, have been mainly employed (Farrington et al., 1983). Mussels have been shown to concentrate many organic contaminants by a factor of 10 above ambient sea water levels, providing a direct representation of pollutant bioavailability (Bergen et al., 1993).

The most frequently detected pesticide was α -HCH (Lindane) followed by HCB and p,p-DDE. Quantity of PCB-52, -138, -77/154 was more than others chlorinated biphenyls in mussel samples. Elevated concentrations of volatile PCBs could reflect the fact that PCBs in our country have atmospheric origin.

EFFECTS OF WASTEWATER TREATMENT ON YIELD AND UPTAKE OF SOME NUTRIENTS BY WHEAT PLANTS

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A field experiment were conduct to use treated and untreated wastewater effluent for wheat irrigation as compared with the effects of well water. Results showed that application of untreated sewage effluent stimulate the yield production as compared with treated and well water. Data revealed that application of untreated sewage effluent increased total nitrogen, phosphorus and potassium content in both grain and straw. It was observed that treated of sewage effluents resulted in a remarkable decrease the accumulation of heavy metal in grain and straw as compared with untreated effluents. Results showed that high grain/straw ratio was obtained in case of untreated as compared with treated and well water. Therefore, it is important to determine long-term change in bioavailability of heavy metal and its impact on plant growth and nutrition status in soil.

**PHYTOPLANKTON, PHYSICO-CHEMICAL AND SAPROBIOLOGICAL
CHARACTERISTICS OF THE DANUBE RIVER, ON THE STRETCH
THROUGH SERBIA**

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By the collaboration between Republic Hydrometeorological Service of Serbia and The Service For Environmental Protection of Serbia, the march-rout examination of water and sediment quality of the Danube river, has been carried out, on the stretch through our country. The field examinations took place in August 2004 using ship-laboratory Argus.

A great floristic variety has been noted according to qualitative analysis of phytoplankton. The presence of 186 taxa from 7 divisions of algae has been noted. The greatest heterogeneity has been shown by the green algae, whilst Diatomae are subdominant by the number of taxa. The results of quantitative analysis show the dominance of centric diatoms: *Cyclotella meneghiniana*, *Stephanodiscus hantzschii*, *Aulacoseira granulata*, *Cyclostephanos dubius* and *Skeletonema potamos*. The high values of biomass that point out on the trophicity increase are noted on the stretch from Nestin (1287 rkm) to Zemun (1174 rkm) with the maximum at Centa (1208 rkm) with 15,885 mg dm⁻³. At this locality the highest pH value, the highest concentration of soluble oxygen and percentage of water saturation by oxygen, have also been noted due to the increased photosynthetic activity of phytoplankton. The PTOT value concentration is the lowest at this locality, because the orthophosphates have been spent by the intensive bioproduction. Downstream Zemun, it has been noted gradual decrease of biomass up to Pancevo, and afterwards downstream the considerable reduction all the way up to Brnjica (1040 rkm), where the value of algal biomass was 1,697 mg dm⁻³.

On this stretch of the Danube river, the trophicity increase leads to diversity of species. Longitudinal variations of phytoplankton biomass are followed by the variations in number of dominant taxa, as well as in variations in Chlorophyll a concentration values. The highest concentration values of Chlorophyll a are measured at Centa (40,87 µg dm⁻³) and the lowest at Smederevo (6,94 µg dm⁻³).

The results of saprobiologic analysis show that the greatest number of bioindicators belong to β and α-mesosaprobionts. The saprobity index was between 2,04 and 2,20 which points out on β-mesosaprobic environment. Water quality was in the II class.

**RESULTS OF QUALITATIVE AND QUANTITATIVE CONTENTS OF
ZOOPLANKTON OF THE DANUBE RIVER THROUGH THE TERRITORY
OF SERBIA**

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Danube, as one of the biggest European rivers (2783 rkm), runs through Serbia by its middle part of the flow (588 rkm). Previous water quality examinations of this river, point out on the influence of the various pollutants and first of all these, that are the consequence of wastes of the cities and suburbs, hydrological changes as well as the developed agriculture in this region.

By collaboration between Republic Hydrometeorological Service of Serbia and Ministry For Ecology of Serbia, from 2 nd to 7th August 2004. the field examinations of Danube have been carried out on 11 localities on the ship – laboratory Argus. The samples for zooplankton have been taken by hydrobiological bottle from the depth of 0.5 m under water surface and have been filtered through the plankton net and immediately conserved by formaldehyde. The total amount of 50 dm³ of water has been filtered for each sample. The further sample treatments took place in the laboratory of Republic Hydrometeorologic Service of Serbia in Beograd.

The qualitative zooplankton analysis showed the presence of 57 taxa from 4 groups: Rotatoria (38 taxa), Protozoa (12 taxa), Cladocera (4 taxa) and Copepoda (3 taxa). The groups of Protozoa and Rotatoria have been the main constituents of zooplankton community that is characterized by the dominance of the species: *Brachionus calyciflorus*, *Keratella cochlearis*, *Trichocerca (rattus, pussila)*, *Diflugia limnetica* and *Staurophria elegans*. Results of quantitative analysis show that the total numerosity of zooplankton was between 54 400 ind. m⁻³ on Brnjica locality to 964 800 ind. m⁻³ on Centa locality. Downstream Centa the considerable reduction on population density of zooplankton has been noted. The variations of biomass of phytoplankton were in accordance with the variations of density population of zooplankton. Results of saprobiologic analysis of zooplankton show that the greatest number of indicator organisms belong to beta and oligosaprobic level. The indices of saprobity are between 1.50 on Zemun locality up to 2.05 on Slankamen locality (the middle of the river).

ENVIRONMENTAL ISOTOPE RATIOS OF HYDROGEN AND OXYGEN IN THE WATER SYSTEMS AND INFORMATION DATA SYSTEM

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Global demand for fresh water is doubling every 21 years, so, water is becoming an increasingly precious resource. Also, it is clear, that water scarcity and its degradation are growing, generally, for all countries of the world. The water could present a burden on economic growth of the countries and a potential danger to human health and the environment if the water resources will be not better managed. Isotope techniques and isotope data of hydrogen and oxygen can help for the better exploitation and the better management of the water resources.

The isotopic compositions of hydrogen and oxygen, which are the elements of the water molecules, are variable because their isotopes are fractionated for some chemical and physical processes occurring in nature. Hydrogen has two stable isotopes (1H and 2H), while, the Oxygen has three stable isotopes (16O , 17O and 18O). It is clear that ordinary water molecules have nine different isotopic configurations. The water pressures of the different isotopic molecules of water are inversely proportional to their masses, therefore, $1\text{H}216\text{O}$ has a significantly higher vapor pressure than $2\text{H}218\text{O}$. So, water vapor formed by the evaporation of the liquid water is enriched in 1H and 16O , while, the remaining water is enriched in 2H and 18O .

Precipitation (atmospheric waters), surface water (lakes and rivers), groundwater, geothermal waters and deep waters there are the water systems that we have considered in our isotopic measurements. The isotopic composition of hydrogen and oxygen in the water samples are measured on a mass spectrometer with double inlet system and multicollectors system. The isotopic composition of hydrogen is analysed by the hydrogen gas taken from the water by the reduction reaction with Zinc and Uran in high temperature and the vacuum conditions. The isotopic composition of oxygen is analysed through the CO_2 which is in isotopic equilibrium with the water. The isotopic compositions of hydrogen and oxygen are reported in terms of differences of $2\text{H} / 1\text{H}$ and $18\text{O} / 16\text{O}$ ratios relative to a SMOW (Standard Mean Ocean Water). All isotopic data are computerized and is made their interpretation. The major changes in the isotopic composition of natural waters occur in the atmospheric part of the water cycle and in surface waters.

MAN'S DEGRADATION OF WATER QUALITY: CLEANER PRODUCTION, A SOLUTION!

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It has already been declared that man's physiological, domestic, agriculture and industrial use of water degrades its quality. But human's activities can cause pollution even when he is not using the water. For example, the dumping of household refuses, or industrial solid wastes, may bring it into contact with surface or groundwater, in old gravel pits for example, with consequent pollution.

In all, the pollution may be gross, so that rivers and lakes become anaerobic, foul, discolored, lifeless waters; or the pollution may be more subtle, when treated waste water stimulates the biological potential of receiving waters with residuals of nitrates and phosphates leading to eutrophication or the pollution may be at an insidious microchemical level where hazards to health are only apparent over long periods.

Measurement of water quality: It is almost axiomatic that before we can control water quality, in a scientific sense, we must be able to measure it. We could set up high-purity distilled water as our aim in quality, and say that departures from it represent impure water. This, however, is unrealistic when considering water as part of man's environment, and we need to look for a satisfactory criterion for drinking water. If this can be done, our other water needs: domestic, agricultural and industrial, can be related to it. Certainly most of us would find distilled water unpalatable, so it would not be acceptable for drinking purposes.

Control of Water Use: Man's needs for water, his degradation of its quality and the increasingly exacting standards required for drinking water all indicate the necessity for control or allocation of water use. More and more, civilized communities are realizing that water is not a free-for-all inexhaustible resource. Consequently the management of as much as possible of the hydrological cycle in a rational manner has become for many nations a desirable, if not essential, goal.

Groundwater and surface water: If in any water supply area a groundwater source exists, even of small output, it could be reserved as the top quality drinking water, leaving surface supplies for the lower grade uses. This is because groundwater is generally much purer than surface water, being more remote both physically, and in time, from pollution.

Parallel systems: It is suggested therefore that a 'hierarchy of water quality' be established so that higher-grade water should not be used if a lower grade is

appropriate and available. By this means the best quality is reserved for the most important purposes, and water degraded in quality may be used again lower in the hierarchy.

Cleaner Production: The concept given by UNEP pertains to the pollution prevention and waste minimization at source, through 3-Rs concept (Recover, Recycle and Reuse). The concept has been successfully initiated in the industries to reuse the wastewater after treatment and conserve the fresh water. Leather Tanneries and textile industries has reduced 20-50% of the wastewater generation by introduction of Cleaner Production Tools. A case study will be presented showing quantitative analysis of an industry in Pakistan

INDEX OF ECOLOGICAL CHANGES (IEC) IN TOTAL ENVIRONMENT SYSTEM

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The work analyses previous researches and works published by certain landscape planners, sociologists and ecologists (of various expertise) for the purpose of exploring possibility of assessment of successfulness (effectiveness) of the observed social system.

Presented are definitions and methods for calculation of the Index of Ecological Changes (IEC) which is an essential indicator (parameter) in formulation of the 'Coefficient of general effectiveness of a social system' as part of the 'global (developmental) existing system'.

Presented are also grounds and initiatives for unification of the Index of Ecological Changes in the water sphere (ICWat). What is offered is actually the base for unification of ICWat in the form of a value expressed in [EBS] = [PE] units, (Number of Population Equivalent = Population Equivalent) .

SURFACE WATER QUALITY IN THE REGION OF TCHELOPETCH WITH A VIEW TO GOLD ORE PRODUCTION

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The surface water system in the region of Tchelopetch (industrialized area comprises a groove, an ore-dressing plant, air way shafts, a waste collector, an central explosive store, a waste water treatment plant and administrative buildings) includes the River Vozdol and its main tributaries – Misazluk, Tchgovishko, Galkovo and Tchiflik rivrs as well a the running nearby a big river Topolnitza – basic water collector. These rivers are the main water suppliers for the industrialized zone and at the same time collectors of the waste water. The natural sources of surface water are the precipitations and the groundwater forming the rivers run-off.

In the present material are discussed the new innovations in the production and their impact on the surface water conditions. The ore-dressing plant technology presumes a completely closed cycle for the waste waters and their direction to the waste collector combined with a special isolation of the bottom and bands of the waste collector. A drainage system gathers the eventual leakages and through the pumping station will transfer them back in the waste collector.

An assessment of the surface water quality in mentioned region is revealed using data from the last detailed monitoring observations (2005). Considering the expected innovations in the ore-dressing production a forecast for the expected water quality condition has been presented as a result of the new technological alterations. The water quality is assessed according the country legislations and the main water quality parameters including heavy metals are analyzed and discussed.

FRESHWATER AND SALT WATER IN PANNONIC DEPOSITS FROM THE SOUTH OF TRANSILVANIA DEPRESSION

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Transilvania depression is situated in the center of Romania, being surrounded by the three Carpathians mountain chains: Oriental, Meridional and Occidental.

Transilvania depression was founded and has been evaluated on a rigid foundation, starting with Paleocene age or even terminal Senonian.

Pannonic deposits have a large development in the central and southern part of the Transilvania depression and there are constituted by marl and clay with alternate sand bands, and subordinate by sandstone and gravels.

The study zone is situated in the south part of the depression, including the Pannonic deposits development area from south of Mures river to Olt river basin.

The aquifer included in this deposits are known trough the information gathered from the hydrogeological bore holes (with depth between 25 and 300 meters).

The chemical analysis made by present shown the presence of salt water in this pannonic deposits, even if there is no saline or gas dome known in the study area.

The paper will present some considerations concerning the lithological and hydrogeological characteristics of the Pannonic deposits in the study area, with accent on the presentation of the freshwater or salt water areas delimitedated on chemical analysis basis.

QUALITATIVE STATUS ANALYSIS OF THE PHREATIC AQUIFER IN THE BÂRLAD RIVER FLOOD PLAIN CONCERNING THE NITROGEN-BASED COMPOUNDS

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In order to implement the 2000/60/EC Water Frame Directive in Romania, a qualitative analysis of groundwater in the Bârlad River flood plain was made, because it was considered that the groundwater body is at risk from this point of view. The normal concentrations of Ammonium ion were exceeded in 49% of the total number of analyzed mean annual values. The used data comes from 38 observation wells of the Groundwater Quality Monitoring National Subsystem, during 1997 – 2004. The preliminary data were statistically processed. The results of this study are represented on GIS maps and charts.

The phreatic aquifer is developing in the flood plain and terraces of the Barlad River and its tributaries. From lithological point of view the aquifer is porous-permeable, has large values of hydraulic conductivity and a poor protection of covering deposits, explaining its high vulnerability to pollution.

SOME PROBLEMS CONCERNING DELINEATION AND CHARACTERIZATION OF GROUNDWATER BODIES IN BULGARIA

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The process of harmonization of national legislation with EU legislation is one of the priority tasks in the Republic of Bulgaria.

For the purpose of implementation of the EU Water Framework Directive (WFD), groundwater bodies (GWBs) in Bulgaria have been delineated according to their initial characterization. These tasks were accomplished by a large collective of the Geological Institute at the Bulgarian Academy of Sciences.

The main difficulties were assigned to specific features of our country related to various physico-geographical conditions (relief, climatic characteristics, surface waters), complicated geological structure, uneven distribution of the population density, and multifarious kinds of human impact. These circumstances hampered the delineation of GWB according to requirements of the WFD. Therefore such delineation was done on the basis of development of aquiferous formations with similar lithological characteristics, in spite of the fact that some of the GWBs may belong to local catchment areas. The layered location of the groundwater bodies is a cause to present them in different layers in the geographic information system (GIS).

The second group of obstacles is related to insufficient exploration of some GWBs. During overcoming of these obstacles, the collective applied different approaches. Several examples are given in this relation.

EXAMPLES OF IMPACT OF HYDROTECHNICAL CONSTRUCTION IN BULGARIA ON THE REGIME OF KARST GROUNDWATER

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Karst terrains cover about 1/4 of the territory of Bulgaria. In most cases one refrains from hydrotechnical construction in such areas, but one can mention several cases as exceptions.

One example of such construction is a dam on the Ogosta, which western shore gets into karst terrain. Independently of protection measures against filtration, the discharge of the neighboring karst spring increased considerably after filling of the dam. This circumstance imposed additional construction in order to prevent Montana town from flooding.

Another important object is derivation canal leading surface waters from the watershed of Iskretz springs (West Balkans) and taking them to the dam in neighbor catchment area. The regime of the karst spring is influenced partly by this human impact, which is better manifested during summer baseflow. The impact from the water deprivation is attenuated by considerable catchment area of the spring with uncovered karstified rocks.

DETERMINATION OF HEAVY METALS IN WATER AND SEDIMENTS OF DRINI RIVER, BUNA RIVER AND LAKE SHKODRA

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Lake Shkodra is located on the border between Montenegro and Albania at 40° 10' North latitude, 19° 15' East longitude. The lake water level also varies seasonally from 4.7 to 9.8 m above sea level. The largest inflow is the Moraca river (Montenegro), which provides more than 62% of the lake water and the outflow is Buna River.

The aim of this study was the monitoring of heavy metal levels in water and sediment samples from Drini river, Buna River and Lake Shkodra.

From the results of analysis of sediments from Shkodra lake, River Drini and River Buna by using two methods of extractions and analysing them in ICP – MS for total concentration of toxic metals as Cr, Co, Ni, we concluded that sites in river Drini and Buna are the most contaminated from these metals which indicate in water quality of Shkodra Lake. The most probably reasons of those results are, geological construction of north Albania and the existence of the considered number of mines of chromium, and nickel very near to Drini river.

CONSIDERATIONS REGARDING THE HYDROGEOLOGICAL AND HYDROCHEMICAL CHARACTERISTICS OF SOME SPRINGS IN BUSTENI AREA (BUGEGI MOUNTAINS)

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Busteni area is situated in the eastern part of the Bucegi Massif, in the Meridional Carpathian chain.

The main geological characteristic of the study area is the presence of some Mesozoic fractured sedimentary deposits placed on a crystalline foundation.

The geological structure developed in this area is characterized by very favorable conditions for the water accumulation – the lithology, the tectonic characteristics, and the presence of some karsts phenomena, rich precipitations.

The precedent studies shown a great groundwater exploitation potential, the estimated value for the groundwater annual mean flow being around 10-15 l/s/km².

In the same time, the study area is very important for the touristic potential and the problem of the people provision with potable water is very important.

The paper will present the results of two years of field measurement concerning both aspects: quantitative and qualitative, of the aquifers in the study area. The measurements for springs flow were made each week and the water chemical analyses were made each month.

The results of this field campaign were used in order to reevaluate the groundwater resources in the study area.

THE HYDROCHEMICAL INDEX CHANGES OF THE MAIN RIVERS WATERS FLOWING INTO LAKE SEVAN, ACCORDING TO THE ANTHROPOGENIC ACTIVITIES IN IT'S CATCHMENT BASINS

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In a result of intensification and extension of different branches of economy (way of living, industry, agriculture, recreation etc.), as well as connected with the changes in density of population, some great anthropogenic changes occur in the structure of ecosystems of that area. In 1990-s the political and the subsequent economic changes in Armenia also influenced the environment. It is impossible to solve the problem of protection of natural resources of Lake Sevan and their effective utilization without investigation of hydrobiont's qualitative and structural and functional interrelations in the system " Catchment basin Û Lake ", as well as the ratio of eutrophic and toxic substances.

The water samples for testing have been taken from eight rivers out of 28 rivers falling into the Lake Sevan . Those are: Gavaraget, Tsakqar, Lichq, Argichi, Vardenik, Arpa, Makenis, Masrik, where systematized regime, monitoring of hydro chemical investigations have been conducted through the

years 2002-2004. The physical and chemical indices of the ecological quality have been defined for each water sample: temperature, the hydrogen indicator of water (pH), saturation with dissolved oxygen, quantity of easily digestible organic substances (PO), as well as its transformation degree – biochemical oxygen demand (BOD), biogenic elements, especially the contents of the main components of mineral nitrogen (NH_4^+ , NO_2^- , NO_3^-) and mineral phosphorus.

Due to different traditional hydrochemical methods the physical and chemical indices in water samples were determined.

The analytic analysis of time dependence dynamic curves of the contents of an organic issue and inorganic forms of phosphorus and nitrogen in the water of the main rivers falling into Lake Sevan testifies about the fact that there continues the flow of water from the rivers to the Lake Sevan saturated with two elements, though in less sizes.

THE HYDROBIOLOGICAL RESEARCH OF THE NISAVA RIVER IN THE PROTECTED AREA “SICEVO GORGE”

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The final objective of Water Framework Directive (WFD) is to achieve the status of good ecological quality for all waters by 2015. The status should be based upon the hydrobiological, physico-chemical and hydromorphological elements. The hydrobiological elements are particularly important.

While presenting results from an interdisciplinary research project, this paper focuses on the hydrobiological research of the Nisava River in protected area “Sicevo gorge”. The field research has already begun (2004 summer), but has not finished yet (expected to be finished by summer 2006). This research includes biological quality elements (invertebrate fauna, fish, phytobenthos, and water macrophytes). Physico-chemical and hydromorphological elements will be supporting elements.

The Nisava River in protected area “Sicevo gorge” is exposed to the anthropogenic impact by multipurpose reservoir “Zavoj”, agriculture diffuse, waste water, channel modification and physical barriers. Those impacts have also been presented in this paper. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers (US EPA 841-B-99-002) will also be used for the assessment of the ecological quality in this river basin.

HYDRIC MONUMENTS AND THEIR PROTECTION ON KOSOVA.

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Kosova has a small surface of 10.877km², but possess a very complex water system. The protection of the nature environment and preservation is linked, in a very inherent manner, with the water issues and the water balance. Currently, one of the most essential issues in managing water is the protection of the fresh water as a source of supplying population with drinking water, sanitary needs, industry, agriculture, etc. Modern, complex and effective measures on preservation of the hydric monuments are usually treated in a regional level and with a very close cooperation with local community.

Among the nature value inheritance in Kosova the hydric objects and the hydric phenomenon take a very insignificant place. In the project is present a differentiation of the important hydric objects and the hydric phenomenon that the nature inheritance represents, and those are qualified based on a very specific characteristic such as the techniques of formation, rare appearance, educative values, spatial dimension, and the esthetical values. Is to be mentioned that the Institute of Nature Protection working groups are listing the hydric objects and the phenomenon that possess unique values with a satisfactory level of the source feature which according to the criteria are listed in the list of the nature inheritance.

By means of law for the nature protection, are defined the categories of the protection of the nature values in accordance to IUCN. The Institute of Nature Protection in Kosova till now has listed 22 objects in the list of the hydric inheritance which are protected by law. A major part of them are characterized as a natural monument according to IUCN.

Due to the undefined political status, Kosova till now has not signed and ratified an international convention on nature protection subject. However, with the final political status solution Kosova will be incorporated in all interrelationships, organizations and international institutions taking into account the implementation of the obligations derived from them.

After the disintegration of ex-Yugoslavia, Kosova is in a faze of building up the governmental institutions, human capacity, judicial infrastructure and the ongoing development for the protection of the nature values and the water values, in general, with upgrading their status to international one.

GROUNDWATER - AND SURFACE WATER INTERACTION IN THE WATERSHED OF TUNDJA RIVER, BULGARIA

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For the purpose of implementation of the EU Water Framework Directive, groundwater bodies in Bulgaria have been delineated together with their initial characterization.

Groundwater - surface water interaction is studied for the watershed of the Tundja River that is transboundary river. Different hydrogeological settings in the left and right riverbanks as well as along the main river flow produce various interactions between groundwater and surface water. Many gauge stations for the river and its tributaries as well as hydrogeological stations allow these interrelations to be analysed.

Groundwater in porous, karst and fractured rock medias is present within the watershed of the Tundja River. Consequently the groundwater bodies are characterized with highly varied parameters.

The purpose of the paper is harmonization of a vast amount of data originating from different databases for the watershed of the Tundja River , which was inhabited from prehistoric times.

INTEGRAL MANAGEMENT WITH THE URBAN WASTE WATER DISPOSAL SYSTEMS

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The biggest sources of concentrated pollution of water resources in a basin are the human settlements and industry, so in solving the problem of integral management of water resources in the last ten years a special attention is paid to the solution of urban waste water disposal systems. The fundamental axiom of the contemporary approaches to these issues states that the quality protection of water resources requires an integral consideration of the problems of town planning, sewage system, operation of the waste water treatment facilities and receptors and an active control all the components with the aid of modern computer systems and technologies.

Due to the complexity and particularity of the problems to be solved, and due to their intensive relation to the spatial data, large number of necessary historical and current data required for the efficient management, the GIS technologies and modeling and simulation of waste water disposal system operation are indispensable and very important components in its design, reconstruction and revitalization, control and management.

By the integral solution of the urban space problems, sewage system, waste water treatment facilities and the receptors, using the existing historical or current data bases, modern simulation and optimization models, careful planning and production of appropriate scenarios, nowadays the optimal high-efficiency strategies are attained in the world, their basic goal being the «hygienic» disposal of waste waters, that is maximal reduction of waste water outlets and harmful effects on the recipients and the environment, with minimization of investments and operational costs.

Successful management of the urban waste waters disposal system depends on the performance of the sewage system. Considering that the sewage systems have been neglected for a long time and that very little was invested in their maintenance, very large number of sewage systems, even in the most developed countries of the world, has very low performance. That is why one of the first steps in solving the urban waste water disposal system problems is taking measures to improve the performance of the sewage system. Lately, in the developed countries, more and more attention is paid to the rehabilitation of the sewage systems, as the new approach to the solution of the problems occurring during their exploitation, with considerably less investment.

This paper presents the modern principles of development of the system for urban waste water disposal as well as the list of principles, phases of development, effects and significant software packages used in modeling of urban waste water drainage systems in the developed countries. It also presents the modern principles, phases and financial investments in the rehabilitation of the sewage systems and emphasizes the importance of application of this approach in the solution of the problems of our sewage systems, regarding their very bad status.

CONTRIBUTION TO HYDROLOGICAL ANALYSES OF THE COASTAL KARST SPRING ALMYROS (CRETE, REECE)

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Paper treats hydrology aspects of the Almyros karst spring (Island of Crete , Greece). Its main characteristic is significant sea water intrusion during low

water period, which is caused by complex hydrogeological conditions in its coastal catchment area. The Almyros karst spring has been investigated by many authors. Reason for numerous investigations is great importance of the spring for the island Crete, since it is situated in vicinity of town Heraklio, administrative and economic centre of Crete, with growing population and water demands especially in summer tourist season when salinity of the spring is highest. Chronological systematization of all previous analyses of the Almyros spring is presented. Resume and review of investigation results about salinity intrusion and hydrogeology of catchment area have been done. Moreover, paper presents contribution to hydrological analyses of catchment area, which according to different authors has different values. Turc formula is used as the first step towards application of sophisticated hydrological models, as well as ground water hydrograph method.

APPLICATION OF MACRO BIOLOGIC METHODS IN SETTLEMENT WASTE WATER TREATMENT AND USAGE OF ITS ENERGY AND RESOURCE POTENTIAL

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The approach to the water protection has been changing lately, and the opinion that the waste water is the resource, and not the waste has been gaining in significance. The research has been intensively directed towards simpler, energy saving and cost-efficient technologic solutions of waste water treatment, primarily in the field of application of macro biologic methods, especially where the favorable climate conditions allow this and where large areas of land are available for this purpose.

The waste water treatment mechanism with macro biological method is a simple method and boils down to the application of the macro biologic living stations (aquatic plants or aquatic and terrestrial animals) which directly or via the food chain transform the organic material and nutrients from waste waters or sludge into biomass. The produced biomass is a concentrated organic material very suitable for simple removal and final disposal a secondary resource, fuel in production of biogas, nutrient or even food, with obligatory sanitary control.

The macro biologic unit operation require small amount of energy in the form of the appropriate ambient temperature, so they can be performed in the natural conditions, cheaply, if the energy used is the free solar energy, and the collector with the smallest losses in the system is the water itself, or water surface. If the produced biomass is only processed through the sludge digester, the increase of the investment and operational costs seldom

exceeds 15-20% of the standard mechanical waste water treatment costs, and if it is used as a resource, fuel in production of biogas, nutrient or food, these costs can be annulled.

Intensive research in this field began in the 80's in the world, and almost simultaneously at the Faculty of Civil Engineering and Architecture of Nis. The initial results were obtained in the 1975-1979 period and in the course of 80's numerous macro biological unit operations (floating macrophyte, aquacultures, aquapolicultures, hydroponics, vermicultures) in cooperation with the eminent experts from the USA, were tested as laboratory models and then translated to the level of macro model, that is, they were tested in the part of the waste water treatment facilities in Sokobanja and Blace.

This paper presents the principles of application of macro biologic methods in waste water treatment, and the experience gained through the research at the Faculty of Civil Engineering of Nis and at the waste water treatment facilities in Sokobanja and Blace.

ABOUT ACCIDENTAL POLLUTION IN BASIN PRAVOHA (ROMANIA)

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Human activities concerned with the development and use of water resources, interfere with the hydrological cycle's mechanisms and affect the quantity, quality, time and space distribution of the resource.

The paper investigates the accidental pollution of the river Prahova.

Main pollutants or other categories of pollutants, accidental pollution presents the same risks for aquatic ecosystems.

Possible causes of groundwater pollution are:

- natural calamity
- loss of pollutants out of reservoirs, ground pipes
- arsons

The monitoring system in water field has target estimating of water quality evolution on river.

Paper presents some users with specific problems, critical points, and operative measures for eliminate the causes and effects thereof.

PHREATIC AQUIFERS VULNERABILITY FOR MOSTISTEA PLAIN USING GIS TECHNOLOGY

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The elaboration of some standard methodologies by drawing up aquifers vulnerability studies represents a scientific and technical topic of interest all over the world.

This article wants to apply for Mostistea Plain freatic aquifer a DRASTIC vulnerability assesment methodology by using Geographic Information System technology; its aim consists in regionalising of phreatic aquifer from Mostistea Plain on zones by different ranks of vulnerability to polution.

ECO-HYDROLOGICAL ANALYSIS OF THE NITROGEN CYCLING IN THE POROUS SUBSTRATES OF A RIVER ALONG A GRADIENT OF ANTHROPOGENIC PRESSURE

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The capacity of a river system to catch, transfer, transform or release nutrients is part of its natural self-purification capacity. In natural conditions it is the result of a balanced and long term adaptation of biota to seasonal variations of quantity and quality of water, i.e. to the regimes of hydric fluxes along a year. For running waters with a dominant porous substrates, a major part of the self-purification process is expected to take place in the hyporheic system whom spatial extension is closely related to flow regime variations and local geomorphic features.

From a 2 years field study gathering specialists from biogeochemistry, biology, ecology and hydrology, we investigate the Nitrogen dynamics in a rural and in a urban landscape along a same river course.

The presentation aims to outline how the Nitrogen dynamics is modified along a gradient of increasing urbanization leading to the modification of both quantity and quality of waters in a water courses. Understanding why and how basic processes are impacted in time and space is necessary to protect the local water bodies. Proposals to improve management strategies of water in urban landscapes are discussed.

GROUNDWATER POLLUTION ORIGINATING FROM GEOLOGICAL FORMATION AND AN EXAMPLE OF KONYA-CUMRA-KARAPINAR PLAIN WITH GIS APPLICATION

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Groundwater pollution can be described as degrading of water quality for any usage. Sources of pollution are grouped into two such as natural pollution and man-made pollution. Natural pollution originated from geological formation is one of the most important one.

Dissolution of gypsum and anhydrite can cause natural pollution. Groundwater in that formation has large amount of dissolved solids and is not suitable for domestic, agricultural and industrial purposes. Lack of casing can lead to vulnerability of groundwater. In order to overcome that problem, thickness of the poor water bearing formation should be identify. Besides chemical properties of groundwater should be determined. These are salinity, SAR, % Na, chloride and sulfate. After analyzing, water quality was interpreted by using diagram.

Geological formation containing gypsum and anhydrite is observed Konya – Çumra – Karapınar plain. All well data and water analysis were collected and mapped by Arc GIS 9.0. It was determined that there is a partly covered fault in the direction of north - south. Poor water quality is observed along the fault line. In order to seepage salty water into the well, salty water bearing formation should be isolated with closed pipe and cement.

DEVELOPMENT OF PRE-TREATMENT MICROFILTRATION AND ULTRA FILTRATION MEMBRANE TECHNOLOGY AND ECONOMICS FOR REVERSE OSMOSIS DESALINATION PROCESS

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Crossflow microfiltration and ultrafiltration processes were investigated for the pre-treatment stage of reverse osmosis desalination process. This would reduce chemical consumption, reduce fouling and increase in membrane life. Optimal working conditions such transmembrane differential pressure and porosity (membrane cut off) were first taken into account.

Three mineral membranes Techsep (ZrO₂-TiO₂ layer on carbon support) and three multichannel tubular ceramic membranes Kerasep (TiO₂ layer on Al₂O₃-TiO₂ support) were utilized.

The permeate flow was measured and titrated by varying the CVF (volumic concentration factor). The recovery ratio between waste waters and permeate was about 99% and the flows of permeate were important. Long time experiments were also performed.

An economic study was investigated in order to include it in DEEP software to make comparison economics study.

ENVIRONMENTAL ASSESSMENT OF WATER QUALITY OF ALBANIAN RIVERS

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Albania possesses a wealth of aquatic ecosystems, many of them having enormous natural and biological value, including more than 152 rivers and torrents. Nevertheless, a detailed knowledge on the rivers water quality is still lacking.

For the first time, a systematic environmental study of the water chemical parameters is presented and the main polluting sources are identified.

Results of chemical parameters for 13 measuring stations in four big rivers (Mati, Ishmi, Shkumbini and Semani) are presented. Seven expeditions are implemented during years 2002-2004. Water samples are analysed for physico-chemical parameters (temperature, pH, redox potential, conductivity, total suspended solids and dissolved oxygen), concentrations of nutrients (P-PO₄, N-NO₃, N-NO₂, and N-NH₄), and levels of heavy metals (Pb, Cd, Cu, Zn, Fe, Mn, Cr, Ni, Hg). Several sediments and biota (algae) samples are analysed for heavy metals, too.

Assessment of environmental quality of waters was based on two "quality standards": (1) Classification of Norwegian Institute for Water Research (NIVA 1997) and Directive of European Community (CEE/CEEA/CE 78/659) for "Quality of fresh waters supporting fish life". An evaluation of quality class for all studied rivers was presented.

The most critical chemical parameters for nearly all studied rivers are: (a) Total suspended solids (TSS) resulted more than 25 mg/L in many sampling points; it is caused from intensive erosion of the land, (b) Nutrient nitrogen compounds concentration in rivers near big towns. Also, very low content of dissolved oxygen (eutrophic levels) were found in river Ishmi near Tirana city

and river Semani near Fieri city, caused by the discharges of untreated sewage wastewaters. The most polluted rivers for nearly all parameters resulted Lana (tributary of Ishmi) and Gjanica (tributary of Semani). The conclusions from chemical results are very similar with those found from a study of biological parameters implemented in parallel in the framework of this study.

Several present environmental problems are directly or indirectly linked to rivers ecosystems, like discharges of untreated urban liquid and solid wastes, industrial and agricultural pollutants, and land erosion.

Systematic monitoring programs are urgently needed to understand the present environmental state of Albanian rivers and other aquatic ecosystems to characterize the main sources of pollution and to set the basis for political guideline to improve the ecological situation.

This study was implemented in the framework of the SCOPES 2000 –2003 Joint research project (Scientific cooperation between Eastern Europe and Switzerland).

ENVIRONMENTAL IMPACT ASSESSMENT FOR PARTICULATE MATTER HEAVY METALS IN AIR MITROVICA REGION

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Kosova is a mountainous farm region which at past was in the process of industrialisation because of its reach coal and mineral resources. The problem of air pollution in the surroundings of Trepça mine appeared as early as 1930 when english company "TREPÇA MINES Ltd".

The city of Mitrovica, approximately 40 km north of Prishtina, was the site of one the largest lead smelters in Europe. Lead – related industries have been a major element of the economy of Kosova, but created extensive health risk due to environmental pollution with lead and a variety of other substances. The most abundant air pollutant in this region was lead dust and PM (particulate substances) other substances.

