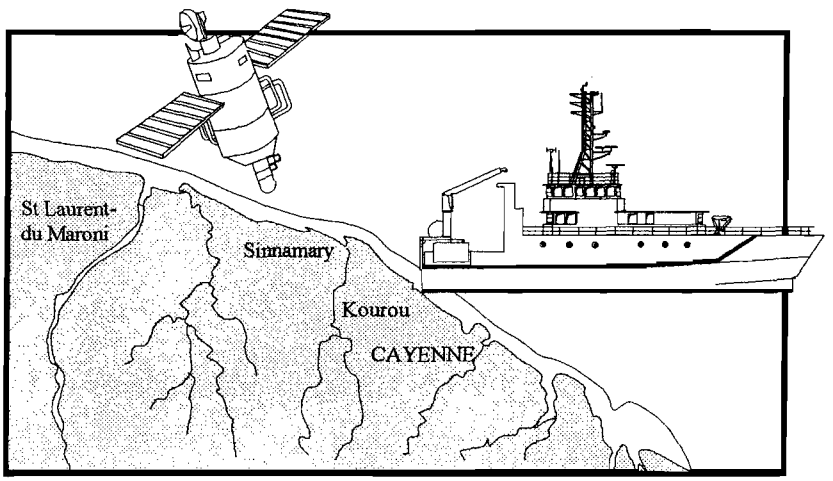
The National Coastal Environment Programme

French Guiana Worksite

Consequences of transport of Amazon discharge along the coastal ecosystems in French Guiana

1999-2003



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Mars 2003

The major objective of French Guiana worksite is to increase our understanding of the consequences of short, medium and long-term variations in current patterns and in the transport of particulate and dissolved matter from the Amazon for the structure of coastal ecosystems in French Guiana, including mudflats and mangroves. Two study strategies have been implemented

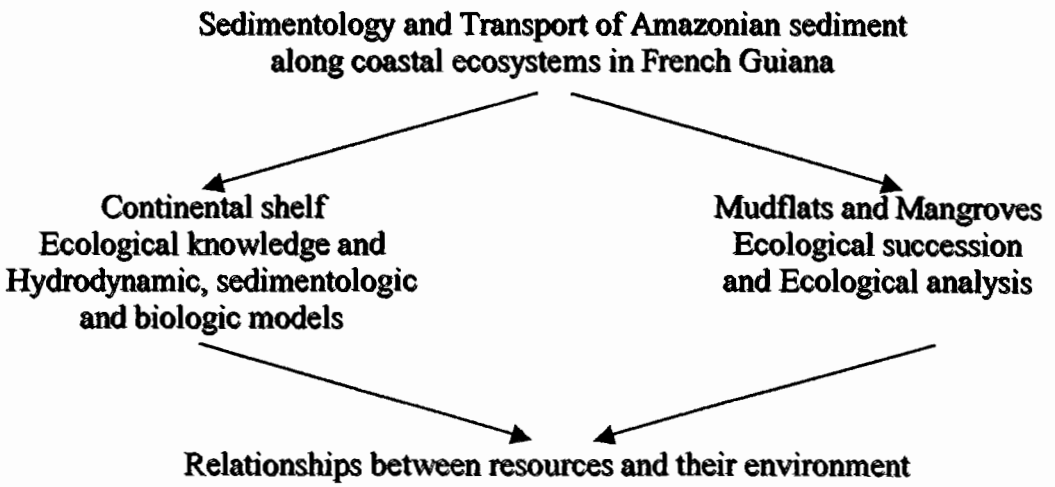
- *In situ* observations campaigns on the continental shelf, and on the mudflats and mangroves swamps of the estuary of the Kaw river.
- Integration of the results using, on the hand: a hydrodynamic model developed for the continental shelf and the coastal zone and, on the other hand, analysis of informations transmitted by satellite (temperature and turbidity), aerial photographs and digital video.

This information and environmental syntheses are preliminary steps towards studies combining hydrodynamics and biological processes:

- Morphological variations in the coastline, excessive silting up and erosion, and short-term changes of sandy beaches along Cayenne Peninsula,
- Steps in biological colonization of coastal mudflats and increasing production during the change from a bare mudflat to a mature mangrove swamp,
- Reproduction and nutrition strategies of marine populations (coastal fishes exploited by local fishermen and prawn exploited by industrial fisheries

The Amazonian inputs have environmental and ecological impacts relative at various of time and space scales. For an exploration as exhaustive as possible of these impacts, two space scales have been considered 1) the continental shelf and 2) the littoral mudflats and mangroves, taking into account their temporal variability.

The choice of these two strongly interconnected entities was necessary for allowing the integration of the concept of hierarchical organization of the ecosystems. It is possible to define the factors that control the organization and the functioning of these various ecosystems and, overall, the various organization levels of the coastal ecosystems in French Guiana.



Scientific and thematic organisation of the French Guiana worksite

	Major uses of littoral in French Guiana		
Scientific Objectives	**Fisheries** - Variability of the cash related to natural environmental dynamics - Impacts of human activity : direct (fishing strategies) and indirect (pollution and modification of sedimentation) effects	**Ports accessibility and geomorphological evolution of the coastline**	**Conservations of rare species and coastal evolution in nature reserves and regional natural parks**
Theme 1 Sedimentology and Transport of Amazonian sediment	++	++	++
Theme 2 Continental shelf	++		++
Theme 3 Mudflats and Mangroves	++	+	++
Theme 4 Relationships between resources and their environment	++		++

Interactions between scientific objectives and major social expectations in regard of use, functioning and management of littoral and coastal zones in French Guiana.
(+ +) hard interaction ; (+) weak interaction ; ( ) no interaction.

