

**JOINT GLOBAL OCEAN FLUX (JGOFS) and
LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE (LOICZ)**

Core Projects of the
International Geosphere-Biosphere Programme: A study of Global Change (IGBP)
of the International Council of Scientific Unions (ICSU)

**FIRST REPORT OF THE JGOFS/LOICZ CONTINENTAL MARGINS
TASK TEAM**

Compiled by J. Hall and S. Smith

Slightly Re-Edited by Bernard AVRIL, JGOFS IPO, Bergen, Norway (July 2003)

LOICZ Reports & Studies No. 7

JGOFS Report No. 21

A paper version of this report was published in 1996 by:
LOICZ Core Project, Netherlands Institute for Sea Research
P.O. Box 59, 1790 AB Den Burg – Texel, The Netherlands

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

1.1 Recommendations

1.2 Terms of reference for the JGOFS/LOICZ CMTT

2. INTRODUCTION

2.1 General Statements about JGOFS and LOICZ

2.2 Role of Continental Margins in the Transfer of Materials including C, N and P

2.3 Objectives of JGOFS and LOICZ Continental Margin Studies

3. GUIDELINES FOR DESIGNATING JOINT JGOFS/LOICZ PROJECTS

4. FACILITATION OF COMMUNICATION BETWEEN JGOFS AND LOICZ

5. JGOFS/LOICZ COLLABORATION

6. REFERENCES

ANNEX 1. LISTING OF CMTT RELATED RESEARCH

* Australia	* Cuba	* New Zealand
* Bangladesh	* East African Region	* Poland
* Belgium	* France	* Romania
* Brazil	* Germany	* Russia
* Canada	* Greece	* South Africa
* China (Beijing)	* Japan	* United Kingdom
* China (Taipei)	* Mexico	* United States

1. EXECUTIVE SUMMARY

The Joint Global Ocean Flux Studies (JGOFS) and the Land Ocean Interactions in the Coastal Zone (LOICZ) are Core Projects of the International Geosphere-Biosphere Programme: A study of Global Change (IGBP). They both have a primary interest in material fluxes in the ocean. JGOFS focuses on carbon fluxes in the open ocean, with interest in the continental margins as inputs to the ocean. LOICZ focuses on the land-sea interface and the coastal zone, with interest in the shelf edge as a boundary of exchange with the open ocean. The region of the continental margins thus marks an intersection between these two projects. Recognising both this mutual interest and the importance of the continental margins, the Scientific Steering Committees (SSCs) of these two projects have established a Continental Margins Task Team (CMTT).

The CMTT was established as a joint working group of the Scientific Steering committees of JGOFS and LOICZ which each nominated a co-chair and three members of the Task Team.

To date, the work of the Task Team has been executed primarily by correspondence. Two ad hoc meetings of the co-chairs have occurred, and most members of the CMTT met in Texel, The Netherlands, on 16 April 1996. This document constitutes the first report of the CMTT back to the JGOFS and LOICZ SSCs.

This document provides recommendations to the respective Core Project Offices (CPOs) to be followed in dealing with proposed or extant research on the open continental shelves, and secondarily to inform the National Committees of IGBP, JGOFS, and LOICZ as to how JGOFS and LOICZ are dealing with research of interest to these two IGBP projects. The report also makes recommendations for facilitating communication among scientists in these two IGBP core projects.

1.1 Recommendations

That the CMTT (Julie Hall as co-ordinator) organise a workshop (approximately 15 people to be held in Nigeria (~ October 1996), to:

- a) Prepare initial budgets of fluxes of water, carbon (C), nitrogen (N), and phosphorus (P) from the land, on the shelf, and at the oceanic boundary of selected "case study" sites (tentatively East China Sea, North Sea, Chile-Peru shelf, Gulf of Guinea).
- b) Produce a draft report, to be used as a background report for item 3, below.

That the CMTT organise a joint JGOFS/LOICZ session dealing with continental margin fluxes of materials, to be held in conjunction with the LOICZ Open Science meeting in the Netherlands in the fall of 1997.

- a) the meeting will be aimed at a synthesis of present knowledge about material fluxes at the shelf margins and transformations on the shelf.
- b) The proceedings are to be published as a special issue of Continental Shelf Research or some other appropriate refereed journal.