POTENTIAL USE OF WATER HYACINTH (EICHHORNIA CRASSIPES) FOR WASTE WATER TREATMENT IN SERBIA

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The aim of this paper is to determine the feasibility of water hyacinth in treating wastewater. This floating perennial has been used in aquatic systems for wastewater purification for many years worldwide. A lot of interests have been shown for this plant in last few years in Serbia too. Water hyacinth is very efficient in removing vast range of pollutants, from suspended materials, BOD, nutrients, organic matter to heavy metals and pathogens. At the same time *E. crassipes* is one of the most notorious weeds worldwide. When introduced to aquatic ecosystem it spreads very quickly thanks to its high reproduction potential . Therefore water hyacinth tends to eliminate all other living organisms in surrounding. A proposal will be given on potential usage of *E. crassipes* for wastewater treatment in Serbia through comparison of results obtained from various studies and scientific papers which represent experience of other countries in using water hyacinth and aquatic systems. These studies and scientific papers also describe this plant as notorious weed and propose different control measures.

THE SERINO SPRING DISCHARGE: ANALYSES OF AN ULTRA-CENTENARIAN HYDROLOGICAL SERIES, SOUTHERN ITALY

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An ultra-centenarian series of spring discharge data were analysed to identify the recharge-discharge relationship of the karst aquifer, located in Southern Italy .

Like other areas across the globe, research carried out on a lengthy historical series has shown an annual drop in rainfall of ~ 18% in Central-Southern Italy and 7% in Northern Italy . In addition, in Southern Italy , the actual number of rainy days displays a downward trend, while rainfall intensity presents a positive trend. These climatic features are known for their tendency to favour run-off and cause a reduction of infiltration.

Other springs of central Italy , in the Umbria-Marche regions, were analysed to evaluate their regime in relation to climatic changes, revealing a negative trend in spring discharge during recent decades.

In this study, after a description of spring discharge, rainfall and temperature data, hydrological analyses were carried out. The trend in hydrological time series was evaluated by application of progressive least-square linear fitting and correlation significance evaluated by test statistic that followed the t - distribution. Correlation between spring discharge and rainfall was improved by introducing the cumulative effective rainfall index, D_i , which consider the effect of evapotranspiration. Frequency of drought was evaluated by the Gumbel type-III distribution function and the limitation of this application is discussed. Forecast of spring discharge was deducted from rainfall data, computing the minimum amount of cumulative rainfall and the required probability needed in avoiding drought.

WHAT CAN KARSTIC STYGOFAUNA TELL US ABOUT GROUNDWATER DISCHARGE AREAS AND WATER QUALITY ?

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Karst groundwater is an incredible natural resource. It provides drinking water for many of our residents, beautiful springs to feed our waterways and habitat for many unusual underground species. The quality of the groundwater is dependent upon how we use the land and how well we protect the quality of groundwater recharge.

Karst groundwater systems provide habitat for many fascinating animals. Most of the food for cave animals is washed in through discrete recharge zones. As a result, cave fauna is commonly concentrated around the points where these discrete recharge zones connect to caves.

Some groundwater recharge seeps and oozes through the subsurface, and in so doing receives fairly good natural cleansing; the fauna is dominated by obligate cave dwelling. Other groundwater recharge occurs through a vast network of localized openings that are able to rapidly transport both water and contaminants; the fauna is especially composed of facultative cave-dweller or evenly accidental fauna.

Losing stream valleys are important groundwater recharge zones in the Middle-Atlas. Although valley areas represent about 10 percent of the land area, they are responsible for about 40 percent of the groundwater recharge to karst groundwater systems. Protection of water quality in these valleys is critical for protection of groundwater quality in wells and springs.

The groundwater fauna is generally ignored in the evaluation of global biodiversity. It is important from four points of views we aimed to demonstrate. It includes a part of regional biodiversity and natural patrimony; its local

variations may indicate changes in water quality and biodiversity can be used for groundwater monitoring

Cave and Well fauna from different parts of North Africa showed clear relationships between reduced biodiversity and level of water quality. Industries, mining, cattle farms and ranches are potential pollution sources, and fertilizer and pesticide use threatens the local water supply in many areas. Though poorly considered by public agencies, groundwater animal species have a potential scientific, practical and educational value. They may have good potential value to humans as « indicator species » since the decline of sensitive species number due to pests or pollution may be a natural alarm for regulators and public health agencies.

These contaminants can also affect people.

Another unique feature of karst groundwater systems is that water entering the subsurface at a single point may sometimes discharge from multiple springs and wells. The discharge points are sometimes in different stream or river basins and may be separated from one another by a number of miles. Such complex flow systems help explain the relatively large ranges for some aquatic cave species.

WATER QUALITY OF THE MORAVA E BINÇËS RIVER

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The water resources are affected by factors that impose different loadings on them. The factors affecting water resources come from the urban areas, industry and agriculture. Protections of water against contamination and water resources management have a strategic role in development of Kosova. Adequate water management practices enable sustainable water use on long terms basic. Sustainable water management offers an adequate response to permanent water quality degradation and decreasing availability of necessary quantities of water.

The aim of the work was to investigate water quality of the Morava e Binçës River , and to identify potential polluters in the catchment's area. For that purpose, six locations were selected for the water sampling. The water quality has been evaluated using selected parameters (pH value, conductivity, DO, COD, BOD 5 , ammonia, nitrates and nitrites). The testing results for 2001-2004, similar to the results of the previous years, indicate certain departures from the requested water quality in a significant number of controlled stations.

Increase in share of discharge of wastewater from the public drainage systems has been determined.

Kosovo problems are encountered in resolving water protection issues, particularly those with treatment and disposal of wastewater. In this sector, Kosovo is lagging behind not only developed countries but also behind countries in transition.

To reach the set objectives, including improvement of the water quality monitoring systems, it is necessary to work out necessary principles of the new approach in planning, implementing and data collection in compliance with the Water Framework Directive.

GROUND WATERS QUALITY IN POTENTIAL ZONE OF INFLUENCE OF ASH DISPOSAL SITE AT THE THERMAL POWER PLANT "KOSOVO A"

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Kosovo Thermal Power Plant which is situated near Prishtina presents major industrial capacity production in our country. From their production capacity after coals is burned a huge amount of ash is obtained, which is disposed near of the thermal power plant. The ash dump site of the thermal power plant Kosovo "A" which is situated among settlement presents one of the most serious problems in the environment and is one of the potential dangers on underground water carrier layers.

Before the ash dump site location was determined a numerous examination were carried out of physical-chemical and biological parameters of ground waters which were continuous also after the exploitation of the dump site. As object study in the paper has been examined the influence of ash disposal site of thermo electric power plants of Kosovo A in ground water quality. On purpose to determine the physical and chemical parameters were taken the sampling of the water of fifteen wells. Sampling places were defined in that manner which allows assessing the impact of landfill in ground water quality.

The increased concentration of ammonia, nitrate, and nitrite, total phosphorous and bacteriological impurity in village's well waters are the indicators of the faecal contamination and they are related to the proximity cesspools and stables. Increased values of manganese, iron, calcium and magnesium are the consequence of the chemical composition of the soil which is determined in initial zero state and during the exploitation of ash disposal site.

The heavy metals and sulphate ion, as the relevant parameters, moves the fastest in ground waters and it serves to follow the influence of the ash dump site of the underground water quality. The variability of their concentration indicates the emphatic changes of the water quality to compare with the initial zero.

The hydro mix disposal of the ash with water, contain a considerable amount of sulphates which contribute in ground water pollution of this area. For all water wells under impact zone of the ash disposal site characterizes with high mineralization. In order to avoid the negative effects of the ash disposal site in ground water quality is still needed to keep in control the landfill which means working in protection system of drain boreholes. At same time is necessary to continue with regular control of chemical and biological parameters of ground water.

ISOTOPIC CONSIDERATIONS ABOUT "GEOAGIU BAI" HYPOTERMAL DEPOSITS

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The health resort Geoagiu Băi is situated on the right border of Mureș river, in the south part of Metaliferi Mountains. He is well knowed from antiquity by reason of his hipotermale waters (23-33 O C) with curative effect.

Due to relative reduced sizes, geological and structural situations, the hydrogeological model is relatively simple.

The recharge is made mainly, by dint of a major hidrostructure (the Rapolt - Geoagiu anticline) and in secondary, through infiltrations directly from the meteoric waters in the zones in which appear to day the crystalline limestones.

The isotopic study it was made in order to confirm or infirm the hydrogeological model already elaborated and to elucidated the aspects of the thermal deep waters origins, their times of residencies in underground ,the degree of blend of these waters with superficial waters, recently infiltrated.

The analisys of stable isotopes confirmed that the thermal waters and the cold karstic waters have approximately identical values for 18 O and D, what means that these waters have the same genetical conditions as season and altitude.

The study of radioactive isotopes was based on tritium and radiocarbon analisys. The tritium values emphasise the fact that there is a clear difference between the cold karstic waters (35 – 46 TU) and the thermal waters (5 – 16 TU). The radiocarbon values emphasise the different age of these waters,

namely 13000 years for thermal waters and current age for cold karstic waters.

The isotopic results in geological and hydrogeological context generally confirmed the hydrogeological model already elaborated.

The novelty consist in specification on the thermal deep waters origins, their times of residencies in underground, the degree of blend of these waters with superficial waters.

All the results conduced to the completeness of the hydrogeological model.

CULTIVATING AND INVESTIGATION OF CYANOPHYTA

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The Cyanophyta species are the most important group of phytoplankton communities. The physiological peculiarities are unique and are determined by the specific feature in their taxonomic state – nitrogen fixation, discharge of different organic substance, heterotrophic assimilation, oxidation of sulphur etc. Recently the interest in Cyanophyta increased because the growth causes fish mortality, poisoning of drinking waters, etc.

This paper presents the study of different mediums aiming to establish the optimal conditions for cultivating of Cyanophyta species for future scientific investigations. About 820 samples from 7 different regions of city Plovdiv , Bulgaria were analyzed. Five kinds of mediums were established. Stamen from 8 species was isolated for the plankton collection of the Plovdiv University .

WATER QUALITY OF KAMCHIA RIVER AND IMPACT ON THE BLACK SEA COASTAL ZONE

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The coastal zone is the recipient for amounts of nutrients and other contaminants from human activities. Kamchia River is the biggest Bulgarian river flowing into the Black Sea . The study of its role for changes of chemical parameters in coastal zone is very important for understanding and estimation of the anthropogenic impact on water quality (WQ).

The study is based on monthly monitoring of Kamchia River . The following parameters were measured: nutrients as dissolved phosphorus (P), nitrogen (N) and silica (Si); BOD; oxidizability, iron and manganese. The investigation of water column in the coastal zone in front of the river mouth was carried out including sampling and "in situ" measurement of temperature, pH, salinity, transparency and dissolved oxygen. The collected water samples were analyzed for nutrients and suspended matter by standard methods.

The results of the study show an anthropogenic influence since the catchment basin contains urban area and regions with intensive agricultural activity. The investigated parameters generally correspond to the Bulgarian WQ standards. The comparison with data from previous periods reveals a relatively improving of WQ in the river. The analysis of data for coastal waters during high flow period (spring) reveals a significant influence of the river discharge on the 1 mile coastal zone. As a consequence of river discharge the close coastal zone is characterized by low transparency and high nutrients concentrations. The contribution of Kamchia River discharge is about 50% as a part of N and P load by all national rivers into the Black Sea

ORGANOPHOSPHOROUS PESTICIDE RESIDUES IN SURFACE WATER AND GROUND WATER IN THE EAST OF MAZANDARAN PROVINCE, IRAN

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Mazandaran province is located between Caspian Sea and Alborz Mountains. Therefore it is very suitable for agricultural activities. It has been one of the main producers of rice and other agricultural crops in Iran. Huge quantities of pesticides have been applied over this region over the last few years without any environmental precautions. Water samples were collected during a period of 3 months, July, august and September 2005. The sampling was included 15 sites in rivers, 21 sites in streams and 10 ground points. Solid-phase extraction followed by GC- NPD was used to determine four numbers of organophosphorous pesticides. These compounds were diazinon, ethion, chlorpyrfos and edifenfos. Only edifenfos were not detected in the samples. River and stream water samples were found to have detectable levels of diazinon, chlorpyrfos and ethion. The percentage of detection in surface water was, respectively 77.8%, 22.2% and 13.9% in July; 91.7%, 33.3% and 30.6% in august while well water being shown to contain diazinon and ethion. The percentage of detection of them was 40% and 10% respectively. The maximum concentration values of diazinon, chlorpyrfos and ethion were 0.940, 0.171 and 0.370 µg/l respectively. Diazinon residues were found at higher concentration and more frequency than others. This pesticide applies

for the pest of rice (Cizamya) and its rate of application is very high in this region. Physico chemical parameters of pesticides such as water solubility and koc coefficient are effective in concentration value and frequency of a pesticide in water samples.

KARST SPRINGS WITH INFLOWS: CASE OF THE JADRO SPRING (CROATIA)

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The study site is the catchment of the Jadro Spring situated in the Dinaric karst. Classical hydrological and some newer time and frequency domain methods are used in order to validate the existing estimations of the catchment area and contribute to factual information about hydrological functioning of the catchment. The groundwater recharge rates are calculated by the mathematical model based on Palmer's soil-moisture balance method. The values of parameters of the groundwater recharge model are estimated by the spectral method. The calculated monthly and annual groundwater recharge rates are the base for estimations of the hydrologic catchment area of the spring and inflows from the Cetina River .

ARSENIC GEOCHEMISTRY IN DELTIC ENVIRONMENT

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We sampled 107 shallow (9-48m) wells, 7 deep wells (>100m) and 11 wells from intermediate depth (60-90m) in a well-demarcated 4km x 4km area in Chakdaha block in West Bengal. High arsenic ($[As]_T = 0.2-0.5 \text{ mgL}^{-1}$) in groundwater is associated with 37-87% (average-64%) ferrous iron and 45-70% (average-59%) was found for safe ($[As]_T < 0.05 \text{ mgL}^{-1}$) water. XRF analyses showed that 8-14mgkg⁻¹ As, 5-9.6% Fe₂O₃, 0.07-0.15% MnO found in silty clay particles whereas fine to medium sand have a typical range of < 5 mgkg⁻¹ As, 1.15-3.9% Fe₂O₃, 0.02-0.06% MnO. High Fe(III)am oxy-

hydroxide (10-12 gkg⁻¹) was obtained by CBT extraction in safe zone. Speciation of Fe(II)_T, Mn_T, HCO₃⁻ and As_T in groundwater samples were done by using MINTEQA2. Fe(II)_{aq} negatively correlated ($R^2 = 0.8$) with the molar ratio of As(III) : As(V) indicating reduction of As(V) to As(III). Positive correlation was obtained in between total dissolved arsenic and phosphate. Batch arsenate adsorption study was made with bulk sediment from riverbank reflects slow adsorption kinetics and low adsorption capacity.

COMPARATIVE ANALYSIS OF THE NISAVA RIVER QUALITY IN TEN YEAR PERIOD

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The Public Health Institute, Niš has been following the quality of the Nišava river for 25 years in the function of environmental monitoring. The paper presents results of the research on water quality of the Nišava river in the period from 1995-2004. Applied methodology enclosed ten different water quality determinants classifying according to the existing Serbian regulations, as well as the Water Quality Index. The water quality of the Nišava river in investigated period has been differed depending on the measuring location and the hydrological situations. As the drinking water source in some part, the Nišava river had adequate environmental characteristics. The results have been showed that different indicators of river water quality have not the same ecological importance. The Water Quality Index has been suggested as a simple way for the evaluation of water quality monitoring. Also forming the PC register of pollutants is necessary for providing of adequate preventive measures.

THE QUALITY OF DRINKING WATER IN NIS, SERBIA - RESULT IN WATER RESOURCES MANAGEMENT AND CITIZENS KNOWLEDGE

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Citizens of Nis have got drinking water from NIVOS (integrated water supplying system with piped water) which maintained and controlled from Public Communal Firm "NAISSUS". External control quality of drinking water performs Institute for public health Nis and the results showed there is no

bacteriological contamination. In spite of that, the six public wells in 'blue city zone' carried everyday risk to health consumers; they are without continuity in control of quality and carried lack of consideration from city fathers whose, according Law about local autonomy from 2002.year, responsible for management of this water-objects.

Aim of this work is to perform good quality of NIVOS water opposite bad quality of public wells; and to show level of citizens' knowledge about drinking water quality in Nis .

Surveying got evaluated results annual monitoring bacteriological and physicochemical quality for over 3.000 samples from NIVOS and 50 samples from public wells. The samples had been done in laboratory accord valid book of regulation about drinking water quality in Serbia . The rate of physicochemical quality is far from allowed 20 % according book of regulation, and bacteriological contamination is not detected in NIVOS' water. Bacteria's (pathogen species) were found in water of public wells in 20 % and reasons of physicochemical incorrect (nitrates like indicators faecal contamination) registered in 25 % samples.

The second part surveys statistical analyse of answers on question mark which distributed people with high school whose work in health firm: the results showed lack of information about water supply system in Nis , and water safety on consumers health. They are no interesting on active approach in solving problems about drinking water in Nis and they do not drink often water from wells - water-borne diseases have got just a little possibility of showing and growing in Nis .

Survey about Nis' citizens knowledge is planing in the future like as emergence measures for improvement their knowledge-this is a way for inform public about need to repair public wells in Nis because some of them were constructing twenty years last century like monument healthful water and then they have been the only source of water in Nis.

CONSEQUENCES OF WATER POLLUTION ON HEALTH

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Consequences of water pollution on health Water is the source of life, but when badly exploited, it becomes a source of problems; polluted, it gives access to all diseases and opens doors to poverty, under development and becomes a cause of death .

Water pollution has many sources. The most polluting of them are the city sewage and industrial waste discharged into the rivers or sea. They can cause many illnesses that range from typhoid , dysentery, cholera , hepatitis A and skin diseases.

This study has been carried out in the town of Oran (west algeria) , it gives an estimate of the evolution of hydrous transmitted diseases these last decades.

We will establish an assessment of general situation and planning of the actions to be taken practical in front of epidemics diseases with hydrous transmission.

We will propose a program which starts with the application of simple standards of hygiene and extends on control of water points, the treatment of tanks and control the drinking water network.

The individual and the community can help minimize water pollution. By simple housekeeping and management practices the amount of waste generated can be minimized.

QUALITATIVE INVESTIGATION OF IZEH KARST AQUIFER USING HYDROGEOCHEMICAL AND NUMERICAL MODELS

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Water samples from five wells and one spring, collected in three periods during 2001, were analyzed to study the hydrochemistry of Izeh karst aquifers. Composition diagrams of the groundwater samples are utilized to investigate the geochemical processes controlling the Izeh karst aquifer. PHREEQC computer program is used to calculate the saturation indices of waters, inverse geochemical modeling, and design mixing model. PMPATH code is employed to determinate the capture zone of groundwater discharge from Izeh alluvial aquifer to Izeh karst aquifer by forward simulation of pathlines of contaminant particles. Based on hydrochemical data two subgroup waters in Izeh karst aquifer are identified, groundwater with intermediate residence times (Ca subtype water) and groundwater with long residence times (Ca-Mg subtype water). Intermittent reversing of groundwater flow direction from Izeh alluvial aquifer to karst aquifer and migration of contaminant particles induced by Izeh town waste water, chemical fertilizers, and leaching of evaporate salts, in tracking time lower than 2 years, indicate that Izeh karst aquifer has high pollution potential.

DETERMINATION OF RESERVOIR ROCKS OF THE CONTACT SPRINGS IN THE SOUTH-WEST OF URMIA LAKE

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Hydrogeochemistry of the springs discharge from the contact of hard rocks / soft rock formations in the south-western part of Urmia Lake were investigated based on graphical techniques and cluster statistical analysis for determination of reservoir rocks of the springs. In this study, 10 springs were sampled which discharged from limestones or contacts of limestones / granites. The composition diagrams indicate that there are three individual groups of springs. The reservoir rocks of springs of Gol Madar, Gol 2, Ezhdeha Madar, Dali, and Gondvila are Permian Limestones, probably. Ezhdeha 1 spring is recharged from granites. The reservoir rocks of springs of Eslam Abad and Narges are Miocene Limestones (Qom Formations). The results show that although using of hydrochemical composition diagrams to separating of springs is a appropriate method but multivariate statistical analysis such as cluster analysis could be served for obtaining detail hydrochemical differences among springs.

THE INFLUENCE OF WATER EUTROFICATION IN DOBCZYCE RESERVOIR ON RELIABILITY OF THE KRAKOW'S WATER SUPPLY SYSTEM

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Krakow, the previous capital of Poland is located by the Vistula river. For many years Krakow water supply system (WSS) was regarded to be the system with "deficiency" i.e. where daily water production wasn't sufficient for increasing needs. Only in the late 80s, when the biggest water intake from the Raba river started to work, the problem of water deficiency was solved. At present, the city is supplied with water from five intakes. These intakes, water treatment plants (WTP) and distribution system create water supply arrangement (WSA) in subsystem of water supply (WSS) and they are independent technological lines of water production. Without doubt, the most important water source is the intake from the Dobczyce reservoir on the Raba river, which supplies on average 52% of daily water requirement. The crucial problem is year by year deterioration of water quality in this reservoir: Water fertility is the reason of rich biological life development. Quality coefficients, which deteriorate seasonally water quality are: total phosphate, chlorophyll

and dissolved oxygen. At present green algae - diatom and blue-green algae phytoplankton dominates in the reservoir, which increases gradually from early spring to late autumn. Blooming processes causes difficulties in the Dobczyce WTP operation and causes the increase of risk of supplying noxious water quality to the users. It is because of water contamination with toxicological substances produced by some algae species settling in the Dobczyce reservoir. That's why the Raba WSA should be entirely reliable. So the water quality state in reservoir, influences the reliability of arrangement operation and result the whole WSS for Krakow city.

In the paper the application of a new reliability analysis of WSS and probabilistic research of surface water source quality are presented. The performed original model RAEP (Reliability Analysis of Eutrophication Process) let find quantitative reliability characteristics by determination of: probability $P(s_j, o_i)$ of appearance of any from four set water purity states s_j . It also present distribution functions and average duration of any state $\bar{t}_{av}(s_j, o_i)$ and gives a number of appearances s_j of any state at any moment. The presented method lets value distribution system by determination of probability of oligo-, mezo-, eutro-, and hipertrophic water supply to the treatment plant. It also allows to determinate duration of any purity state in the whole reservoir and at any level of intake. The research over eutrofication process of the Dobczyce reservoir water was made in the years 1993-2015 using the mathematical model WASP4. It allowed to get convergent results to the true ones. The received simulations and research showed, that the intensity of blooming, which cause decrease in water quality, still increases.

The performed method of investigations of water supply system is innovative and it follows world trends as far as water pipe work is concerned. It treats water system as a bio-technical system, where an exploitation of technical elements is dependent on water quality in the source, which changes are at random.. The presented method may be used for the estimation of water supply systems not only for Krakow, but other city centres, which are supplied in water from periodically eutrophicated sources.

THE WATER PRODUCTION SUBSYSTEM FAILURES AFFECTS OF KRAKOW'S WATER SUPPLY SYSTEM

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The increase of regulation requirement regarding water quality delivered to consumers challenges administrators of water supply systems. Operations intend to improve quality of water and reliability of its supply cannot only limit

to subsystem of water production. Nowadays the level of water treatment technology allows reaching good quality of water (much better than formal requirements). Nevertheless the majority of subsystems of water distribution do not fulfill criteria that allow maintaining such quality during delivering it to a consumer.

The actual level of computer techniques allows usage them in process of water supply system functionality estimation and analysis of their critical elements, as technological process and technological solution. They give possibility for simulating different variations of random events of different probability of occurrence. Computer analysis results usage gives possibility of providing against effects of these events or minimizing them. In consequent it limits the risk taken by water companies and improves safety of consumers.

This paper contains the preliminary reliability analysis of the water supply system (WSS) of Krakow city, regarding influence of failures of water production subsystem elements on the whole system usage. Considering, current water supply system operation parameters, the results of computer simulation of water distribution subsystem operation in the damage states variants are presented. Individual scenarios, reflecting hypothetical situations of interference for correct water supply system operating, cover random events like: water contamination, lack of power, mistakes in usage which influence on water treatment effects, failures of transit networks and others. That allows setting the critical points in production subsystem, as well in distribution subsystem. Their damage states may cause the biggest failure of the system that is break of water supply.

REFILLING OF AQUIFERS (SEASONAL AND SPECIAL PERIODS OF HEAVY RAINS)

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Measurements in wells down to aquifers in territory around Modena . TV inspections inside wells will be presented in particular from screen windows in wells towards aquifer. Flow measurements close to windows and piezometric measurements around well will be also presented.

Aim is to reconstruct piezometry and flow fields.

A simple model under cylindrical approximation will be presented capable to represent fields immediately outside screen window.

Time series of observed fields will be studied to show an eventual correlation with external observations of heavy rains, during appropriate season or during exceptional events of heavy rains.

STUDY FOR ECOLOGICAL FLOWS IN THE SOUTH EASTERN PART OF BULGARIA

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Humans have long been fascinated by the dynamism of free-flowing waters. Yet we have expended great effort to tame rivers for transportation, water supply, flood control, agriculture, and power generation. It is now recognized that harnessing of streams and rivers comes at great cost. The extensive ecological degradation and loss of biological diversity resulting from river exploitation is eliciting widespread concern for conservation and restoration of healthy river ecosystems among scientists.

The increasing social demand of a clean environment has imposed in the hydraulic planning the consideration of which at least "ecological flows" or "minimum environmental flows" circulate in the channel regulated. The concept of these "ecological flows" includes scientific approaches that normally occupy different professionals with diverse work areas. The term of flow is basic element of hydraulic engineers and managing engineers of the water resource, whereas the ecological adjective refers us to the world of the Biology and the management of the nature. For this reason, the definition of ecological flows is a task with a clear vocation of a multidiscipline.

The ecological flows are not playful or capricious flows nor an ecological and unacceptable extreme vindication but a moral obligation of the man towards the nature. This is the cause of the established order of preference in the hydrological plans. Important task for the water manager is to conjugate the different interests from the man without forgetting the right pretensions of the rest the nature.

A flow can be considered ecological if it is capable of maintaining the operation, composition and structures of the river ecosystems.

The need for water for diverse uses obliges us to consider not only the optimum ecological volumes, but also minimum ecological flows which are defined as those which will maintain the natural river populations and its

ecological values. To determine the ecological flows, in the past twenty years methodologies have been developed classified basically as methods based on the analysis historical flow records (hydrologic) and methods based on hydraulic simulation models.

This article argues, the methods most common for the determination of the ecological flows, having in consideration the peculiarities of the Bulgarian rivers, in particular during the period of low water. The hydrological and hydraulic data from several gauges stations were used.

BIOLOGICAL CHARACTERISTICS OF TWO SMALL AQUATIC ECOSYSTEMS – UNCOVERED WELLS ON THE EXPERIMENTAL SCHOOL ESTATE OF THE FACULTY OF AGRICULTURE UNIVERSITY OF BELGRADE

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Biological investigations of small aquatic ecosystems such as uncovered wells are scarcely present in the literature. Therefore a study of biological characteristics of two uncovered wells on the Experimental School estate of the Faculty of Agriculture, University of Belgrade was carried out monthly from April to October 2005.

Investigation included monitoring of basic physical and chemical parameters of water (temperature, dissolved oxygen and conductivity), as well as of qualitative and quantitative composition of zooplankton and macroinvertebrates (macroinvertebrates that lives on plants) of the ecosystems investigated.

The analysis has shown changes of basic parameters that influence development of the communities investigated. Changes included variation from top towards the bottom of the well, as well as changes dependent on the season (April - October).

Abiotic environmental factors influenced specific dynamic of zooplankton organisms development, and of macroinvertebrates found in higher water levels. Contrary to the qualitative and quantitative dynamics of aquatic invertebrates in upper water levels, composition of the benthocenosis from the bottom of wells investigated has shown minimal changes during the study period, as a result of small variation of abiotic environmental factors (stable temperature and very low dissolved oxygen values).

NUTRITIONS AND QUALITY OF IRRIGATION WATER OF RIVER ZETA

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In this paper are shown characteristic values of parameters of river Zeta quality comparing with limitary FAO values. Through values of some (mol relation Ca/Mg; Ca/Ó k ; P/N; N/K) indicators, pollution of its waters is measured from in the first place agricultural areas, which was really the main goal of this paper.

For realization of this paper are used data gained by observation of water quality on four localities of 144 samples along the river flow. These data were established in project titled "Capability of waters for irrigation of Zetsko-Bjelopavlicka Plain" during 2000-2005.

Results shown in this paper are pointing to compliance of river Zeta for irrigation except in period of small waters when we have significant content of NH₄-nitrogen, trend of lack of phosphate and nitrate and significant surplus of oxygen, almost on entire river flow. Change of water quality is shown thorough aperture of: effective salinity 206-403 $\mu\text{Sm/cm}$; pH of 7,0-8,8; total hardness 5,8-11,4 0 dh. Aperture of SAR values is from 0,02 to 0,38 in which mol ratio P/N from 0,002 to 3,979; Ca/Mg (0,66 - 37,4) and ratio Ca/Ó k from 0,38 to 0,98, which with no doubt is pointing on unfavorable ecological status of river Zeta.

EVALUATION OF POTENTIAL POLLUTION FROM AGRICULTURAL ACTIVITIES AT DURRES REGION (ALBANIA)

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The agricultural region of Tirana-Durres-Kavaja with about 25 000 ha of cultivated land (Arenosol – FAO-UNESCO, 1992) is located between mountains Dajt-Krujë and Adriatic seaside. In this zone lives 1/3 e country population (city of Tirana 800, 000 inhabitants, city of Durresi 120, 000 inhabitants and rural part with about 100, 000 inhabitants). In rural zone there are about 14 000 agricultural farms with 1.7 ha each one. The region is

traversed by two small rivers (Ishmi and Erzeni) with 2 m³/s and 10 m³/s, each one, respectively in summer and winter season. In river Ishmi flows and the Lana river (2 m³/s water) where are poured untreated waste waters of Tirana city, without any treatment. Recent investigations indicate that these rivers are heavy polluted. The soils are shallow and with loamy and sandy soil texture. Here there are more than 1 million chicken, 16,000 cattle and 2 complexes for pork meat production. Animal wastes are major agricultural pollutant. The amount of N provided by the livestock is accounted about ½ of total needs for agricultural production. Depositing, processing and distribution of these amounts of organic stable manure are not organized and it is a potential risk for groundwater and surface water resources pollution. This manure amount it is able to cause serious damage on human health through food chain, mainly by fresh-market vegetables.

In order to have an estimation of pollution degree from agricultural activities, municipalities, discharge points in the rivers, point and non point pollution from others sources, an analysis of both N and P inflow and outflow it was done by using values interpolation, which were found out and/or studied in the experiments made. For this reason, there were defined certain important calculation parameters such as: Potential Available Nitrogen (Phosphorous) – PAN, Nitrogen (Phosphorus) Mass Balance Analyses – PMBA, Dissolved Organic N (P) – DOP, P Adsorption Capacity – PAC, Nitrogen (Phosphorus) Uptake and Recovery Efficiency – N(P)RE, Fertilizers Efficiency – FE.

The fresh – market vegetables production takes the first place on country level supplying a population of about 1.1 million inhabitants (a production of about 130,000 ton/year). The area of greenhouses is about 100 ha where is cultivated the fresh – market vegetables with an average yield of 150 ton/ha/year. Applied fertilizers give a contribution of 80 kg N/ha/year, while the poultry, pork meat and beef industry supply the soil with such amounts of animal manure which is equal with about 50 kg N/ha/year. The total calculated amount of fertilizers supplying the soil is about 130 kg N/ha/year. In rural areas, an important part of households are supplying with drinking water from groundwater. Monitoring of drinking water quality in rural zone is realized. Knowing, in general, the water resources which supply the zone and the application of intensive doses of N and P in soil together with polluted rivers traversed it, we also suppose that drinking water is polluted and in any case much polluted. Also, according to preliminary assessment, drinking water in rural zone which is supplied from groundwater wells, result polluted and much polluted (N > 100 mg L⁻¹ NO₃⁻).

POSITIVE EXPERIENCES FROM SOLVING OF PROBLEM WITH HYDRO-BIOLOGICAL MINIMUM IN THE RIVERBED OF STUDENÈICA

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The spring of river Studenèica, which is the primary water source for several municipalities, during periods of extended droughts had been reaching its critical minimum abundance, causing extreme water deficits at its final users. At the same time, during these unfavorable conditions, a large deficit of water flow occurs in the riverbed downstream from the intake, causing insufficient water supply for the citizens of villages Gorni and Dolni Dobrenoec

According to the results from several series of hydrological measurements of the water flow in the riverbed, water losses are evident, in other words, there is evident infiltration of the surface water in the underground.

It has been established, that mayor water losses are situated at the distance of approximately 2000 m upstream from village Gorni Dobrenoec.

SUMMARY:

In order to solve the problem with water infiltration , the Public Company Studenèica has undertaken measures to landscape the natural riverbed at the section with extensive water losses. The solution consists of following: a water resistant covering geo-membrane is fitted down at the bottom of the riverbed. Above the geo-membrane a layer of geo-textile is padded, which serves as protection of geo-membrane from mechanical damage. Above such a padded layer, the riverbed is formed from gabbions filled with rocks from the natural riverbed.

Positive effects:

A 100 % water resistant profile is fitted down. There are no water losses.

Such a landscaped riverbed is totally becoming with both its natural surrounding and the original riverbed.

The geo-membrane is ecologically safe.

Such a landscaped riverbed is flexible and endurable to linear deformations.

This solution is much cheaper from classical methods of riverbed landscaping, ea. concrete.

The method to build such a riverbed is simple and fast.

It requires little or no maintenance.

Negative effects: In order to make the embedded rocks within the gabbions work together, and to achieve a compact aggregate, a period of time is

needed for the riverbed to stabilize. (empty spaces between the rocks must be filled with river carried material ea. Grabble)

DYNAMIC OF NUMBER COLIFORM BACTERIA IN WATERS FROM EXPERIMENTAL FIELDS

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Potential risk for human infection are vegetables and fruits, which are contaminated with pathogenic bacteria. Source this contamination are waters for irrigation, underground waters, surface waters or waste disposal waters. Experimental results all over the world confirm concept that each water is not good for irrigation, and it is need to do microbiological analyses of water which is used for irrigation.

The main goal of this investigation is dynamic total and fecal coliform bacteria in waters on location Radmilovac (near Belgrade) which are used for irrigation.

Samples were taken in waters from: two uncovered wells, covered well and stream "Sugavac" (up-stream and down-stream). They were collected during spring, summer and autumn 2005.

It were determined number of total coliform and fecal coliform bacteria, presence of *E. coli*, and *Salmonella* sp.

Number of total and fecal coliform was determined on MacConkey broth with method most probably number (MPN), *Salmonella* sp. was determined on SS Agar, *Escherichia coli* on EMB Agar.

Isolated pathogenic bacteria were identified by API 20E (Biomérieux, France).

Resultates of investigations show that total coliform bacteria were established in all samples, fecal coliform bacteria were not found out only in uncovered well 1. In all samples it was established higher number total then fecal coliform. There were no significant differences between total and fecal coliform in Šugavcu 2. The most number total and fecal coliform was in Sugavac 2 (25.04.2005.). During the first sampling (14.4.2005), it was not established presence coliform bacteria in uncovered well 1. In the most occurrences, the highest number of total coliform bacteria was on date 25.4.2005. After that date, number of total coliform decreased.

Salmonella sp. was established in Sugavac and uncovered wells, *E.coli* in Šugavac and covered well.

THE EFFECT OF DENSE MARITIME TRAFFIC ON THE BOSPHORUS STRAIT AND MARMARA SEA POLLUTION

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The Bosphorus Strait is a geological strait separating the European and the Asian parts of Istanbul and it lies between the Black Sea and the Sea of Marmara. Historically, the Bosphorus has a strategic importance since it is the only maritime route for the five neighboring Black Sea states and the Central Asian Turkish Republics.

Although the Bosphorus strait is a difficult body of water to navigate due to its treacherous currents, great twists and turns, it is one of the heaviest sea-traffic regions in the World. The volume of traffic in Bosphorus is five times heavier than the traffic in the Panama Canal. In 1936, when the Treaty of Montreaux had been signed, the number of ships passing through Bosphorus was only 4500 per year. Today, about 55000 ships pass through the Bosphorus per year. Percent of the ships carrying hazardous cargo increased from 10 % to 18 % in 2000. While the amount of hazardous cargo (especially oil and petroleum products) carried on the Bosphorus Strait was 63 million tons in 1997, it was increased to 129 million tones in 2003.