Institute partners

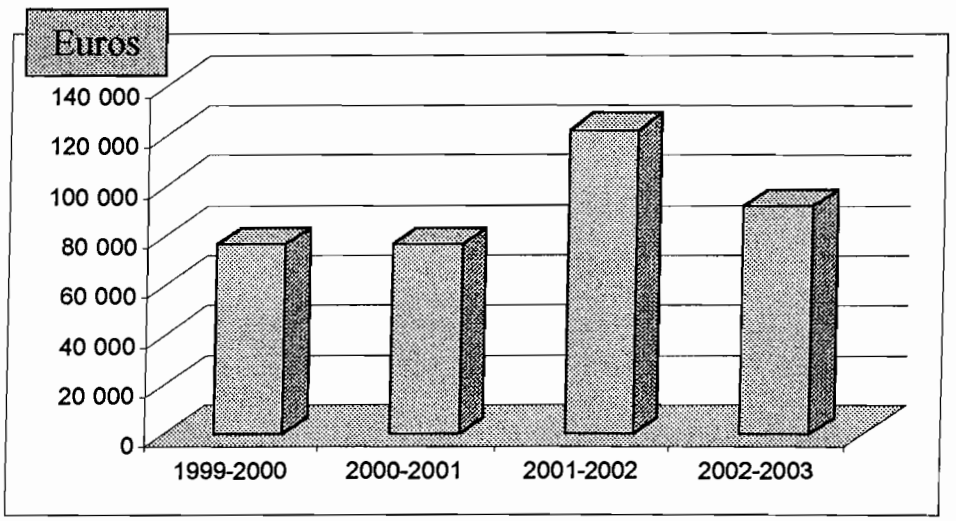
1) BRGM : Unité Aménagement du Territoire et Littoral, Centres de Cayenne et d'Orléans
2) Centre d'Océanologie, Marseille
3) Département de Géologie et d'Océanographie, Bordeaux
4) Ifremer : Station de Cayenne, laboratoire Ressources Halieutiques
5) Institut des Sciences de la Terre, Orléans
6) IRD : Laboratoire d'écologie littorale, Cayenne (coordination), Centre de Bondy et accueil au COM
7) Laboratoire Arago, Banyuls sur Mer
8) Laboratoire d'Écologie Terrestre, Toulouse
9) Laboratoire Ecosystèmes Lagunaires, Montpellier
10) Laboratoire d'Océanographie Biologique, Arcachon
11) Muséum National d'Histoire Naturelle, Laboratoire de biologie des invertébrés marins
12) Université de Bretagne Occidentale, Laboratoire de Rhéologie
13) Université d'Angers (coordination), Laboratoire de Géologie
14) Université du littoral Côte d'Opale, Wimereux
15) Unversité Santa Ursula, Brésil
16) Université de Bretagne Occidentale, Institut Universitaire Européen de la Mer: Laboratoire "Ressources halieutiques- Poissons marins".

Time activity (in equivalent month/researcher)

	1999-2000	2000-2001	2001-2002	2002-2003
Theme 1				
E. Anthony (14)			1,5	
T. Aubry (12)				
N. Baghdadi (1)			1	
A. Bourguignon (1)			0,5	
C. Chevalier (6) (cf Theme 2)				
M. Delaune (6)				
F. Dolique 14)			1,5	
N. Gratiot (6)		8	8	4
D. Guiral (6)	3	2	1	
JM Jouanneau (3)				
JM Froidefont (3)				
J.P. Lefebvre (6)	8	8	8	4
A. Oblinger (14)				
C. Olivieros (1)		0,3	1	
M. Parra (6-3)	8	8	8	
E. Palvadeau (1)		0,3		
M. Pujos (3)				
P. Roquefort (12)				
V. Sipka (14)			1,5	
P. Watermez (1)		0,5		
Theme 2				
COM (2)			18	23
(M. Baklouti (2-6) - A. Bourret, C. Chevalier (6) - I. Dekeyser - J.L. Devenon - A. Ramamonjiarisoa - V. Van Nieuwererberg)				
P. Le Loeuff (6)	5	2		
L. Quiniou (16)	0.5			
E. Rivot (4)	2			
J.F. Ternon (6)	8	6	6	6
P. Vendeville (6-4)	6	4	4	4
R. Von Cossel (11)	5	2		
Theme 3				
P. Albéric (5)			3	3
J.M. Amouroux (7)				
L.F. Artigas (14)	1	3	4	
G. Boucher (11)	1			
J. Clavier (6)	1			
J.P. Debenay (13)	1	2	1	1
J.R. Dinsnar (5)			2	2
F. Fromard (8)				
D. Guiral (6)	2	2	2	3
T. Lam Hoai (9)	3,5	3,5	2,5	3,5
E. Lallier-Vergès (5)			3	3
C. Marchand (5)			8	8
C. Proisy (6)				
C. Rougier (9)	4	4	3,5	4,5
A. Sygut (10-6)			6	
F. Sylvestre (13)	2	2	3	3
M. Tavares (15)				
A. Thevand (8)				
A. Vaquer (9)	2,5	1	1	1,5
R. de Wit (10)	1,5	1,5	2	1,5
Theme 4				

P. Vendeville (6-4) A. Charuau,, M. Léopold, J. Rosé (4)	2	4 3	4 4	4 4
Total				

Annual Budget



Theme 1
Sedimentology and Transport of Amazonian sediment

Ocean colors, mudflats and mud suspension observed from satelloite data in French Guiana *(J.M. Froidefond)*

The French Guiana coast, located about 500 km north of the Amazon mouth, is characterized by mangroves and large mud banks migrating north-westwards. These banks are composed of fine clay sediments originating from the Amazon River. In November 1998, field work was carried out on the Mahury River to measure the water colour and the concentration of suspended particles in surface water. An increase of the remote sensing reflectance due to high concentration of mineral particles was observed. The Mahury river survey (November 1998) together with an oceanographic survey onboard the ANTEA vessel (PRECHICO cruise – April 1999) enabled us to identify several classes of remote sensing reflectance spectra characterizing the continental shelf between Cayenne and the Brazil frontier: 1) light blue waters above the shelf break; 2) low salinity dark brown waters above the continental shelf, originating from the Amazon River; 3) green waters above the 20m isobath and 4) beige waters close to the coast and in the rivers mouths. The normalized water leaving radiances (nLw) computed from these spectra in the spectral bands of SeaWiFS are examined. The standard OC2 performs poorly in retrieving chlorophyll from the reflectance data because the relatively high suspended particulate matter concentrations (Froidefond et al., 2002).

The littoral of French Guiana is also characterized by high suspended sediment concentrations (SSC) coming from the Amazon River. A correspondence function is established between *in situ* optical data and SSC measurements obtained from three coastal surveys on the Kaw River, the Mahury estuary, and on the continental shelf. This function is applied to five Spot satellite images to estimate SSC distributions near the sea surface. Two typical situations have been observed: the mud suspensions are generally confined near the coast and drove by a strong North-Westward coastal current, while in one case (Spot scene of 2 July 2001) the turbid plumes, probably resulting from the wave action on the mud banks, are directed seawards. From offshore to inshore waters SSC varies from a few milligrams to more than 300 milligrams per litre. Turbid plumes are observed down-stream, with regard to the Guyana Current, of small islands along the coast. The satellite data allow estimates of suspended solids discharges, and allow observing the main structures of the emerged part of the mud banks (mudflats). At the surface of the mudflats longitudinal mud undulations, parallel to the crest waves and characterized by a wavelength between 200m and 1000m, are observed. These structures are interpreted as a consequence of the wave action on the fluid mud. In many occurrences, these features induce an orientation of the tide channels sub-parallel to the coastline. The young mangrove colonizes the mudflat following these primary topographic structures. The structures shaped by the waves are thus preserved (Froidefond et al., submitted at Marine Geology)

Bibliography

Articles

Froidefond J.M., L. Gardel, D. Guiral, M. Parra, J.F. Ternon (2002). Spectral Remote Sensing reflectances of coastal waters in French Guiana under the Amazon influence. *Remote Sensing of Environment*. 80, 225-232.

Froidefond J.M., F. Lahel, C. Hu, D. Doxaran, D.Guiral, J.F. Ternon. Mudfats and mud suspension observed from satellite data in French Guiana. *Submitted at Marine Geology*.