1. This document and the recommendations were approved by the JGOFS and LOICZ SSC's at a joint meeting on April 18th in Bad Munstereifel, Germany.

1.2 Terms of Reference for the JGOFS/LOICZ CMTT

I. The primary issues to be addressed by the CMTT are:

- (a) Develop guidelines to designate projects as JGOFS, LOICZ, or joint; and recommend mechanisms for dealing with projects which overlap both programmes.
- (b) Facilitate communication between JGOFS and LOICZ, including:
 - (i) developing of compatible data management procedures;
 - (ii) compilation of directories of scientists;
 - (iii) communication among research projects;
 - (iv) communication among discipline groups.

- (c) Encourage national and regional collaboration between JGOFS and LOICZ, including:
 - (i) development of multidisciplinary studies in continental margin areas identified or suspected to be quantitatively important to carbon and nutrient transfers between shelf seas and open ocean;
 - (ii) development of procedures for reviewing the progress of continental margin studies undertaken nationally and regionally.
- II. Specific tasks of the CMTT involve developing a structure for an initial joint JGOFS/LOICZ meeting and/or workshop designed to:
- (a) Synthesise current knowledge of carbon and nutrient fluxes in the continental margins;
 - (b) Review existing protocols applicable to estimating carbon and nutrient fluxes in continental margins;
 - (c) Facilitate exchange of information and enable scientists from developing countries to contribute expertise to regional programmes and global synthesis efforts; facilitate extrapolation from regional/national to global scales.

2. INTRODUCTION

2.1 General Statements about JGOFS and LOICZ

The Joint Global Ocean Flux Studies (JGOFS) and the Land Ocean Interactions in the Coastal Zone (LOICZ) are two core projects in the International Geosphere-Biosphere Programme (IGBP). The primary goals of those two projects may be briefly summarised as follows:

For JGOFS (IGBP/SCOR, 1992) the goal is to:

Assess more accurately and understand better the processes controlling regional to global and seasonal to interannual fluxes of carbon between the atmosphere, surface ocean and ocean interior and their sensitivity to climate changes.

This goal will be achieved through the following products, that serve as JGOFS objectives:

- * an assessment of large-scale carbon fluxes, obtained from a greatly increased network of observations;
- * a set of models that express our understanding of the processes controlling large-scale carbon fluxes;
- * a procedure for observing the ocean in a routine, synoptic manner to detect possible changes in the ocean cycle in response to climate change;
- * a well-cared-for data set, comprising observations made according to standard protocols and a system for making subsets of these data easily available to researchers;
- * knowledge and understanding of fluxes across the continental margins, to provide reliable boundary conditions for global models; and,
- * an increased number of countries with an interest and skill in planning JGOFS-type activities and making the appropriate measurements and global scale inferences.

And for LOICZ (Pernetta & Milliman 1995) the goals are:

- * to determine at global and regional scales:
 - (i) the fluxes of materials between land, sea and atmosphere through the coastal zone;
 - (ii) the capacity of coastal systems to transform and store particulate and dissolved matter;
 - (iii) the effects of changes in external forcing conditions on the structure and functioning of coastal ecosystems.
- * to determine how changes in land use, climate, sea level and human activities alter the fluxes and retention of particulate matter in the coastal zone, and affect coastal morphodynamics.
- * to determine how changes in coastal systems, including responses to varying terrestrial and oceanic inputs of organic matter and nutrients, will affect the global carbon cycle and the trace gas composition of the atmosphere.

* to assess how responses of coastal systems to global change will affect the habitation and usage by humans of coastal environments, and to develop further the scientific and socio-economic bases for the integrated management of the coastal environment.