The Strait has very special ecological conditions in terms of both marine environment and terrestrial environment since it connects two different seas, Mediterranean Sea and Black Sea, which have different salinity, temperature etc. In addition, the Turkish Straits (Bosphorus and Canakkale) form an "acclimatization zone" for transiting species, allowing those from the Mediterranean to adjust to the different environmental conditions in the Black Sea, and vice versa.

International importance of the Sea of Marmara stands in the forefront even though it is an inland sea of Turkey and it deals with increasing ecological problems for the last 50 years. The Pollution in the Sea of Marmara which threatens all living species cause dramatic falling in fishing potential.

Increase in the volume of maritime traffic on the Strait and the Sea of Marmara have increased the risk of the maritime accidents over the years and since 1948 the number of ship accidents have been recorded as 403. Furthermore, being on the transportation way of hazardous and dangerous materials poses environmental and safety hazards for the Bosphorus Strait and the Marmara Sea with the surrounding residential areas.

In this paper, adverse effects and environmental impacts of the dense maritime traffic in Istanbul and measures to take to prevent and lessen the environmental damages are discussed.

THE EFFECT OF THE KOPRUBASIU MINE ON THE GROUNDWATER CONTAMINATION IN MANISA, TURKEY

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This study involves the geochemical investigations on water to evaluate the effect from the Koprubasi U mine. The groundwater samples collected at the mine (K1, K2 , E1, T2, C1 and U1) are nearly neutral which have pH values varying between 6.2 and 6.7. Electrical conductivity (EC) values of groundwater for K1, K2 , E1, T2, C1, U1 samples are between 87-329 m S/cm. U concentrations of groundwater samples vary between 1.71 and 23.97 m g/l. Groundwater sample (K1) collected at the Kasar village has the highest U content of 23.97 m g/l. All of the ground water samples from the uranium mine, have low uranium concentration than EPA (2003) guidelines of 30 m g/l. In groundwater, heavy metals including Hg, Mn, Cd, Cr, Pb, Zn and Cu are lower in concentrations than Turkish drinking water standards and US EPA (2003) drinking water guidelines. The maximum concentration of Fe in groundwater samples was 1617 m g/l, while the drinking water guidelines of Turkish (TSE, 1997) and US EPA (2003) were suggested 200 and 300 m g/l; respectively. Turkish and US EPA guidelines for Arsenic in drinking water are 50 and 10 m g/l, respectively. Two samples, K1 and K2 , showed As-concentration of 16.4 and 10.2 m g/l, slightly exceeding the US EPA guideline. Fe is caused major water quality problems rather than other heavy metals in the study area. This high Fe content of groundwater is attributed to Fe-oxhydroxides which are generally the most important sorbents for U.

TENDENCIES OF ALTERATION OF THE RILSKA RIVER WATER QUALITY

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The present papers summarized the long period investigations on the surface water in the forest reserve "Rilo - Manastirska gora", as well as in the whole

protected territory – National Park Rilski manastir. The collected information generalizes the results of the monitoring system in the Rilska river catchments area from its springs (Ribni lakes) till the end of the protected area. The alteration of water quality content is analyzed and estimated along the studied stream and in a long-term period to be assessed the impact on the reserve. The studied water quality parameters touch the oxygen regime, organic pollution, mineral content and biogenic elements influencing directly over mountain ecosystem.

ANALYSIS AND ESTIMATION OF SURFACE WATER QUALITY IN THE JANTRA RIVER'S CATCHMENTS AREA

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As a component of the environment water is necessary for the life of man, plants and animals. That is why, the current report examines the water quality in the River Jantra Basin, tendencies in its variation for the last ten years period on the basis of ecological monitoring.

There have been investigated contemporary pollution sources of surface waters, their type and quantity of the main pollution substances. There are proposed measures for pollution reduction and preservation of the Jantra River Waters.

NITRIFICATION OF AMMONIA FROM SYNTHETIC WASTEWATER WITH DIFFUSER "DALMACIJA+40%"

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This report presents the results from the analysis of the correspondence between the oxygen input amount (aeration) with diffuser "Dalmacija+40%" and the velocity of nitrogen compound removal from the synthetic water.

The nitrogen compound removal is conducted in a laboratory reactor, with the help of microbial mixed cultures. During the wastewater treatment, under defined ecological parameters of the surrounding: pH 7,5; temperature 22 °C; dissolved oxygen concentration 3,96 mg/l, 4,5 mg/l, 5.15 mg/l and 5,9 mgO₂/l (which correlates with 6,10,15 and 20 NI/h air) and starting microbial biomass concentration of 2,5 mg/l. The microbial mixed culture, in the

aeration condition of 5,9 mgO 2 /l, decreases the total nitrogen concentration by 96,8%.

POLLUTION OF THE DRINKING WATER SOURCES OF ISTANBUL CITY AND THE PREVENTIVE MEASURES : BUYUK CEKMECE LAKE CASE STUDY

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Approximately all of the water demand of Istanbul city, which accommodates more people than many countries with its 12 million populations, is being provided from surface water resources that can be polluted easily.

To meet the need of the water demand constitutes the main element of the human and other living creatures. As a result of the increase in the populations, cities are growing rapidly and the water resources are limited to meet the increasing need of water. Buyuk Çekmece Lake and basin is one of the most important water resources of Istanbul city.

In this study, the quality of the Buyuk Çekmece Lake as a drinking water resource is determined. Also, the effect of the pollutant resources that discharges to the lake and the preventive measures are discussed.

The results of the water quality analysis of water Büyük Çekmece Lake and its water streams are evaluated in this study. The results of the analysis are compared with the various standards and the water quality of the lake as a drinking water resource is determined.

Furthermore, the precautions for at least preserving the present state and the preventive measures to prevent the water resources from contaminations are advised according to the considerations of the present water quality of the Büyük Çekmece Lake.

ECOLOGICAL STATUS OF UPPER PART OF ISKAR CATCHMENT

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Iskar River is the longest Bulgarian river (length 368 km) which flows on the territory of country . It has an important meaning for Sofia because of its use for drinking water supply of town, irrigation and satisfaction of industrial needs. The waste waters of Sofia are out flowing in Iskar River by constructed treatment plants or by direct outlets.

Although that Iskar River is one of the best studying Bulgarian rivers in hydrobiological aspect, the basic investigations have been realized for the part after Sofia in relation with intensive pollution of river during the in times past. For the upper part of its catchment, the purposive hydrobiological investigations are missing at that moment. The study area has a critical significance for formation of water quality in Iskar Dam – a main water source for Sofia.

During the realization of international project “ Evaluation and improvement of water quality models for application at temporary waters in South European catchments ”, Acronym : TempQsim , supported financially by the European Commission, 5 th Framework program, the detail study of ecological state of upper part of Iskar catchment was carried out. The present work is ecological assessment of the section from formation of river to its inflow in Iskar Dam.

The general analysis has been realized by complex of parameters estimated the macrozoobenthos communities (composition and density) and basic physicochemical and hydrochemical factors (temperature , pH , oxygen saturation , redox potential). The saprobe characteristics was estimated by the method of saprobe valences (Zelinka & Marvan, 1961, Rothschein, 1962), based on the bioindicative potential of macrozoobenthos.

Five sites were investigated by the river length during the different seasons of 2004. The qualitative and quantitative samples were collecting by the ISO - 7828-1985 and ISO - 9391-1993 methods.

The obtained results divided the study area into three zones . Over the town of Samokov , the zoobenthos communities were presented of species, typical for oligosaprobe mountain streams with main inflow of vegetal matter. The biodiversity was low but the density was comparatively high.

Under this town , the density was sharply reduced but the increase of total count of species in benthos cenoses was observed. The main reason was dynamic conditions of environment strongly influenced by pollution of Samokov. Only the inhabitants of organic polluted rivers were numerous.

Over the Iskar Dam, the zoobenthos communities had the highest density and the most complex composition . The established species were typical for rivers with stable ecological conditions in climax β – mesosaprobe state.

The successive modification of zoobenthos communities by the river length was related with the water quality , assessed by the studying parameters .

DECREASING OF RADIONUCLIDES CONTAMINATION OF THE DNIEPER WATER DUE TO A MODE OF OPERATION OF HYDROELECTRIC POWER PLANT

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The Dnieper Basin includes nearly 50% of the total area of Ukraine and contributes about 80% of the total volume of Ukrainian water resources. The floodplain areas near the Chernobyl Nuclear Power Plant and surrounding catchments are heavily contaminated by radionuclides, especially ^{90}Sr . The operation of a hydro power plant (HPP) makes influence on a water level, volume of the reservoir, flow velocity, time of water transportation and, as a result on changes of concentrations of pollution in the outlet. So it may be used as one of countermeasure for water protection especially in emergency situation. The work analyzes the opportunities to control of ^{90}Sr concentration in the outlet of the Kiev HPP with modes of operation. A box model with lagging argument (UNDBE) describing the transport ^{90}Sr in the reservoir has been developed. The model takes into account the time of transportation of the pollutant through a reservoir and mixing the pollutant in a certain part of compartment volume to the moment of completion of transportation. It is possible to considerably increase the accuracy of the on-line prediction of pollutant concentration at the outlet of the reservoir with minor complication of mathematical and programming tools and without increasing requirements to the quality of full-scale measurements. Results of calibration of the model on data set of field measurements 1991 and 1994 are resulted. The situation of February – June 1999 when high spring flood in the Pripjat River took place is the example of validation. With help of model the possible influence of modes of operation the Kiev HPP on change of concentration ^{90}Sr is appreciated. For evaluation of the influence of the modes operation of the Kiev HPP where made two scenarios – “the best” and “the worst” for 1991 and 1994. The first case gives maximum discharge of polluted water till the end of transportation with maximum time of transportation, the second - vice versa. The results of modeling show the possibility to change the concentration nearly upon 20% and time retention of peak of concentration nearly for 18 days. It gives us chance to make the concentration less than the Maximum Allowable Concentration in extreme situations. The Kiev municipal tap water supply may work continuous in this case. Another situation – the short peak of maximum concentration quick flow by water supply system with minimum time of shut off water supply point and pass to alternative water supply. It makes minimum collective dose from water for population with minimum economy damage. The Desna River surrounded at once after the Kiev reservoir. Water in the Desna is clean from radionuclides and spring-flood takes place a bit later than in the Dniiper and in the Pripjat. A change of the time of the peak transportation makes the

possible coincidence with the peak of the Desna spring-flood water for maximum discharge of the radionuclide pollution.

SOLIDIFICATION/STABILIZATION OF POWER PLANTS WASTES- POTENTIAL WATER POLLUTANTS

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The intensive firing of coal in power plants can harm the environment. The problems are caused by the emission of solid particles, sulphur oxides, nitrogen oxides, carbon monoxide, carbon dioxide, as well as by pollution of the surrounding waters and the degradation of the land due to the disposition of the solid wastes: fly ash, bottom ash and FGD gypsum (a by-product of FGD-flue gas desulphurization process). To saving the surrounding areas the disposition of waste materials should be ecologically harmless and environmentally acceptable. Solidification/stabilization (S/S) is a widely used treatment for disposal of wastes which inhibits the migration of wastes into the surrounding environment. This treatment involves the addition of some additives to induce both physical and chemical reactions between the wastes and added reagents. Research has shown that there are certain advantages regarding the combined disposal of fly ash and FGD gypsum in the presence of lime (as an additive). The aim of the present study was to test the possibility of solidification/stabilization of fly ash from the Serbian lignite power plant Nicola Tesla and FGD gypsum from the Bohemian lignite power plant Hvalětice (no Serbian plants have a FGD system installed yet). Two mixtures were prepared: 1. fly ash-FGD gypsum-lime-water (the mass ratio of components was 16:3:1:16, respectively) and 2. fly ash-calcined FGD gypsum-lime-water (the mass ratio of components was 7:2:1:5, respectively). The so prepared samples were cured 30 and 180 days in ambient air. Subsequently, the samples were tested for their compressive strength. Strengths of cured samples varied from 0.9 (30 days) to 1.5 MPa (180 days) for the first mix, e.g. from 2.9 (30 days) to 4.7 (180 days) for the second mix, what means that all the samples developed more than the 0.34 MPa required for S/S applications. Also, the samples were examined by means of X-ray diffraction analysis (XRD), differential thermal analysis (DTA) and thermogravimetric analysis (TGA). On the basis of these results it was concluded that fly ash reacts with FGD gypsum and lime forming ettringite. Ettringite formation is important because of its possibility for immobilization of the trace elements in oxyanion form (oxyanions can be incorporated into the ettringite structure). The present study showed that the power plant wastes

(fly ash and FGD) could be solidified with good cementitious properties and the potential for immobilization of hazardous trace elements.

GROUNDWATER QUALITY IN SERBIA , NITRATE-NITROGEN

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Groundwater quality can be affected by both natural and anthropogenic activities. In aquifers unaffected by human activity, the quality of groundwater depend on geochemical reactions between the water and rock matrix as the water moves along flow paths from area of recharge to area of discharge. In general, the longer groundwater remains in contact with soluble materials; the greater the concentrations of dissolved materials in water. The quality of groundwater also can change as the result of the mixing of water from different aquifers. In aquifers affected by human activity, the quality of water can be directly affected by infiltration of anthropogenic compounds or indirectly affected by alteration of flow paths or geochemical conditions.

Changes in water level in wells reflect changes in recharge to, and discharge from aquifer.

In addition to natural sources, groundwater quality can be affected by agricultural, municipal and industrial activities in the recharge zone of aquifer. Potential sources of contamination include recycled irrigation water, wastewater from human activities, and waste by-products from industrial activities. Nitrate-nitrogen is an important constituent in fertilizers and is present in relatively high concentrations in human and animal wastes. In general, nitrate concentrations in excess of a few milligrams per liter indicate that water is arriving at the well from shallow aquifers that are polluted from human or animal waste, or from excess nitrates used in agriculture.

The work is concerned with the current state of groundwater quality in particular regions of Serbia, based on the monitoring program that have been recently carried out, with a special reference to the Province of Vojvodina, agricultural region. In Serbia and Montenegro, the practice of monitoring groundwater quality is based on the measurement of the corresponding physic-chemical and microbiological parameters.

BRIDGING THE GAP BETWEEN WATER MANAGERS AND RESEARCH COMMUNITIES IN A TRANSBOUNDARY RIVER: NUTRIENT TRANSPORT AND MONITORING REGIMES IN THE DRIM/DRINI CATCHMENT

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The DRIMPOL Project, a joint research project between Albania, Macedonia and Norway, aimed at estimating nutrient losses from different sources in the Drim/Drini River Basin. As the project evolved it was also faced with the challenges of bridging the data and information gap between the scientific community and the managers of this transboundary river. The Drim/Drini is one of thirteen internationally shared catchments in the Balkan region, and is unique in that it, despite of its relatively small size of about 14.000 km², is monitored and managed by six institutions in four countries and one UN Protectorate (Albania, Macedonia, Serbia and Montenegro, Greece and Kosovo). The need for harmonised and transparent procedures for monitoring, data assessment and data flow, as well as for transboundary co-operation to achieve integrated management of this catchment, is eminent.

In this region, the problems associated with the management of transboundary waters include insufficient or inadequate monitoring and lack of common approaches; identification and appropriate quantification of pollution sources; deterioration of water quality and over-exploitation of water resources; lack of bilateral and multilateral agreements with subsequent potential tensions; and non-integrated policy for protection of land and water.

This paper will present some of the results of the DRIMPOL Project linked to, inter alia, the load of nitrogen and phosphorus throughout the catchment, soil erosion risk assessment and agricultural nitrogen balances in the catchment. It will also raise the questions of data accuracy and reliability, and the consequences of these for the political priorities and decisions taken by managers. One of the products of the DRIMPOL Project is a first source apportionment map for nitrogen and phosphorus, with discharge calculations per source and sub-catchments. The use of such maps for management purposes in transboundary catchments may include the establishment of harmonised environmental goals, which again pinpoints the importance of data reliability and transferability. The need for an internationally agreed monitoring network, with transparency and data management across borders, will also be targeted.

ECOLO-ECONOMIC OPTIMIZATION OF THE LOCATION OF SOURCES POLLUTING GROUNDWATER

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The world community has set fourth and faced the task of preserving and reproducing the environment. The optimal solution of this problem under the conditions of the modern social-economic development is possible if the so-called waste-free technologies are developed and implemented. Unfortunately, this optimal approach to the achievement of this task cannot be always applied at the present stage of development of science and technology and in many aspects is still only a cherished desire. This circumstance imposes the necessity of selecting at the design stage the location of construction sites, which regularly pollute groundwater, in such a way that certain ecological-economic considerations within the standard (BDS) water quality requirements are met. The problem becomes still more important when the diversity of polluting substances with respect to their origin and character is taken into account. Groundwater is the main source of drinking and irrigation water supply for many settlements and the need for controlling its protection is beyond doubt. The project proposes the development of a hydrogeological model for thermal dispersion of pollutants in groundwater with the use of an optimization approach implying a single numerical solution for finding the optimal location of the pollution sources. In the world practice such problems are solved by means of imitation methods without considering the influence of the variable hydrogeological parameters. The model represents the three-dimensional (x,y,z,t) migration of active admixtures in non-pressure flow in porous media and the numerical solution will be based on the finite element method with Matlab visualization. Similar three-dimensional solutions taking into account temperature and sorption are not known in the world.

THE HYPERCHLORINATION OF TAP WATER AND BLADDER CANCER IN MOSTAGANEM

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Chlorination is the most widely used technique for disinfection of drinking water.

A consequence of chlorination is the formation of trihalomethanes which are result from the reaction of chlorine with naturally occurring organic materials

presents in water, this relationship was founding between trihalomethanes in drinking water and bladder, colorectal cancers.

This study is based for collecting data from hospital cases bladder and colorectal cancers during the period (1990-2004) and collecting tap water samples from each city of Mostaganem center also the deferents neighbourhoods in order to analyse the rate of chlorination and trihalomethanes.

The statistical analyses indicated that 89% are from mans and only 10% are from womans, the average age situated between 70et 85 years. The analyses of the tap water show an increasing rates of chlorination in the most samples. However the analyses of trihalomethanes confirmed these results.

In addition to trihalometanes analysis, the correlation between trihalomethanes and cancers was investigated.

THE HARMONIZATION OF DAM AT THE LARGE RIVER BASIN FOR SUSTAINABLE WATER AND ECOSYSTEM SERVICES - VISTULA RIVER CASE

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The necessity to achieve good ecological status of fresh water ecosystem by 2015 required by European Union Water Frame Directive stimulates the efforts toward formulating the integrative view on the largest river basin and its estuaries. The ecohydrology by proposal the use of ecosystem properties as a management tool is relevant to ecosystem approach of EU and in consequence provides an useful framework as a system approach for analysis of threats and opportunities for implementation of Water Frame Directive UE.

One of the problems under dispute has been the construction of dam on the Vistula River which maintains in a large part section a natural character. In the contrary to postulated by NGO organizations destruction of W³oc³awek dam, the systemic analysis indicate necessity of construction of second dam – Nieszawa. It is because the annually electric energy gain reduction of CO 2 emission equal to 360 train of coal also reduces 20-40% nutrient pollution load to the Baltic coast provided by Vistula catchment. This is especially important in the stage of progressing of toxic bloom appearance during the summer because the Gdansk bay is used for recreation by over Million people. Moreover the retention of water in central Poland will prevent of

progressing process of groundwater decline and prevent the degradation of the natural ecosystem due to xerosery process.

The negative effect of dams on fish populations can be reduced by by-passing channels, in case of birds by creating of compensatory habitats at the islands and at the bays of reservoirs.

HYDROGEOLOGICAL CHARACTERISTICS OF UNDERGROUND WATER IN PLOVDIV REGION, USING FOR MELIORATION

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The underground water is an element of irretrievable mineral recourses of the country. The water is an important abiotic component of ecosystems.

The aim of investigation was related to hydrogeological characteristics of the water, using for irrigation in the Plovdiv region.

Some hydrogeological objects (5) have been studied during last two years. All obtained results of hydrochemical, hydrodinamical, geothermal and microbiological analyses have been discussed. The main ecological indexes of the water are normal (according Bulgarian standard of MOEW) . The hydrogeological elements, situated in Plovdiv city are suitable for melioration needs.

A MULTI-SCALE FRAMEWORK FOR STRATEGIC MANAGEMENT OF DIFFUSE POLLUTION IN THE WESTERN BALKANS

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A multi-scale framework for strategic management of diffuse pollution is proposed as a conceptualisation of the strategy taken within a UK based project related to the application of biosolids to farmland, and as a possible mode to drive forward Integrated River Basin Management (IRBM) in the Western Balkans, taking on board the philosophy of Earth Systems Engineering and Management (ESEM). The framework uses a combination of experiment, models, GIS, communication, visualisation and decision support tools to arrive at a realistic strategy for improved land management practice. Effective partnerships between researchers and stakeholders play a key part in successful implementation of this strategy. The Decision Support Matrix (DSM) is introduced as a set of visualisations that can be used at all scales, both to inform decision making and as a communication tool in stakeholder

workshops. An example DSM; The Phosphorus Export Risk Matrix (PERM) is discussed. The PERM was developed in an iterative way as a point of discussion in stakeholder workshops, and as a tool for decision support, communication and visualisation. The resulting interactive PERM contains a set of questions and proposed remediation measures that reflect both expert and local knowledge. It is proposed to develop a similar tool in the course of Waterweb, a research project dealing with water resource strategies and drought alleviation in Western Balkan agriculture.

NITRATE POLLUTION OF THE LESNOVSKA RIVER CAUSED BY FILTRATION OF CHEMICALS BY AGRICULTURE AREAS

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The nitrate pollution caused by filtration of chemicals from agricultural areas is a subject to a number of studies during the last decade. The main purpose of this study was to specify the river flow (Q , m^3/s), nitrate concentrations and conductivity in a part of the Lesnovska River Basin, situated near the Sofia City, the capital of Bulgaria. The investigated river section is between two villages – Dolni Bogrov and Chepinci. There is predominantly agricultural land along the riversides.

Hydrometrical survey of the Lesnovska River was carried out. Incoming flow (Q , m^3/s) by filtration in to the river and evaluation of the contaminated with nitrate water quantity were defined by means of balance methods, based on the results from the precise performed measuring.

The main tasks of the study were verification of the mathematical model of the nitrate pollution formation in the river terraces groundwater and to define the contribution of this contamination in to the river. Thus, the affects of fertilising on agriculture areas and on the river water quality were determinate on the basis of information about the quantity of the nitrate pollution coming from the groundwater and by filtration (Q , m^3/s).

ASSESSMENT OF THE WATER QUALITY AND TRENDS AT THE DRINI CASCADE SYSTEM BASED ON PLANKTON DATA

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Its well known that eutrophication processes caused by an enrichment in nutrients results in an increase of photosynthetic biomass. In the water ecology however, the factors which drive the shift in species composition of the assemblage along trophic gradients are yet poorly understood (Reynolds, 1996).

Being rather tolerant to different environmental conditions, many zooplankton species are good indicators of water quality and can be used for the ecological monitoring of water bodies. The aim of this study done in the course of Drin/Drim POL (A Norwegian Research Council support) was to explore fauna of Rotifera-Cladocera and Copepoda (Cyclopoda & Calanoida) from Lake Ohri, Micro Prespa, Macro Prespa, Fierza and Shkodra and to determine the water quality on the basis of the noted bioindicative zooplankton species. During the investigated period 118 species were identified. Their qualitative composition varied dependent on season and locations. The most diverse composition was recorded in summer. The rotifer composition in the quiet bays with macrophyte vegetation is rich and more exuberant than in sand localities. The most of the noted species were oligo- to mesosaprobic and mesosaprobic indicators, except *Rotaria rotatoria* that belongs to oligo- to mesosaprobic water. Saprobiological testing based on rotifera showed that the water was oligo- to mesosaprobic.

MONITORING OF BACTERIOLOGICAL INDICATORS AND SALMONELLA SPP. IN PRODUCTION ZONES OF BIVALVE MOLLUSKS IN ALBANIA ON 2004

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In Albania, during 2004 have been monitored 8 production zones of bivalve mollusks for bacteriological indicators of fecal coliforms, *E. coli* and presence of *Salmonella* spp. 458 samples of bivalve mollusk have been analyzed with standard methods respecting hygienic conditions mentioned in the EEC directive 91/492 for the bivalve mollusks control. 451 sea water samples have been also analyzed for level of fecal coliforms and *E. coli*. Monitoring of sea water and bivalve mollusks producing zones from south to north part of Albanian coastal line remains a major objective promising to guarantee the Albanian and E. U consumers the freshness of this product. On the other hand, analytical control for the presence of *Salmonella* spp has been realized in order to accomplish the analytical specter and also to protect the people from salmonellosis which is one of most widespread food borne diseases in

world. Regarding this research as part of water environment and food safety studies has been confirmed that Albanian product of bivalve mollusk is classified in some harvesting areas of bivalve mollusks as good product and sometimes as this is classified in class B which means that this product should be depurated. Study has been continuing and has been focusing on bacteriological control of main species of bivalve mollusk which are present in natural batches. Samples has been collected from production zones where are mostly natural breeding of bivalve mollusks. The monitored species have been as following: *Mytilis galloprovincialis*, *Donax trunculus*, *Donax semistratiu* and others species of *Donax* spp . From results have been confirmed 1 samples of *Donax* spp contaminated with *Salmonella* spp which represent 0.2 % of total number of bivalve mollusk samples. Production zones of bivalve mollusk have been classified mostly in class B and some of them in class A, respecting the microbiological criteria for classification of bivalve mollusk production zones mentioned on Directive 91/492 of CCE. Production of *Mytilis Galloprovincialis* in Butrinti Lake which is the biggest reservoir of bivalve mollusk in Albania has been classified in class A, promising to export it in E. U countries. No *Salmonella* spp has been determined in this production zone. Sea water samples have been analyzed for level of fecal coliforms and *E. coli* and in summer time have been confirmed some points with high level of these pollution indicators in BM3, BM5 and BM7 zones located respectively in Vlora, in Karavasta and in Durres (BM7). The high value of *E. coli* is resulted in Durres on July supposing to be indicated from fecal water and high population in this area in this time. The maximum range values of fecal coliforms and *E. coli* have been confirmed respectively between 27-110/100ml and 14-80/ml of sea water. The high bacteriological pollution verified in summer time in some monitored sea water areas is caused mainly because of dense population in beaches and contaminated water of rivers. Considering the monitoring of bacteriological indicators of bivalve mollusks and production zone

ROLE OF THE AERATION SOIL ZONE ON THE GROUNDWATER FLOW CONTAMINATION

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Results from an investigation on soil water movement processes, in the area of the contact with the saturated zone in particular, are considered in the present article.

The investigation consists in a detailed registration of the processes in field (in situ) conditions and in applying numerical simulation of the processes for the

same conditions as in the field using the WAVE software program. The observed agricultural area is situated in the vicinity of the Sofia City near the Chelopechene village.

Soil samples were collected periodically during the time period 2002 -2004 from fixed observation points at depths at every 10 cm to the groundwater level. The hydro-physical properties of the layers were determined in a laboratory. The obtained graphs (profiles) of the soil moisture provide possibilities of interpreting the results in a hydro-mechanical aspect. A zone of capillary fringe can be delineated, where the soil moisture movement has an ascending direction.

Analyzing the obtained data and results for the observed period, it may be shown that only in several moments (time intervals) rainfall can produce full saturation of the pores in the capillary fringe zone and reverse (upside down) water and dissolved substance movement. During these time intervals the feeding of groundwater comes from the aeration zone.

It may be concluded that the aeration zone has the role of a dispenser and a buffer in the processes of influx of water and substances in the groundwater flow.

The simulation of the processes using the numerical model respectively the WAVE program yields analogous results about the exchange of water and substances as shown by the field observations.

The simulation by means of the model and the WAVE program give good possibilities for predicting groundwater pollution processes due to active fertilizing in agricultural areas.

WATER POLLUTION IN THE BASIN OF DRINI I BARDHE

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The paper includes water pollution and protection effects on 6 measurement points in the hydro-metrical network.

Physical and chemical, as well as bacteriologic analysis were performed on these profiles, in the river of Drini i bardhë.

Comparisons were made from profile to profile. As the consequence of the absence of treatment of sewage waters, the quality of the rivers on soils, located on plains, is rather low.

This has been treated since 1980, due to the fact during this period, in many rivers were highly polluted and the quality of the rivers was related to main municipalities, especially to Peja, Klina, Gjakova and Prizren, in which the quality of the water is of the 3 d and 4 th class.

These highly polluted rivers are in contrast with pure rivers (of the 1 st class) on soils located on plains, in which problems are localized exclusively around villages.

Samples taken in 6 profiles present the reality of the content of the structure of bringing the water to a particular profile.

DISPOSING WASTEWATER FROM PIGS-FARMS : DIMINISHING POLLUTION RISKS

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The solid share from the mechanical step together with the decantation sludge is composted, and after a period of at least half a year it can be used as natural fertiliser to increase agricultural yields. The quality of wastewater thus disposed of is good (CBO 5 40 mg/l, CCO 98 mg/l, pH = 7, O₂ 8-10 mg/l); therefore it can be disposed of or stored in basins and used in irrigations. The good quality of disposed water allows it to contribute to the recovery of the eco-system in a positive sense.

FORMER INVESTIGATIONS OF FAUNA OF GASTROPODA (MOLLUSCA) OF BOSNIA AND HERZEGOVINA

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The fauna of Gastropoda (Mollusca) in Bosnia and Herzegovina is very rich because of its geological and geographical position, climatic conditions and still poor anthropological impact in this area of Europe .

For this reason, numerous scientists have been investigated the land and freshwater Gastropoda in Bosnia & Herzegovina during last two century. The most of scientists were outside of Bosnia & Herzegovina. Some of them collected personally the gastropods, another only studied already existing collections of Gastropoda provided from Bosnia & Herzegovina .

The investigations of Gastropoda in Bosnia & Herzegovina are possible to divide into 3 phases:

XIX. century, when numerous scientists visited this area [Boettger, Brancsik, Brusina, Kimakowicz, Kittl, Möllendorff, Pfeiffer, Rebel, Sturany, etc.] who described some new species from Bosnia and Herzegovina : *Agardhia truncatella biarmata*; *Cochlostoma gracilis martensianum*; *Cochlostoma septemspirale bosniacum*; *Cochlostoma sturanyi sturanyi*, etc. XX. century, when another numerous scientists were in this area: Bole, Berberovic, Brancsik, Hesse, Kobelt, Knipper, Kušèer, Nordsieck, Pinter, Radoman, Riedel, Schütt, Simroth 1916, Velkovrh, Wagner, Wohlberedt, Zilch, etc. They described also numerous new species from that region : *Herilla pavlovici pavlovici*; *Herilla illyrica plasensis*; *Herilla bosniensis brancsiki*; *Medora albescens troglavensis*; *Oxychilus absoloni*; *Marstoniopsis vrbasi* , etc .

XXI. century, when the study of Gastropoda in Bosnia and Herzegovina is continuing, including the species from the subterranean waters and caves, and the results of these investigations are still in process.

The present fauna of Gastropoda in Bosnia & Herzegovina is consisting of nearly 362 taxa from 44 families, and the new taxa are waiting to be discovered during the next investigations.

THE AQUIFER BASIN OF ELBASANI , ALBANIA AND THE PROBLEMS OF ITS MANAGEMENT

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The aquifer basin of Elbasani represents one of the largest water resources of Albania . It extends along both sides of Shkumbini River , in the segment from Labinot Fushe to Cerriku. The aquifer basin is organically linked with the alluvial deposits of this segment as well as with the activity of the Shkumbini River . The geological history of this basin is also that of the Shkumbini River . The alluvial field of the Labinot Fushe – Cerriku segment has a considerable and interesting spatial development with a size of 20 x 5 km and it is more than 200 m thick. Shkumbini River in this segment, similar to the alluvial field, is characterized by a wide river-bed, testifying for a continuous extension of this sector. The Elbasani alluvial field is formed under an extensional tectonic regime that is active to the present days. This tectonical situation is related to the Elbasani-Diber transversal fault which has the most spectacular expression in the evaporite diapirs of Dumrea and Peshkopia. The extensional tectonic regime created the conditions for the river flow to pass along this sector, the spatial designation of this graben structure, but what is most important created also the necessary conditions for the sedimentation of

considerable thicknesses of gravels. Hence the Elbasani aquifer basin is conditioned and related to two main elements: the gravel thickness and the Shkumbini River. The gravels play the role of the storage and filtering tank whereas the river is an intensive water supplier. The aquifer basin is used for the drinking water supply of the Elbasani city, and other inhabited centers around it, as well as for the water supply of many industrial activities. Waters are mainly of the calcium-magnesium hydrocarbonate type, with total dissolved solids ranging between 0.2-0.5 g/l, water hardness 8-13 German degrees, dry residue 0.2-0.4 g/l. The exploitation of the aquifer basin is carried out by wells 20-100 m deep. Well discharges are considerable varying between 50 to 150 l/sec. Currently, the basin is under the impact of an extensive urban development. Numerous investments and constructions are taking place in this area; this stimulated also by the infrastructural strategic position of this sector, among others a passing way of the Transnational Corridor-8. Hence the aquifer basin is suffering the negative impacts of a bad management and of environmental pollution from numerous factors. The Elbasani aquifer basin has large water resources, offers considerable potential for exploitation and usage in the service of the community, but special protection measures against the pollution for the aquifer basin area as well as for the entire watershed of the Shkumbini River are required.

ASSESSMENT OF DISSOLVED POLLUTANTS IN KRISHNA RIVER USING MASS BALANCE APPROACH

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The River Krishna in Andhra Pradesh is typical receiving water body for urban and rural runoff. The river shows strong seasonal dependence for various constituents and the water quality deteriorates sharply as municipal and Industrial wastes are joining the River Krishna. The important characteristic associated with the pollution of the river is the slightly reduction of self-purification process over a stretch of about 85 km. A chemical mass balance approach has been used for measuring changes in the concentration and/or load to the river, which in turn calculates the transport of pollutants. The mass balance calculations conducted for certain water quality constituents indicated that additional inputs are needed to account for the observed differences in load along the river. The sources may include non-point sources of pollution due to agricultural activities, sediment remobilization or entrainment, ground water intrusion or a combination of these sources. Mass balance calculations over a 4 years period indicate that pollutants are retained in the sediments of the investigated 85-km long reach of the stream (2500kgs of Potassium,

40000kgs of Sodium, 25000kgs of Chloride, 2000kgs of Fluoride and 2000kgs of Silicates). Other pollutants such as Calcium, Magnesium and Sulphate appear to be retained and washed-out, depending on loading rates and local stream conditions. The retained pollutants represent a substantial part of the total mass transport through the stream (10- 75%). Almost 80% of the transported Potassium is retained within the stream sediment. Subsequently, the deposited pollutants represent a potential pollutants source.

GEOLOGICAL STUDIES OF ADRIATIC ALLUVIAL PLAINS AS A KEY ASPECT FOR WATER BASINS INVESTIGATIONS

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If we want to know the exact water supply available for the national economy, we have to study the position and the geometry of aquifers, as well as the amount and quality of water stored therein. It required the implementation of observation wells.

Human cultures evolved on plains. Agricultural production was the most important activity in the millennia preceding the industrial revolution. The ownership and control of alluvial plains represented the power of the empires. Therefore it was by no chance that they were the theatre of largest military operations as well. They were also the scenes of river regulations, transport of goods, and voluntary or forced migrations facilitating the improvement of engineering, road network and the expansion of civilization

The formation of plains was facilitated throughout constant change of the Earth's surface. Tension builds up in the crust as a result of the drift of lithosphere plates

The erosion of mountain ranges and filling of depressions starts immediately after their formation throughout the action of water available on the ground surface. Streams and rivers act as the agents of transport of the eroded material, disintegrating, classifying and eventually depositing it as a function of its grain - size and unit weight.