Posters

Froidefond J.M., Gardel L., Guiral D., Parra M., Ternon J.F. (2000) Coastal water colours in French Guiana. Application in remote sensing. *V Workshop ECOLAB* Ecossistemas Costeiros Amazônicos, Macapa – AP, Brasil, 19-25 nov. 2000.

Communications

Froidefond J.M., Ternon JF, Lahet F., Parra M. & Guiral D. (2001) Quantification des matières en suspension par mesures optiques et application aux données satellites Spot en Guyane française. *8e Congrès français de Sédimentologie* (Symposium international Mangrove), 12-14 nov. 2001, Orléans.

Froidefond J.M., Lahet F., Doxaran D., Guiral D., Prost M.T, Ternon J-F. (2002). Les sédiments en suspension des eaux côtières de la Guyane française observées à partir de données satellites Spot. *VI ECOLAB Meeting,* September 23-29, Belém/Pa, Bras

Geophysical processes involved in deposition and erosion of mud banks *(J.-P. Lefebvre and N. Gratiot).*

This initial work dealt with the identification and geo-morphological description of the physical processes, responsible of the migration of mud banks along the littoral of French Guiana. Furthermore, the potential contributions of remote sensing techniques, applied to an highly turbid coastal area have been examined.

It has been possible to link data sampled on the field to observed geo-morphological features, by mean scenarios based upon the physical processes.

From 1999 to 2002 an estuarine area was monitored in order to quantify the rate of geomorphologic changes. The period covers the early stage of mudflat consolidation and mangrove colonisation to the arrival of a following mud bank at the edge of the study area. During this inter bank period, the vertical and horizontal rates of erosion along the muddy coast indicates that this process acts mainly along a very narrow fringe of the shoreline and that no significant erosion occurs behind the vegetation limit. This fringe corresponds to the main area of waves action and highlights on the importance of this forcing (Lefebvre et al., 2002).

In 2001 and 2002, some physical experiments were conducted in the laboratory in order to quantify settling processes (under flocculated and hindered regimes) and erosion processes.

In 2002, the field of experiments has been extended to intertidal and subtidal areas with the characterization of simple physical parameters, mostly surface, benthic and bed sediment concentrations and bathymetric data. The analyse of the geomorphologic changes is reinforced by the coupling of the field measurement to optical and RADAR images (Baghdadi et al., in prep.).

These scenarios are based on the physical interactions between rheological properties of the sediment and the hydrological conditions (liquefaction, viscous damping of wave, fluid mud entrainment by shear, ...). The studies of both optical and radar remote sensing have demonstrated the possibility to map the sediment according to its properties (MES rate, state of consolidation).

Bibliography

Articles

Lefebvre J.P., Dolique F., Gratiot N., 2002, Geomorphologic evolution of coastal mudflat under oceanic influences: an example from the dynamic shoreline of French Guiana" *Submitted to Marine Geology* .

Baghdadi, N., Gratiot N., Oliveros C., Lefebvre J.-P. and Bourguignon, A., Coastline and mudbank detection and monitoring in French Guyana : contribution of radar and optical satellite imagery. *to be submitted to the Canadian Journal of Remote Sensing.*

Communications

Lefebvre J.P., Dolique F. & Gratiot N., 2001. Suivi de la dynamique géomorphologique du littoral guyanais : exemple de la flèche vaseuse de la rivière de Kaw (Guyane française) -poster. XXVII *colloque des Océanographes de France - Ecosystèmes côtiers : Flux et Dynamique. Villeneuve d'Asq, 5-7 sept 2001.*

Dolique F., Lefebvre J.P. & Gratiot N., 2001. Dynamique à moyen et court terme de la flèche vaseuse de Kaw (Guyane française). *8e Congrès français de Sédimentologie (Symposium international Mangrove*), 12-14 nov. 2001, Orléans.

Gardel A., Proisy C., Gratiot N., Polidori L., de Coligny F., 2002. Du banc de vase à la mangrove : apport d'une série d'images SPOT 1986-2001 pour le suivi de la dynamique du littoral guyanais, *VIth workshop ECOLAB, Belém-PA, Brésil,* 13p.
Gratiot N. and Lefebvre J.-P., 2002. Dynamic of mud banks in French Guiana : An experimental investigation of sediment settling processes, *XXVIIth General Assembly of the EGS, Nice, France*.

Rheological behaviour of sediment *(T. Aubry et P. Roquefort)*

The aim of this study was to characterise the linear and non-linear rheological behaviour of sediments taken on the Guianan coast in order to understand and predict the transport properties of these natural muds when subjected to constant and oscillatory hydrodynamic forcing.

The density of the samples tested has been measured by pycnometry and shown to lie between 1350 kg/m^3 and 1400 kg/m^3. All rheological tests were performed with a constant stress rheometer at 27°C.

Creep tests

The strain response of the mud samples to a constant shear stress shows that the behaviour is viscoelastic on short time scales and viscous on longer time scales. Moreover, for any samples tested, the flow behaviour exhibits a yield stress marking the transition from a Newtonian behavior, with very high viscosity levels (~10^7 Pa.s), at low shear stresses to a drastic shear-thinning and thixotropic behaviour at high shear stresses.

Oscillatory shear

First of all, the response of the mud does not depend significantly on the frequency. At low shear stress amplitudes, the mud samples are very cohesive (the elastic modulus is very high and is about 10 times the viscous modulus). Above a critical shear stress amplitude, the mud exhibits a thixotropic behaviour which leads in fine to a destructuration of the sediments (loss of cohesion), as characterised by a viscous modulus higher than the elastic modulus.

Sedimentological study of the estuarine system of Kaw river *(J.M. Jouanneau, M. Delaune and M. Parra)*

The study of the estuarine zone of the Kaw River provides information on the past and current sedimentological processes occurring on the French Guyana coastline. Morphological data brought by comparison with maps and satellite images have shown that large changes of the shoreline occurred at a decennial scale with quick successions of periods of accretion and erosion related to the longshore drift of mudbanks. This pattern leads to the displacement of very important quantities of fine-grained sediment.

These deposits are always muddy clayed generally bad sorted. The clay minerals assemblages are similar to those delivered by the Amazon river which settled also in the mud belts of the French Guyana shelf.

The preponderance of smectites during some episods and conversely of illite during other ones may be related to differences in sources inside the Amazon's drainage basin and could reflect a climatic fingerprint.

The surface deposits are generally oxidized but the reducing conditions occur quickly with depth. However sulfide and organic matter contents remain weak.

The distribution of the activity (^{210}Pb exc) is relatively complex in the cores. Indeed, among an on going deposition characterized by values around 60 Bq.Kg^{-1} more or less constant on several decimetres, frequently one can observe beds with lower to null activities. This fact could testify of pulsed sedimentation taking in account large volumes of recent muds and muds originated from erosion of older units. This process is confirmed by the variability of activities measured either in the surface samples of the mudbank or in SPM collected inside the estuary and offshore. Episodes of settling seem to take place at a short scale of time (few years). As a matter of fact it is seldom possible to observe net gradient of decrease of ^{210}Pb

exc in any sequence of cored sediment. This lack of gradient may be also the consequence of mixing by biota.

