

DOCUMENT 4.6.

**NEED FOR DEVELOPING
AND STANDARDIZING AUTOMATIC SENSORS**

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01. When surveying the role of satellites in data collection, the planning report of WMO (*) makes clear distinction between two different types of the application of satellites :

- applying space methods to obtain a wide variety of information concerning the state of the atmosphere and the Earth's surface
- using the satellite to transmit data observed in situ to decision points rapidly from remote areas.

02. The effective utilization of observations by means of instruments installed in satellites is indisputable in hydrology. Not only the improvement of forecasting critical weather conditions (on the basis of satellite-data concerning the conditions of both the atmosphere and the surface of oceans) assist the operation of water management systems and the timely warning in connection with the development of extreme hydrological events, but there are also some hydrological parameters being observable by instruments installed in satellites (e.g. snow line, snow cover, ice cover, surface temperature, albedo, extension of inundation, soil type and cultivation, moisture content near the surface).

03. Analysing the list of the various hydrological parameters, their required accuracy and the possibility of the application of satellite technic (which is given in Table iii of Annex ii in the WMO report referred to already), it can be stated, that most of the important hydrological data should be observed in the field, and satellites can be used only to collect and disseminate them. Before investigating the problems of data-transmission via satellites, an important distinction should be made between the various hydrological data :

- the first group is composed of parameters being directly and continuously observable ; and
- the characteristics calculated from other directly observed data (e.g. flow rate from recorded water level) or determined by analysing samples taken from the water are belonging to the second group.

04. It is necessary to emphasize, that reasonable automation and telemetering can be solved only to collect hydrological data of the first type. Although there are water-quality monitoring systems in which the sampling and analysis is also automatized and the results are transmitted in the form of electrical signals, but the slow process of the analysis (e.g. in the case of KOD) sometimes hinders the achievement of the original purpose : i.e. to get immediate information on the condition of the hydrological system. There is also a general attempt in the development of the networks of hydrological observations to deduce all the parameters required in the practice from directly measurable parameters and to characterize the whole water regime by using the continuous records of observations and the models which provide the necessary characteristics as the functions of the recorded data (the best example of this method is the rating curve to determine flow rate, but a project is executed now in Hungary, the purpose of which is to prepare similar models for the characterization of chemical transport on the basis of data recorded continuously and to use

(*) JOHNSON D.S. and VETLOV J.P. : The Role of Satellites in WMO Programmes in the 1980s. WWW Planning Report No. 36. Geneva, WMO-No. 494.

sampling only for checking the validity of the models). The final consequence of this explanation is to concentrate the efforts of satellite teletransmission of directly and continuously observable hydrological data.

05. Central Europe is densely populated. The extension of the countries situated here is generally small. Remote areas can hardly be found. The telemetering problems in the national networks can be solved, therefore, by using the conventional methods (by constructing transmission lines or wireless connections between the sensors and the data collecting centres). Our interest being common with the establishment of satellite teletrans is generally small. Remote areas can hardly be found. The telemetering problems in the national networks can be solved, therefore, by using the conventional methods (by constructing transmission lines or wireless connections between the sensors and the data collecting centres). Our interest being common with the establishment of satellite teletransmission lies in the development and standardization of automatic sensors.

06. According to our investigations, the automatically and continuously measurable parameters - the observation of which can be directly transformed into electrical signals suitable for telemetering - are as follows :

- water level data (gauging data of rivers, lakes and reservoirs ; position of the water table or piezometric level of groundwaters ; observation of evaporation pans ; some types of rain gauges ; pressure values when they are indicated by equivalent water column e.g. in the case of snow pillows, etc.) ;
- pressure data observed directly (either by recording the position of manometers or using devices transforming the change in pressure into electrical signals e.g. crystals or strain gauges ; the most frequent fields of the application of such observations is the tensiometers, and the determination of pressures in closed conduits and wells) ;
- temperature data (including the determination of air, water and soil temperature ;
- water quality data (there are some parameters which can be recorded directly and which can be used to calculate other characteristics of chemical and solid transport e.g. electric conductivity which can be related to total salt content dissolved in the water, transparency being proportional to the suspended load ; pH, etc.) ;
- moisture content of soils (among the various devices the neutron probe is the most suitable method to measure moisture content but its automation is difficult ; applying the method based on electric resistivity, the automation can be solved easily but its reliability is not sufficient ; a newly developed method measuring dielectric constant is suitable for telemetering and its accuracy seems to be acceptable at the same time).

07. One of the greatest assistance would be for the hydrological practice in connection with the development of automated observation and telemetering (either via satellites or by using conventional connections) to collect and evaluate all the various sensors constructed for the continuous recording of the parameters listed, to check their accuracy and reliability and finally to prepare recommendations concerning the standardization of these devices.