Plains form commonly on sites occupied by closed sea basins or lakes before. The deposited material tends to constitute layers preserving in their pores the water present at their formation. As a function of the pores' ratio we differentiate between beds or rocks of high and low conductivity, in other terms, aquifers and aquiclude horizons, respectively. Water in the pores can later be pushed away by gases or oil produced by micro-organisms resulting

in the formation of hydrocarbon reservoirs. If we want to know the exact water supply available for the national economy, we have to study the position and the geometry of aquifers, as well as the amount and quality of water stirred therein. It required the implementation of observation wells

Thickness of the Quaternary deposits, position of the basement of Quaternary deposits, states of environment-potential pollution sources, principles of research methodology, sampling and laboratory tests are main factors to conservation water basins connect with quaternary depositions.

Geophysical investigation methods examine, however, only physical parameters. Samples are needed in order to learn the chemical composition of the sediments and perform paleontology and technological tests

CONSEQUENCES OF HYDRO-TECHNICAL INTERVENTIONS IN THE MOKASNICA CATCHMENT AREA

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In the article the state of utilization and protection of the water resources in the Mokašnica catchment area (SM) within the bigger Mostar Mud catchment area is described. The data about Mostar Mud catchment area are presented and the earlier research of flows surface and ground-waters have been described, particularly that which are carried out in the river Mokašnica catchment area (SM). Existing hydro-technical and other interventions in the environment have been described and their influence on the regime of the surface and ground-water has been estimated. In order to protect the space SM from further devastating, security measures and improvements of harmful interventions, as well as directives for the further research are suggested. For the purpose of the better management to the waters and space in the Mokašnice catchment area, the special environmental protection study is necessary, including an analysis of the possibility of missing water currents revitalization.

AN EXAMPLE OF WATER INFILTRATION MODELLING THREW A ROCK-FILL DAM

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The subject of this work is the transition part of HE Varaždin head water channel, that is, the part between the conventional gravel fills and engine room as a solid object. The transition part made of gravel fill and the concrete lining is connected by dilatation, a problem of water convection in the contact zones occurs, which can result with negative influences. The useful data related to the object condition and guidelines for further ways of maintenance are gathered based on the material investigation, that is, the parameter evaluation and software infiltration modeling.

IMPACT ASSESSMENT OF THE SOLID WASTE LANDFILL IN THE MUNICIPALITY OF CENTAR ZUPA

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The paper deals with assessment of the most important environmental impact of the solid waste landfill in municipality of Centar Zupa. These analyses are part of the complex Environment Impact Assessment Study for the solid waste landfill. Description of the implemented methods for the impact assessment is performed. Brief description of the landfill location and project are presented, too. Identification of all possible impacts (both positive and negative) associated with each phase of the project and the activities undertaken on environment have been done using matrix method. Also, prediction in order to forecast the nature, magnitude, extends and duration of the main impacts has been done. Taking into consideration the designed measures for elimination and mitigation the negative impacts it can be concluded that there will be no negative impacts on environment. Also, the authors propose more detailed analysis of the phase of determining the significance of the residual impacts that cannot be eliminated and mitigated.

**AN APPROACH FOR PREVENTING THE NEGATIVE IMPACT ON THE
NATURAL SOIL AND WATER MEDIA FOR THE AREA OF SOLID WASTE
LANDFILL IN CENTAR ZUPA**

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A Radika river basin is situated in the far western and north-western part of the Republic of Macedonia. The basin nature is well preserved, ecologically balanced and with healthy environment. For the protection of the environment in the catchments area, it is worked on a concept for building appropriate public facilities, i.e. building of a local sanitary landfill and municipal wastewater treatment plants on certain locations. This paper gives an approach which is designed for the solid waste landfill at Centar Zupa, especially the part connected with the preventive measures in designed to reduce to the lowest possible level negative impact on the soil and water environments. The special conditions of the natural geological environment, which are a factor of a prime importance for design are analysed. The design concept is shown briefly, especially the element of geosynthetic system as a main measure for preventing of the possible negative influences.

TOPIC 6: LAKES AND WETLANDS

THE ROLE OF WATER QUALITY IN WETLANDS: TWO DIFFERENT WETLANDS STUDY FROM WESTERN PART OF TURKEY: IZMIR BIRD PARADISE AND KUCUK MENDERES RIVER WETLAND

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Wetlands are the most important part of the hydrological cycle because of the wetland functions that are water quality, flood and groundwater discharge-recharge controls. Hydrogeological and hydrogeochemical properties help us to identify wetlands water type, discharge and recharge boundaries of wetlands and water-rock interactions.

In this study two coastal wetlands are discussed by hydrogeochemically that in occurred in and around Izmir , western part of Turkiye. Both of them have the similar geological units. In Izmir Bird Paradise that is protected by Ramsar Convention the main aquifer is Quaternary alluvium and also limestones of Neogene sedimentary unit. In Kucuk Menderes River wetland Paleozoic marbles are the main aquifer. Drought can be seen especially in summer both of these wetlands. The annual rainfall values are 546.3mm and 689.2mm and the annual evapotranspiration values are 893.9mm and 868.4mm, respectively. In Izmir Bird Paradise, there are two different ecosystem: fresh and saline according to hydrogeochemical data. In contrast, at the Kucuk Menderes River wetland all of the wetland members (3 lakes: Lake Akgol, Lake Gebekirse, Lake Kocagoz and one swamp: Eleman Swamp) are saline by sea water. For hydrogeochemical investigation, the samples were taken from salt pans, swamps and Neogene sedimentary hills for Izmir Bird Paradise, and lakes and Eleman swamp for Kucuk Menderes River wetland. The dominant major ions are sodium and chlorine (Na-Cl), at the both wetlands except Lake Kocagoz with Na-Ca-Mg-Cl-HCO₃ mix water type. This salinization comes from seawater intrusion due to excessive pumping of ground water both Menemen Plain near Izmir Bird Paradise and Selcuk Plain near Kucuk Menderes River wetland. On the other hand, the industrial zone around the Izmir Bird Paradise is endangered this wetland with their waste waters. At the Kucuk Menderes River wetland there is no industrial activity but there is an uncontrolled disposal waste area between Ephesus and Lake Gebekirse .

ECOHYDROLOGY OF DOJRAN LAKE

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In the Republic of Macedonia there are three natural lakes: Ohrid, Prespa and Dojran. Smallest one is Dojran Lake but not less significant as a water resource and as a scenic beauty. The last 15 years this place of natural heritage is threatened because the lake's water level decreased seriously. The watershed area of the lake and the lake itself are shared by Macedonia and Greece. Recharge of the lake is from direct runoff, small rivers and groundwater. Since 1988 the lake surface dropped from 42 km² to 31 km², and more significantly the water volume decreased from 262 million m³ to only 80 million m³ in 2000.

This water declination together with the simultaneous deterioration of the water quality resulted with serious ecological impacts. Biodiversity diminished and the reduction of plankton led to a reduction of fish portion. Also the number of birds decreased dramatically. The attack on the ecosystem had a harmful impact on the economy in the region. Tourism had been the most important sector, but it completely stopped, and in 2000 were only tenth of the level in the eighties.

How much the present state of this natural lake is under the impact of hydrology and climate, and how much this is due to some other not clearly identified causes, should be main goals in future water management in both countries that share the lake watershed and the water lake itself. As the environmental state of the water bodies are very close related to hydrological characteristics of the region, there can not be complete environmental assessment without serious analyzes of the basic hydrological parameters and their monitoring. This paper will present some hydrological and meteorological analyses of Dojran Lake based on the data collected at meteorological station Nov Dojran. Quantity and quality of hydrological and meteorological data, water use and water quality data will be assessed and discussed as well. The intention of the authors is to stress out the vulnerability of lake waters and its biodiversity and to initiate urgent and strong support of the international community in undertaken joint interstate projects and actions on both sides, Macedonia and Greece.

AGE, GROWTH AND CONDITION OF EUROPEAN MINNOW, PHOXINUS PHOXINUS (L.), IN FOUR HIGH-MOUNTAIN LAKES, THE RILA MOUNTAINS, BULGARIA

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The lakes studied are located in the cirque Sedemte Ezera, North-West Rila Mountains, at altitudes between 2095 and 2243 m a.s.l. European minnow was considered one of the monitor species for the Rila Mountains. The relationship between mean body length (L) and mean length of diagonal radius of scales (S) was described by the equation $L=a+bS$, and the relationship between mean length and weight (W) - by the equation $W=kL^b$. Mean weights calculated according to the latter equation at the same round length values were used as condition factors of different populations. The populations were composed of five age groups (from 0+ to 4+). Fishes at age 1+ and 2+ predominated in the catches from the Lakes Detelinata, Ribnoto and Dolnoto, and fishes at age 2+ - in the Lake Bliznaka. Growth rate of minnow from different water bodies was compared by mean values of body length calculated at the same age.

SAME EXPERIMENTAL DATES ABOUT THE LEVELS OF CHLORINATED PESTICIDES AND PCBS IN THE BIOTA OF OHRID LAKE

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In this research paper are presented some experimental data about the levels of Chlorinated Pesticides and PCBs in the biota of Ohrid Lake. This contaminant compounds are known as persistent organic pollutants (POPs). Their highly lyophilic properties coupled with the relationships between human factor, atmospheric depositions and food chain; suggest that the biota represent pollution levels in the Ohrid Lake.

Interesting facts are exposed for the presence of these pollutants in endemic species of biota that live in this large basin, with unique values for tourism and region. In this publication we have determine that levels are considerable. They are compared with levels of POPs in biota of other lakes of the region. We come to the conclusion that the origin of this POPs is both anthropogenic and atmospheric. Levels of pollution in Ohrid Lake are compared with other

regional lakes. We suggest that the levels of contaminant organic pollutants must be kept in control.

PRELIMINARY INVESTIGATIONS ON THE PARASITIC CRUSTACEA OF - FRESHWATER FISHES FROM MACEDONIA

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In an extensive parasitological investigation of the fishes from Macedonia, - 5 species of parasitic Crustacea have so far been identified. Four of them belong to the -Copepod Crustacea, -: *Ergasilus sieboldi*, *E. gibbus*, *Lerneae cyprinacea* and *Lamproglana pulchella*, and one belongs to the -Branchiura - *Argulus foliaceus*.

During the parasitological examination - 13 fish species were examined from the lakes and some fish farms in Macedonia. The results showed that 83 fish were infested with crustacea of the 809 examined (10,26%). The average intensity of infestation was 3.76.

Within the parasite species, the highest prevalence was with *Ergasilus sieboldi* (5,81%). The highest intensity of infestation was with *Ergasilus gibbus* (15,25). *Lamproglana pulchella* and *Argulus foliaceus* are recorded for the first time in the ichthyoparasitefauna of Macedonia.

EVALUATING PIGMENTED MACROPHAGES AS BIOMARKERS FOR FISH HEALTH AND ENVIRONMENTAL POLLUTION: EVIDENCE OF NATURAL SEASONAL FLUCTUATIONS IN OHRID TROUT (SALMO LETNICA KAR.)

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In parallel to growing pollution and decline of the trout population at Ohrid Lake, there is an increased need for establishing efficient systems to monitor both fish and environmental health. Accumulation of visceral macrophages (MACs) holds potential as one biomarker in monitoring programmes. An extensive literature exists supporting an increase in number, size and/or pigment content of MACs in relation to toxicant exposure, disease, nutrition and age. Previous preliminary data (based on a semi-quantitative approach) suggested that those cells might be also seasonal and breeding dependent. Thus, looking for more evidence as to such hypothesis, the aim of this study was to demonstrate (quantitatively) the suspected changes in the type (melano- vs iron-laden MACs) and amount (relative volume) of pigmented MACs in visceral organs (liver and spleen), throughout the breeding cycle in the wild population of Ohrid trout. So, we examined the liver and spleen of 38 female Ohrid trout obtained from the fisherman legal catches, from 2000 to 2001.

In general, in both examined organs the amount of MACs showed a tendency to gradually increase from pre-vitellogenesis to post-spawning. High values during and after spawning for spleen MACs significantly differed ($p < 0.01$) from the values obtained in pre-vitellogenesis and in vitellogenesis (early and late). The cited changes were mainly due to fluctuations in the melano MACs, because for iron-laden MACs we found only one difference ($p = 0.028$) between fishes in late-vitellogenesis and in post-spawning. We also found differences ($p = 0.038$) between late-vitellogenesis and post-spawning in hepatic MACs, but the amount of either melano or iron-laden MACs was not statistically associated with the gonadal stage.

In conclusion, fish macrophages accumulation is being used as a fairly efficient health-monitoring tool, due to its apparent sensitivity, relative low cost and easy evaluation. However, this potential biomarker merits further scrutiny, due to a number of ecological and physiological variables that modulate the macrophage pool. Our data prove that using trout pigmented MACs for biomonitoring should take into account the natural variations that occur along the breeding cycle, especially when using spleen macrophages as monitors of fish and environmental health.

THE GRUZA RESERVOIR – AN ECOLOGICAL STUDY

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The Gruža Reservoir was constructed in 1984 for the purpose of supplying Kragujevac and its surroundings with the drinking water. The Gruža Reservoir has a whole series of "unfavorable" characteristics that make accelerated

eutrophication possible. The reservoir was created in a lowland region by flooding a highly fertile river valley. Owing to this, a large amount of organic matter was present in water of the newly formed reservoir. Most of the reservoir (almost two thirds of it) is shallow and exhibits characteristics of lowland reservoirs, many of which are subject to accelerated processes of eutrophication, as too are natural lakes that are exposed to strong human influence.

Analyses of water and sediment show that the physicochemical condition in the pelagial differ from those in the littoral. These differences depend both on allochthonous and autochthonous factors; they are the result of inputs of allochthonous materials, chemical exchange at the mud-water interference, and the biological production of the reservoir.

On the basis of total abundance of bacteria (T), water of the reservoir can be classified as clean. Aerobic heterotrophic bacteria constitute the dominant microflora in the reservoir. On the basis of representation of the heterotrophic bacterial population (H) and according to the categorization of Kohl (1975) water of the Gruža Reservoir belongs to quality classes I and II.

The qualitative composition and abundance of phyto- and zooplankton indicate a high level of eutrophication in the Gruža Reservoir.

Macrophytes there are developed very quick after the reservoir's creation. In contrast to the that period, today increased number of species can be seen, but, as for abundance and mass no significant enlargement is spotted because frequent fluctuations of the water level limits this development. Because of that, the presence of macrophytes is not excessive, with the results that they are still a desirable component of the reservoir.

Values of the saprobity index were mainly within the limits of β -mesosaprobity. Analysis of the saprobic valence gave values most often within the limits of oligo- and oligo- β -mesosaprobity, although ones corresponding to β - and α -mesosaprobity were observed from time to time.

The results of saprobity analysis (as a measure of organic pollution) are completely in keeping with consumption of KMnO_4 , which is high in the Gruža Reservoir. Average consumption of KMnO_4 varied from 17.2 to 27.7 mg L⁻¹. The obtained values of saprobity and the saprobic valence are one more indication that a considerable organic burden is present in the given reservoir.

A special problem in the case of the Gruža Reservoir is the existence of a very large number of pollution sources. Water of the tributary is polluted by large amounts of organic waste entering it directly from the open septic pit of a mushroom farm, after partial treatment from a slaughterhouse, and by means of seepage through soil from a poultry farm. A great contribution to pollution is also made by land under cultivation (56% of the reservoir's drainage area), from which fertilizers and pesticides are washed, as well as by many households with inadequately constructed septic pits enabling liquid

organic waste to enter the water directly. The reservoir is a fishing area, so its water receives fuel and products of fuel combustion from motor boats. Although not in great numbers, bathers, fishermen, and excursionists visit the lake during the summer period, and this leads to urino-fecal pollution.

ORIGIN AND CLASSIFICATION OF THE NEW SPERMATOGONIA OF OHRID BELVICA (*ACANTHOLINGUA OHRIDANA*) IN THE PERIOD AFTER THE SPAWNING

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This article contains the description of the origin and classification of the new spermatogonia of Ohrid belvica (*Acantholingua ohridana*) in the period after the spawning.

As to the new spermatogonial population we can conclude that in the latter phase of the postspawning period it is more present in the wall of the seminiferous lobules, an intensive spermatogonial proliferation, i. e. multiplication can be noticed, especially in seminiferous lobules which contain rare sperm residues.

The new spermatogonial generation in Ohrid belvica (*Acantholingua ohridana*) is represented by spermatogonia of A and B type, which are single or organised in cysts.

The primary spermatogonia of type A are hypertrophied, they possess bright cytoplasm, clear cell borders, well seen nucleus with a bigger diameter, emphasized nuclear contours, euchromatic characteristics, peripherally located chromatin, centrally located nucleolus.

In the contrast of these spermatogonia, in the wall of some seminiferous lobules, spermatogonia of the second generation can be seen, i. e. groups of spermatogonia of smaller dimensions, that is of smaller diameter of the nucleus and presence of more heterogenous chromatin, i. e. spermatogonia of type B.

In some spermatogonia, two nucleoli can be noticed in their nucleus, which means that these cells are in the process of preparation for division (mitosis) or are in the course of division.

Very often in the some spermatogonia accompanying precursor Sertoli cells with triangle shape of nucleus or in the shape of halfmoon can be noticed. They have prominent nucleolus.

**TRACES OF OIL PRODUCTS AND NATURALLY OCCURRING
HYDROCARBONS IN THE LAKE KOUMOUNDOUROU OF
ASPROPIRGOS, ATTIKI PREFECTURE, GREECE**

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In this paper the environmental self purification ability of Lake Koumoundourou (Attica, Greece) was investigated, concerning oily wastes transported to it from nearby leaking refinery fuel tanks, through a karstic spring and merging at a depth of 3 m under its surface.

The lake, part of Aigaleo Marginal plain mountain of Attica basin, is encountered at the southeast exit of Thrace plain, one of the most polluted industrial areas of Greece. It is located at the vicinity of greek vital refinery of Aspropirgos (ELDA) and the military camp AVEK, which is the main fuel supplier of the greek army.

Hydrogeomorphologically, it is a shallow lake with a mean depth of 1.5 m and an absolute mean altitude of 1.41 m. It has a surface of 143.000 m², a total perimeter length of 1300 m, while its maximum length and width is 600 m and 400 m respectively. The lake is discharging into the sea through a passage under the nearby freeway connecting Athens with Peloponnesus.

According to an official governmental gazette published in 1972 the lake has been nominated an archaeological protected area of significant importance with a protected zone of 50 m around its perimeter. It was devoted to goddess Dimitra, while the one devoted to her daughter Persephone was filled with rubble in 1952 and lies under the premises of ELDA.

Parallel with the monitoring campaign for the collection of water samples covering the whole surface of the lake, the water budget of the spring was calculated with the use of G.I.S. tool layers (hydrological, topographical, geological and soil maps).

The carbon reference index (CPI) was used to present the results, employing GS/MS techniques for the analyses followed by statistical manipulation of the data. Monitoring that took place in the area around the under water spring, where the main hydrocarbon pollutants are merging, revealed kerosene and diesel distillates with CPI indices taking values around 1. On the other hand, through monitoring of the whole surface of the lake and its outlet only chain alkanes with odd numbers of carbon atoms were detected and CPI indices taking values greater than 1.

The final conclusion is that Lake Koumoundourou sustains a very good potential for self purification under oil pollutants stress. This is due to the high concentration of dissolved oxygen from the spring water.

SEASONAL CHANGES IN THE VERTICAL DISTRIBUTION OF HIRUDINEA FROM LAKE OHRID

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The representatives of Hirudinea, as well as the representatives of Oligochaeta and Crustacea, characterize highest frequency of occurrence among the whole macrozoobenthos from Lake Ohrid. The high frequency of occurrence of class Hirudinea is a result of their wide ecological valence for settling the bottom of the Lake basin. Particularly, in this class there are eurybathic forms that settle as well as the littoral, sublittoral and profundal region of the Lake.

To register, and make evidence of the changes in the density of leeches' communities from different depths, was the main subject in our investigation. Our investigations comprised the time interval from 1999-2000 year. By monthly dynamic of collecting, from 18 depth points from the three main depth zones of the Lake, it was made insight in the variations of the density of Hirudinea in different seasons of investigation.

The results from our investigation showed different dynamic of changes in the leeches' communities on different depths. In this way, the changes in the density of Hirudinea as a result of the season are much more expressed in the littoral and sublittoral, but they are almost inappreciable in the profundal region. Further more, the littoral and sublittoral leeches communities show two distinctive maximum of density, while the profundal communities do not have distinctive maximum of density.

WATER AND SEDIMENT MANAGEMENT CHALLENGES ON NARTA AND KARAVASTA COASTAL WETLANDS, ALBANIA

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Because of their position at the interface between the continent and the sea, and the irregularity of the Mediterranean climate, there are clearly no easy neither evident solutions to manage Mediterranean coastal lagoons according to their multiple uses and functions. The lagoons of the Albanian Myzeq plain, Narta and Karavasta lagoons, are exposed to very energetic coastal dynamics due to high sediment discharges and changing morphology of their neighbouring river deltas: from North to South the Shkumbini, the Semani and the Vjose,. To maintain connectivity between the open sea and lagoon, management strategies of their inlets either natural or artificial are necessary, with subsequent dredging and associated costs. Nevertheless, this does not mean that a particular area now undergoing sedimentation will not suffer from erosion within decades or even years. Some works for stabilizing the banks, and a better way of conducting dredging operations (disposal of dredged material) should diminish its frequency. A field survey (bathymetry of the sea bed, topography of beaches, sediment cores analyses, current measurements) should be done in order to derive a sediment budget as pre requisite to big dredging operations. Nevertheless, in order to maintain hydraulic connectivity as it was done during last years, selective dredging operations can be done. The management of their drainage basins during the last decades has significantly reduced freshwater input to the lagoons, and increased their pollutant load. As a consequence, exchanges with the sea were modified, changing the hydrological and salt balance of these systems. Concerning pollution, it seems that the Narta and Karavasta lagoons will difficultly support any increase of organic and nutrient load from the catchments without experiencing problems of eutrophication causing more frequent dystrophic crisis in confined areas during summer. The Narta wetland ecosystems have inherited a bad environmental situation because of former industrial and chemical activities in Vlora. The heavy metals stocks in the open sea are gradually diluted, but in the lagoons the renewal of polluted sediments will undoubtedly take a longer time.

For both lagoons, management options must be retained, favouring whenever possible maintenance of freshwater input of acceptable quality and diversion of urban sewage water to treatment systems or to the sea. Nevertheless, in the mid term, discharging of all sewages to the sea should not be retained as a sustainable solution. Both the need for good quality of sea water entering the lagoons, and the quality of swimming waters for tourism development in the Karavasta area and Vlora bay imply that water treatment systems should be installed. There is a need for an adequate monitoring both of hydraulic and water/sediment quality parameters for these sensible wetland ecosystems.

THE RIVER SATESKA AND CONSEQUENCES OF ITS DIVERSION TO LAKE OHRID

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The River Sateska is the largest river in the Lake Ohrid watershed. Its river basin reaches around 411,47 km². From the whole surface of the Ohrid Lake watershed, 39,36% belongs to this river.

In 1961 the River Sateska has diverged its river bed. Its mouth has changed from the River Crni Drim into the Lake Ohrid.

From the day when the course of the River Sateska diverged into the Lake Ohrid, until nowadays, remains the dilemma, does that decision and that action is the right one. There are opposite thoughts about the same; although in 1998, project has been made and decision brought by the Government of Republic of Macedonia, for returning the River Sateska into its old river bed.

Hydrobiological Institute during the period from 1996 till 2005, on the River Sateska, made some researches, according to the circumstances, continuously and periodically. The researches point out that the River Sateska is loading up the lake's ecosystem with 10% ammonium nitrogen, 12% nitric nitrogen, 53% nitrate nitrogen, or a sum of 29% total nitrogen in relation of the quantity nitrogen which are within the water course, as the 39% of the total phosphorus brought by the water course. According to the microbiological parameters river water was II-IV class.

The goal of this presentation is to show what the River Sateska means for the Ohrid Lake according to physical, chemical and microbiological parameters.

Categorization is according to OECD regulations, positive by law regulations of Republic of Macedonia and criteria by Kohl (1975).

Continued loading of organic and inorganic matter during the period since diversion of the River Sateska to Lake Ohrid had significant influence. Impact of the river water to the lake water was evident, so the lake water in front of the river mouth was I to II-III class with except III and IV class during the summer period. The great amount of silt are changing the shape of the littoral where the river inlet is.

**CHARACTERIZATION OF TROPHIC STATE OF SOME ALBANIAN
WATER ECOSYSTEMS BASED ON PHYTOPLANKTON
PHOTOSYNTHETIC PIGMENTS**

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Eutrophication of water bodies can be classified according to their "trophic state", which can be divided into three categories based on trophic state oligotrophic, mesotrophic and eutrophic. These categories reflect the nutrient and clarity levels, or reflect the level of nutrients and algae in the water. The count of individual algae cells in water bodies is difficult; these categories are most easily determined by measuring the chlorophyll content of the water. Chlorophyll, a plant pigment found in algae, indicates how much algae is present in the water, providing an indication on the amount of nutrients present. Therefore, chlorophyll allows to classify water bodies according to their trophic status. As a primary nutrient responsible for algae growth is phosphorus, is established a direct relationship between phosphorus concentrations, chlorophyll a (algal biomass), and clarity; phosphorus drives algal growth which then affects water clarity.

We have represented data on the trophic state of some Albanian water bodies as Ohri-Prespa ecosystem and Adriatic lagoons: Vilun, Kune-Vain, Patog, Karavasta and Narta. Evaluation of trophic state is based on chlorophyll a content in water, distribution of photosynthetic pigments, level of phosphorus and clarity of water, monitoring these parameters during a year from march to October.

Based on the collected data on the period 2003-2005 we can evaluate that Ohri lake is characterized by a low trophic state - oligotrophic level. Whereas Prespa lake is characterized by a high trophic state - mesotrophic level. Vertical profile of Chl content demonstrated different distribution in Ohri and Prespa lakes.

Lagoons of Adriatic coast represented different trophic state. Lagoons of Vilun, Kune-Vain and Patog are characterized by a oligotrophic level. Meantime, the Karavasta and Narta lagoons are characterized by a higher trophic state, estimate as mezotrophic.

BIOCHEMICAL-GENETICAL MARKERS AS USEFUL TOOLS FOR SYSTEMATIC AND POPULATION GENETICS OF FISH

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Very often phenotype differences in different organisms can not be markers for differences in their genotype. In fact, in the final formation of some species phenotype, except genetical factors, is impacted by the environmental factors too. On the account of this, more variations of the phenotype in just one species are possible. In the literature there is data about using allozyme electrophoresis for identification of fish species and using the technique of multilocus enzyme electrophoresis addressing the issues related to systematic of fish. The conservation of animals is focused on a species or a strains of animals, aiming towards maintaining of a group as a genetic resources. Protein polymorphism may be very good indicator of genetic diversity of fish populations.

In our paper a total of 22 samples of species *Barbus meridionalis* petenyi Heck. from Lake Ohrid were collected during 2003 and 2004. Miogens (sarcolemmal proteins) and six enzymes (AAT, EST, MDH, LDH, ME, SOL) were electrophoretically analysed. Based on protein starch-gel electrophoresis and isoelectric focusing (IEF) on thin polyacrilamide ampholine gel with pH gradient between 3-10, polymorphism on several enzymes were detected.

CHARACTERISTICS OF THE SEDIMENTATION PROCESSES IN THE LAKE SREBURNA

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The article observes the processes of sedimentation in "Biosphere reserve lake Sreburna", Northeastern Bulgaria. The lake is part of Danube catchments. The water balance is connected with fluctuation in the level of river Danube. The other factor is water flow from the two rivers with irregular regime in southeastern and southwestern part of the lake. The general factor is the karstic waters in the region of the lake.

The investigation accents on the speed of the sedimentation process of the different materials in the lake. The deposit of this material is basic reason for water changes, quality of the water and degradation of the lake system. The coefficient of Stock used for the statistical analysis and measurements.

The basic part of the sediments on the bottom of the lake is organic material (80-85%). The other part is formed as a result of erosion processes (5-10-15%). The slime substrate consists organically and inorganically materials. The link between plant production and sedimentation is basic for the present-day function of the lake. The sedimentation material is base for spreading of the reed in the lake. This process is general factor for the transformation in the water body.

The general types of plant zones are determinate based on the system of Shilkrot (1970). The monitoring of these zones can show the level and direction of the future vegetation expansion in the lake. The article consists also the spatial model of the plant zones.

The research gives some recommendations for future management plans. They are very important for the process of nature protection and different conservation activities in the lake and Lake Basin.

LONG-TERM DYNAMICS OF A LAKE ECOHYDROLOGICAL SYSTEM AND THE IMPLICATIONS FOR RADIATION EXPOSURE

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Long – term ageing and physical transformation of ecosystems may occur while a continuous leakage of radionuclides from a repository is going on. This will imply additional uncertainties as regards the consequences for exposure to man.

The turnover of nuclides during the ageing of a lake ecosystem and its successive development into agricultural land is simulated using a multicompartment system. Parameters of a major importance for the distribution and reconcentration of radionuclides supplied into the lake as surface ecohydrological inflow are identified. Seven radionuclides occurring in high – level waste are treated. These are I 129 , Cs 135 , Ra 226 , Pa 231 , Y 234 , Np 237 and Pu 239 . The activity distribution is highly dependent on the sorption behavior of the radionuclides. The major pools for radionuclides distribution are lake outflows 15 – 97 % (Pu 239 - I 129) and deep lake sediment 2 – 84 % (I 129 - Pu 239).

Performed dose calculations for different time periods of the lake evolution showed that the individual doses increase with a factor of hundred for Pu 239 during the life – time of the lake. For comparison doses have also been calculated for two different well scenarios in order to discuss the possibility of generic conversion factors from release to the biosphere and resulting

individual doses. However, for all nuclides the obtained doses from exposure from a well situated in the discharge area to the lake were higher than for those obtained from the turnover of lake. For rough estimates the obtained doses can be used as standards when studying the impact on man from the turnover of long – lived radionuclides during the evolution of this type of ecosystem.

ICHTHYOFAUNA OF THE BULGARIAN NATURAL LAKES

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The ichthyofauna of the natural lakes in Bulgaria has been characterized based on both published and original data. The lakes that have been affected by the human activity and have therefore lost their natural features are not subject of the present work. The lakes are divided into six categories according to the origin of their lake kettles – glacial, riverside, coastal, tectonic, carst and landslide. Despite the fact that the total area of the Bulgarian natural lakes is very small – 95 sq. km (0.09% of the country's territory) 65 fish species belonging to 21 families have been reported for them up to date. This is by any measure a high diversity – more than 42% of all 154 freshwater fish species confirmed for Bulgaria . Richest in terms of species diversity are the coastal lakes – 51 species, while the poorest is the glacial lakes group – 5 species. A full faunistic list with notes on the origin and the conservation status of fish species has been given, as well as a short hydrological and biological characteristic of the different lakes.

STUDY OF UPPER LAKE CATCHMENT AREA WITH REFERENCE TO FACTORS INFLUENCING ITS ENVIRONMENT STATUS

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Water is life entire universe depends upon water for existence. Life and water are two inseparable faces of the same coin. There would be no life without

water. We are faced with many environmental issues today that have to be dealt with, from the depletion of water resources to the ecological imbalance. Some of these problems have some solutions; however, the unfortunate thing is that some do not. The only way to tackle these types of problems is to initially prevent them from occurring. The population explosion, industrialization and agricultural practices are responsible for increase in the eutrophication of the surface water, deterioration of catchment area of water bodies as well as the water quality.

The study was conducted in the year 2004-05 and study area selected was the Upper Lake situated in Bhopal (23° 0' 16"N latitude and 77° 0' 25"E longitude), the state capital of Madhya Pradesh, India. The upper lake is the main source of potable water supply. A large number of activities such as religious (idol & tazia immersion) agriculture, colonization etc. are going on in the catchment area, as a result of which variety of materials including residual chemical fertilizers, pesticides, insecticides waste water sewage, silt and various possible parasites organisms, are finding their way into the lake. Such factors present in the catchment area of any aquatic body are to a large extent responsible for the degraded environmental status of the water body. Physico-chemical parameters studied were:

pH: The water of the Upper lake is slightly alkaline and between ranges 8.32-8.35 were obtained.

Dissolved oxygen: DO concentration of the water was found in the range of 8.41-14.21 ppm.

Nitrate: Nitrate content of the water in Upper Lake was in the range 0.542-1.451 ppm. The APHA standard drinking water quality guideline for nitrates is 40 ppm.

Phosphate: Phosphate content of the water was found in the range of 1.122-1.291 ppm in Upper Lake . The APHA limit for Phosphates in drinking water is 0.1 ppm.

Total Hardness: The concentration of total hardness was found in the range of 82-128 ppm.

The study reveals that the activities going on in the catchment area directly or indirectly affected the water quality of the lake. Under the Bhoj Wetland Project (A project for the conservation & management of Bhopal Lakes-funded by JBIC- Japan). An attempt was made to conserve the lake through implementation of various sub-projects including catchment area treatments.

PHYTOPLANKTON COMMUNITY IN THE BULGARIAN AND MACEDONIAN LAKES

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The paper presents results of investigations of two lake systems with different trophic status: Varna - Beloslav Lakes system in Bulgaria and Ohrid - Prespa Lakes system in Macedonia . These Bulgarian lakes are hot spots along the Black Sea coastal zone. Their ecological state is strongly influenced by anthropogenic pressure. Along the lake coast many point sources of pollution such as rivers, ports, and industrial enterprises are located . Ohrid and Prespa Lakes are significantly influenced by fishing, aquaculture and tourism.

The goal of this study was to obtain an information about the rate of change in trophic state of the lakes as a consequence of the anthropogenic impact.

Seasonal and inter-annual variability of species composition, predominating groups, abundance and biomass of microalgae in relation of main hydrochemical parameters in both areas discussed.

RECENT STATE OF BELOSLAV LAKE (BULGARIA)

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The paper deals with the dynamic of hydrochemical parameters in Beloslav Lake - one of Bulgarian Black Sea coastal lakes. It is strongly affected by human activities. An estimation of water quality (WQ) and anthropogenic impact on the lake is of the first importance for a sustainable management in context of EU Water Framework Directive/60/2000.

On the base of seasonal monitoring data for nutrients (nitrite, nitrate, phosphate), dissolved oxygen, BOD and oxidizability the lake could be considered as a high eutrophicated area. High polluted rivers discharge into the lake and cause negative changes of WQ, including hypoxia in the near bottom waters. The paper discusses different periods of anthropogenic influence depending on human activities and different kind of pollution sources. The comparison of the data after 2000 with the data from period of

intensive eutrophication (80s) reveal a slight decreasing tendency of nutrients in relation of the collapse of the economy during the last 10-15 years.

POLLUTION WITHIN LAKE OHRID – AN IMPEDIMENT TO ADDRESSING AN IMPORTANT ECOLOGICAL QUESTION

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To what extent do natural enemies limit animal populations? What roles do predation and disease play in controlling animal populations? Is the impact of natural enemies different in recently-established versus ancient animal populations? Because Ohrid is an ancient lake, it represents an invaluable location to conduct a study relating to these questions. One of the dominant members of its macrozoobenthic community is the endemic mussel *Dreissena stankovici*, and a research project is now underway to examine the impact of natural enemies on this *D. stankovici* population. This project will be in contrast to our previous studies examining the impact of natural enemies on the “younger” *Dreissena* spp. populations in North America and Western Europe which are, respectively, no more than 25 and 200 years old. Of course, the population dynamics of all species in an ecosystem, including *D. stankovici* in Lake Ohrid, are impacted by a wide range of biotic and abiotic factors, not just natural enemies. Over the last century, Lake Ohrid has been subjected to increasing levels of anthropogenic pollution. For this reason, the potential confounding effect of lower water quality within localized areas of the lake must also be addressed within our study. In localities where pollution is elevated, for example, mussels may be stressed and disease and death more prevalent. The water quality of Lake Ohrid is believed to have been relatively stable for most of its several million year existence. Now it is under threat of continued degradation. This pollution also represents an unwelcome, yet unavoidable, factor to consider in our study. Thus, we, as researchers, are stakeholders too in the success of the ongoing pollution abatement efforts occurring in Lake Ohrid.