Results of ^{210}Pb exc consistent with morpho-sedimentary ones. This coastal zone in under the influence of successive erosion and deposition cycles which concern several hundreds metres of shoreline in length and some metres in thickness and last only a fewyears. Two main patterns of functioning seem to run successively :

- When the shoreline is eroded and when the coastal mudbank has shifted westward, the input of marine waters in the Kaw estuary is higher. This large input induces higher current velocity and erodes deposits like fluid muds and river banks (relative age older: ^{210}Pb exc 30 Bq.Kg^{-1} or less)
- When the shoreline is protected by a coastal mud bank the hydraulic energy decrease. The estuary and the lateral tidal flats should be in a deposition phase with younger materials originating from the on going coastal mudbank (^{210}Pb exc 50 to 65 Bq.Kg^{-1}).

Bibliography

Communications

Jouanneau J.M. Parra M. & Guiral D. (2001) Apport des mesures du ^{210}Pb exs à la connaissance de la sédimentation de la vasière de Kaw (Guyane). *8e Congrès français de Sédimentologie* (Symposium international Mangrove), 12-14 nov. 2001, Orléans.

Mapping coastal changes and mudbanks migration by using radar (SAR) and optical satellite images *(C. Oliveros, N. Baghdadi, A. Bourguignon)*

The constant shifting of mudbanks deposited by the Amazon River has an enormous impact on the French Guianese environment and economy. This leads to a great local interest in finding low cost tools for mapping and monitoring mudbanks migration. This involves the ability to detect submarine mudbanks and coastlines. Local climate is a strong limitation for the use, all along the year, of optical sensors. The aim of the study is to improve radar (SAR) and optical satellite images as a way to map with high time series coastline changes and shallow waters (mudbanks). The study area is mainly located east from Cayenne (Kaw marsh coasts). Work was based on radar (ERS and RADARSAT) and optical (ASTER) images acquired between 1997 and 2001. They have been analysed in order to assess their utility in detecting mudbanks and monitoring coastline change.

The information derived from radar and optical satellite imagery was considered with respect to tidal height. We analysed the influence of the radar incidence angle and the advantages of having multi-date sequences in mapping coastal zones undergoing significant change. A study comparing radar (ERS and RADARSAT) and optical (ASTER) imagery was also conducted, along with an investigation of the relationship between bathymetry and satellite data. At this stage, results based on the analysis of 8 radar images, showed that low-angle radar is more suitable for detecting mudbanks, and that high-angle radar is more appropriate for monitoring coastline change. Emerged mudbanks (slikke) and mudbanks under shallow water (a few tens of centimetres at the most) are easily detectable on radar images. Lower the water level is (Guiana is under a meso-tidal regime), and better is the information collected for coastline, slikke, and mudbank under shallow water.

Bibliography

Articles

Baghdadi, N., Bourguignon, A., Oliveros, C., Gratiot, N. and Lefebvre, J.P. 2002. Coastline and mudbank detection and monitoring in French Guiana. Contributions of radar and optical satellite imagery. In prep.

Morphodynamics reponses of sandy beaches in Cayenne to the migration of mud banks *(E. Anthony et F. Dolique)*

The aim of this work was to identify the morphodynamic responses, at short to long time scales, of headland-bound beaches in Cayenne, to Amazon-derived mud banks migrating in the nearshore zone.

Mud banks affect the beaches by attenuating wave power and by inducing differential refraction. The effects resulting from this are marked longshore variations in beach dynamics and morphology. Periodic alternations in longshore drift caused by the mud banks lead to rare forms of total or partial beach rotation, insofar as such rotation does not result, as is generally reported for non-mud bank-affected beaches, from seasonal/multi-annual variations in deepwater wave approach directions. The results also suggest that these changes do not affect the long-term beach sand budgets. Mud welding onto the beaches may, however, sequester at short time scales (order of months to years) sand eroded from the beaches. Subsequent mud erosion leads to release of these sand stocks and their restitution to the beach sand budget.

Bibliography

Articles

Anthony, E.J., Gardel, A., Dolique, F., Guiral, D., 2002. Short-term changes in the plan shape of a sandy beach in response to sheltering by a nearshore mud bank, Cayenne, French Guiana. *Earth Surface Processes and Landforms*, 27, 857-866.

Books

Anthony, E.J., Guiral , D., Dolique, F., Gardel, A., 2002. Le fonctionnement dynamique d'un système lagunaire 'perché' et ses répercussions écologiques : les Salines de Montjoly, Cayenne, Guyane. *Terres d'Amérique, vol. 5.*

Communications

Anthony, E.J., Dolique, F., Guiral, D., Gardel, A. & Lefebvre, J.P., 2001. The influence of migrating mud banks on the sediment dynamics of a headland-bound beach in Cayenne, French Guiana. 8e Congrès français de Sédimentologie (Symposium international Mangrove), 12-14 nov. 2001, Orléans. Publications ASF, Paris, N° 36, p. 15-16.

Gardel, A., Anthony, E.J., 2002. Aerial videographic monitoring of short-term beach morphological change, Montjoly Beach, French Guiana. VIth Ecolab Workshop, 22-29 September 2002, Belém, Brazil.

Dynamic models on the transport of mud along the coast around mud-bank *(C. Chevalier)*

Aside experimental researches, numerical simulations are made to understand the main characteristics of mud banks dynamics. During the PNEC Phase I, preliminary studies have tried to understand how the suspended transport occurs around mud banks.

The numerical code used for this purpose is the same as the one developed for the continental shelf hydrodynamical modelling and is refined on a mudflat scale domain. Semi empirical analytical laws issued from literature were added to parametrise erosion and deposition processes. Simulations were made on the schematic domain forced by a permanent littoral current and they focus on erosion, deposition and suspended transport around banks. They seem to be in good agreement with known observations : erosion back of the bank and deposition in front of it.

Bibliography

Articles

Chevalier C. Déplacement de bancs de vase le long du littoral guyanais, *Journal de recherche océanographique*, sous presse.

Communications

Chevalier C. (1999) Déplacement de bancs de vase le long du littoral guyanais, troisième rencontre hydrodynamique marine, Casablanca.

Chevalier C., (2000) Déplacement de bancs de vase le long du littoral guyanais. *V Workshop ECOLAB* Ecossistemas Costeiros Amazônicos, Macapa – AP, Brasil, 19-25 nov. 2000.

Theme 2
Continental shelf

Coastal oceanography *(J.F. Ternon)*

The CHICO (Physique et CHImie COtière en Guyane) program of coastal oceanography should provide a complete view of physical, chemical and biogeochemical parameters distributions over the French Guiana continental shelf, at characteristic seasonal periods. The program aims at understanding and quantifying the influence of the Amazon outflows over the shelf. This knowledge will serve for the analysis of the "sister-program" GREEN results to evidence relationships between leaving resources (particularly those commercially exploited) and the oceanographic environment.

Due to the unavailability of a research vessel in French Guiana during most of the PNEC 1 period, only a preliminary cruise has been achieved in April 1999, a period where the Amazon influence is supposed to be most pronounced. Measurements evidenced the presence of a low salinity surface layer (8-m thick) over most of the studied area, limited by a very sharp vertical salinity gradient. The associated pycnocline appeared to be a dynamical, hydrological as well as biological frontier. Other remarkable features are the pronounced short term variability of the surface salinity (due to variable inputs of Amazonian waters), the homogeneous parameters distribution within the underlying oceanic waters, the well established north-westwards flow over most of the shelf and the influence of coastal inputs (local rivers, runoff). An interesting signature in temperature (minimum) and nutrients (maximum) has been evidenced at depth over the 40-50 m isobathics, corresponding to an area of intense fishing activity.

Bibliography

Articles

Ternon J.F., Lefebvre J.P. & Guiral D. Physical and chemical characterization of the French Guiana continental shelf : spatial distribution and temporal variability in prep for *Continental Shelf Research* (special issue for *Regional estuarine and coastal systems of the America).*

Poster

Ternon J.F., Guiral D. & Lefebvre J.P. (2001) Caractérisation physico-chimique des eaux du plateau continental de la Guyane : Distribution spatiale et variabilité temporelle XXVII colloque des Océanographes de France - Ecosystèmes côtiers : Flux et Dynamique. Villeneuve d'Asq, 5-7 sept 2001.

Ternon J.F., Guiral D. Lefevbre J.P. (2001). Physical and chemical characterization of the French Guiana continental shelf : spatial distribution and temporal variability. Estuarine and coastal systems of Americas Joint IAPSO/IABO Assembly: 2001 An Ocean Odissey, 21-28 October 2001, Mar del Plata, Argentina.

Ternon J.F., Guiral D. Parra M. Lefebvre J.P. Vendeville P. Chevalier C. (2001). A multidisciplinary study of coastal ecosystems in French Guiana under the Amazon influence. Estuarine and coastal systems of Americas Joint IAPSO/IABO Assembly: 2001 An Ocean Odissey, 21-28 October 2001, Mar del Plata, Argentina

Ternon J.F. (2002) The influence of the amazonian waters over the French Guiana continental shelf : the CHICO programme. VIeme Workshop ECOLAB - 23-29 septembre 2002, Belèm.

Communication

Ternon J.F., Guiral D. & Lefebvre J.P. (2002) Physical and chemical characterization of the French Guiana continental shelf : spatial distribution and temporal variability . *VI ECOLAB Meeting*, September 23-29, Belém/Pa, Brasil

Benthic and demersal communities *(P. Vendeville)*

During the preliminary cruise of the GREEN programm benthic and demersal communities have been sampled by means of deep trawling hauls, operated night and day, from 20 to 80-m depth. At these depths, relatively constant hydrological conditions cannot be considered as structuring constraints for these communities. On the contrary, three communities have been distinguished according to the depth and ground sediment type: a coastal community (20 m) on muddy bottoms, a middle continental shelf community (30-50

m) on sandy mud-muddy sand grounds, and offshore community (60-80 m) on sand. Each of the communities can be related to the biotope of one of the three main commercial peneid shrimps of French Guiana. Differences between night and day catches have been evidenced, a lot of species showing a night/day variability in the hauls. The presence of the low salinity / high turbidity surface layer over part of the shelf reduced the light penetration and may have disturbed the diel rhythms of several species

Bibliography

Articles

Le Loeuff, P. & Von cosel R. (2000) Aperçu sur la macrofaune benthique du plateau continental de la Guyane Française. (Résultats de la campagne GREEN 0, 16 au 20 avril 1999). *Doc. Sci. Tech. Cent. IRD Bretagne*. 86, 39 p.

Artigas, L.F., Vendeville, P., Léopold, M., Guiral, D. & Ternon, J.F. (2002) Marine Biodiversity in French Guiana : estuarine, coastal and shelf ecosystems under the influence of Amazonian waters (*Submitted to Rev. Chil. Hist. Nat.*).

Comunication

Vendeville P., Le Loeuff, P. & Von Cosel R., Bourgeais J. (2000) Éléments de structuration des communautés benthiques et démersales du plateau continental de Guyane Française. *Véme Workshop ECOLAB Ecossistemas Costeiros Amazônicos, Macapa – AP, Brasil, 19-25 nov. 2000.. Poster and abstract*, 5 p.

Vendeville P., Le Loeuff, P. & Von cosel R. (2001) Éléments de structuration des communautés benthiques et démersales du plateau continental de Guyane Française. *5éme Forum halieumétrique, 26-28 juin 2001, Lorient. « Halieutique : complexité et décision ». Ifremer*, Actes de colloques 2002. 33, 39- 40

Artigas, L.F., Ternon, J.F., Léopold, M., Guiral, D. & Vendeville, P. (2002) Marine Biodiversity in French Guiana : estuarine, coastal and shelf ecosystems under the influence of Amazonian waters *First South-American Workshop on Marine Biodiversity, October 28-30 2002*, Universidad de Concepción, Chile.

Continental shelf hydrodynamics *(M. Baklouti, A. Bourret, C. Chevalier, I. Dekeyser, J.L. Devenon, A. Ramamonjiarisoa, V. Van Nieuwererberg)*

Along with experimental researches, a complete understanding of the physical processes characterizing the French Guiana continental shelf also relies on a realistic representation of the principal phenomena by means of dynamical models and the numerical solving of the correspondent coupled equations. This has been the leading purpose of this study which focuses on the continental shelf hydrodynamics including the advection/diffusion of scalar state variables (heat, salinity, concentration,...).

This was considered as a preliminary stage from which a better knowledge of the physical and biochemical processes could be achieved, the ultimate aim being to build a comprehensive tool to predict if possible the evolution of the local marine ecosystems.

Major modifications have been performed on a 3D finite-difference code to adapt it to the French Guiana context: due to a strong stratification of the local ocean and consequent sharp vertical gradients, some numerical improvements (i.e. finite-volume representation using TVD schemes) have been introduced for the scalar passive transport equations. Moreover, several passive open boundary conditions have been tested retaining radiation condition for the baroclinic mode, and the characteristic method for the barotropic one. The remaining open boundary conditions must be specified, particularly for validating operations where they have to be provided by experimental campaigns. The unfortunate delay of the CHICO project (only few results from the preliminary 1999 CHICO cruise are presently available) led us to perform only qualitative simulations using academic boundary conditions to determine the influence of the local and the Amazon rivers on the continental shelf, and to assess the influence of the tide.

Bibliography

Articles

Chevalier C. , Ramamonjiarisoa A. , Baklouti M. , "Modelling the influence of wind and rivers on current, salinity and temperature over the shelf of french Guiana", à soumettre à *Oceanologica Acta* in prep.