WATER POLLUTION IN THE DURANKULAK LAKE IN BULGARIA

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The importance of the wetlands as ecosystem types consists in the stable maintenance of high biodiversity in the limited space of the ecotone. For this reason the system can be relatively easily studied and managed, and a great number of plant and animal species can be easily protected. The Durankulak Lake situated in close proximity to the Black Sea is one of the few natural wetlands preserved in Bulgaria . Almost the whole population of the globally threatened red-breasted Goose species (*Branta ruficollis*) winters in the wetland area. The lake is remote from big industrial centers, but is strongly affected by using of fertilizes and dugs, because it is located in the North Dobrudzha , an arid region with developed agriculture. The main objective of the present hydro-chemical study is aimed at establishing the water pollution trends for the Durankulak Lake situated along the Bulgarian Black Sea cost, as well as to determine the reasons for this pollution. The previous studies carried out in this unique natural area have been reviewed in detail. Systematic sampling of the lake water during one-year period has been made. The comparative analysis of the historical information has proved a considerable increase in the amount of the inorganic forms of nitrogen and phosphorous in the lake and an accelerated eutrophication that is due to the pollution. The negative impact is due mainly to intensive water pumping and the resulting reduction of outflow from this open lake. Recommendations for particular activities are made in conformity with the conclusions about the hydro-chemical state with the aim of protection and sustainable development of this wetland. The results from the present study could be used as a basis for a future monitoring with respect to the methodology and database that are necessary for an integrated water management in the investigated sub-basin.

DENSITY VARIATION OF THE DREISSENA (CARIODREISSENA) STANKOVICI IN LAKE OHRID PELAGIC ZONE, FROM 1996 TO 2005

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Dreissena (Cariodreissena) stankovici which is constantly present during the whole year and in the all water layers is an important component of the zooplankton in Lake Ohrid (Kozminski, 1935; Serafimova-Hadzishce, 1957; Kostoski, 1998).

In this article is presented the seasonal dynamic of *D. (Cariodreissena) stankovici* in Lake Ohrid pelagic zone, during the longer period of investigation 1996-2005.

According to obtained results, although significant annual oscillations are noted, the annual cycle of this species is recurrent considerably regular during the years.

Over the period of investigation the larval number is highest in the late autumn period and in the first winter months.

The maximum density in larval stage *D. (Cariodreissena) stankovici* reaches between 10 and 20 m depth where the water temperature is from 11.40 to 22.0 C.

In the period 1996-1999 the population density ranged from 109 to 1710 ind/m³. The investigations show rapid increase of population density after year 2000. In August 2000 the number of individuals increased to 3856 ind/m³ and in November 2000 this number significantly increased to 21 022 ind/m³. In the subsequent period of investigation the values are also high and in November 2004 they reached a marked numerical values of 45 418 ind/m³.

The obtained results are contribution to the long-term continuous zooplankton investigations. They are very important in point of fact (Fahnenstiel et al. 1995; Coakley et al. 1997; Burla et al. 1998; Pace et al. 1998) that *Dreissena* larvae have significant effect on zooplankton community as well as on some water quality parameters.

Zooplanktological investigations are important in point of fact that in this part of the lake, in the last decade, some changes have been happened besides opinion that pelagial withstand of negative human impact.

RECENT SPECIES COMPOSITION OF ROTIFERA FAUNA OF THE LAKE DOJRAN

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Lake Dojran represents a typical eutrophic lake of the Aegean lake zone conditioned by edaphic, morphometrical and climatic peculiarities. In the last two decades the process of natural aging of the Lake is accelerated with unreasonable and irresponsible activity of human factor. Due to imprudent exploitation of the water and the drought years, there has been a rapid decrease of water level. Depth is reduced to less than 5 m and total destruction of habitats in littoral region is found out. The Lake Dojran has been brought to the ecological catastrophe.

Changed ecological conditions in the ecosystem produced outstanding changes in living world composition as disappearance of some species and appearance of other "strange" for the lake, mainly ubiquitous taxa and representatives of muddy fauna.

The present study comprises the rotifers collected from Lake Dojran over a period of one year (July 2004 - September 2005). The purpose of the investigation was to describe the recent species composition of rotifera fauna inhabiting the limnetical and the littoral zones of the Lake and to compare our results with those of previous studies in order to determine how structure of rotifer populations has changed in the past 50 years.

Our results in comparison with previous surveys show that important changes have taken place in the qualitative composition of rotifers. A considerable increase in trophy has been observed to result in the extinction of some species and emergence of others. From the general picture it is possible to observe a tendency of decreasing diversity with increasing trophic level.

CHAROPHYTES BIODIVERSITY IN DIFFERENT LITTORAL PROFILES FROM LAKE OHRID

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This work presents the results of investigations on qualitative composition of Charophyta from two different profiles (localities) from Lake Ohrid : Zaum and Grashnica. The differences are about the character of the bottom, its exposition, the quality of the water, and different vascular hydrophytes that share the bottom with the charophytes.

The locality Zaum is located in the south-eastern part of the Lake . The width of the belt of charophytes in this profile is 26 m . From the samples collected from three depth points of this profile, it was established that Charophyta are presented by the pure population of the *Chara tomentosa* L. species.

The second locality-Grashnica is located in the north-eastern region of the lake. The width of the belt of charophytes in this profile is 640 m . On the 27 sampling depth points from this profile have been recorded following species from Charophyta: *Nitella opaca* (Bruz.) Ag., *Chara tomentosa* L., *Chara ohridana* (Kostic) Krause, *Chara imperfecta* A. Br., *Chara globularis* Thuill., *Chara spera* (Deth.) Willd and *Chara denudata* A. Br.

It is obvious that the biodiversity of Charophytes in the locality of Grasnica is much higher compared with the same from the locality Zaum. The main

reasons for such differences in the biodiversity lie in the general differences of the ecological factors on these two localities.

DENSITY TRENDS OF CRUSTACEA (AMPHIPODA AND ISOPODA) FROM LAKE OHRID

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Many characteristics such as the age, the depth, oligotrophic character of the water, as well as the numerous endemic and relic forms among the benthic and the fauna at all, give Lake Ohrid a stamp of extraordinary aquatic ecosystem in world frames.

Nevertheless the stability of the physico-chemical and other ecological conditions, some of the groups from macrozoobenthos (Turbellaria, Oligochaeta) from this Lake characterizes negative trends in their density over the past 50 years.

The recent researches (1998-2001) on the groups of Amphipoda and Isopoda showed that these two groups have different density trends. In group of Amphipoda, the "initial" density registered in 1937-1939 had been 614 ind·m⁻². During the period 1964-65, the density raised to 800 ind·m⁻². 27 years later, the density decreased to 492 ind·m⁻², while in our investigations (1998-2001) there was registered new raise (726 ind·m⁻²). Unlike Amphipoda, the group of Isopoda characterizes negative density trend. In this way, the "initial" density of 338 ind·m⁻² registered in 1937-1939 raised to 552 in 1964-65. In the following period from 1965 to 1972 until now, the density decreases. So in 1972-1973 there were registered 176 while in our investigations (1998-2001) 132 ind·m⁻².

SEASONAL DYNAMIC IN THE DENSITY OF GASTROPODA ON PROFILE HBI-V.RADOZDA FROM LAKE OHRID

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Lake Ohrid represents an old aquatic ecosystem where numerous endemic and relict gastropod species exist under stable ecological conditions. These complex conditions, during the different seasons and different depths influence the population of the gastropods causing changes in its density.

Our results are based on the researches done on the profile HBI-v.Radozda (in the littoral and sublittoral zone), in the period 2001/02, on ten different depth points from Lake Ohrid .

According to these results, we found out different density dynamic in the gastropod population during the different seasons as well as on different depth zones. In this context, in the littoral zone, the maximum in the density was registered in the spring season (March, April and May) – 11701 ind ·m⁻² . More precise, the maximum in the gastropod density was registered in April - 4436 ind ·m⁻² . In sublittoral zone, the maximum in the density was also registered in the spring, but one month later than in the littoral-in May (1285 ind·m⁻²).

THE DOMINANT INVERTEBRATE GROUPS MACROZOOBENTHOS FROM THE UPPER FLOW OF THE RIVER TRESKA

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In the period from January 1999 to December 1999 macrozoobenthos in the upper part of Treska river was investigated.The bottom fauna of the Treska river is composed of over 10 groups of macroinvertebrates with 64 determined taxa, 37 being determined at the species and 27 at the genus level.

The orders Diptera (19 taxa-than fam.Chironomidae-13 taxa), Ephemeroptera (9 taxa), Trichoptera(8 taxa), Plecoptera and Oligochaeta (7 taxa) how and Gastropoda (5 taxa) are the most diverse, whereas the Hirudinea Isopoda and Amphipoda orders have the most uniform structure, each containing one species.

Most abundant species in the Treska river are the following: from Gastropoda- Ancyclus fluviatilis and Horatia macedonica ; from Oligochaeta- Limnodrilus hoffmeisteri ;from Ephemeroptera- Rhitrogena semicolorata and Baetis sp; from Trichoptera- Hydropsiche angustipennis , Sericostoma sp. and Potamophylax sp.; from Chironomidae- Cricotopus gr.sylvestris, Prodiamesa olivacea, Polipedium bicrenatum, Paratanitarsus confusus and Tanytarsus longipes.

On the basis of biocoenotic analysis, three biocoenotic complexes may be distinguished on the bottom of the Treska river; one specific of the river cours near the source, the second is peculiar of the lower part in "mountain zone", and the third specific with new species from macrozoobenthos.

LITTORAL ZONE TROPHIC STATE AT THE MACEDONIAN PART OF LAKE OHRID

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Lake Ohrid is a transboundary water body, and one of the largest and deepest lakes in Europe with big significance and meaning for the Republic of Macedonia.

In purpose to establish the trophic state of the water from littoral zone at the macedonian part of Lake Ohrid, during the period 2003-2005 investigations were performed from many aspects, for getting credible picture of loading of the lake with drainage, communal and industrial waste water. Part of this investigations based of some physico-chemical and microbiological parameters and chlorophyll a concentration, shows the antropogenic influence in the lake water. For realization of this investigations, we defined measuring points which covered all the shore of the Lake, from St.Naum to Radozda.

The application of the Carlson's method for determination the trophic state of the water referring to the following parameters: concentration of total phosphorus, content of chlorophyll a and Secchi transparency, provides the numeric value of the trophic state index. According to the mean values of this index (on the basis of total phosphorus concentration and chlorophyll a content) a classification of the respective measuring points was made, showing that the littoral water near the mouth of rivers (Sateska, Koselska, Velgoska, and Cerava) is more loaded with nutrients, and have higher trophic state, which is more expressed in summer.

Based on microbiological investigations there is evident organic pollution, which confirms that the water in front the inflows of the rivers is more loaded, especially at Grasnica, there River "Velgoska" enter the Lake.

According to the obtained results of the performed analyses, basis of the water act of RM, OECD regulations and criteria by Tumpling, a categorization of the water was made in the respective measuring points.

MICROBIOLOGICAL WATER QUALITY OF LAKE PRESPA AND ITS TRIBUTARIES

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In parallel with physicochemical and biological investigations undertaken at Lake Prespa (from littoral at 3 stations and from a vertical profile in the pelagic zone at 4 points) and its tributaries (Golema, Kranska and Brajcinska), microbiological water quality analysis were conducted during 2004 and 2005.

The total count of aerobic organotrophic bacteria were determined on nutritive agar; proteolytic on MPA with gelatine; amilolytic on MPA with starch and lipolytic with tributyrine. The most probable number of coliforms was determined on ALPA medium; *Escherichia coli* on Coli JD and *Clostridium perfringens* on Wilson-Blair agar.

According to the results from this research, there is close relation between water pollution and bacterial number. Their quantity is usually higher in the water of tributaries, than in the lake water. Dominant bacteria are organotrophic. Amylolytic bacteria occurred in greatest number, followed by proteolytic bacteria while lipolytic bacteria numbers were lowest. Seasonal succession of these groups depend on the nature and the quantity of organic components in the water.

Based on the investigated microbiological parameters, the water quality of the lake during the test period was generally within the limits of Class II and II-III, with the exception of the littoral region in front of River Golema mouth profile where it was sporadically found to be Class III and profile in front of River Kranska, Class III-IV (according to the total count of organotrophic bacteria) and within Class I to III (based on the total coliform bacteria).

A series of water quality tests conducted on the tributaries reflected variations consistent with the circumstances in the drainage area. Compared to the lake water, a greater count of all investigated groups of bacteria were registered in all tributaries. Based on the total coliform and organotrophic bacteria, the water quality of the tributaries varied from Class II to maximum Class IV.

WATER QUALITY OF LAKE DOJRAN FROM BIOLOGICAL AND PHYSICAL-CHEMICAL ASPECTS

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During 2004-2005 research of Lake Dojran water quality was conducted on to five localities at coastal part of lake (Partizan, Gradska plaza, Kaldrma, Acikot and Nikolik) and from one part of lake, about 1000 m distance from the coast (vertical profile with 3 points). Biological and physical-chemical properties were analyzed.

Water quality is presented through following parameters: number of organotrophic bacteria, most probable number of total koliforms, indicators for fecal pollution (*Escherichia coli*, *Clostridium perfringens*), water temperature, dissolved oxygen, organic loading (as a KMnO_4 consumption) total phosphorus, total nitrogen, and composition of Lake Dojran rotifers and their saprobiological belonging. These investigations were done according to standard limnological methods.

Number of examined microbiological parameters was mainly in the scope of II-III and III water category with worse water quality in some coastal part of the lake (III-IV). The obtained results from biological investigations were in correlation with physical-chemical.

The results of chemical investigations shows that the concentration of dissolved oxygen was between $3,08 \text{ mg.l}^{-1}$ and $11,95 \text{ mg.l}^{-1}$; dissolved organic matter were generally more than 30 mg.l^{-1} , with maximum of $73,33 \text{ mg.l}^{-1}$, the content of total phosphorus was between $0,05 - 0,519 \text{ mg.l}^{-1}$, and total nitrogen between $0,311-3,245 \text{ mg.l}^{-1}$. According this parameters Lake Dojran is generally eutrophic lake (except in some cases when it is mesotrophic, and hypertrophic).

It has been confirmed that the water quality, from the microbiological and physical-chemical aspects, varies depending on the measuring location, season, and the hydrological situation.

ECOLOGICAL ASSESSMENT AND INTERCALIBRATION OF LAKES ACROSS THE EUROPEAN UNION

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Our intention is to give an overview of the development of ecological classification schemes of lakes as well as progress of the intercalibration of ecological classification scales across the European Union.

The EU Water Framework Directive (WFD) requires development and harmonisation of the ecological quality status assessment systems for all surface waters (lakes, rivers, coastal waters) and all quality elements (phytoplankton, macrophytes, benthic fauna and fish).

In order to ensure comparability of the ecological classification scales and to obtain a common understanding of the good ecological status of surface waters all over the EU, the WFD requires an "intercalibration exercise" that will be completed by the end of 2006.

The intercalibration exercise is carried out within 5 Geographical Intercalibration Groups (GIGs) – Alpine, Atlantic Central/Baltic, Mediterranean and Northern GIG. 19 common Intercalibration types shared by Member states were defined for the Intercalibration exercise.

The plan for the Intercalibration exercise is as follows :

- defining of common Intercalibration types, quality elements and pressures;
- compiling of Intercalibration sites register;
- collecting of datasets, including biological and chemical data;
- defining of reference criteria and reference lake datasets;
- developing of the relationships between biological quality element and pressure gradient;
- setting of high-good and good-moderate boundaries;
- developing of ecological quality ratio (EQR) values.

Defining of common IC types, quality elements and pressures has been completed during 2003 (Report "Overview of common Intercalibration types").

The Final Intercalibration register was established by October 2004 containing 1500 surface water sites from 27 countries (Report "The Water Framework Directive Final Intercalibration Register for lakes, rivers, coastal and transitional waters: overview and analysis of metadata).

All GIGs have collected extensive lake datasets , Mediterranean GIG has completed sampling campaign during summer 2005. Data sets include the broad range of biological data (phytoplankton, macrophytes, for Northern GIG – benthic invertebrates) as well as basic chemistry and hydromorphological data (depth, area etc).

All GIGs have defined reference criteria and compiled reference lake datasets . Lake Central GIG and Lake Nordic GIG have developed reference conditions for chlorophyll values as well as High / Good ecological status boundary for most of lake types. Lake Central GIG has developed the method for boundary setting of chlorophyll values via secondary effect on macrophyte light climate.

QUANTITY OF MAIN NUTRIENTS IN BIOMASS OF RED HEAD GRASS (POTAMOGETON PERFOLIATUS L.) FROM LAKE OHRID

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Red head Grass (*Potamogeton perfoliatus* L.) as a submerge aquatic plant utilize the different chemical elements from the surrounding (soil and water).

The aim of this work was to determine the content of main nutrients: N, P, K, Na, Ca, Mg, Fe, and Mn in the biomass of Red head Grass from Lake Ohrid. For this purpose we made the investigations in the course of the Red head Grass's maximum development (in august).

The results of investigations shows that in the biomass of Red head Grass along Macedonian shoreline per year there are 144.99 tons main nutrients. In the total amount of main nutrients accumulated in the biomass of Red head Grass (144.99 tons) the folowing main nutrients participate with highest quantities: potassium (42.84 tons or 29.55 %), nitrogen (33.39 tons or 23.03 %), and calcium (32.42 tons or 22.36 %). With quite lower quantities participated the folowing main nutrients: sodium (17.5 tons or 12.07 %), magnesium (10.99 tons or 7.58 %), and iron (5.68 tons or 3.92%). Phosporus with 1.66 tons or 1.14 % and manganese with 0.51 tons or 0.35 % have the lowest quantities.

The investigations shows that Red head Grass (*Potamogeton perfoliatus* L.) from Lake Ohrid has a significant role in the nutrient cycling in this aquatic ecosystem.

ANNUAL PRODUCTION OF OF RED HEAD GRASS (POTAMOGETON PERFOLIATUS L.) FROM LAKE OHRID

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Macrophytic (submerged, emergent and flotant macrophytes) and microphytic vegetation are the producers in aquatic ecosystems.

The Red head Grass (*Potamogeton perfoliatus* L.) as one of dominants submerged plants from Lake Ohrid has a significant role in primary production in the Lake's littoral region. In order to receive authentic data for the annual production of the Red head Grass from Lake Ohrid the investigations are made during the 3 vegetation periods (april 2000 – november 2000, april 2001 – november 2001, april 2002 – november 2002).

All the values for the annual production of the Red head Grass have gotten as a result of the changes in the biomass in 5 different localities from Lake Ohrid (St. Stephan, Mazija, Pristaniste, Caneo, and Grasnica).

The results from the investigations shows that maximum biomass, respectively the production of the Red head Grass from Lake Ohrid was evidenced in the middle of the Summer period - in August (2747.85 tons per year for Macedonian shoreline).

SURFACE AREA OF THE BELT OF RED HEAD GRASS (POTAMOGETON PERFOLIATUS L.) IN LAKE OHRID

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The pondweed, Potamogeton forms almost continuous belt around Lake Ohrid. The species Red head Grass, Potamogeton perfoliatus predominated and forms sometimes almost pure associations in this belt.

The data for the surface area of the Red head Grass belt we received from the detailed investigations of the Red head Grass' distribution in Lake Ohrid performed in total of 59 profiles covering almost the whole Lake' coasteline (in the territory of Republic of Macedonia).

The obtained results shows that the whole surface area of the Red head Grass belt along Macedonian shoreline, respectively from Radozda to St. Naum is in total 1021.13 ha or 10.21 km², which is 4.28 % of the surface area of Lake Ohrid from R. Macedonia.

SUSTAINABLE FISHERIES AS A KEY FACTOR FOR THE ENVIRONMENTAL CONSERVATION OF THE BALKAN TRANS-FRONTIER LAKES

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The trans-frontier lake ecosystems in Macedonia region of Northern Greece as the Lakes Megali (Big) and Mikri (Small) Prespa and Lake Doirani , are very important ecosystems due to their natural environment, while the most of them currently are protected from specific laws. The above ecosystems are traditionally inland water fishery areas not only for Greece but also for the neighbouring countries they are belonging. Unfortunately during the last decades their fishery production has downgraded significantly and they are under intensive exploitation of their natural biological resources as also in conflict functions and uses of their waters.

This paper describes the change of the fishery production in the three trans-frontier lakes in the area of Macedonia (Greece) during the last 30 years. Fishery data were collected from the relative Greek Prefecture Fishery Departments and bibliography references. Data were initially organized in a spreadsheet, with MS-Excel. Information for each lake concerns descriptive characteristics or changes of fish production for the total catch and for the most important commercially fish species as the common carp (*Cyprinus carpio*), the common roach (*Rutilus rutilus*) and the goldfish (*Carassius auratus*) separately. Forecasts for the near future annual production were generated for every lake ecosystem with the statistical software Minitab 13.20, using the methods of 'trend analysis', 'moving average' and 'ARIMA models'.

The results are signifying the unfavorable fisheries future of these sensitive lake ecosystems; however, they can provide aid to the authorities within the development of common trans-frontier suitable sustainable fishery management and protection. Traditionally inland water fishery areas of southern Balkans tend to lose their characteristic profile in our days due to the degradation of the quality and quantity of the ecosystems, the damage of their fisheries and the reduction of the most important commercially fish populations. The agricultural, the civil and the industrial development, which took place during the last decades, consist the main responsible reason for the described degradation, while no protection was provided for the natural environment. In the case of these trans-frontier lake ecosystems, the organized and processed information for the existing fishery management and its effectiveness in the near future is a key factor for their environmental conservation and protection. Decisions for local interventions must take into consideration to maintain the special protection character of the area of lakes and must be planned within the framework of sustainability and in respect to the natural environment.

MAIN ECOHYDROLOGICAL CRITERIA OF THE ACIPENSERIDAE POPULATION STABILITY IN THE NORTH CASPIAN SEA

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The aim of the work is the revealing and evaluation of principal geocological factors that influence the distribution of Acipenseridae in the North part of the Caspian Sea. Six species and one subspecies of sturgeon population are in the Caspian Sea, which belong to two genera: *Huso* and *Acipenser*. For each reference point (we selected 260 points of the North Caspian sea) we received data on 76 parameters, including physical-geographical, hydrochemical, hydrobiological characteristics, which have been analyzed using method of pair correlation. Then on the base of this analyses we selected several main ecohydrological variables as determining the ecosystem according to the principal functioning features. These variables are: X1 – average long-term temperature of the water surface during the February ($^{\circ}\text{N}$); $\bar{O} 2$ – ice cover spreading (coded character in marks); $\bar{O} 3$ – NO₂ on the sea surface (mkg NO₂ / l); $\bar{O} 4$ – O₂ (mg/l) on the sea surface; X5 – average annual salinity ($\uparrow / \uparrow\uparrow$) in the water body; X6 – radiation balance for a year (Mega joule/m²); X7 – depth, (m); X8 – distance from the Volga-Caspian main canal (in kilometers); X9 – total zooplankton biomass (g/m²) in the Caspian Sea; X10 – phytoplankton biomass (mg/m³) in the Caspian Sea; X11 – biomass of the zoobentos (g/m²); X12 – average annual content of phenols (mg/l) in the water body; X13 – average annual distribution of the oil hydrocarbons (mg/l) in the water body; X14 – average annual data of the 5 sturgeon species catch. Then for substantiation of the influence of abiotic environmental factors on the surviving of Acipenseridae we processed the received basic variables, which characterize the integral state of ecosystem, by the method of basic components, where the dependent variable \bar{O} – catch of Acipenseridae. In the first group of columns we gave factor loads of 13 parameters on the three common factors, which we received using the method of main components and in the second group – final factor loads, received as the result of three rotations. The rotations were made for more accurate estimation of the loads of separate variables of main components. The analysis showed that all meaning variables could be separated according to loads into three common ecohydrological factors. Each group of parameters make its input into some factor and has its own meaning content. Factor 1 has the highest meaning of total dispersion in factor matrix – it defines 39.7% of variables. The highest load on the factor has variables $\bar{O} 3$, $\bar{O} 4$, $\bar{O} 5$, $\bar{O} 6$, $\bar{O} 10$, $\bar{O} 11$. Taking into consideration the meaning of parameters included into this factor, we can say, that it characterize the influence of hydrochemical, natural-climatic, biotic and feeding features of the sea on the distribution of Acipenseridae. We defined it as "Natural factor".

Factor 2 has the second degree of meaning, it defines 15.5% of total dispersion (table). We revealed the high meanings of variables $\bar{O} 1$, $\bar{O} 2$, $\bar{O} 7$ and $\bar{O} 9$, which enabled us to define it as "Wintering – post-wintering factor". This factor evaluates the influence of temperature, depth overfall (the wintering pits), ice distribution and quantity of zooplankton on the distribution of sturgeon during winter. "Wintering – post-wintering factor" defines the seasonal redislocation of sturgeon in the sea water body as well as conditions of feeding base formation for the future feeding period. Factor 3 - the third meaning factor. Its input into total dispersion in the factor matrix is 12.7%. Maximum load of variables ($r > 0,7$) $\bar{O} 8$, $\bar{O} 12$ and $\bar{O} 13$ on this factor indicate that it could be defined as "Factor of anthropogenic load". This factor includes not only variables that characterize distribution of oil and phenols in the water body, but the variable that characterizes the influence of the Volga flow as well. The researches show that inter-year dynamics of oil carbohydrates content in the Volga and the North region of the Caspian Sea is synchronized. Increasing or decreasing of concentration of the oil hydrocarbons and phenols in the Volga River during each specific year are accompanied by unilateral changes of content of this toxicant in the North region of the Caspian Sea .

The Volga River runoff is the most important factor of the pollution in the North Caspian Sea .

According to A. Poddubny (1971), meanwhile even in the centers of volley fault of toxic waters some individuals can identify the danger and try to escape from the polluted zone, that is possible, as the oil pollution is still mosaic. Maybe the ability to identify the polluted zone and to escape from this region makes the "factor of anthropogenic load" not so significant for the distribution of the Acipenseridae .

The main ecohydrological factor of ecosystems stability in the North Caspian Sea is the natural conditions factor. It means that the process of dynamics/or changes of the natural condition of the region (including climate changes) can lead to the most significant changes in ecosystems. As for as under conditions of possible climate change it is desirable to model the processes of the changes on subaquatic conditions which leads to the changes of aquatic ecosystems composition, health and stability.

TROPHIC STATE OF LAKE PRESPA

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Lake Prespa is situated in South-Western part of R. Macedonia, on the border between Macedonia, Albania and Greece. It is a relatively shallow lake with a

large surface area. Lake Prespa has no surface outflow and it is connected with Lake Ohrid by underground hydrological connection so its trophic state might as well influence on the trophic state of Lake Ohrid. Both of them are one of the oldest lakes on earth. Over the past 50 years and especially over the last 10 years Lake Prespa was exposed to a large anthropogenic pressure which eventuated in increased input of nutrients and water level declination. In order to obtain information about the rate of change in its trophic state as a consequence of the anthropogenic influence and decline in the water level were carried out investigations on the basic trophic parameters. The investigative period of this study took place over the years 2001, 2002, 2003.

According to the results obtained during these investigations, the trophic state of Lake Prespa has significantly worsened in the last decade and Lake Prespa is in a process of eutrophication. During this period of time, transparency decreased by 50% while total phosphorus concentration doubled. TN:TP ratio showed a tendency of decrease. During the 2001 it was determined that Lake Prespa was in mesoeutrophic state and during 2002 and 2003 in mesotrophic state. However, during the summer period of 2001 Lake Prespa was in a eutrophic state.

The water level declination of Lake Prespa, along with increased nutrient input, has a large effect on its trophic state.

In Lake Prespa it was determined that there was a highly significant, strong inverse correlation between Secchi transparency and chlorophyll a and there was a significant inverse correlation between chlorophyll a and TN:TP ratio.

IS LITTORAL AREA OF LAKE OHRID , ST. NAUM ENDANGERED BY EUTROPHICATION ?

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St. Naum springs located in the south part of Lake Ohrid are one of the largest surface water sources of Lake Ohrid . The springs and the littoral area of Lake Ohrid locally of them are one of the most attractive locality on the lake's coast. In the past, trophic state of the lake water was very low but in the last several years changes in negative trend were observed.

The most characteristic sight was observed in May 2002 and in June 2005 when in the lake water with green colour was registered very high chlorophyll a concentration and massive growth of the green alga *Pandorina morum* which is indicator of â-mesosaprobic waters. In these months this species comprised over 90% of the total phytoplankton biomass. In May 2002

maximum chlorophyll a concentration of 108.84 $\mu\text{g l}^{-1}$ and in June 2005 maximum chlorophyll a concentration of 70.19 $\mu\text{g l}^{-1}$ were registered.

These data indicate that water which arrive in this area by the flow is high eutrophic and originate from Albanian part of Lake Ohrid where don't exist sewerage system for lake protection of communal and industrial waste waters.

AN INTEGRATED MODEL SYSTEM FOR THE WATER PROTECTION OF LAKE CALDONAZZO, ITALY

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Lake Caldonazzo is one of the most important lakes in Northern Italy. Urban wastewaters have always been led into the lake. In the second half of the 20th century with a general increase in standard of living, together with the introduction of phosphate detergents and a large increase in summer tourist populations, the amount of nutrients entering the lake gradually reached and the exceeded the loading capacity of the lake. Between the mid 60s and mid 70s there was an evident deterioration of water quality with algal blooms, severe hypolimnetic anoxia and fish kills. In cooperation between the University of Trento and Pirkanmaa Regional Environment Centre, a monitoring and research project started in autumn 2002. In the project, many different models were used: runoff and nutrient loading models in the catchment, steady state and dynamic water quality models in the lake. A main general result of an integrated modelling system was that the internal loading is 5 to 10 times bigger than the external loading. Mitigation of negative consequences of phosphorus release from bottom sediments should be considered. For example, the aeration efficiency could be improved. A continued control of external loading, both point and diffuse sources is still one of the most important measures to improve the water quality of the lake.

**EARLY DEVELOPMENT OF THE POSTCRANIAL AXIAL SKELETON IN
SALMO LETNICA KARAMAN, 1924 (TELEOSTEI: SALMONIDAE)**

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The ontogeny of the axial skeleton of *Salmo letnica* Karaman, 1924 was investigated, focusing on the formation of the dorsal and anal fins and their pterygiophore supports, the neural and hemal spines, and the formation of the hypural complex. The first appearance and location of these skeletal elements in their cartilaginous precursors were observed, and their further ontogeny described, including the ossification sequences. Ontogenetic sequences of the axial skeleton were reconstructed through examination of in toto trypsin cleared and stained ontogenetic series of fishes. At the one dph (days post hatching) old trout the presence of the neural arch from the first to 47 th vertebra (NA1-NA47) as well as the haemal arches from 29 th to 47 th vertebra (HA30-HA47) were noticed. At the same stage, the presence of the cartilaginous hypural 1 and parhypural were noted in the caudal complex. The beginning of the formation of the dorsal and anal fin was observed at 8 dph. Their further development occurred both anteriorly and posteriorly. The rays of the unpaired fins were noted in the 5 dph old trout. Ossification of the hypural complex begins at 16 dph trout. Ossifications of the vertebral centres start simultaneously with that of the haemal and neural arches at 18 dph. A completely ossified vertebral column was observed at 92 days old trout. Baseost from the anal and dorsal fins are the last structures which ossified. Their presence was observed at 184 dph. The results of skeletal ontogeny are compared with the pattern of development of the other teleosts.

**COMPARATIVE ANALYSIS OF SOME MERISTIC MARKS OF MORANEC
PACHYCHILON PICTUM HECKEL ET KNER FORM OHRID LAKE, RIVER
CRN DRIM, ARTIFICIAL BASIN SPILJE (R.MACEDONIA) AND RIVER
SKUMBA (R.ALBANIA)**

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Lake Ohrid is a transboundary water body, and one of the largest lakes in Europe . In the Lake existed a zoogeographical important fish species

Pachichylon pictum Heck & Kner. It is relict and endemic fish species in the Ohrid-Drim-Skadar water system.

In this paper are presented the investigations of some meristic marks of the moranec *Pachichylon pictum* Heckel et Kner from Lake Ohrid , River Crn Drim, artificial basin Spilje (R. Macedonia), and River Skumba (R. Albania).

There are analyzed the number of scales in the lateral line, the number of scales in the superior lateral line, the number of the scales in the inferior lateral line, the number of the fin rays in the dorsal fin, the number of the fin rays in the anal fin, the number of fin rays in the pectoral fin, the number of the fin rays in the ventral fin, the number of the fin rays in the pelvic fin, the number of the fin rays in the caudal fin, and number of the vertebrae.

The results of the investigations indicate that there are constated some variation between their investigations and some early investigations.

MONTH CHANGE ON NUTRITION ON MORANECOT PACHYCHILON PICTUM HECKEL ET KNER OFF OHRID LAKE

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Lake Ohrid is a transboundary water body, and one of the largest lakes in Europe . In the Lake existed a zoogeographical important fish species *Pachichylon pictum* Heck & Kner. It is relict and endemic fish species in the Ohrid-Drim-Skadar water system.

In this paper are presented results of investigation of moranec's (*Pachichylon pictum* Heckel et Kner) visceral composition from Lake Ohrid in the period March-October.

The results of the investigations indicate that in the visceral composition are constated representatives of Chironomidea, Cladocera, Ostracoda, *Draisenia*, *Oligochaeta*, and detritus with algae. The visceral composition had different qualitative and quantitative composition in different period in the year.

**MORPHOLOGICAL DIFFERENCES ON POPULATION OF THE
MORANEC PACHYCHILON PICTUM HECKEL ET KNER OFF OHRID
LAKE, RIVER CRN DRIM, ARTIFICIAL BASIN SPILJE (R. MACEDONIA)
AND RIVER SKUMBA (R. ALBANIA)**

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Lake Ohrid is a transboundary water body, and one of the largest lakes in Europe . In the Lake existed a zoogeographical important fish species Pachichylon pictum Heck & Kner. It is relict and endemic fish species in the Ohrid-Drim-Skadar water system.

In this paper are presented the morphological differences between the populations of the moranec Pachychilon pictum Heckel et Kner from Lake Ohrid , River Crn Drim, artificial basin Spilje (R. Macedonia) and River Skumba (R. Albania).

The results of the investigations indicate that there are constated some morphological differences between populations of the moranec Pachychilon pictum Heckel et Kner from the investigated aquatic ecosystems (Lake Ohrid, River Crn Drim, artificial basin Spilje - R. Macedonia and River Skumba - R. Albania).

**FACULTATIVE OLIGOTROPHIC BACTERIA AS A INDICATOR OF THE
TROPIC STATE OF LAKE OHRID**

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In the water of pelagic zone of Lake Ohrid (water column 1-275m depth) several times (every five month period) in 2003 and 2004. As an autotrophic flora, presence of facultative oligotrophic bacteria was investigated. Aim of these investigations was to identify the position of these bacteria in the trophic state of Lake Ohrid .

LOWER DANUBE – THE LAST REFUGE FOR SURVIVING OF STURGEON FISHES IN THE BLACK SEA REGION

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Six Sturgeon species were represented as native to the Black Sea and the Danube River : Beluga (*Huso huso*), Russian sturgeon (*Acipenser guldenstaedti*), Stellate sturgeon (*Acipenser stellatus*), Sterlet (*Acipenser ruthenus*), Ship sturgeon (*Acipenser nudiiventris*) and Atlantic sturgeon (*Acipenser sturio*). Nowadays only four of them certainly reproduce in the Lower Danube River . Atlantic sturgeon has become extinct from the region. Although vary rare announcements by fishermen about caught Ship sturgeon, its availability needs confirmation.

During the last 60 years the Danube River and the Black Sea are subjects of intensive anthropogenic impact. Some negative changes in the structural and functional parameters of aquatic ecosystems are came on. The following alterations as construction of dams, pollution, waterflow variations, overfishing etc. influence directly on the Sturgeon populations. The Lower Danube has become the only main river for natural reproduction of Sturgeons in the Black Sea region after barraging the lower parts of the rivers Dnestr and Dnepr.

Although the Sturgeons are endangered throughout the World, the trend of decreasing of their catches because of reducing of stocks is obvious.