Posters

Bourret A., Chevalier C., Devenon J-L. (2002) Model of a hyper-stratified ROFI on tidal shelf: investigation on open boundary conditions, XXVII General Assembly of the EGS, Nice, France

Bourret A., Chevalier C. & Devenon J.L. (2002) Modélisation de la circulation hydrodynamique sur le plateau continental guyanais: choix d'une condition aux frontières", *Journée « Frontières ouvertes et couplage de modèles océaniques"»*, Lyon, 2002

Bourret A., Chevalier C., Devenon J-L. (2002) Modélisation de la circulation hydrodynamique sur le plateau continental guyanais: choix d'une condition aux frontières, VIeme Workshop ECOLAB - 23-29 septembre 2002, Belèm.

Chevalier C., Baklouti M., Van Neuwerbergh V., Dekeyser I., Ramamonjiarisoa A. (2002) "Modelisation of the circulation the french Guiana continental shelf, *journées* EGS Nice, 2002.

Communications

Chevalier C. (1999) Circulation sur le plateau continental de Guyane, troisième rencontre hydrodynamique marine, Casablanca.

Chevalier C. (2000) Circulation sur le plateau continental de Guyane. *V Workshop ECOLAB* Ecossistemas Costeiros Amazônicos, Macapa – AP, Brasil, 19-25 nov. 2000.

Theme 3
Mudflat and mangroves

Functional ecology of photosynthetic biofilms growing on the surface of the mudflats *(R de Wit)*

The aim was to characterise the phototrophic community structures by HPLC pigment analyses and determine their productivity and respiration rates under a range of environmental conditions (darkness, different light intensities, different temperatures). A second aim was the study of ecological interactions with the mangrove.

Diatom were omnipresent in the biofilms. In the upper intertidal, communities were dominated by cyanobacteria and in the lower intertidal by diatoms, with a fringe of tufty mats comprising green filamentous algae in between. The cyanobacterial dominated community showed optimum photosynthesis rates at 37 °C, no photoinhibition, and community metabolism was saturated above 600 µmol photons m^{-2} s^{-1} (Pgross = 9 mmol O_2 m^{-2} h^{-1}; Pnet = 2.2 mmol O_2 m^{-2} h^{-1} at 27 °C). Experimental studies showed a stimulatory effect of a leaching from mangrove leaves, on diatom and cyanobacterial growth, which was attributed to phosphate fertilisation.

Bibliography

Communications

Guiral, D., De Wit, R., Sylvestre, F., 2001. Caractérisation des communautés phytobenthiques au cours du stade de pré-colonisation biologique des vasières littorales de la Guyane (Estuaire de Kaw). *8e Congrès français de Sédimentologie* (Symposium international Mangrove), 12-14 nov. 2001, Orléans.

Foraminiferal assemblages *(J.P. Debenay)*

The aim of this work was to study the distribution of foraminiferal assemblages in space and time with a view to using them as environmental bio-indicators and as proxies for paleoenvironmental interpretations.

The first result was the determination of assemblages and dominant species characteristic of different stages of evolution of the mangrove swamps. These assemblages were used as proxies for reconstructing paleoenvironments in three cores, about 15 m long. Their changes during the colonization of mud flats by mangrove trees, and during the seasonal cycles, were followed along a four-year period.

Bibliography

Articles

Debenay, J.-P., Guiral D. & Parra M., (2002). Ecological factors acting on the microfauna in mangrove swamps. The case of foraminiferal assemblages in French Guiana. *Estuarine, Coastal and Shelf Science*, 55(4) : 509-533.
Debenay J.-P., Guiral D. & Parra M. Behaviour of foraminiferal assemblages in mangrove swamps of French Guiana. Environmental and paleoenvironmental implications (Submitted to *Marine Geology*).

Communications

Debenay, J.-P., Guiral D. & Parra M, 2001. Distribution and seasonal cycles of agglutinated foraminifera in mangrove swamps of French Guyana. 6th International Workshop on Agglutinated Foraminifera. Prague 1-7 sept 2001. Abstract : 16-18.
Debenay, J.-P., Guiral D. & Parra M, 2002. Behaviour of foraminiferal assemblages in reaction to Environmental parameters in mangrove swamps of French Guyana: towards paleoenvironmental interpretations. *Forams2002. Int. Meeting of Foraminiferal Researchers, Perth, Australie, février 2002*
Debenay, J.-P., Guiral D. & Parra M. (2001) Environmental parameters and associated foraminiferal assemblages in mangrove swamps of French Guyana: towards paleoenvironmental interpretations. *8e Congrès français de Sédimentologie* (Symposium international Mangrove), Orléans, 12-14 nov. 2001.

Distribution of benthic diatoms *(F. Sylvestre)*

The aim of this work was to study the distribution of the modern benthic diatoms in surficial sediments in the Kaw estuary and adjacent mangrove swamps, according to seasonal variations (wet versus dry) and mudbank stability phases, from fluid mudflat to mangrove swamps overgrown with vegetation. This study was conduced for a reconstruction of the past estuarine and coastal dynamics, covering at least the late Holocene.

The results show that the distribution of the modern benthic diatoms is related of the level of the sediment stability. Three main diatom assemblages is identified from the fluid mud phase to progressive stable areas and finally to stable mature mangrove swamps. This study also evidenced that the oceanic water penetration has a wide influence into the Kaw estuary, the continental freshwater influence appearing really upstream in the Kaw estuary.

Bibliography

Articles

Sylvestre, F., Guiral, D. & Debenay, J.P. Modern diatom distribution in mangrove swamps from Kaw estuary (French Guyana). (Submitted to *Marine Geology*)

Communications

Sylvestre, F., Guiral, D., Debenay, J.P. (2002) Réponse des diatomées benthiques actuelles à la dynamique sédimentaires amazoniennes sur les côtes guyanaises : l'exemple de l'estuaire de Kaw (Guyane Française). *Actes du 21ème colloque de l'ADLaF.*
Sylvestre, F., Guiral, D. (2001) Distribution des diatomées actuelles dans les vasières et mangroves de l'estuaire de Kaw (Guyane, France). *8e Congrès français de Sédimentologie* (Symposium international Mangrove), 12-14 nov. 2001, Orléans.

Phyto and zooplankton in estuarine and mangrove ecosystems *(T. Lam Hoai, C. Rougier, A. Vaquer)*

The phytoplankton and zooplankton communities occurring in the estuarine area of the Kaw River in French Guiana were the objects of the present study. The study was aimed at comparing their organisations in the estuary station and in two mangrove swamp stations at two different stages of development.

The plankton within the dry seasons of November 1998 & 2001 and for all the stations was of coastal type, whereas it became of continental type during the rainy season (1999). Within the dry seasons, the diatoms and dinoflagellates (algae) and the tintinnids (ciliates) were the dominant components in term of density, while the rainy season (1999) was marked by low abundance but with a great diversity of green algae and rotifers. The distribution of the various plankton populations varied depending on the stations(estuary, old mangrove swamp, recent mangrove swamp) and the tides (rising / ebbing tides, spring / neap tides).

Bibliography

Articles

Rougier C. et Pourriot R. 2003 On a new planktonic rotifer from Guyana : Synchaeta spinifera n.sp. (Rotifera, Monogononta, Synchaettidae). Soumis à Hydrobiologia le 19/12/02.

Rougier C., Pourriot R., Lam-Hoai T. et Guiral D. Rotifers in the estuary of Kaw River (French Guyana). *(In prep.)*

Lam-Hoai T., Rougier C., Vaquer A. et Guiral D. Hydrodynamic effect on the plankton community in the estuary of Kaw River (French Guyana). *(In prep.)*

Lam-Hoai T., Rougier C, Vaquer A. et Guiral D. Structural comparison of plankton communities in a mangrove creek and a seaward muddy strand of the Kaw River estuary (French Guyana). *(In prep.).*

Seasonal coupling between phyto and bacterioplankton in a hydrochemical gradient from fresh water to Guianese shelf water *(L. F Artigas, D. Guiral)*

The aim of this study was to follow the dynamics of both the phytoplankton size fractions and the attached and free-living heterotrophic bacteria, in a gradient from the fresh waters of the Kaw River to the Guianese shelf waters, in some characteristic seasonal situations. In order to better assess the importance of microbial heterotrophic pathways in these systems, some bacterial productivity estimates were conducted, in collaboration with the Institut Pasteur of Cayenne.

At the end of the wet season, the high percentage of degraded pigments along the riverine and transitional estuarine zones suggests an important contribution of allochtonous matter from the flooded lands, forest marshes and the Kaw swamp, that would be in an advanced degradation stage and would have stimulated bacterial production, leading to important abundances associated to very low chlorophyll *a* values. Exportations from the mudflat and young mangrove seem to have contributed to the important pigment concentrations measured in mudflat waters.

At the end of the dry season, mean total estuarine chlorophyll concentrations are up to ten times higher than in July, and they are positively correlated, along an upstream decreasing gradient, to bacterial abundances. The highest photosynthetic stocks were measured in coastal waters at the end of the dry season, probably due to the combination of senescence and grazing of a large phytoplankton bloom, enhancing and diversifying the organic transfer pathways between photautotrophs and heterotrophic bacteria. The preliminary estimates of bacterial productivity showed important differences between dry and wet periods, specially in the coastal systems, out of the maximum turbidity zone where some methodological problems still need to be solved.

Bibliography

Articles

Artigas, L.F. & Guiral, D. Seasonal variability of phytoplankton size-fractioned and heterotrophic bacterial biomasses in a dilution gradient assessed along the Kaw River to the Coastal Waters off French Guiana *(in prep).*

Communications

Artigas L. F. & Guiral D. (2001). Seasonal evolution of phytoplankton size classes in an estuarine and coastal system influenced by the Amazon River discharge (French Guiana) (poster). Estuarine and coastal systems of Americas Joint IAPSO/IABO Assembly: 2001 An Ocean Odissey, 21-28 October 2001, Mar del Plata, Argentina.

Artigas, L.F. & Guiral, D. (2002) Seasonal Dynamics of microplanktonic biomasses along a dilution gradient from the Kaw River to the coastal waters off French Guiana, *VI ECOLAB Meeting*, September 23-29, Belém/Pa, Brasil

Structural features and dynamics of mangrove forests in the Amazonian coastal region. A case study in the Kaw River estuary, French Guiana, using field measurements and high resolution remote sensing techniques *(F. Fromard, C. Proisy, A. Thévand)*

Guianese mangrove forests are characterized by very original structure and dynamics, due to the influence of the « Amazon dispersal system ». As a result, mangrove ecosystem, the only type of vegetation adapted to this harsh environment, develops rapidly successive stages of different ages and structures, from young pioneering mangroves established on recently accreted mud banks on the sea front, towards mature formations and riverine mixed stages on moving inlands. Within this context, a representative test-site has been selected at the Kaw river's estuary, French Guiana, where sedimentological processes and mangrove forest evolution are particularly dynamic.

Field surveys, spectral and textural analysis of resolution remote sensing data (aerial photographs, Spot and Ikonos images) and statistical treatments lead to the identification of different mangrove types and distinct developement stages. Self thinning phenomena during growing stages and forest gap processes in mature stands are the main mechanisms directing the evolution of the mangrove vegetation in this area. Coastal changes which took place during the last fifty years at the study site have been characterized and mapped, and related to the mangrove dynamics.

Based on this structural, functional and historic data set, a global scenario of mangrove forest dynamics is proposed, including forest development model, forest gap processes and sedimentological dynamics.

Bibliography

Articles

Almeida Ribeiro T., Fromard F. Processing of Remote sensing images for coastal vegetation studies in French Guiana.. *Int. J. Remote Sensing.*

Baltzer F., Allison M. and Fromard F., 2003 - The coast of the Guianas and other mangrove fringed coastal zones, Special Issue, *Marine Geology* .

Betoulle J.L., Fromard F., Puig H, 2001 – Caractérisation des chutes de litière et des apports au sol en nutriments dans une mangrove de Guyane française. *Can. J. Bot.* 79(2): 238-249.

Fromard, F., Vega C., Proisy C., 2003 - Coastal evolution and mangrove dynamics in French Guiana over the last fifty years. A case study based on aerial and satellite remote sensing data and field surveys. *Marine Geology*

Proisy C., Mougin E., Fromard F., Karam M. A., 2000 -: Interpretation of polarimetric signatures of mangrove forest. *Remote Sensing of Environment* 7 : 156-66.

Proisy C., Mougin E., Fromard F., Trichon V., Karam M. A., 2002 - On the influence of canopy structure on the polarimetric radar response from mangrove forest. *Int. J. Remote Sensing.* 23 (20) : 4197-4210.

Communications

Fromard F., Rebelo Mochel F., da Cruz Sales M.E., Prost M.T., Proisy C., Thévand A., 2003 -Caracteristicas ecológicas dos manguezais da zona costeira amazônica. Proposta de criação de uma rede de observações à longo prazo, do Norte do Brasil à Guiana Francesa. *International Conference « Mangrove 2003*,Connecting research and participative management of estuaries and mangroves » Salvador de Bahia, Brazil, May 20-24, 2003.

Fromard F., Vega C., 2000 - Coastal evolution and mangrove dynamics in French Guiana over the last fifty years (1951-1999). A case study from the Sinnamary area, French Guiana, based on aerial and satellite remote sensing data and field surveys. *V Workshop ECOLAB* Ecossistemas Costeiros Amazônicos, Macapa – AP, Brasil, 19-25 nov. 2000

Fromard F., Vega C., Proisy C., Betoulle J.L. (2001) Caracteristiques structurales et fonctionnelles des mangroves de Guyane en relation avec l'évolution des substrats. *8e Congrès français de Sédimentologie* (Symposium international Mangrove), Orléans, 12-14 nov. 2001.

Fromard F., Vega C., Proisy C., Cadamuro L., 2001 - Dynamique sedimentologique et evolution des mangroves de Guyane française au cours des 50 dernières années. Etudes in situ et par télédétection aérienne et satellitale. *8e Congrès français de Sédimentologie* (Symposium international Mangrove), 12-14 nov. 2001, Orléans.