CHIRONOMIDAE (DIPTERA) LARVAE FAUNA FROM THE MANTOVO RESERVOIR AND THE MOUTH OF RIVER KRIVA LAKAVICA

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Density and species composition of chironomidae larvae fauna from seven localities of Mantovo reservoir and one locality from the mouth of river Kriva Lakavica were studied. Monthly sampling was done from May 2003 to April 2004 from the reservoir and in May, June and July 2003 and March and April 2004 from the river.

Chironomidae from the river (41 taxa) were much more diverse than from the reservoir (21 taxa). Low species similarity (19,23%) among both habitats were noticed. *Procladius choreus*, *Cladotanytarsus* gr. *mancus* and *Chironomus* gr. *plumosus* were the most abundant Chironomidae species from the Mantovo reservoir. Dominant species from the river Kriva Lakavica were the following: *Polypedilum* gr. *pedetre*, *Cricotopus bicinctus*, *Micropsectra praecox* and *Cricotopus inaequalis*.

TOPIC 7: HYDROLOGICAL MODELING

**A REGIONAL HYDROCLIMATE MODEL FOR TIGRIS-EUPHRATES
WATERSHED, REGHCM-TE: RECONSTRUCTION OF HISTORICAL
HYDROCLIMATIC DATA OVER THE WATERSHED**

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In order to establish a basin-wide water management plan for the Tigris-Euphrates (TE) watershed, which covers 967,000 sqkm area, it is necessary to perform rigorous water balance studies of the whole watershed at least for critical historical drought and flood conditions, and under various water resources development scenarios. Performance of such water balance studies over the watershed requires climatic and hydrologic data sets, corresponding to historical critical flood and drought periods, at fine time and spatial grid resolutions in order to provide the necessary precipitation, air temperature, radiation, wind, evapotranspiration, infiltration, soil water, direct runoff, and streamflow information. Due to various political reasons in this region, such historical climatic and hydrologic data over this watershed are not available internationally at the desired fine time-space coverage that is necessary for performing reliable water balance studies over the watershed. Reconstruction of such climatic and hydrologic data sets requires, a) the development of a regional hydroclimate model for the watershed in order to reconstruct the historical climatic (precipitation, temperature, radiation, wind), and land hydrologic (infiltration, soil moisture, evapotranspiration, direct runoff) data; and 2) the development of a hydrologic model in order to reconstruct the historical streamflows within the whole watershed. In turn, the development of above models, and their subsequent simulation studies require the development of a comprehensive inventory of the topography, land use/land cover, vegetation, soils and geology of the whole watershed.

Within the above framework a comprehensive geographical information system (GIS) for the topography, stream network, soils, land use/land cover and geology of the watershed was developed by means of the existing global data sets and information. Then the coarse (~285 km grid resolution) historical global atmospheric databases over the Tigris-Euphrates watershed and its environs, that are available from U.S. National Center for Environmental Prediction (NCEP) and U.S. National Center for Atmospheric Research (NCAR) for the 1956 – 2001 period at 2.5o latitude x 2.5o longitude spatial grid resolution and at 6-hr time increments, were retrieved. In order to downscale these atmospheric datasets over the Tigris-Euphrates (TE) watershed at fine spatial (15km) and time (hourly) increments, and to reconstruct the above-mentioned climatic and land hydrologic data sets, the

nonhydrostatic Fifth Generation Mesoscale Atmospheric Model (MM5) of NCAR was coupled with the physically-based land hydrologic component of Integrated Regional Scale Hydrologic-Atmospheric Model (IRSHAM (Kavvas et al. 1998)), and implemented to the TE watershed as its Regional Hydroclimate Model (RegHCM-TE). The implementation of RegHCM-TE to the watershed was realized by means of an objective estimation procedure for all the hydroclimate model parameters directly from the existing global data sets, without performing any fitting exercise. RegHCM-TE was validated by means of comparison of model simulations to the corresponding available historical precipitation and air temperature data over the watershed. Since snow is the main source of water for TE watershed, a physically-based energy balance snow model (Ohara and Kavvas, 2005) was implemented to the watershed for the reconstruction of historical snowpack evolution and snowmelt processes. The historical simulations of this snow model over the watershed were tested by comparison against the corresponding satellite observations of snow cover over the watershed. In order to route the flows and reconstruct historical streamflow data over the Tigris-Euphrates river network, an HEC-HMS (Hydrologic Modeling System) model was constructed over the watershed. This streamflow routing model was validated by comparison of its historical streamflow simulations against corresponding historical observations at various stream gauging sites over the watershed.

In the paper, the GIS, the RegHCM-TE, the snow model and the streamflow routing model for Tigris-Euphrates watershed, along with their corresponding parameter estimation and implementation procedures, will be described, and the reconstruction of historical climatic and hydrologic data over the watershed by means of these models will be presented.

MONITORING OF PERFORMANS A HYDROLOGICAL MODEL TO ESTIMATE ANNUAL WATER YIELD IN A SMALL WATERSHED IN MERYC RIVER BASIN

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Although long term measured water yield and some hydrologic data are available to build up some hydrologic structures on the basins, it is not easy to monitor these data in detail at every time and at every specific location. The main objective of this study was to estimate dry and wet periods annual water yield of Kumdere Watershed in between 1985-2004 years, which is a small nonurban watershed occupying 4.40 km² area in Edirne Province of Turkey using SWMHMS Hydrological model.

Observed daily precipitation and monthly runoff, meteorological data to compute evapotranspiration (average temperature, crop consumptive coefficients and percent daylight hours for month) and six watershed parameters (CN, AWC, SYC, SC, PERCCEOF, IRAC) were the inputs to run the model. The model uses Blaney-Criddle Equation to compute evapotranspiration and Soil Conservation Service curve number procedure to determine surface runoff.

Using long term (1985-2004) observed values of average monthly precipitation and runoff model was tested for simulation. Using average annual precipitation data, dry and wet periods were determined in Kumdere basin. To determine drought period was used Percent of Normal Precipitation Index. Model was tested both period and compare with all period simulated results.

These results show that SWMHMS model can be used to simulate annual water yield in Kumdere Watershed in Meriç River Basin .

RESERVOIR MANAGEMENT USING ARTIFICIAL NEURAL NETWORKS

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The management of the water resources is of crucial importance since it directly affects the design and operation of many water resources structures. Conventional procedures for design and analysis are basically iterative trial-and-error procedures. The methods that are used for the reservoir operation study are especially based on the continuity equation. The storage capacity of the dam, the inflow to the reservoir, the evaporation losses in the reservoir and the demand are the main parameters of the continuity equation. In these methods the aim is to optimize the reservoir volume (that is storage) for abstracting sufficient amount of water from the dam reservoir. At the stage of the planning of the reservoir size this is a very important subject. Here the monthly total inflow of the reservoir is the main data series. It is better to have a data record length as long as possible.

Artificial neural networks (ANN) are black box models that are used for forecasting and estimating purposes in so many different areas of the science and engineering. In this research two artificial neural network (ANN) approaches were used for the reservoir management and operation purpose. It is aimed to see that if the artificial neural network (ANN) approaches are applicable and useful for the operation and management of the reservoirs. At

first the monthly inflow data of a given reservoir was forecasted for the future. Then the study continued with the monthly evaporation forecasts on the same reservoir. After this, the total volume of the reservoir at the end of each month was estimated. The ANN methods employed in the study are Radial Basis Functions (RBF) and Feed Forward Back Propagation (FFBP) methods. The data were divided into two parts. The first part that has a data length of 35 years was used for training of the Artificial neural networks (ANN). The remaining data were used for testing.

At the end of the study the results of the artificial neural networks were compared with those of the reservoir operation programs that are commonly used by the General Directorate of State Hydraulic Works (DSI) of Turkey.

A COMPARISON OF THREE METHODS FOR THE PREDICTION OF FUTURE STREAM FLOW DATA

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Stream flow data are very important for many areas of water engineering. One of the main research topics related to stream flows is predicting the future flows in a stream. This subject is very important in the areas such as dam planning, flood mitigation and domestic water supply.

In this study three methods were applied for prediction of the future flows of Canakdere stream in Istanbul . First two methods are Artificial Neural Networks and the third method is a regression analysis in which the flow data of a nearby stream (which is called Göksu stream) is used.

Artificial neural networks (ANN) are a branch of Artificial intelligence. They can be considered as black box models that can predict output values. The first method of the Artificial Neural Networks applied here is the Feed Forward Back Propagation method (FFBP). The second one is Radial Basis Functions (RBF).

The regression method used in this study is mainly based on the previous flow values of the Canakdere stream and the flow data from the Göksu stream. This kind of regression approach in which the available data of a nearby stream is used can be applied if the hydrological and geomorphologic conditions of the basin of the nearby stream are similar. This is the reason for the selection of Göksu stream since this stream is in the same basin with our project stream.

At the end of the study the results of the three methods were compared with each other and the real values which were observed at the gauging station. Then the correlations between the estimations were examined.

**ADAPTATION TO THE ROMANIAN'S PHYSICO-GEOGRAPHICAL
CONDITIONS OF THE METHOD "DEGREE/DAY" FOR WATER'S
EQUIVALENT DETERMINATION BY THE LAYER OF SNOW USING THE
REPRESENTATIVE BASINS DATA**

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The primary hydrometeorologicals and nivometrics data synthese and sistematization from the representative basins consist in observations of factors which determine the dynamic of the snow's layer, the exposure and the forest cover of versants.

For this synthesis and sistematization it was very important to estimate the spring's runoff, when the snow's aport it's very important.

Because we dispose by the large diversity of natural conditions and a good nivometric activity, we can use de data of the representative basins for the purpose - adaptation to the Romanian's psihico-geographical conditions of the method "degree/day".

In this time for this basins there were precised on the altitude levels, the surfaces caracterised by diverses expositions and foreste coverages.

In this diversity of natural conditions, the study of the evolution of the snow layer and in specially the snow melt process, it was based by the principals meteorologicals factors which determine this evolution, like:air's temperature, global radiation, the wind's speed and quantity of precipitations (liquids and solidés) which are full down in the interval(step) of time studied.

The analyse of corelation between water's layer which provided from the snow melt process h_s and the daily mean's air temperature t_{daily} , $h_s=f(t_{daily}, D_s)$ and the study of the liquid's precipitations quantity full down on the snow layer, too, evidentiated the accelerator role of these to the snow melt.

HYDROMETEOROLOGICAL PREDICTION FOR HYDROPOWER PRODUCTION IN THE RHONE RIVER

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One of the Compagnie Nationale du Rhône's (CNR) "traditional" missions is to operate hydropower development schemes on the French part of the Rhône river. In the framework of opening up the electricity market in France, CNR is now an independent electricity producer and has been marketing electricity generated from the Rhône since 2001.

This activity has led it to set up the Rhône Production Management Center (CGPR) whose role is to formulate production programs covering the next few days for the hydropower plants on the Rhône.

Given the constraints related to new demands from the electricity market and the specificities of run-of-the-river hydropower plants whose production directly depends on flow-rates, CNR has developed an integrated chain of operational prediction tools that incorporates every step from data acquisition to production forecasts.

Consequently, the CGPR asked CNR's engineering office to formulate flow prediction models for the Rhône and twenty tributaries having very different hydrological characteristics. These tools rely on input data from:

- CNR's hydrometric network composed of about 150 stations. The data is transmitted in real-time by the HYDROMET software;
- meteorological observations and 2 day weather forecasts supplied by the ARPEGE model developed by Météo France (weather forecasting agency) in the form of average precipitation levels every 6 hours by watershed;
- 4 day weather forecasts supplied by GFS, an American model, and processed by the OPALE software based on the analogues method and developed at CNR.

This information is then used in hydrological and hydraulic models to formulate flow predictions for the Rhône's tributaries. Seasonalised ARMAX type stochastic rain-flow rate models have been developed. For certain tributaries, these models have been combined with MUSKINGUM type propagation models.

Lastly, the flow rates of the tributaries are introduced in GAIPAR, a hydropower production prediction software program developed for the Rhône.

The performances of the hydrological models are monitored via an experience feedback procedure (REX) set up by CNR and applied after each hydrometeorological event. On the one hand REX permits evaluating the quality of the meteorological predictions, while on the other it permits improving the hydrological models if necessary.

An example is given for the watershed of the Saône, the main tributary of the Rhône and little affected by developments upstream.

ASSESSMENT OF CLIMATE CHANGE IMPACTS ON THE ELEMENTS OF HYDROLOGICAL CYCLE FOR THE STRUMA RIVER BASIN USING MONTHLY DATA FOR THE HBV MODEL

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The report presents an application of a HBV model version developed for the project "Climate Change and Energy Production", a Nordic project aimed at evaluating the impacts of climate change on the water resources. It has a simple vegetation parametrization including interception, temperature based evapotranspiration calculations, lake evaporation, lake routing, glacier mass balance simulation, special functions for climate change simulations etc. The HBV model can be classified as a semi-distributed conceptual model. The main input variables used in this report are the average monthly temperature, monthly totals of the precipitation, the potential evapotranspiration and the monthly discharges.

The HBV model was applied for assessment of climate change impacts on the elements of hydrological cycle for the Bulgarian part of the Struma River basin (cross section Marino pole, > 10000 km²). The River Struma flows from North to South up to the Aegean Sea. The obtained results are promising and they show the potential possibility for the HBV model use to assess the climate change impacts on the elements of hydrological cycle for the Bulgarian river basins using monthly data.

INTEGRATED HYDROLOGIC MODELLING IN LARGE SCALE CATCHMENTS WITH THE MIKE-SHE METHODOLOGY: APPLICATION TO PINIOS RIVER CATCHMENT, GREECE

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The mathematical modelling of both groundwater and surface water in complex, large scale hydrologic systems has always been an ambitious goal for hydrologists. The interaction between surface water and groundwater is difficult to quantify mainly because of the uncertainties in accurately describing the structure of the hydrologic system. Scale issues, both temporal and spatial, impose significant influence on the conceptualisation of water flow paths and catchment's response. However, in some cases where these interactions comprise the key components of the hydrological balance and therefore their determination and modelling are vital within the framework of water management implementation.

The physically based, fully distributed, hydrologic model MIKE – SHE was used to assess the complex interaction of different hydrologic processes and sources of runoff in Pinios River, Thessaly District, Greece. Special attention is paid to the Western Thessaly region with an area of 6410 km² at the most downstream river gauging station which is located at the western extent of a plain aquiferous area of approximately 2200 km². This specific catchment is well-known for the over-exploitation of its groundwater resources whereas its surface water potential, although significant, is underused. It is an extremely diverse system with surrounding mountainous areas and thick sedimentary deposits on the valley in the central part of the catchment. The recharge of the alluvial aquifers is originated to an extent from the karstic limestone masses of the Pindos mountain range and mainly from infiltration through the river bed in certain reaches particularly at the periphery of the plain where the main river and tributaries reach the flat parts of the catchment. An amount of recharge is also attributed to the deep percolation of the valley deposits. Surface and groundwater flows on the plain area appear well interconnected with the piezometry of the alluvial aquifer to augment the base flow at the most downstream river reach. The spatial distribution of such interconnection between surface and groundwater involves extensive site work in order to be accurately determined.

The whole of the surface component of the hydrologic cycle is being simulated with the MIKE – SHE model, including overland flow, flow in the unsaturated zone and actual evapotranspiration from vegetation and the soil layers. Flow in the saturated zone was simulated with a 2000 m grid finite

differences groundwater model based on the available data on groundwater piezometry and lithology. Groundwater abstractions were assessed and assigned in each calculation node of the model. It is noted that confidence on lithology was sufficiently assured, utilising data of more than 300 borehole loggings. The groundwater model was fed by daily and monthly input data from the surface water model and it was calibrated on weekly and monthly observation data with runs involving daily and 5days time steps.

The surface model is being applied in daily time-step and calibrated in terms of mean daily discharges in 5 river cross sections (3 mountainous catchments and 2 in the valley) as well as of the levels of the monitoring wells scattered around the valley. The success of calibration is checked against statistical indices (e.g. the Nash-Sutcliffe index) both in daily and monthly time step.

RESULT OF HYDROMETRIC MEASURING ON THE DRAINAGE SYSTEMS IN VOIVODINA

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Appropriate dimension and condition of channel network of drainage systems enables proper collection and drainage of excessive water at the right moment. During the construction of this part of drainage system it is necessary to optimize earthworks and to consider the effectiveness of channel network. If the maintenance of channels is irregular or inadequate, planned functions can be lost (for example, leaking and accepting ability is smaller), which can provoke variety of irregular functions of drainage systems.

The results and considerations in this paper are pointing out the importance of hydrometric measuring, as permanent and indispensable process based on which the hydraulic review of drainage system is achieved. Unquestionably, these investigations are significant, the first of all for environmental protection, which demands constant value of designed functional parameter for facilities of drainage system. The results of hydrometric measuring on drainage system, under the climatic conditions in Voivodina, are presented on this paper. Measuring is done on the main channel of Plavna and Ćurug-Žabalj drainage system. The discharges are measured, and rough coefficients are determined.

Based on the research results it can be concluded that during the summer period, flow conveyance of main channel in Plavna and Ćurug-Žabalj drainage system is considerably decrease. This complicates collecting and drainage of excessive water, which can negatively effect the conditions for carrying out agro-technical works and other components of agricultural production.

USAGE OF ARTIFICIAL NEURAL NETWORK FOR GENERATING MONTHLY AVERAGE FLOWS AT THE UNGAGED RIVER PROFILES

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A cluster of small to medium area watersheds in natural water regime in Serbia is selected to study possibility of usage of Artificial Neural Network (ANN) for generating average flows with one month discretization period. Apart from understanding and calculating high and low flow indicators - characteristics at the ungaged river profiles, insight into average flows of different discretization periods is of the equal importance for many purposes and water users - clients. There are many estimation methods and techniques available for the purpose, but ANNs look pretty attractive and user friendly, due to amazingly good results achieved for hydrologic phenomena prediction for short time discretization periods.

The aim of the paper is to examine possibility of usage of ANN for generating synthetic flows at a larger time discretization period of river flow than usual, within different data availability scenarios. The idea is to use surrounding river profiles' gauged data, as well as climatic data (i.e. rain depth, average temperatures) for specifying the deterministic element of the flows. The watershed characteristics planned for additional time series generation quality improvement are going to be combined among physiographic, vegetation, and soil variables. The spatial distribution and inter-watershed relations are also going to be subjected to variation.

It is anticipated that the following questions would be answered from the research:

- a) Is it possible to use ANNs with one month time discretization period for generating river flows within required precision?
- b) What is the level of contribution of different climatic data for synthetic flow series generation?
- c) What is the minimum number (out of the available set) of physiographic, vegetation, and soil variables required by the model to maintain the precision of results?
- d) How does the spatial relation between the modelled watershed and the analogue influence the flow generation results?

A sequentially adaptive radial basis function network will be applied for generating flows. Sequential adaptation of parameters and structure will be achieved using the extended Kalman filter. A criterion for network growth will be obtained from the Kalman filter's consistency test.

QUANTIFICATION OF THE SNOW COVER AND PREDICTION OF THE FLOWS GENERATED BY THE PROCESS OF MELTING

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Water resources under the form of snow have always brought interest of engineering as a natural system for the control of the water flow. In particular, in Spain this phenomena is of special relevance at the upper basins of Pyrenees, "Cordillera Cantábrica", Central and Iberian System and "Sierra Nevada".

The author has adopted a methodology to quantify the snow build up as from the study of snow-watching, and its inclusion in a water simulation model, allowing a continuous study of its evolution and forecasting of downstream water volume.

The aforementioned methodology implies two different conceptual models. The first one is a model of water simulation rainfall-runoff and the second is a geostatistics model that allows quantification of the snow cover for a date in which snow observations are available (on site campaign and satellite photography). Finally, these two models are combined on the same working support giving as a result a joint model.

As principal characteristics of the global model, it may be pointed out the following: the incorporation of snow information with different origins, in particular, it makes use of climate data and it may include data from on site point measures (poles and snow gauge), as well as information coming from remote sensing; space treatment of information to correct the runoff model and its calibration through the geostatistics model from a developed optimisation.

The results obtained define a methodology that can be directly implemented on high dams under normal conditions of exploitation and routing of flows resulting from fast melting.

THE REAL-TIME TORRENT FLOOD DEFENSE PRACTICE IN SERBIA

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The paper presents practical results developed Real-time Torrent Flood Defense methodology, which combines radar meteorology, torrential hydrology and new GIS techniques to enable quick determination and assessment of the detected situation in order to provide a sufficient time for the flood defense system to be put in operation.

The characteristics of torrential floods necessitated the development of various methods for its reconstruction and genesis. Different types of cloud pattern and wind situation can cause, for similar cloud situation, different flood hydrograms. This is a key point for a design of the efficient flood forecasting emergency system applicable for the remote areas.

SIMULATION OF SPRINGS DISCHARGE FROM MOTRU SEC – BAIA DE ARAMĂ KARST SYSTEM MEHEDINȚI MOUNTAINS, ROMANIA

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Time Series analysis is concerned with data which are not independent but serially correlated, and where the relations between consecutive observations are of interest. One of main applications is to forecasting , and the Box-Jenkins approach, is attracting more and more attention. There are now very few disciplines in the Sciences, Business and Technology, which are not investigating its possibilities, and this paper is an example of its use in karst hydrogeology domain.

The Motru Sec-Baia de Arama karst system is a complex system with recharge both difusse by precipitations and organized from Motru Sec river swallet. The outlet is a line of sources in the Baia de Arama zone. Labelings have proved both the Danubian Autochtone carbonatic deposits and karst system continuity under the Getic Nappe.

The ARIMA model was used to simulate temporal variations of discharge from two of most important springs of the system and the flow of the Motru Sec

river which recharge the system by its sinking. Simulated discharge was visually calibrated against measured discharge; the similarity between the two supports the validity of this approach. The model can be used to study the effects of climate change on groundwater resources and their quality.

TOWARDS INTEGRATED WATER RESOURCES MANAGEMENT OF THE MESTA/NESTOS CATCHMENT BY HEC-HMS MODELLING

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The Balkan rivers that are shared by more than one country, and aquifers that underlie more than one nation, are international resources and need special attention. The catchment of Mesta/Nestos lies between Greece and Bulgaria and the river crosses a border between former Eastern and Western blocks, which was isolated area, periphery, often discriminated, scan attention was paid to these lands. However with the ongoing integration efforts of the eastern countries to the European Union (EU) and the requirements of the implementation of the EU Water Framework Directive (WFD) these specific catchment areas reveal high importance and special attention. To be able to implement river-basin principle of water management and the WFD, to be able to avoid potential conflicts and issues and to ensure the success of sustainable regional development an effective transboundary river management of Mesta/Nestos and relevant actions are needed.

The paper discusses Bulgarian-Greek efforts for creation of a common management of the Mesta/Nestos river by HEC-HMS hydrologic model. The river rises in the mountain Rila in Southern Bulgaria and after a distance of 230 km discharges in the Thracian Sea . The total catchment area is about 5,800 km² of which 52% belongs to Bulgaria and 48% to Greece . A section of the Rila National Park and the Pirin National Park is listed under the UNESCO Convention for Protection of the Global Natural Heritage. The Delta is an ecosystem of high importance and because of the rare fauna "Nestos Delta and Adjoining Lagoons" was designated in 1975 as a Ramsar Site as wetlands of international significance.

A short history of the Bulgarian-Greek cross-border cooperation on water resources of the Mesta/Nestos river basin is presented. The Bulgarian-Greek working team has developed a spatial database (GIS) for the territory of the river basin. It covers the following layers: relief, rivers, lakes, settlements and municipalities, roads, land cover, forests, soil, precipitation stations, streamflow monitoring stations, irrigation systems, thermal mineral water

sources, tourist sites and protected areas. The Mesta/Nestos GIS is a basic component of the integrated water resources management of the basin.

The team is considering the Hydrologic Modeling System (HMS) program developed by the Hydrologic Engineering Center HEC as a tool for continuous hydrologic simulation as well as for event hydrologic simulation in the Mesta-Nestos River basin. In this work only continuous hydrologic simulation is presented. The software simulates precipitation-runoff and routing processes, both natural and controlled. The main step of HEC-HMS hydrologic model of the common Mesta/Nestos river basin is presented. The applied parametrization and calibration methodologies for a set of submodels of HEC-HMS relevant for Mesta/Nestos are discussed. The calibration is done using daily precipitation and streamflow data of the territory. The territory was divided in eleven subbasins in Bulgaria and four in Greece for better representation of the specific character of the catchment.

Model performance indicates that the developed parametrization and calibration methodologies work well when applied to the Mesta/Nestos river basin and should be applicable to other watersheds in the Balkans.

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HYDROLOGICAL MODELING FOR FLOOD WARNING AND RESERVOIR MANAGEMENT

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The paper presents the application of hydrologic modeling for flood warning and reservoir management. The basin of choice is that of the Ibicui River , a watershed of 43,000 km² wholly spread out in Brazilian territory. The Ibicui River is a major tributary of the Uruguay River , which constitutes a bi-national boundary and is crossed by a large hydropower dam downstream from the confluence.

A continuous lumped hydrologic model (the differential approach of the Sacramento) has been calibrated, fed by areally-averaged rainfall estimates and temperatures.

Although a (relatively reduced) number of rain gauges are installed inside and near the catchment, availability of rainfall records strongly depends on formal

agreements with network operators. Therefore, these data are not to be supplied in real time, which is necessary for the operational use proposed here. Consequently, the South-American version of the Hydro-Estimator technique was used. This is a satellite rainfall estimation algorithm developed by the US National Oceanic and Atmospheric Administration / National Environmental Satellite, Data, and Information Service (US NOAA/NESDIS). This technique uses an empirically-derived relationship between rain rate and cloud-top temperature (GOES 8 - 10.7 μm channel). These estimates are readily available in quasi-real time.

Regarding temperatures, the calibration was performed using the results from reanalyses made by NOAA through the National Centers for Environmental Prediction and the National Center for Atmospheric Research (NCEP / NCAR).

The operational use as a forecasting tool necessarily requires not only observed but predicted inputs, in order to expand the forecast horizon. Rainfall and temperature outlooks for South America, made available by the NCEP, are useful for extending the input series.

The results are promising in the sense that a reliable forecast may be issued from the result of modeling with input data readily downloadable from the Internet. Measurements from sparse networks, unreliable and unavailable in real time, are not a limiting factor for operational hydrology.

THE MATHEMATICAL MODEL "MONERIS" APPLIED TO CATCHMENT AREAS IN THE REPUBLIC OF BULGARIA

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This report is a part of the joint research project "Nutrient management in the Danube basin and its impacts on the Black Sea" by the Fifth Framework Program of EU. The project is aimed at the development of methodology for determination of the Black Sea pollution. One of the tasks was to determine the balance of nutrients in pilot watersheds and for this purpose six pilot river basins with different conditions have been selected and among them was the Lesnovska river catchment area in Bulgaria. Three mathematical models such as DIFGA, MONERIS and SWAT are used.

Herein the mathematical model MONERIS and its application to the Lesnovska river basin is described. The model consists of two submodels: water balance calculation and determination of the pollutants concentration. The first one calculates the water balance of the river catchment area by making use of the water balance equation based on the ways in which the

polluters get into the waterbodies. For determination the equations terms are used empirical formulas derived and based on wide investigations and data including more than 300 watersheds in South Germany . The obtained results and difficulties arisen at the model application to the Lesnobska watershed as well as some additionally made investigations concerning other river basins show the necessity of reformulating some of the equation components in order to reflect adequately the peculiarities of the watersheds on the territory of Bulgaria .

TOPIC 8: INFORMATION SYSTEMS

USING GEOGRAPHIC INFORMATION SYSTEMS IN TRACKING THE RELATION BETWEEN WATER POVERTY & DEVELOPMENT INDICES

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As the water sector in Egypt plays huge effort and faces great challenge to sustain enough water for the rapidly increasing population, however still safe drinking water represents a critical constrain for development, on which, without progressive work development would be impossible.

Internationally: Egypt is a medium human development country ranking 115 with HDI = 0.680*

Nationally: 6,847,500 people have no access to safe drinking water. *90,000 Citizen**and 17,000 Child*** die each year due to water related diseases.

Referring to the previous figures, accessibility to piped water as a human right is not that important in Egypt, moreover it doesn't consider quality or quantity of accessible water.

Here comes the objective of this paper: To examine the impact of water poverty quantitatively and qualitatively on the Human Development Index (HDI) in Egypt.

The Hypothesis made is that:

There is a direct relation between water poverty, public health, human productivity and the overall medium country profile.

Reaching to such result must pass through:

- Clarifying the conflict in defining some keywords like: Piped water, water poverty, and water accessibility according to governmental definitions and individual perceptions based on field interviews and surveys in urban and rural areas in Egypt.
- Tracking the relationship between rates of water accessibility and each of human health, individual productivity, and the final human development index in Egypt.

Case Study: According to the United Nations human development report /Egypt 2003:

DarEsalam district was the poorest district in Egypt in Human Development Index = 0.529 with percentage of total households without access to piped water 70.9 % and highest percentage of population suffering from kidneys failure diseases because of polluted drinking water .

Domiat district ranked the richest in Human Development Index = 0.708 with percentage of total households without access to piped water 0.77 %

By Using ArcGIS: as a tool that relates information to geographical location and overlapping layers in order to achieve a comprehensive analysis of data: rates of districts of Egypt was tracked in some indicators like, human development index (HDI), gross domestic production (GDP) ,water accessibility rates , maternal mortality, literacy rate, unemployment rates, water related diseases:

An impact of water poverty quantitatively and qualitatively on the overall country achievement can be clearly noticed.

Conclusion:

Water poverty may be not the only factor affecting human productivity, however it is one of the most critical factors, since on quantitative and qualitative basis: water affects human health, which by its turn affects his mental and physical capabilities and abilities, moreover it may cause him certain disabilities, which will certainly limit his productivity leading to delaying the country overall profile on the international level. Which will certainly need deeper analysis to support effective decision making based on Geographic information systems analysis. And this what the paper will present.

DISCHARGE ESTIMATION BY CONTINUOUS MEASUREMENT OF WATER VELOCITY

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Accurate discharge estimation is crucial for an efficient river basin management and especially for flood forecasting and issuing warnings related to possible extreme flood events. The traditional way of estimating the discharge in hydrological practice is to measure the water stage and to convert the recorded water stage values into discharge by using the single-valued rating curve, which is a relationship between the stage and discharge derived from direct measurements of discharge, which are done at convenient times with measurements of flow velocities at different points over the gauging cross section, and hence the discharge values of the rating curve for the extreme events are usually extrapolated by using different mathematical methods and are not directly measured. By using the Starflow ultrasonic Doppler instrument we recorded the actual relation between the water stage and the flow velocity at the occurrence of flood waves. Unsteadiness in the water stage – water velocity relation causes the trajectory of the flood event to

appear as a loop on the stage – velocity diagram. Results of the 3-year time measurements at different water stations on different Slovenian rivers (the Sava, Dragonja, Gradascica, Reka, etc.) show non-negligible differences in water velocities on the rising and falling limbs of the flood waves at the same water stage. Neglecting the influence of different water flow velocities on the rising and falling limbs of the flood waves can result in underestimation of peak discharges during highly dynamic floods and less accurate estimation of the time of the flood peaks.

Measurements of velocity increase also accuracy of estimation of water balance significantly and make more transparent hydraulics regime in particular cross section of the river.

DECISION SUPPORT SYSTEM FOR INTEGRATED WATER MANAGEMENT IN ROMANIA: RECENT DEVELOPMENTS AND FUTURE PLANS

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The Baia Mare cyanide spill in the transboundary basin of the Somes-Tisa River in Northwest Romania in March 2000 and a series of damaging floods culminating with those ones of 2005, has focused attention on the need for improvements in both the infrastructure and institutional capacity of Romania to better manage water quality and quantity. Furthermore, as part of its activities related to EU accession, Romania must harmonize its legislation with EU law, including 19 directives related to water. While much of the legal transposition has been completed, implementation of water directives represents a substantial institutional and financial burden for the country.

Several U.S. and EU funded projects have been undertaken or are planned to analyze the current monitoring, data management and decision support systems and provide recommendations to the Romanian government on investment and institutional needs. Already, two major investments have been implemented: 1) \$55 million in investments in meteorological monitoring and forecasting systems (SIMIN system); and 2) \$46 million in investments in automated hydrologic monitoring stations, data communications, and DSS (DESWAT). A new EU-funded project will assist Romania in preparing a management plan for the Somes-Tisa river basin as required by the EU Framework Water Directive, while a second EU project will support capacity building in the management and dissemination of water quality and quantity

data. A complementary project (WATMAN), funded by USAID, has been started that will provide recommendations on how to coordinate all of these monitoring and data collection systems into a single integrated water management system that will ensure that water allocation decisions are coordinated with weather and flood forecasting.

This paper will provide a synthetic review of these efforts and describe plans for integrated water management in Romania. The paper includes the following components:

- 1) Overview of water quantity and quality issues in Romania;
- 2) Legislative and policy framework, including a discussion of international obligations and requirements to harmonize Romanian laws and regulations with EU legislation;
- 3) Description of the SIMIN and DESWAT components of integrated water management, including a discussion of the weather and flood forecasting models that will be used in Romania;
- 4) Describing WATMAN project, current applications of DSS in Romania, and opportunities for applying decision support systems at the river basin and sub-basin levels applied to integrated water management in Romania.

INTEGRATED HYDROLOGICAL DATA AND KNOWLEDGE MANAGEMENT TRANSFER FOR FLOOD WARNING CENTRES IN GERMANY AND AUSTRIA

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The flood catastrophe which struck mid-Europe during the summer of 2002 made the need for rapid access to relevant information apparent to all countries involved. Additionally the need for simplified communication pathways was highlighted as well as the speed and efficiency of flood warning distribution process.

A further result that came to light was the necessary partial renewal of the hydro-meteorological measuring network. The measurement network was found, in some cases, to no longer be satisfactory for the demands made by such a catastrophe. Additionally, there was a need for heightened data security through the development of stand-by systems.

The distribution of knowledge during the flood phases was also recognized as being in need of improvement. This related to the integration of all available hydro-meteorological data and information in the existing complex forecasting

and warning system. Improvements were also necessary to ensure the rapid and secure forwarding of information to other authorities and services, as well as affected residents and the general public.

This article will present the results experienced from two flood warning centres in Sachsen-Anhalt , Germany and the Flood Warning Centre of the Lower Austrian Hydrographic Service, Austria . In both cases, the KISTERS AG, Germany were contracted to supply all necessary components for the modernization of the centre. In conjunction with the successful cooperation of other partner companies, the following tasks were accomplished:

1. Optimization of the remote call process and communication pathways for the online collection of hydro-meteorological data.
2. Optimization and diversification of the flood warning centre by specific water stage notification regarding content, inflow and details of reservoirs and storage basins.
3. Consolidation of hydro-meteorological data and information from different organizations, authorities and observers. This includes precipitation and snow depth reports, as well as precipitation and thaw forecasting. Information about weather development patterns and storm warnings has also been integrated.
4. Renewal and optimization of flood reports and warnings based on weather and storm warnings, or raised water table levels in the respective catchments. Examples include the automatic distribution of messages to predefined groups via varied communication methods such as Fax and SMS. The quality assurance of distribution pathways and receiver confirmation and tracing of the transmission is also important.
5. Integration of flood forecasting (models) and other flood information with details of the current situation and potential flood developments.

Details of the technical infrastructural measures in both flood warning centres will be discussed and the initial results presented. An area of particular interest is the integration of different hydro-meteorological information and forecast results. Additionally, the transfer of this information from the control centre to the publishing of the data to intra- and internet will be covered as well as other methods of data dissemination to specific receiver groups (Fax, SMS, Email, Phone).

WATER OBSERVATION WITH RADAR OF SYNTHETIC OPENING IMAGES

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For many years has been much progress in understanding land surface-atmosphere processes and their parameterisation in the management of water resources. Earth Observations techniques in different regions of the electromagnetic spectrum have been used for about three decades to monitor land surface. Nowadays, these techniques are ready for being transferred to operative applications of great impact on the management of water and land resources. In the same time, technological developments of new generation of remote sensors provide the opportunity for new observational and modelling perspectives. The guarantee of reliable verification of pollution of sea from activities of boats renders necessarily the use of effective tools of systematic follow-up and mediation. Basic factor for the successful follow-up is the methodical remotely monitoring. To a great extent this can be achieved with the use of air patrols, or with optical recognition or with use of remote sensing receptors in the regions of wavelength of microwaves. The satellites that are equipped with Radar of Synthetic Opening (SAR), because their faculty detect impurities in the surface of sea, but also because their faculty to inspect big marine regions independent from the sunlight and the covercloud, are presented as ideal tools for the completion of conventional air means.

CORRECTION OF OBSERVATION DISCHARGE DATA IN FLOOD

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In flood case, discharge observation is measured by rod float method or portable current meter by boat keeping out of dangerous conditions. But these observation method are not based on hydraulic theory, just only integration of velocity and cross sectional area. This method is seldom to get correct data, because a few positions of measuring locations in complicated flow. That why, it is important to be modified discharge observation data. The method of modification is hydraulic way by water surface gradient. After the modification, the verification events survey whether modified discharge data are correct or not are inspected by the method of 2 dimensional numerical analysis on

unsteady flow. This 2 dimensional numerical analysis is given modified discharge data as boundary condition of upstream, and given observed water level as boundary condition of downstream. If resolution of this analysis can get almost same water level with another observation water level not to be used as boundary conditions (middle stream gauge), given modified discharge data are correct. It is convinced that observation discharge data are needed to modify correctly.

This report has been divided into three parts. In the first part is experimental conditions. In the second part is how to modified hydrometric observation discharge data. And in the final part is how to prove modified discharge data are correct, and the necessity of correcting observation discharge data.

Experimental conditions

The experiment was used rod float to have a depth of immersion 75% of the water depth. Its Reduction factor of rod floats is $k=0.94$ (by WMO). Passages numbers of floats in section are five sections and measuring sections are 100m.

How to modified hydrometric observation discharge data

Modified Manning formula based in water surface gradients is appropriate for correction of observation discharges.

How to prove modified discharge data are correct, and the necessity

A two-dimensional theoretical treatment is based upon the continuity equation and the motion equations for incompressible flow. Given coefficients on this model to be the main characteristics of natural rivers are following:

- a) compound cross-section with extreme lateral variation
- b) floodplain vegetation
- c) profiles of bed configurations by topographic map(1/2,500)
- d) varying bed roughness

So, modified discharge data are inspected by the model.

For irregularities of bed slope, ground roughness, vegetation lead, vortex current rapidly changing from one cross-section to another, it is too difficult to measure velocity in those such complicated flow of flood. That why, necessity of correction are introduced in this report.

COMPARISON OF BED LOAD FORMULAE IN HYDRAULIC GEOMETRY USING SIMILARITY PRINCIPLE

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Employing the similarity principle, this paper derives the bed load formulae. The formulae include relations for stream width, meander wave length, and bed slope, which are related to friction factor, bed load discharge, bed load diameter, and the water depth. On comparison using the data on the hydraulic geometry of several alluvial laboratory streams, the derived formulae are found to match well with those by Einstein (1950), Shields (1936), and Meyer-Peter and Muller model (1948).

APPLICATION OF METHODS FOR ANALYSIS OF RAINFALL INTENSITY IN AREAS OF ISRAELI, JORDANIAN, AND PALESTINIAN INTEREST

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One Application of Methods for Analysis of Rainfall Intensity in Areas of Israeli, Jordanian, and Palestinian Interest was developed as part of the Water Data Banks Project and is based on rainfall data collection and collaborative compilation by the Core Parties.

The purposes of this publication are to describe

the meteorologic conditions and precipitation data for a selected study area within the region,

methods developed to analyze precipitation data in the region, and

results of a pilot application of the methods to analyze precipitation data for selected precipitation stations in the study area

The methods include computer software developed specifically for rainfall data compilation and analysis by the Core Parties, but which has broad application for the management and analysis of precipitation data anywhere.

The computer software is intended for the storage and analysis of long-term at-site precipitation data collected at precipitation stations.

QUALITY ASSURANCE OF HYDROLOGICAL DATA

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The author would like to present his experiences to assure the hydrological data in this report. Hydrological data are a key issue to water resources development, flood reduction and environmental protection. In spite of application of high technology to hydrological data acquisition, missing or irrational data are sometimes found in hydrological database. The author already pointed out problems at the steering committee meetings of GRDC and the IAHS workshop at Sapporo in 2003. Problems are divided into two, one occurs at observation sites and another is found in data processing. He proposes in the reports how to solve the problems based on his experiences. The problems are mostly simple but critical. First of all, field survey must be carefully carried out at observation sites to make sure locations, facilities and observation procedures. Rainfall observation is useless if the receptacle of the gauge is covered with the crown canopy of the tree standing near the gauge. The heater is required for a rain gauge to keep stored water liquid even in the temperate zone, because in winter, temperature becomes usually under the freezing point in the zone. A reference benchmark sometimes disappears near the water gauge. The zero point of the gauge is changed due to river bed degradation or land subsidence. Secondly, attention should be paid to velocity measurements. A currentmeter should be regularly calibrated by the test machine. The current measuring procedure must be met to the regulation. A drift rod is usually used at the period of flood discharge observation in Japan. Its length, the adjustment factor and spacing must be adequate.

In the data processing procedure, the stage-discharge relation must be strictly investigated. The relation forms approximately a parabolic curve. When the surface gradient increases at the rising period of a flood, the discharge is observed bigger than the parabolic relation. When the surface gradient decreases at the falling period, the discharge is observed smaller than the parabolic relation. Therefore the stage-discharge relation forms a loop, which is counterclockwise where the water level is on the ordinate and the discharge is on the abscissa. When some undulation comes from downstream, for instance a tidal wave, the stage-discharge relation makes a clockwise loop. This trend is mathematically proved. In the full text, other methods of quality assurance of hydrological data will be illustrated. Such a kind of experience must be shared to assure hydrological data for reasonable water resources development.

ADCP MEASUREMENTS OF SUSPENDED SEDIMENT FLUXES IN RIVERS, ROMANIA

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Acoustic Doppler Current Profilers (ADCP) are increasingly used to perform river discharge measurements. Water velocity profiles are computed from the Doppler frequency shift measured between emitted and received ultrasonic signals. The intensity of the sound backscattered by suspended solids depends on water (temperature, absorption coefficient, etc.), ADCP (frequency, beam spreading, etc.) and particle (size, concentration, absorption coefficient, etc.) hydroacoustic properties. The field tests reported here mainly aim at comparing suspended sediment concentration and flux values provided by ADCP and conventional procedures routinely followed by the Romanian hydrometric network.

Test measurements have been performed at two hydrometric stations in the Banat Basin, Western Romania. We used a RDI WorkHorse Rio Grande 1200 kHz ADCP mounted on a floating board. First, stationary ADCP profiles were acquired simultaneously and close to bottle sampling verticals. These linked measurements were later used to calibrate hydroacoustic parameters and convert backscatter profiles to concentration profiles. This calibration step and further analysis were supported by the Sediview commercial software (DRL Software, UK).

Several successive ADCP transects were acquired across both hydrometric sections of Faget, on the Bega river; and Lugoj, on the Timi^o river. Due to shallow water depths and technical restrictions, linked concentration measurements were not possible at Faget, but discharge measurements are in good agreement. In the Lugoj study case, sediment calibration was carried out and concentration contours show some contrast throughout the cross-section. Water discharge and sediment mean concentration and flux are similar to the values provided by conventional measurements (respectively about 35 m³/s, 85 mg/l and 3 kg/s). Technical problems and respective advantages of both methods are discussed. Further experiments are required to evaluate more accurately potential of the ADCP method, especially in large and deep river cross-sections and during floods.

**THE DIGITAL TERRAIN MODEL FOR THE SUPPORT OF
HYDROLOGICAL APPLICATIONS IN STANA DE VALE HYDROGRAPHIC
BASIN**

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The continuous variation of an object or geographical phenomenon in space may be represented by the modeling of the topographic surface. This is based on digital data series which contain information about the elevation of every point and which, will finally be materialized in a Digital Terrain Model (DTM).

The realization of maps, therefore the building of the database, was made through a series of steps, namely their scanning, then their geo-reference and vectoring. After finalizing the vectoring process, the digital model was made based on the layer which contains the topographic isolines of the terrain, therefore the level curves. The geographical analysis is made through analytical commands and operations which allow the inquiry of the database, combination of thematic layers, data filtering and tabular analyses.

This model can have numerous practical applications – visibility analyses for determining characteristics that can be observed from a certain position, displaying different information, like: vegetation types, land use and geology, surface and volume calculations, the identification of floodable or risky areas for building structures.

**THE USE OF GIS IN THE ANALYSIS OF DRINKABLE WATER
RESOURCES IN THE VEDEA RIVER INFERIOR HYDROGRAPHIC BASIN**

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The Vedeia River has its sources in the piedmont area, and crosses the Romanian Plain from North to South, having its inferior basin in the plain region.

Drinkable water is available only under the form of groundwater and is exploited by small and medium depth wells.

The paper is based on the data from the well drilling, supplied by the state hydrogeological network, managed by the NIHWM. The database is made of both data regarding the placement of wells, and the technical and lithological characteristics, the aggregate grading of the aquifer, discharges, unevenness, data regarding piezometric levels, temperatures, but also data regarding

physical-chemical analyses. Based on these primary data, I made maps resulted from their processing: hydrogeological map, water pollution sources, hydroisohypsies.

In the Vedeia River hydrographic basin, geological conditions are favorable for water resources forming. This is why, through scanning and digitization, I cartographically represented the influence of geological layers on drinkable water resources.

In the analysis of water resources, topography has also an important role in which, with the help of GIS techniques and through the processing the level curves, the MDT resulted. The main morphometrical parameters can also be determined based on the MDT: slope, mean basin altitude, slope exposure, 3D visualizations, obtaining a much more complete hydrographic network compared to the one existent at a survey level.

DATABASE STRUCTURE AND GIS ANALYSES OF THE LARGEST KARST AQUIFER IN NE BULGARIA

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For the purpose of implementation of the EU Water Framework Directive in Bulgaria, groundwater bodies (GWBs) have been delineated according with their initial characterization.

One of the most large and important transboundary groundwater bodies is the Upper Jurassic – Lower Cretaceous carbonate aquifer. Harmonization of a vast amount of data originating from different databases concerning this GWB into a hydrogeological database in geographic information systems (GIS) started in the frames of a Project for young researchers launched by Bulgarian Ministry of Education and Sciences.

The database structure and GIS analyses allows generalization of large amount of data for the purpose of future hydrogeological modeling of the area.

THE DETERMINATION OF FREE WATER SURFACE CURVES ON THE SECTORS BETWEEN TWO CONSECUTIVE DAMS AS A RESULT OF CERTAIN INCIDENT/ACCIDENT SCENARIOS AT THE UPSTREAM DAM

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This study simulates some incidents/accidents that could happen at the weirs of the most important reservoirs from Lotru river basin. The obtained discharges hydrograph from the different scenarios were determined through the one-dimensional hydraulic model UNDA (Amaftiesei, 1998) calibrated on a defined river bed on the cross-sections.

UNDA model works in one-dimensional schema and it is built on the basis of the numerical integration of the Saint-Venant equation system, according to a rectangle network in pan X, T , in implicit schema with the equations linearisation, using the double raster algorithm, for a time interval $D t$.

On the analyzed sector of Lotru River, natural inflow hydrographs into the reservoirs are transited downstream with modified discharges.

The following incidents/accidents were taken into account:

for Vidra, Petrimanu, Jidoaia, Lotru-Aval and Malaia weirs we consider that a bottom outlet valve is blocked in "complete open" position;

for Bradisor weir we consider that two segment valves from two bottom outlets are blocked in "complete open" position;

rupture of the CHE Ciunget feed pipe at the Manaileasa passage;

In the studied scenarios the hydrographs from the weir section were considered so that the discharges can transit only the bottom outlets opened completely (without opening the surface weirs). Initial state into the reservoirs is assumed at normal retention level.

The set up of the support for hydrological modeling supposes two stages: first consists of topo-geodesic measurements in the field and the second consists of processing and GIS integration of obtained data. This way, final products are both transversal profiles and maps, and a series of general morphological and hydraulic parameters.

Two field campaigns were made. They consisted of topographical measurements with total station and satellite observation using differential GPS receivers. In the field known coordinates were stationed, CSA landmarks, obtaining 22 longitudinal profiles and 101 transversal profiles, of which 75 on the Lotru River, 18 on the Latorita River and 9 on Voinesita River.

After processing, the obtained data was introduced in ArcView in order to be visualized, and then, based on certain extensions of this software, transversal profiles in the characteristic points were made.

As a result of the modeling and obtaining the determined free surface for different scenarios stage, tables with known height points which delimit the floodable area were obtained. Based on those points and the ArcView software, the delimitation of the floodable area on 1:5000 topographic maps was made. These areas were delimited using points on the profile, other points in the field that weren't used for profiles and topographic information (level curves and heights) contained by maps.

DEVELOPMENT OF THE SOFTWARE SYSTEM FOR SUPPORT OF THE INTEGRAL WATER RESOURCE PROTECTION FROM POLLUTION

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Management of the water resource quality in the area of river basins and their protection from pollution are very complex and multidisciplinary problems. The research in this field has a goal to reduce the complexity and bring it down to the realistic and practicable solutions, both for the users of water, and for managers of the water resources in these areas.

At the Faculty of Civil Engineering and Architecture of Nis, the software system for support of integral water resource protection from pollution in the river basins has been developed for several years. This software system is a starting ground for the expert system for protection of water resources in a basin and a very significant component of the future program system for support to the integral management of water resources in a basin.

Software system is GIS/CAD orientated and connected through the RDBMS module with the existing data bases and cadastres and has a large number of simulation and optimization tools (general simulation tools: CSMP, GPSS; specialized simulation tools based on the classic methods: QUAL2E, WASP, SWMM, SWAT, HSPF; artificial intelligence methods; fuzzy logic; signal processing; single criterion and multi-criteria optimization, etc.).

The software system facilitates, above all, modeling and simulation of all the components related to the pollution and protection of the water resources in the basin from the pollution (sewage system, waste water treatment facility, rainfall/drainage, water courses), defining of the real status in the water course at any of its profile in the basin, at any given time and consideration of the influence of polluters on the water course not only at the place of effluence

but also downstream, and then, on the basis of the obtained results, for the defined criteria and target functions, obtaining of the optimal management actions, scenarios and plans of operative protection from pollution of the water resources in the basin.

This paper presents the software system for support to the integral protection of water resources from pollution, within the river basins, whose development is underway at the Faculty of Civil Engineering and Architecture of Nis. It also presents the postulates and principles on whose basis the system has been developed, and some of its potential is demonstrated on the demo basin or the river Toplica.

APPLICATION OF GIS AND HYDRO SOFTWARE TO INTEGRATED WATER RESOURCES MANAGEMENT

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Using new technologies, such as GIS applications, will provide faster exchange of information about flow, pollution, navigation etc. And more efficient dealing with problems of Public Water Management Company (PWMC) in the country and neighboring countries, as well. Usage of GIS applications for hydrological and hydraulical analysis, according to the principles of sustainable development, will contribute to development of infrastructural objects of water resources engineering in Vojvodina.

Research results should contribute:

- to achieving optimal technical solutions
- managing water supply systems in the best way
- good choice of appropriate land (for ecological food production, for mud deposits etc.)
- easier choice for interested users or buyers and giving space and mineral resources for usage (waters, soils, clay, sand, gravel etc.)
- more efficient taxes for usage of resources and space
- establishing laws about conditions of certain usages of a space, about conditions of protection etc.

Final results can be used in all PWMC in Vojvodina and other regions and countries.

GIS SOIL MAPS OF VOJVODINA FOR INTEGRATED WATER RESOURCES MANAGEMENT

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Sustainable ownership of lands and water, demands rational organization of noticing and measuring different phenomena in time, establishing physical, chemical and biological characteristics etc. In the analyses of natural phenomena, it is necessary to use modern informational systems for integral managing of land and water resources which enable fast and efficient exchange of data, experiences and knowledge.

Development of I and reclamation s, as a long term aim in realized application of new strategy of sustainable development for the ownership of water and land, above all considers: collection, systematization and analyses of topographical, pedological, hydrographical and other bases, choice of a computer programme and entering data into basic GIS (Geographical Information System) programmes and applications for hydrological, hydraulic and other analyses and for making digital maps (hydrographical systems, pedologic maps) application of researching results etc. Methodologically, this is the best way to precisely define the whole complex of mentioned problems and to build a good base for sustainable development of agriculture and water management in Vojvodina.

Soil resources importance within environment, and degradation processes by which this resource can be influenced are pointed out in this paper. Review of main elements of GIS and working procedure for GIS layer of Vojvodina's soil map are shown. Importance and possibilities of GIS application within integral protection of soil resources is distinguished.

INTEGRATION OF DATA AND KNOWLEDGE FOR PLANNING AND DECISION-MAKING IN THE WATER SECTOR

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Climate change and its impacts in different sectors of the economy are issues of great interest and concern in the last few decades. On the other hand, economic activities are amongst the biggest contributors in respect to environmental impacts, including climate change, due to significant natural resources exploitation. Many studies and practical actions are undertaken or

underway worldwide to respond the need for making economic activities more environmentally friendly, but being site and country specific, these have to be continued and expanded. For the water resources and water sector respectively, relevant planning and decision-making are of essential importance for exploitation and management in a sustainable way.

In the paper, a conceptual model for integration of diverse information, data and knowledge into the process of planning and decision-making so that to better meet both, consumer/user needs and requirements as well as recent environmental standards for efficient resource use and low impact, is presented. The integration can be schematically shown as following:

production of data and knowledge => communication => integration

(collection and processing of data, ----- (process between ----- (into the practice of studies on the water resources, ----- researchers, policy ---- planning and management water quality, clean technologies, etc.) ---- and decision-makers,----of the water sector) business, citizens)

The first element of such a chain – production of data and knowledge, is realized the best: huge volume of publications and other information sources, that can be of use in the water sector, exists . The second element of the chain - communication of the obtained knowledge and results, is not yet very well realized. Because "(communication) ... is how you manage information, how effectively this information is provided to ... external audiences", efforts to further develop and improve the ways for communication are necessary. The third, and most important element in the chain – integration, depends on the success in realization of the other two and here most efforts are needed for changing current non-sustainable economic practices. The use of Geographical Information System (GIS) is considered in the model as tool to characterize in details areas being studied and where practices of planning and management in the water sector are foreseen or going on .

THE GEOGRAPHICAL WATER RESOURCES INFORMATION AND ASSESSMENT SYSTEM – AN ELEMENT OF THE IWRM

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The water resources are considered to become increasingly important in the future and to be strategic resources in the XXI century. The Integrated Water Resources Management (IWRM) is a highly interlaced procedure covering different spatial scales and various fields of expertise. This management is impossible to be effective in the case of a lack of information of the state and the use of the water resources in the past, for the time being, and without prognosis for near and distant future. The effectiveness of this management, taking into account the stochastic character of the water resources, is directly dependant from the volume of the information, covering long periods of time, and from the reliability and the possibilities to be easy used by the investigators. Often the water resources information, especially in Bulgaria, is scattered in different institutions, not structured, and usually gathered in unusable files. Habitually these files need to be processed and generated in long synthetic time series needed for the mathematical simulation of the water resources systems functioning.

The Geographical Information Systems (GISs) may be a suitable device for easy communication between the different groups of data interested in the assessment of the water resources distribution and utilization. GISs describe the properties of an area in a visual form. They can be useful tools, but in the common type, as they can be found on the market, they are not suitable for some of the specific water resources problems. A database is a logical collection of interrelated information, managed and stored as an unit. A GIS database includes data about the spatial location and shape of geographic features recorded as points, lines, areas, pixels, ... as well as their attributes.

The next stages of development of the information system (IS) will be discussed and examples from the elaborated by the authors Geo graphical Water Resources Information and Assessment System - " GeoWaterRIAS will be presented :

Stage 1. Drawing a structure of the IS that can contain all the primary and processed data needed for the IWRM of a given basin(s);

Stage 2. Gathering and processing in a GIS a large number of primary data concerning the water resources for all the river basins in Bulgaria . Often a linkage between different scales of data can be necessary to make;

Stage 3. To make in use models and software (standard and especially compiled codes) for processing the primary data in the goal to receive new elaborated more expressive and comprehensible sets of data and suitable for input data in the simulation models of the runoff, the man-made water systems functioning, and water quality models;

Stage 4. Embedding simulation models of the runoff, the man-made water systems functioning and water quality modeling in the river flow;

Stage 5. Validation of the System on a real watershed.

BASIC FEATURES OF THE NILE RIVER BASIN DECISION SUPPORT SYSTEM

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The Nile River Basin is spread over ten countries covering an area of about 3.1 million km², or approximately 10 percent of the African continent. The river discharge per unit drainage area is very small, and almost all of the Nile water is generated from only 20 percent of the basin, while the remainder is in arid or semi-arid areas.

The Nile River Basin Decision Support System (Nile DSS) constitutes a component of the Nile Basin Water Resources Project (GCP/INT/752/ITA), which has been implemented in the Nile Basin by the Food and Agriculture Organization of the United Nations (FAO) with financial support of the Government of Italy. The Nile DSS component was developed in the period 2002 – 2004 through a collaborative effort of the Nile Basin Countries, FAO and the Georgia Water Resources Institute at the Georgia Institute of Technology (Georgia Tech).

The purpose of the Nile DSS is to serve to the Nile Basin countries as an unbiased and neutral technical tool for assessing the benefits and tradeoffs associated with various water development scenarios, management options and water sharing strategies in the basin that may interest the riparian countries either individually or as an inter-dependent community of nations. The Nile DSS includes six main components: database, river simulation and management, agricultural planning, hydrologic modeling, remote sensing, and user- model interface.

The paper describes guiding principles used for the development of the Nile DSS and presents basic features of the developed system. Complex water resources development & management issues and dilemmas in the Nile basin, and in the large international river basins in general, are discussed;

Emphasis is on the role and usability of decision support tools such as the one developed for the Nile River Basin in assisting the riparian states to assess the potential benefits and tradeoffs associated with various scenarios and strategies for water resources development in the international river basins, including those in Europe and the Balkans. As a rule, the ultimate objective of the exercise is to reach an agreement on harmonious water resources development & management in the basin in order "...to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin resources" (as agreed upon by the Nile Basin States when the so-called Nile Basin Initiative (NBI) was launched in 1998 - quotation taken from the NBI web site - www.nilebasin.org).

EFFECTS OF TRANSVERSAL STRUCTURES IN THE TORRENTS OF THE RIVER DRINA CATCHMENT

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The management of torrential catchments include different concepts. One of them is the classical European system, based on the theory of equilibrium between bed slope and its ideal value (normal slope).

The paper presents the effects of the constructed transversal structures (sills and dams) in the torrential watercourses of the river Drina catchment, i.e. its tributaries (Simi æa potok, Èikariæa potok, Potok Tepavac, Grabovièka reka, Bitinovac potok), along the sector Loznica-Baèevci.

The effects of technical works were evaluated by the slope of siltation and the quantities of deposited sediment.

Correlations between the newly formed slope of siltation (l_z) and the natural bed slopes (l_t), particle-size distribution of sediment (d_{50} - $d_{97,5}$) and coefficient of sediment nonuniformity (U, K_m, K_d, K_k, S, S_o), were analyzed.

The study results show the correlation between the slopes of siltation and the particular factors. They are the basis for further forecasts of the slopes of siltation.

**INVESTMENT OF HYRAULIC PARAMETERS OF THE FLOW AT
DOWNSTREAM END OF REACH IN OPEN CANALS IN CONDITIONS OF
UNSTEADY FLOW**

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With computer modeling of unsteady flow running in irrigation canals are studied the change of the basis hydraulic parameters of the flow. It is made a detail investigation at the very often used cases to the boundary condition at the downstream end of reach at the irrigation systems with open canals in conditions of insteady flow.

It is made a general conclusion of received results at the mathematical modeling.

**OVERVIEW OF THE ARTIFICIAL NEUTRAL NETWORKS AND FUZZY
LOGIC APPLICATIONS IN OPERATIONAL HYDROLOGICAL
FORECASTING SYSTEMS**

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Damage due to flooding has increase in many countries in the last years, and due to the global climate change, which is now recognized as a real threat, an increase in the occurrence of flooding events and especially of flash flooding events is likely to continue into the future.

In those conditions and because building new flood defences structures for defending vulnerable areas has serious financial implications, the timely forecasting of floods is becoming more important for flood defence and in general for water management purposes.

The complexity of natural systems and of hydrological processes that influence river levels evolutions make the traditional modelling approaches, based on mirroring natural processes with physically based equations very difficult. Despite the fact that in the last decades the Operational Hydrological Forecasting Systems were significantly developed, becoming more and more complex systems, ingesting and processing in real time a great amount of data from automated hydrometrical and meteorological stations networks and high resolution grided data from radars and satellites, together with the use of distributed hydrological models, the warning and forecasts improvements are

not very significant, in many cases the performance of the new physically based distributed models being comparable with the "older" conceptual lumped models.

The paper presents an overview of some alternative and complementary modelling approaches, artificial neural networks and fuzzy logic systems, possible applications for the improvements of the Operational Hydrological Forecasting Systems, and presenting also some example of rainfall-runoff modelling implementations.

Artificial neural networks are widely used as an effective approach for handling non-linear and noisy data, especially in situations where the physical processes relationships are not fully understood and they are also particularly well suited to modelling complex systems on a real-time basis.

Fuzzy logic is a generalisation of boolean logic implementing the concept of partial truth or uncertainty, so within the fuzzy set theory an element can have a gradual membership to different sets. To describe a system behaviour with fuzzy logic, you need to define fuzzy sets, fuzzy rules or so called IF-THEN rules and apply a fuzzy inference scheme. The generation of a fuzzy forecast model can be based both on experts knowledge and historical data.

In conclusion, both artificial neural networks and fuzzy logic modelling systems offer the potential for a more flexible, less assumption approach to hydrological processes, and they have already been demonstrated as successfully substitutes for the classical rainfall – runoff models, and also as tools for the real time updating of hydrological forecasting models and especially for the multimodel approach.

ONLINE OPERATIONAL MONITORING AND TSI ESTIMATION SYSTEM OF LAKES

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In this paper, we will present an online operational monitoring and Trophic State Index (TSI) estimation system of lakes in general. Our work is related to the ecological state of all lakes (including instilling rivers) that would have use of the system by receiving real time statistics. The study aims to present the system potential for instance remote and fast information management, detailed contents and reports, allowance of international distributed cooperation in order to establish or confirm the status of lake water bodies

thought to be at risk and finally database processing that follows the European standards. Hence, data storing, analysis and TSI estimation are all performed at one place using only a Web Browser, where some components are available to all users and confidential data is only available to authorized users.

MONITORING AND IMPROVING THE RIVERS IN VARDAR/AXIOS WATERSHED

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The paper will present the following: (i) Actual situation in the Vardar/Axios river watershed; (ii) The problem to be addressed in the paper; (iii) The main steps of the MWS (Monitoring the Watershed Sustainability) path and IWS (Improving the Watershed Sustainability) path and their corresponding relative weights; (iv) The science or technology that should be developed and applied in order to realize the MWS and IWS paths; (v) The status of related research and development activities in the Republic of Macedonia and world-wide; (vi) The equipment and facilities necessary to realize the MWS and IWS paths, as well as the corresponding budget; (vii) The detailed explanation of the methodology and activities that should be performed in order to realize the MWS and IWS paths.

Vardar (in the Republic of Macedonia) or Axios (in Greece) is the longest and largest river in Macedonia and one of the largest in Greece, with a length of 302 km in Macedonia and 87 km in Greece. The average elevation of the Macedonia's basin is 793 m (Vardar springs in Shara massif, near Vrutok/Gostivar, is at 683m), the average annual rainfall is at 660mm and the total annual discharge is 4,5 million m³. Independently of the evaluation criterion {i.e. geographical extent, economical resource, environmental resource, supplier of drinking water, supplier of industrial water, supplier of agricultural water, supplier of energy, receiver of municipal sewage, receiver of industrial wastewater, fishing, recreation, tourism, history, social aspect, etc} the Vardar River could be considered as equivalent with the Republic of Macedonia, because its watershed is more of 80% of the state territory, and offers more than 75% of the country's water resources.

The water quality in Vardar/Axios is very low and it is not allowed to be used for drinking, swimming and even for irrigation purposes. However, since

Vardar river is used for irrigation purposes, both in Macedonia and in Greece, it is necessary to monitor and control the river instream quality, because it may have direct or indirect impacts to humans' food and health. The groundwater resources along the Vardar/Axios river aquifer are used for drinking purposes, usually in summer periods when there is a lack of water. Thus, it is considered important to implement a monitoring and Supervisory Control and Data Acquisition (SCADA) system for reliable remote control of the water quality along the river and in its aquifer, because it will increase the people security sentiment and will allow the testing of different rehabilitation solutions. Since Vardar/Axios delta near Thessaloniki, is very sensitive and protected by the Ramsar Convention, the implementation of a SCADA system along the river will indirectly contribute to the amelioration of the water cleanness along Vardar/Axios river and eventually of its delta, by revealing with data the main polluters of the river and by defining the environmental importance of new required investments for environment protection infrastructure.

Different kinds of water quality monitoring activities throughout the whole Vardar/Axios watershed will be proposed in this paper: (i) Real-time monitoring and control on a continuous basis at fixed locations, (ii) Real-time monitoring and control on an as-needed basis or to answer specific questions at selected locations; (iii) On a temporary or seasonal basis (such as during the summer drought period); (iv) On an emergency basis (such as after a flood or spill). The SCADA system proposed in the paper will provide the necessary control, system monitoring and data collection activities. The uniqueness of a SCADA system relative to other process control systems is SCADA ability to monitor and control remote processes.

APPLICATION OF INFORMATION TECHNOLOGY IN SUPPORT OF LONG IRRIGATION CANAL OPERATION AND MANAGEMENT

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At present Bulgarian irrigation systems consist mainly of open canals under manual control. The hydraulic behavior of the open canals network is not always easy foreseeable , especially in case of changing outflow discharge for a short period in several demand points. Precise daily water distribution is difficult of attainment and the canals suffer substantial water losses. To manage the canal properly, the person who is in charge of canal operation needs information about the canal response to varying water demands.

The purpose of the simulation model of irrigation canal presented in this paper is to be applied as decision support tool that assists the canal manager to attain better management. Flow simulation is performed with consideration of hydraulic conditions along the entire canal solving numerically the complete Saint Venan equations and the model is capable of providing information on hydraulic behaviour of irrigation canal under different operating conditions. An assessment of applied operational procedure can be accomplished on the basis of the precise hydraulic analysis results. Additional post data-processing procedures linked to the flow simulation model facilitate decision-making process of the canal managers. Application of canal simulation model helps them to determine measures of increasing water use efficiency as in phase of planning as well as in real time canal managing .

APPLICATION OF WHEATSTONE BRIDGE CIRCUIT IN WATER LEVEL MEASUREMENT SYSTEM

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A conceptual model of simple water level meter, based on the tide gauge's principle of the stilling well float gauge's type, has been designed by applying a Wheatstone Bridge (WB) circuit as a measuring part of it. By using this model it can be predicted that its sensitivity depends on the accurateness of variable resistor of WB as well as other resistors. Moreover the change of water level, which will be measured directly, can also be interpreted directly through the change of electric current reading at galvanometer of WB. Implementation of this model will then improve the ability of water level monitoring system in various observation fields.

ON DATA PROCESSING IN THE METEOROLOGICAL DATABASE OF THE BULGARIAN

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The Meteorological database MeteoDB of the National Institute of Meteorology and Hydrology is developed under management of RDBMS MS SQL Server 7.0 in the environment of Windows. Current meteorological information and historical data entering is carried out using special programs

with ASCII output for direct import into the corresponding basic database tables. The different codes used to enter data into computer-compatible form are imported into code tables. Meta tables contain detailed information about the stations from the national hydrometeorological network on the territory of the country.

Data processing for different purposes is executed by stored procedures written in Transact-SQL by specialists from the Meteorological Database Management Division. Thus the user stored procedures are very important part of the database giving possibility to perform the main activities in MeteoDB (standard meteorological data processing, data quality control, specialized customer requests, applications).

Some priorities of using stored procedures are pointed out, as follows: the modern language SQL, which is used with small differences for data manipulation in all relational databases, is comparatively easy to be learned and besides, it has new additional possibilities such as cycles, conditions, etc.); the source of a given stored procedure is always available in the database and it can be easily changed if necessary; missing data (particular dates, months and years) in the database is taken into consideration – it can not be done using built-in functions of SQL which ignore them; applications are developed by appropriate programming language in such a way that they use data from the database through execution of corresponding stored procedures – in many cases it is enough to change only the procedure but not the application that is very convenient .

The results from standard meteorological data processing (monthly and annual conclusions for different meteorological elements), as well as from execution of applications (presentation of meteorological parameters on the map of Bulgaria) are presented.

MONITORING AND ALARMING IN REAL TIME ON THE EXAMPLE OF PSI ECONTROL

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The German country of Saxony has released the system PSI econtrol in the country's flood control centre (Landeshochwasserzentrum). Rivers in Saxony are monitored in real time, prognoses about the development of water levels are made with the help of weather forecasts of the German Weather Service (Deutscher Wetterdienst). In the case of a threatening or real happening flood a big number of authorities responsible for civil protection are alarmed.

Building up such an information system requires a communication infrastructure that goes far beyond the realization of such a system in information technology. The question "Who is going to be informed when and via which communication channel from whom" is not only highly political and so very difficult to answer. Also the realization with IT has its limits in the case of a real catastrophe.

How tight such real time systems are integrated in the every day reality is shown by examples of different communication infrastructures in different regions in Germany . In the case of threatening floods the time between alarming and the really rising flood is decisive:

- How much time remains for additional flood securing measures?
- How long is the information chain between the first recognising a threatening flood and the last affected persons, the citizens?

Environmental monitoring systems with real time character are becoming a more important factor in times of worldwide changing meteorological conditions. The last floods in 1995 in south Germany , Bavaria , showed that time is a decisive factor for civil protection. Time for alarming can be shortened a lot by real time systems, yet they have to be embedded in a working communication infrastructure with clear responsibilities, short information ways, away from thinking like "We ever did it another way".

**ORGANISING INFORMATION SYSTEM FOR GLOBAL MONITORING -
EVERYTHING RELATED TO ENVIRONMENT TOGETHER ON ONE
SERVER AS ONE EVERYDAY ACTIVITY**

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The first presentation of the stage of information system for global environmental monitoring (multi-scale, multi-language, multi-purpose) was two years ago in a frame of the same event (Balwois 2004 - Ohrid). The main conceptual model of starting idea has not changed since than. The existing conceptual model is: small team, small hardware, open source if possible, adding or breaking the monitored element in a shortest period of time, non-commercial base for the main part of the products. The main privilege of this is almost everyday work of the information system since September 2005 (<http://emLab2005.blogspot.com>)

Normally, it is not possible to organise such large and complex chain of procedures on one PC. The further development of this information system will be extended in two different ways:

- The first one is with additional PC (on Win XP Pro. Or Linux operating system) in a way to provide 3D- animated content of observed and calculated situations with intention to attract and keep the attention of as much as possible targeted group.
- The second one is with additional laptop installation (enable to perform the biggest part of daily tasks) and changeable extern HDD, to keep thing as mobile as possible, and close to the administrator (the start of work is still not automated)

The documentation of such large number of applications, which are called during the work (more than 50) from the main application, should be made as a step of reliability. More than 600 files (with large scale of formats and content) are archived every day. Five small, separated databases are updated every day. More than 200 files per day are stored as a temporary data (only the last five days are on the server).

Next activities should be: a monthly thematic CDs with mainly graphical and multimedia products, providing printed media with solid and useful information about the changes in our global and near environment and many new ideas.