Proisy C, Souza Filho P.W. , Fromard F., Prost M.T.,.Mendes A.C., de Coligny F., 2003 - Monitoring the dynamic of the Amazon coast (Pará, Brasil and French Guiana) using a common methodology based on a spatial analysis coupled to a simulation tool. *Intern. Conf. « Mangrove 2003*, Connecting research and participative management of estuaries and mangroves » Salvador de Bahia, Brazil, May 20-24, 2003.

Proisy C., Mougin E., Fromard F, 2001 . Radar remote sensing of mangroves: results and perspectives *Proceedings of IGARSS 2001*, Sydney, Australia, 9-13 July, 2001.

Thévand A., Fromard F., Proisy C., Couteron P., 2003 - Structural features and dynamics of mangrove forests in the Amazonian coastal region. A case study in the Kaw River estuary, French Guiana, using field measurements and high resolution remote sensing techniques. *Intern. Conf. « Mangrove 2003*, Connecting research and participative management of estuaries and mangroves », Salvador de Bahia, Brazil, May 20-24, 2003.

Origin and quantity of sedimentary organic matter in the mangrove soils *(C. Marchand et E. Lallier-Vergès)*

The purpose of this study was on one hand to characterize origin and quantity of sedimentary organic matter along the mangrove fringed coast of French Guiana, on the other hand to assess the various factors affecting the diagenetic processes.

The sedimentary organic matter increases with forest development (pioneer to senescent), deriving from algal mats and radial cable roots of *Avicennia germinans* in the younger forests (litter being exported by tides), and mainly derived from higher plant debris (litter and roots) in the mature forests. Results exhibit the strong impact of the vegetation on the sediment geochemistry, and highlight the differences in diagenetic processes properties induced by mangrove species and by seasons.

Bibliography

Articles

Marchand, C., Lallier-Vergès, E. and Baltzer, F. (2003) .The composition of bulk sedimentary organic matter in relation to the dynamic features of a mangrove-fringed coast in French Guiana. *Estuarine Coastal and Shelf Sciences*.

Marchand, C., Baltzer, F., Lallier-Vergès, E. and Alberic, P. (soumis) Decadal and seasonnal evolution of geochemical parameters in a mangrove environment, Sinnamary, French Guiana. (Submitted to *Marine Geology*)

Communications

Marchand C., Baltzer F. & Lallier Verges E. (2001) Organic composition and environmental conditions in mangrove sediments : a key for reconstitution the evolution of the French Guiana coast, Sinnamary. *8e Congrès français de Sédimentologie* (Symposium international Mangrove), 12-14 nov. 2001, Orléans.

Marchand, C., Baltzer, F. and Lallier-Vergès, E. (2001) Biogeochemistry of mangrove sediment as witness of the evolution of a highly dynamic mangrove-fringed coast in French Guiana. GEOTROP, Townsville, 7-11/05/01.

Marchand, C., Lallier-Vergès, E. and Baltzer, F. (2001) Organic markers as witnesses of the dynamic features of the mangrove coast in French Guyana. EUG, Strasbourg, 8-12/04/01.

Marchand, C., Lallier-Vergès, E., Baltzer, F. and Alberic, P. (2002) Dynamique de la matière organique lors de l'évolution d'une mangrove à palétuviers gris (*A. germinans*), Guyane française. Un exemple de processus suboxiques en milieu hydromorphe. JNES, Orléans, 22-24/10/02.

Theme 4
Relationships between resources and their environment

Seasonal and inter annual variability of young stages Penaeus subtilis shrimps abundance and growth in Kaw estuary *(P. Vendeville)*

Samples with conic plancton net were collected bimonthly during daily flow tide in the estuary of Kaw river during one year in 2000-2001. Maximum shrimp *Penaeus subtilis* postlarvae abundance occurred in september, december and march. These three periods of abundance enforcement were identified during 1988-1994 ORSTOM's program in other guianese estuaries (Cayenne River, Organabo and Sinnamary), but the observations in Kaw estuary presented a relatively low postlarvae recruitment in the second and third period. Similar mechanism of intrusion (short time in the estuary) like in other estuaries was observed during flood and ebb tides for shrimps postlarvae ; it looks like available for juveniles shrimps and most of the fishes juveniles.

Analysis of juveniles growth was conducted on samples catch during the same period. The external sexual dimorphisms occurs early . Length frequencies analysis permited to situate the recruitment at 3,5 months old ; depending environmental conditions, recruitment

can occur one month earlier or later. These results are in accordance to existing assumption using other methods.

Effect of environmental factors on postlarvae abundance tested on 1988-94 period shown the importance of wind (intensity and direction) and tide. Simple multilinear models on two estuaries (Cayenne river and Organabo) using these parameters explained respectively 56 % and 65 % of variance.

Bibliography

Communications

Vendeville P. (2001) Estimation des paramètres de croissance des juvéniles de crevette *Penaeus subtilis* à partir de micro cohortes journalières. Poster. 5éme Forum halieumétrique, 26-28 juin 2001, Lorient. « Halieutique : complexité et décision ». Ifremer, *Actes de colloques* 2002. 33, 74- 75

Vendeville P. (2001) Biologie et écologie de la crevette de Guyane -Les connaissances, les hypothèses, les zones d'ombres. Quelles implications ?- Seconde Conférence Maritime, Cayenne 18 décembre 2001.

Vendeville P. (2002) Réunion d'information auprès des professionnels de la pêche de Guyane: Ressources crevettières et fluctuations environnementales (apports des campagnes GREEN et CHICO d'avril 1999) – Cayenne – centre IRD, 7 février 2002.

Shrimp stock assessment and management *(M. Léopold)*

During this PNEC session, Ifremer treated two questions related with shrimps stock assessment and management :

(i) Effects of shrimpers surveys duration on stock assessment and diagnostic. More accurate monthly trawlers activity estimators (fishing time and landings), according their surveys duration, are considered. They don't modify global diagnostic on shrimp resource using Virtual population Analysis, but relationships between some population dynamic parameters are improved. Thus, using the new parameters would authorize comparison between fishery datas and young stage abundances experimental datas.

(ii) The fishery shrimp discard. Today, no shrimp discard is assumed in the fishery datas analysis. The actual study initiated during PNEC points out the importance of the shrimp discard. More than 25 % of total catch weight is discarded. Because discard is composed of young shrimps, the number of individuals discarded represents more than 50 % of numerical total catch. Estimated discard catch would be taken into account in fishery stock assessment. Ifremer realized one discard cruise in 2001 and three in 2002. Discard study will also give information on length and age at shrimp migration and recruitment.

Bibliography

Communications

Léopold M., J. Rosé et A. Charuau. (2001) Influence de la durée des campagnes de pêche sur l'évaluation des stocks. Le cas de la pêcherie crevettière guyanaise. Poster. 5éme Forum halieumétrique, 26-28 juin 2001, Lorient. « Halieutique : complexité et décision ». Ifremer, *Actes de colloques* 2002 . 33, p 68