CADASTRE OF TORRENTS INFORMATION SYSTEM

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The Cadastre of Torrents and antierosion measures is one of the modules of the Water Resources Management Information System of the Republic of Serbia . It is designed for data collection relating to erosion, erosive processes and complex anti-erosion protection. Collected data should be used in the process of integrated water resources planning and management, specially as decision support tool.

Since woods cover a great part of torrential flows catchment areas, the application of an antierosion forest management is very important and it is provided for using the Cadastre and the GIS technology.

Roads and railways connect settlements . This traffic corridors pas over many torrents. Good Cadastre of Torrents contain information's which can help as decision support during design of traffic corridor and its protection.

THE USE OF INTERNET AND WEB TECHNOLOGIES APPLIED TO THE BALWOIS INFORMATION SYSTEM

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The main activities of BALWOIS network are :

(I) the implementation - at the Balkans scale - of a Water Observation and Information System for Decision Support which collects and combines various data and information on the water cycle, on the water resources, on their natural environment and on their uses,

(II) the organisation of conferences, workshops , scientific visits and training courses :

for promoting a regional and multidisciplinary approach (Hydrology, Climatology, Hydrobiology, Ecohydrology, Socio-economy, etc.)

for encouraging scientific exchanges between researchers from Balkan institutions and

for offering them opportunities to improve their networking at global level and more specifically to collaborate with European institutions, and

(III) the dissemination of suitable, reliable and comprehensive knowledge products to end-users by using the newest information and communication technologies (dynamic and cooperative websites, regional database, etc.).

The BALWOIS information system displays in free access on its web site www.balwois.net more than 1500 references (papers from Balwois conferences, reports, maps, multimedia, websites links, etc.) and many data series on Balkan rivers and lakes stored and managed in a regional Hydrometeorological database. All these documents and data are managed in a MySQL Data Base Management System. (UNIX environment) The language linking the database and the Internet application is PHP.

The BALWOIS Website is a dynamic website :

The Front office is the part of the system which is seen on Internet by the users of the website. Two main menus allow the user to access to the information.

The Back Office is the part of the system that allows the Administrator and the partners who have rights to manage the information on the Website. Web interfaces have been developed and implemented to give the possibility to the "Administrator" and some "Supervisors" to modify HTML pages and to upload

the information stored in the information system from any computer located in any place.

EFFECTS OF PIXEL SIZE VARIATION ON ACCURACY OF DIGITAL ELEVATION MODEL (DEM)

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Digital elevation models (DEM) have wide applications in various fields such as hydrology and natural resources. Some hydrologic, ecologic and geomorphologic models, rely on the DEM as their main input. Slope, aspect, flow direction, flow length and flow accumulation are DEM derivatives whose accuracy are dependent on the DEM. Many factors affect the DEM and its accuracy, pixel size is one of the most important factors.

In this paper, effect of pixel size on DEM accuracy was investigated. First, contour lines on 1:50000 topographic map were digitized. The selected Catchment that covered various topographic conditions, i.e., selected is including mountain, hill and plain. DEM with pixel sizes 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 meter was derived by interpolating contour lines. DEMs was also classified into several classes (e.g. 1100-1200m , 1200-1300m ...) and the And the area of each class was determined by the GIS. On the other hand, the original digitized contour map was polygonized and rasterized in such a way that the area falling within elevation classes (e.g. 1100-1200m, ...) could be computed. The area of elevation classes from DEM (A-DEM) and from the polygonized contour map (A-Poly) were compared for different pixel sizes. The results showed that the difference between A-DEM and A-poly increased catchment average of 3.5% to 17% as the pixel size increased from 10 to 100 meters. The locations causing highest error is mainly around rivers.

CURRENT LEVEL OF SURFACE AND GROUND WATER OBSERVATION NETWORK OF TURKEY

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Turkey has a surface area of 779 452 km² and. The Asian part; Anatolia is a plateau rising progressively towards the east. Turkey has a variety of climates, changing from the temperate climate of the Black Sea region, to the continental climate of the interior, then to the Mediterranean climate of the Aegean and Coastal Mediterranean regions. Annual rainfall in Turkey varies between 220 mm to 2500 mm with an average of 642.6 mm and this corresponds to an average annual rainfall of 501 mm . Turkey is divided into 26 river drainage basins to study the water and land resources as extensively as possible.

With the purpose of optimum use of available surface, subsurface and ground water resources of Turkey , for the purposes of domestic use, irrigation, and hydropower production and minimizing the flood effects, Turkey had to set up a hydro-meteorological observation network to follow up the spatial and time variations of precipitation and surface and groundwater flow.

The hydrometric observations in Turkey was started by a staff gage in 1935. General Directorates of Turkish State Hydraulics Works (DSI) and Electrical Power Resources Survey and Development Administration (EIE) are main organizations responsible of hydrometric network, and State Meteorological Organization (DMI) is the sole responsible for the meteorological network and weather forecasting of Turkey . Some more state organizations and university research laboratories also make hydro-meteorological observations but they are local and continue for a limited period of time and after completion of the work the results are transferred to these main organizations.

According to 2002 figures, DSI operates 1210 hydrometric stations, equipped with 815 water stage recorders, 219 current meters, 108 sediment samplers. At the beginning of 2003, DSI and EIEI together had 1475 hydrometric stations in operation and this corresponds to 1 station per 528 Km². DSI set up 2120 water quality observation stations till 2002, and at present 1140 of the are in operation.

Meteorological observations are made by DMI and DSI. According to 2002 figures, DMI set up and operates 396 meteorological stations, located mainly at urban areas and mainly for climatic information. Starting from 1956, at present DSI operates 363 stations located mainly at upper reaches of the watershed of reservoirs. Out of this total, 92 is for precipitation measurement, 271 for the measurements of both precipitation and evaporation from free water surface. DSI meteorological stations are equipped with, 244 pluviographs of different types and models, 256 Class-A type evaporation pans, and 36 Mount Rose type snow samplers.

DSI also operates 280 ground water observation wells equipped with special ground water level recorder, with monthly visits, and about 20000 ground water production wells, with biannual observation program.

In this paper, a detailed survey of current situation of Turkish hydro-meteorological network is presented.

SYSTEM FOR WATER FLOW MEASUREMENT, MONITORING, MANAGEMENT AND REMOTE TRANSFER THE INFORMATION OF THE DEBRESTE STATION AS A PART OF THE REGIONAL WATER SUPPLY SYSTEM "STUDENCICA"

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Debreste is one of the stations, where The Regional water supply system "Studencica" is separated on two parts:

- a part to Prilep and
- a part to Krusevo.

The Public water supply Company "Studencica" has purpose to build a Main system for remote monitoring, measurement and management of The Regional system. In order that, The Public Company plans to place local stations on all parts, where The Regional system is separated and it ' s necessary to measure the relevant values. The local stations will be equal in the placement between them and connected with the Main system, which will be placed in the Dispatching centre in Drugovo station.

The Public Company has begun to place a local station in Debreste and its tasks are as follows:

- The relevant values measurement: water flow, pressure, electrical conductivity, PH values, temperature;
- To manage the local electric drive valves and attending their positions;

- Alarms for possible non regular situations about the process and the equipment;
- Possibility for automatic drive, basically on a remote adapted parameters and adequate software;
- Data for manual and automatically activities;
- To registration and memory the information;
- Graphical interface with user-operator at a local level and using a touch screen monitor;
- Possibility for compulsory manual drive the local valves in non regular situations or damages;
- Wireless radio-modem communication with the Dispatching centre in order to sending information about the measured values, the alarms and the status of the equipment and also receiving information about adapting the parameters and management;

Opportunity for modem communication with the interested subjects, such as Communal companies in the region, for example: sending information about the current and cumulative water flow, the current trend of the water flow increasing or decreasing;

Video monitoring of equipment.

The Public Company tends to finish this local station in several phases. The first phase, which is finished, provided the water flow measurement on the entrance of the Debrešte station and on the part to Prilep, video monitoring of the equipment and transfer the data by modem communication to the Dispatching centre in Drugovo and the Management in Skopje.

PROBLEMS WITH CONSISTENCY OF HYDROLOGICAL DATA SERIES CAUSED BY DIFFERENT TIME DISCRETIZATION USED IN THEIR PRIMARY ANALYSIS

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One of conditions for multi-annual series of hydrological data to be statistically analyzed is that they are homogenous, which is often not the case. Causes of non-homogeneity are generally attributed to man induced changes in water regime, and too short time series available for analysis. However, it is often neglected that inconsistency of hydrological data series arises from different primary analyses of observed data. Increased discretization of hydrological data results in growing precision in describing actual nature of observed hydrological phenomena. Negative side effect is that consistency of earlier

collected data series is disturbed. Large quantities of hydrological data are exchanged, often on large distances, and within greater regional areas. Thus, they often reach users (hydrological series analysts) which are not aware of changes in nature of primary analyses of the obtained hydrological data, and therefore do not respect them. Consequently, the available series are processed and interpreted as a whole.

The present paper reports on comparison of results obtained by different primary analyses of hydrological data, and experience with and directions for work with HIS 2000 hydrological database of the Hydrological and Meteorological Service of the Republic of Croatia. Examples of recording stations on torrential and stationary streams were used for comparative analysis of mean daily discharges obtained from mean daily water levels (standard practice until 2001) and those obtained from digitized hourly water level readouts (since 2001). The obtained different time series of actually identical hydrological data were used for additional hydrological analyses of water balances and probability of their occurrence. HIS 2000 database was created in the way to enable building of consistent hydrological data series, and to allow its users to check which time data series are digitized, and select method of their primary analysis. The paper highlights need for international exchange of hydrological data series to ensure and respect information on character of primary hydrological analyses.

INTERNET ORIENTED TOOLS FOR FLOOD FREQUENCY STUDY ON SERBIAN RIVERS

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Extreme events (flood and drought) are still one of the main hydrological topics. Results of flood frequencies study are widely used for flood protection system analyses, flood structures design, flood area maps derivation and flood risk maps production. Even the evidences of global changes do not diminish the significance of statistical approach in Hydrology. On the contrary, statistical methods are applied for judging the significance of changes and for introducing the uncertainty concept in flood mitigation and management studies.

From the theoretical point of view (and available literature and programs) flood frequency techniques are very well known. In practice water authorities and government institutions have a problem to make objective judgments of

design flood frequency obtained in same specific project and at the catchments scale. Problems (mainly) arise for three reasons: (i) application of different data lengths (maximum flood observation periods) (ii) application of different probability functions for different flood measurement points at the same catchment (iii) absence of systematic and complete point and regional flood frequency study for all territory (hydrological homogeneity regions). In some cases important steps from the complete statistical procedure are missing too or so called "experts opinion" (subjective judgments) is accepted instead of objective (unique) control rules.

As a consequence at the catchments scale desired flood protection level is not obtained. In some river reaches protection level is higher than necessary (and cost more than necessary). In some reaches protecting level is lower and flood risk is higher than acceptable. Additional problems present: (i) judgment of protection level for the existing part of flood protection system (built in different periods of time i.e. using different data periods and/or different frequency distributions) and (ii) how to introduce influence of global and local changes (not only global climatic changes but special influences of land use changes and urbanization development) i.e. dynamic control of flood protection level state.

The most of cited problems can be overcome if: (i) so called "standard period" exists, (ii) unique flood frequency distribution is adopted and applied, and (iii) point and regional flood frequency analyses are realized by the reference institution.

Internet oriented tools for flood frequency study presented in this paper describe how we suggest to solve cited problems for the territory of Serbia. Data from all 170 hydrological gauging stations (Serbian national network profiles) are processed and included.

Using consistent and complete methodological approach different versions are developed for water authorities, hydrological office and end users. Internet oriented tools are realized at the environment of mapping tools developed before and improved during the realization of MED-HYCOS project (WMO and WB, 1996-2001). Additional methodology is introduced for the recursion maximal flood frequency estimation which obtain tool for global changes and influence of river training influences study. Some examples for tools applications and suggestions for future development are included too. Presented results are part of some previous research project realized by the Faculty of Civil Engineering University of Belgrade as well as from the current project » Hydrological Bases of Water Resources Development and International Cooperation« which is a part of National Water Program Republic of Serbia (2003-2007) and in which coauthors closely cooperated.

STRUCTURE OF DAILY HYDROLOGIC SERIES IN SERBIA AND NORTHERN MEDITERRANEAN

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Classical domains of stochastic analyses of hydrological series are predictions and forecasting. For that purpose two approaches are developed: (i) TIPS (Tendency-Intermittency-Periodicity-Stochasticity) method introduced by V. Yevjevich and (ii) Box & Jenkins approach. There are many differences but a lot of similarity in the two approaches. First approach is based on assumption that time series consist of deterministic and stochastic (random) components which can be detected from the observed data. Second approach is based on assumption that time series are stationary. Main domain of TIPS approach applications are long-term predictions and main domain of Box&Jenkins approach application are short-time forecasting. Instead of fundamental assumptions differences, the way of model derivations are also different: (i) TIPS approach is based on time series decomposition and separate derivation of mathematical model for each (deterministic or stochastic) component and (ii) Box&Jenkins approach is based on a priori model type acceptance and model order derivation according to the time series stochastic properties study (properties of auto and cross correlation functions). In practice, when deterministic components are extracted (by applying TIPS method) further analyses are equivalent to the Box&Jenkins method application. Both method applications need sophisticated software: (i) at the TIPS approach detection of some deterministic components (periodicity) need transformation from time to frequency domain, and (ii) at the Box&Jenkins approach derivation of model order need application of optimal estimators and for the forecasting purposes recursive algorithm application.

For both model practical applications are restricted by the properties of hydrometeorological series; (i) hydrological series are not stationary and application of Box&Jenkins approach needs first original data transformation (ii) usually explained variances by the deterministic components in TIPS approach are very low (stochastic characteristics are dominant). Instead of objective restrictions, both methods are widely applied for the predictions and forecasting of yearly and monthly time-step hydrometeorological series. Usual, obtained results are not satisfactory for a long term forecasting purposes.

In the available literature only one reference of TIPS method application on daily time-step hydrometeorological (rainfall and runoff time series) can be found (Yevjevich V., 1984, Structure of Daily Hydrologic Series, Water Resources Publications, Fort Collins, Colorado, U.S.A.). In this paper TIPS

method is applied not as a model for prediction or forecasting model but as a stochastic model of daily time series statistical functions derivation (mean, standard deviation, skewness coefficient and kurtosis) during the hydrological year. Based on these functions three new applications are introduced: (i) hydrological regime studies, (ii) early (and continual) detection of catchment state behaviour (flood potential and/or drought condition), and (iii) statistically based time-varying threshold derivation (for the purpose of floods and droughts duration, volumes and intensity studies). Methods are demonstrated to the daily runoff data sets from 21 catchment (5 from the MED-HYCOS data base and 16 from national data-base of Serbia). MED-HYCOS data are from the rivers in Spain, France, Italy, Slovenia and Montenegro. Gauging profiles from Serbia are representative (concerning locations and catchments area). Researchs are part of Serbian National Water Program Project: » Hydrological Bases of Water Resources Development and International Cooperation«.

DEVELOPMENT OF DROUGHT MONITORING SYSTEM FOR SERBIA

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Number of registered natural disasters, human victims and following economic loses at the second part of XX century are dramatically increased. The newest data published by UN World Water Development Report (UNESCO, 2005) for the last decade of XX Century shown: (a) Number of people affected by natural disasters increased for 70 % (b) Economic losses from natural disasters increased for 43% (c) Near 90% of all natural disasters were water-related (d) Since 1996 the number of hydrometeoro-logical disasters (floods and droughts) has more than doubled (e) Droughts participated by 11% of registered disasters but they caused 42% of all deaths from all natural disasters (f) None part of the World is protected from natural disasters.

The literature available on hydrological drought is limited; in particular material that deals with quantitative methods for drought analyses and mitigation. At the beginning of XXI century only USA has drought monitoring system. In Europe solid scientific bases for future drought monitoring system development presents results obtained through regional projects as FRIEND, ARIDE, MED-HYCOS etc. Droughts, for which the onset is slow are also associated with significant human and socio-economic losses. Droughts are induced by natural climate variability and their propagation through hydrological cycle. Meteorological droughts cause first agricultural than

hydrological droughts. Socio-economic droughts consequences are highly connected with water and land use practice and water competition indices for specific region.

As a components of hydrological cycle, different drought types are highly connected but with different speed (dynamic) for separate process. So, drought monitoring system must include all types of droughts and specific characteristics for some regions. Future droughts monitoring system for Serbia is based on that principle. Project is part of National Water Program for Serbia and it can be realized at the period 2004-2007. This paper presents first-stage of obtained results including literature and drought indices review, representative data base formation (meteorological, surface water and ground-water stations network selection), referent period adaptation and preliminary analyses of different methodologies for hydrological drought analyses. At the selected representative profiles inter-comparison of different constant and variable threshold methods for hydrological drought derivation are made. New techniques, based on TIPS approach and deciles plus MA-method, are introduced for daily variable threshold derivation and (instead of daily total runoff) method which includes daily base flows is introduced too.

Severe droughts have regional character. According to that: (a) meteorological drought must be analyzed in the climatically homogeneous regions and (b) hydrological droughts must be analyzed at the catchments scale. In the Balkan area different micro-climatic regions are detected, as well as different hydrological regimes and many trans-boundary catchments and ground-water bodies. So, for the efficient drought monitoring system development data exchanges and regional cooperation are obligatory. The purpose of this paper is to exchange tools and experience and to stimulate colleagues from neighboring countries to participate in regional drought monitoring system development and global drought mitigation techniques development.

RIVER'S WATER QUALITY MONITORING IN ALBANIA

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Albania is a country that is naturally rich in water. High precipitation causes high runoff rates. Two of the country's main rivers, Drini and Vjosa, have their sources outside the national territory. It is clear that the assessment of water availability for future projects requires the use of criteria for water quality as well as water quantity.

The Hydrometeorological Institute of Tirana is in charge of monitoring the quality of surface water in Albania . Starting about 1967, the HMI launched a

systematic water's sampling programme. Up to 1984, the analyses intended to determine only the physic-chemical properties of the samples. The monitoring network included 47 stations. In each station, 20 to 130 have been taken and analyzed. Afterwards, it appeared necessary to change the type of analysis to be performed to assess the pollution levels. The results obtained after 1994 and 1995 confirm a clear improvement of quality of river water following the slowdown of industrial activities.

Now the HMI is planning the new monitoring network, based on a family of curves leading from catchment area , average river slope and ratio of maximum discharge to minimum one, to minimum number of monitoring stations in the catchment and the minimum number of samples to be taken each year.

PROBABILITY THEORY USED IN HYDROLOGY (SITNICA RIVER SHED)

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The use of probability theory and mathematical statistics in hydrology has begone very late. Nevertheless, lately, the statistical methods in hydrology engineering and in economy aspects as well, has found to be of vital importance, by sucseessfully solving many problems considering the hydrological laws and the quantity evaluation of the many characteristics of different hydrological regimes.

The use of the statistical methods should not be used formaly, because it can lead to wrong conclusions, which would lead to bad dimensioning of the hydrotechnical objects.

The solving of many hydrological problems with statistical methods, is made possible with the aid of computational calculations.

Considering the facts mentioned above, we have made on simple program, in excel, for achieving probabillistical results for different time frequencies, using the logatithmic functions taken by four different authors.

This program has been used for analysing the river bed and bed load transport of the Sitnica river shed, in the teritorry of Kosova.

**THE DEVELOPMENT OF A DATA BASE FOR THE LITTORAL LAKES IN
NORTHERN GREECE AIMING TO THEIR RATIONAL AND
ENVIRONMENTAL FRIENDLY FISHERY MANAGEMENT**

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This paper describes the development and use of a database for the effective exploitation of coastal fresh water resources. The case study refers to the registration of various information concerning littoral lakes located in Northern Greece, which are sensitive wetlands, currently under a special national and international protection status.

Data were collected from scientific references, relative studies and recent research programs and stored in a relational database that was especially developed for that purpose. There are descriptive, qualitative and quantitative information of the lagoons such as the physical and chemical characteristics of their water, the flora and fauna, the avifauna and fish fauna, the fishery production, human interventions, land uses, protection level, characteristics and also information on the active management plan and measures for the protection, rehabilitation and sustainable development of ecosystems.

The total organization, storage and retrieve of information take place through a Data Base Management System (D.B.M.S.) by multiple forms that support the control of information flow within the Database. The structured registration of all available information in a data management process through a user-friendly GUI, enables the identification of social, productive, economic and biological values of littoral lakes areas from any user, computer literate or not, based on local characteristics and aiming in their sustainable exploitation..

This information system constitutes a useful implement for the authorities concerning management, protection and research for coastal areas since it speeds the dissemination of valid information about ecosystems and enhances public access to it. The system will be also able to supply the necessary data for relative environmental studies and also for Environmental Education projects. It would also contribute in the research field as a reference in studies for littoral lake ecosystems, for local comparative studies and littoral water resource management projects in general.

**APPLICATION OF MODSIM SOFTWARE TO THE OPERATION OF A
REAL BULGARIAN WATER RESOURCES SYSTEM**

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Advanced computer softwares are commonly used to simulate reservoir system's performance. MODSIM (MODified SIMyld), developed by Dr. J.Labadie (Colorado State University) is originally an extension of the SIMYLD network simulation model (Texas Water Development Board). MODSIM is a simulation model based on network programming designed. This is water rights planning model capable of assessing past, present and future water management policies of WRS / river basins. The physical river system is represented as a series of nodes (i.e., reservoir, demand, inflow locations, stream gage location) and links (i.e.,canals, tunnels, stream reaches). A MODSIM network of nodes and links is created through a graphical user interface (GUI). There is a capability to load a network including its data spreadsheet into the interface.

The paper proposes an application of MODSIM software to simulation of Water Resources System (WRS) "Iskar" in Bulgaria . This is multi-reservoir complex WRS (with seasonal and long-term regulation) and is used for water supply, irrigation, power production. Experiments with the software was implemented with the data for monthly time step.

**STUDY OF A COMBINATION BETWEEN AN HYDROLOGIC MODEL AND
A GIS - APPLICATION TO THE WATERSHED OF MACTA (WESTERN
ALGERIAN)**

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In the field of the water resources, the decisions are frequently maked on a large watershed (several hundreds of km²). To decide it is necessary to know, but to know it is initially necessary to understand the relations between the various factors (of various aspects: water, ground, employment of the ground, etc.) at the watershed level.

By the techniques of modeling, it is possible to make progress in the fields of the representation and functioning that determine the interactions between these various factors. Models exist and provide many elements of

comprehension of these factors and their interrelationship. In a first place, it is necessary to understand them, and then implement them on real cases.

The geographic information systems GIS, powerful by the spatial analysis, prove their capacity as tools not to be exceeded in the field of the territory management in all its branches. They can be used to manage the spatial data and to automate and facilitate the preparation of the input data files (data bases).

The integration of hydrological model in a GIS allows, undoubtedly, a spatialization, a quantification of process and a proposition of scenarios.

An application is achieved on a large watershed (Macta, western Algeria) using an hydrologic model (SWAT), already validated, and a software GIS (ArcView).

SOME TOOLS FOR ANALYSIS AND DECISION MAKING IN CASE OF INTEGRATED WATER RESOURCES MANAGEMENT

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The integrated river basin management is closely interconnected with the sustainable water resources development and requires joint consideration of water resources and uses in the watershed. Some theoretical treatments of the integrated management are considered such as creation of conceptual framework, definition of problems and their ranking by order of significance, marking alternative water resources management plans, ecosystem approach application.

The present report is an extension of the developed by the authors ecosystem approach based on the relationship between the water resource system and environment. The adequate mathematical representation of ecological and social objectives requires the use of nontraditional for the water resource investigations methods and tools such as matrices, diagrams, expert judgment, multiobjective optimization. Programs for expert judgment of qualitative criteria through the use of check lists for the different stages of planning and operating processes as well as tools for environmental assessment and decision making are proposed. Some experiments are carried out and the obtained results are shown.

USE OF GIS AND GPS FOR MAPPING AND ANALYSES OF SOME HYDROLOGICAL FACTORS

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The purpose of this paper is to show the capability of GIS (Geographic Information Systems) in the interpretation of complex geographical information, especially when multiple features are combined on the same map, as well as the possibility of using this technology in conjunction with GPS (Global Positioning System). Several features has been mapped, some from existing maps, some with the use of GPS surveying on the field.

The subject of this research is the park-forest "Gazi-Baba" (A = 110 ha), located in the capital of Macedonia, Skopje.

Six cadastral plans have been scanned, digitized and geo-referenced. Several features regarding the land use/cover like: forest borders, meadows, paths, urban objects in the forest and other have been surveyed with a GPS and mapped.

All features have been mapped onto a 2d and 3d model of the terrain. Further, this 3d model has been used to extrapolate the hydro net of the object and this model can be used for different terrain analyses related to runoff and erosion processes.

This paper intends to show that with the use of GIS and GPS it is possible to get a more comprehensible picture of complex geographical information in an urban forest area, as well as to have a possibility to easily update the existing data and in this way to have a continuous overview of multiple features.

WATER COOPERATION BETWEEN NORWAY AND BALKAN COUNTRIES IN THE FIELD OF OPERATIONAL HYDROLOGY

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Due to the warlike conditions in the West Balkan region during the 1990s there is a strong need for support to the national Hydrometeorological Institutes in their efforts to be active and important parts of society. The operational infrastructure for hydrological data acquisition and field measurement has in

many cases to be rebuilt. This demands financial investments and transfer of knowledge. Lack of new equipment and measurement techniques may thus prevent normal activity levels for many Hydrometeorological Institutes in the Balkan region. The Norwegian Water Resources and Energy Directorate (NVE) has therefore with financial support from the Norwegian Ministry of Foreign Affairs (NMFA) cooperated in several projects within operational hydrology in the region. Of special interest is the focus on field measurement techniques, quality management of hydrological data, and assessment of small hydropower potentials. The cooperation even includes advice on relevant legislative matters. The paper describes the content and the expected value of these bilateral projects, some of which are of regional character.

A LAND-WATER-ECONOMIC INFORMATION SYSTEM FOR WESTERN BALKAN AGRICULTURE

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Waterweb is a 6th Framework programme project examining water resource strategies and drought alleviation in Western Balkan agriculture. The project will provide strategies for managing water resources for the Western Balkans by combining modern technologies from a single plant water use through to a complete river basin, taking account of environmental, socio-economic and health implications of different types of land-water use. Water quantity, quality and crop water use have been monitored which, in combination with economic and institutional analysis will help to define optimum water-use under field conditions. A geographical information system (GIS) is under development which categorises three Western Balkan areas, two in Serbia and one in the Republic of Macedonia. The GIS is linked to a database containing multi-scale data on river and canal flow, evaporation, rainfall patterns, runoff, water availability and cost benefit analysis of different crops to form a prototype Land-Water-Economic Information System (LWEIS). The LWEIS will support greater understanding of local and regional water resources, sources of contaminated runoff, agricultural water use, and economic impacts of farmer uptake of changes in land and water use. Ultimately the LWEIS will help underpin decision making in the area in the future.

ORGANIZING GIS DATA FOR HYDROLOGICAL APPLICATIONS

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The information system provides fast and comfortable tools for querying and screening geodata and their attributes. Different hydrological problems and tasks are solved by applying scientific methods within the GIS.

Changes in the environment and the factors influencing those changes are frequently phenomena with differ between places and vary in direction of effect, i.e. demonstrate spatial characteristics. To assess the status of an environmental indicator or model potential changes to it those variations should be taken into account. Spatial analysis of environmental indicators requires ancillary data to be available as spatial data layers in a suitable form. The suitability of data is largely determined by its intended use and hence the degree to which it can be integrated with other data.

Suitability is often linked to the scale of the data or projection. Progresses in the area of integrating data from different regions to obtain a homogenous Balkan coverage are rather slow.

Specific Thematic Data Layers:

1. Digital Elevation Data

Elevation data is a fundamental base layer to a wide range of applications, like the delineation of catchments, soil erosion assessment or crop suitability evaluations. Sources of the data are variable; some are derived from satellite images, others from digitised topographic maps.

2. Drainage and River Data

For hydrological applications the identification of drainage direction in a river network is essential. The use of elevation data alone to derive a drainage data set cannot be recommended.

A more satisfactory approach to the identification of catchments is the integration of elevation data with data containing the actual flow of water. Such information can be derived from a river network data set.

3. Lakes and reservoirs

4. National boundaries

5. Hydrological stations

6. Watersheds

CONSTRUCTING BALKAN AREA OVERVIEW MAP

Detailed national data sets would be integrated in a BALKAN GIS and harmonized along national boundaries.

Constructing the overview map from national data sets requires several intensive processing steps:

Availability of national data sets in suitable common format.

Harmonization of data sets along international boundaries.

Integration of harmonized data in a single system.

Downscaling of data for presentation in overview map.

The boundaries of a trans-national river basin like STRUMA river and associated groundwater have to be co-ordinates between neighbouring basin authorities of different nations.

VISUALIZATION AND ANALYSIS OF HYDROLOGICAL CHARACTERISTICS

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Hydrological maps have special significance for all environmental tasks concerning water supply, waste water and water protection. These maps describe the main features of surface water system by means of individual thematic maps. The mapping procedures are driven by individual tasks and the specific hydrological conditions of any study area. Therefore, every mapping project produces different kinds of thematic maps. Harmonization of the mapping process and the documentation of its result is required for further hydrological mapping and for updating of existing maps.

Modern geographic information systems offer new opportunities for the collection, storage, analysis, and display of spatially distributed data.

ArcGIS® Geostatistical Analyst is an extension to the ArcGIS Desktop products (ArcView®, ArcEditor™, ArcInfo®) that provides a powerful suite of tools for spatial data exploration and surface generation using sophisticated statistical methods. ArcGIS Geostatistical Analyst allows creating a surface from data measurements occurring over an area where collecting information for every possible location would be impossible. ArcGIS Geostatistical Analyst effectively bridges the gap between geostatistics and geographic information system (GIS) analysis. ArcGIS Geostatistical Analyst with spatial data measurements gives the freedom to investigate, visualize, and create

surfaces for advanced spatial analysis. Each view is interconnected with all other views as well as with the ArcGIS ArcMap™ application. ArcGIS Geostatistical Analyst provides a variety of interpolation methods for the creation of an optimal interpolated surface from data. There are two main groupings of interpolation techniques: deterministic and geostatistical. Deterministic interpolation techniques are used for creating surfaces from measured points based on either the extent of similarity (e.g., inverse distance weighted) or the degree of smoothing (e.g., radial basis functions). Geostatistical interpolation techniques are based on statistics and are used for more advanced prediction surface modeling, which also includes error or uncertainty of predictions. In addition to maps of prediction uncertainties, ArcGIS Geostatistical Analyst provides validation and cross-validation tools that allow evaluation the model and predictions. Models can also be compared after the surface is created to choose the optimal model.

Demonstration of the above methods is made for the distribution of annual precipitation totals and temperature of the Struma river basin and the influence of climate changes. Struma river basin is very complex. There are several mountain ranges surrounding the basin and the visible Mediterranean climate influence. That is why the distribution of the annual precipitation amounts has so complex behaviour there. Comparison between representative parts of the basin and tendency is also made. Specific discharge from watersheds at a hydrological stations, min and max discharge are analyzed and visualized.

WATERMARK – A MODULAR IT ARCHITECTURE FOR INTEGRATED WATER MANAGEMENT

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WATERMARK is a multi-disciplinary research initiative at the Austrian Research Centers which aims at developing intelligent knowledge-based services and solutions in order to support the implementation of the EU Water Framework Directive (WFD). One of the basic requirements for realising the requested integrated water management approach is to develop advanced information and data management tools and applications. WATERMARK combines the research expertise of experts in water management, information technologies and environmental planning in order to develop innovative

methodologies for comprehensive information management in the field of water resources management.

The main objective of the WATERMARK project is to produce additional value out of the environmental data which will become available in the course of WFD implementation, e.g. by supporting the decision making process in companies and public authorities, providing impact and risk assessment tools and performing scenario analyses. In the course of the project a number of case studies of ground water management were defined, ranging from the transport and distribution of pollutants in groundwater bodies to the exploration and sustainable management of groundwater resources.

The project architecture defines a loosely coupled system of data stores, modelling components and information retrieval interfaces. A primary requirement for WATERMARK was to build a framework of reusable components that can easily be combined with standard OGC and ISO compliant clients and services.

In its basic implementation a WATERMARK application consists of a web based graphic user interface, a business logic component (currently implemented as a web application in Model View Controller architecture), a model access service, and a data access service.

The first realized business logic component is a decision support tool for tracing of ground water pollutants, originating from punctual events. Where sufficient data and models are available, questions are answered in real-time and provided on a web-interface or forwarded to experts for further processing. Other components in the course of realization will deal with the impact assessment of anthropogenic activities on the environment through selected criteria and indicators.

Future development of WATERMARK is directed towards full ORCHESTRA (Open Architecture and Spatial Data Infrastructure for Risk Management) architecture compliance, integration of additional ORCHESTRA services, real-time access to sensor networks, and implementing further environmental management modules.

ON GREEK LOANWORDS IN THE ENGLISH VOCABULARY OF HYDROLOGY (A LEXICOLOGICAL APPROACH)

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Owing to migration, ease of travel, mass communication, and similar factors (such as science or technique), words of foreign origin – and particularly English ones – abound in present-day Romanian speech and writing,

including the language of hydrology. These words are either totally assimilated, or they may retain traces of their foreign origin, or they remain semantically tied to the English context, or they are context-limited. Well understanding them can only ease communication in the field particularly if we take into account the fact that accessing the EU also asks for adaptation to EU standards in nomenclature.

GEOINFORMATIONAL SYSTEM IN PLUMBING AND SEWER SYSTEMS

Alihodzic Muzafer, Fejzic Dzemil, Vanja Pasic, Lena Bratic
CEEf, Center for energy efficiency, BOSNIA AND HERZEGOVINA

In professional part will be presented and explain ways, methods and experiences at establishment of GIS in bigger plumbing and sewer systems. After establishment of digital cadastre plans of plumbing and sewer network, address models and GIS database in general, will be presented GIS establishment on total client/sewer platform and connection with business and other informational systems. Through the work it is explaining implementations of Autodesk, ESR and Oracle company programs, in the part which includes digitalization, database organization, client/server organisation of GIS architecture based on Autodesk Map, Autodesk Map Guide and Oracle.

Through the work significant interest precedes methods of GIS implementation on basic processes of business activity of plumbing and sewer companies. Primarily are explained GIS implementation methods on finding matters, record keeping, account opening and malfunction and leaking repairs on plumbing network. Methods of connection with business systems are explained that matters water payment, water consumption system calculating by sectors and sub-sectors of water supplying, water consumption counted by streets and hydraulic knot models for hydraulic analysis and GIS implementation on active battle against water loss usually big in regional/Balkan countries at all.

At the end integral part of presentation is hydraulic analysis of plumbing network, explanations as part of complete GIS project.

RIVER MONITORING SYSTEM IN MACEDONIA – RIMSYS

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RIMSYS Project (River Monitoring System) in Macedonia, a bilateral project between governments of the Republic of Macedonia and Switzerland, is designed to revitalize the national river monitoring system in Macedonia. The main aims are to monitor water quantity and quality on main rivers in Macedonia.

RIMSYS Project existing several years and in this period are implement next important issues:

- Establish a network of 20 stations (part of national hydrological network);
- Implement on a HydroPro Hydrological DataBase;
- Reestablish on a Hydrological Book (after 16 years);
- Establish a Water Quality Laboratory;
- Establish on a basic center for receiving data from 7 automatic stations.

In the near future with the next phase of the RIMSYS Project, partners Hydrometeorological Service, Ministry of Environment and urban planning and ITECO Ingenieurunternehmung will continue with modernization on the River Monitoring System in Macedonia.

On the poster presentation will be present details of the RIMSYS working experience in the hydrological monitoring of the water in the Republic of Macedonia.



MINISTRY OF EDUCATION AND SCIENCE
 MINISTRY OF AGRICULTURE, FORESTS
 AND WATER ECONOMY
 HYDROMETEOROLOGICAL SERVICE
 HYDROBIOLOGICAL INSTITUTE - OHRID



MINISTRY OF ENVIRONMENT
 AND PHYSICAL PLANNING



FRENCH MINISTRY OF ECOLOGY
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