2.2 The Role of Continental Margins in the Transfer of Materials including C, N, and P

A definition of continental margins is, "those provinces of continents and of the ocean which are associated with the boundary between these two first-order features of the earth". (Although continental margins occupy less than 10% of the total sea surface, they are disproportionately important for the following reasons:

1. They are regions of active biogeochemical interactions between land and the open sea; they provide a pathway for receiving, transferring and transporting large amounts of terrigenous natural and anthropogenic materials from land to the open sea. The flux of this terrestrial material, its spatial and temporal variation, and its ultimate fate all need to be understood before we can construct overall budgets of carbon, nitrogen and phosphorus in the ocean.
2. The rate of biological production per unit area of the continental margin can be several times higher than in the open ocean, due to nutrient inputs from land, coastal upwelling, and so forth. In addition, the growth of various types of marine organisms in shallow waters apparently presently accounts for about half of the calcium carbonate production in the marine environment. Quantitative understanding of the river fluxes of nutrients, the fates of these nutrients, and the spatial and temporal variability of metabolism are needed.
3. The physical and biogeochemical processes occurring in the margins make these regions important for intense air-sea exchange of CO₂, N₂, N₂O, CH₄, DMS and other gases. However, the quantitative role of this region in the overall air-sea exchange of these gases needs to be better understood.
4. The high biological productivity, combined with the shallow water depths of the margins and terrigenous inputs of organic matter, makes this region the site of high organic matter deposition and associated benthic remineralisation. It has been estimated that up to 50% of the annual primary production of continental margins may reach the sea floor, where much of it is remineralised in a redox environment, which is very different than that of open waters. Sedimentary processes are markedly different from water column processes and thus can greatly affect chemical mass balances in the ocean.
5. The sediment accumulation rates on margins can be orders of magnitude higher than in open ocean regions. Therefore these sediments may locally contain high resolution records (especially in basins with anoxic bottom water) of processes that have occurred at the margins in response to variability of environmental conditions. Study of these sediments could therefore be useful in understanding controls on and rates of transfer of carbon and associated biogenic materials between water column and bottom sediments and the relation to long-term changes.
6. Development of realistic global scale models for the oceanic carbon-nitrogen-phosphorus cycles requires knowledge of fluxes across various ocean boundaries. Therefore a good understanding of the fluxes between the margin and the open ocean is crucial to model development.
7. Studies of coastal oceans are directly relevant to societal needs. Coastal regions are densely populated and are subject to human exploitation for food. These regions are responsive to environmental changes resulting from natural processes and human activities. The response of the coastal and margin environments to such perturbations, and how they affect the global carbon-nitrogen-phosphorus cycles, need to be better understood.
8. Many important commercial and subsistence marine fisheries are based at the continental margins, where biological production tends to be much greater than in the open ocean. Exploitation of marine organisms by humans results in the removal of biomass from the sea

and also may impact the functioning of the marine ecosystem, with consequent implications for carbon fluxes.

2.3 Objectives of JGOFS and LOICZ Continental Margin Studies

Objectives of continental margin studies in the JGOFS context are listed in the JGOFS Implementation Plan (IGBP/SCOR, 1992):

- * to quantify the exchange of carbon between given marginal zones and the open ocean;
- * to understand the seasonal and interannual fluctuation of carbon fluxes and nutrient cycles due to physical and biogeochemical variations;
- * to estimate exchanges between shelves, slopes, and the open ocean by lateral transport;
- * to evaluate the importance of carbon deposition on the continental slope;
- * to determine the air-sea CO₂ exchange rates in upwelling areas; and
- * to characterise those features of continental margins that enable extrapolation to the global scale.

Relevant LOICZ activities listed under Focus 1 and Focus 3 of the LOICZ Implementation Plan (Pernetta & Milliman, 1995) are:

- * catchment basin fluxes into coastal systems;
- * atmospheric inputs to the coastal zone;
- * exchange of energy and matter at the shelf edge;
- * factors influencing the mass balance of materials in coastal systems, especially in relation to the cycling of organic matter; and,
- * estimation, for the coastal zone, of the fluxes of N₂O, CH₄, DMS, and other climatologically important trace gases.

3. GUIDELINES FOR DESIGNATING JOINT JGOFS/LOICZ PROJECTS

Research designed to elucidate processes occurring at the boundary between the open ocean and continental shelf seas is clearly of interest to both projects to define the conditions operating at the common boundary between the primary domain of each project. Hence such projects would be designated joint.

In general, projects which are strongly tied to land inputs are appropriate for LOICZ, as are those dealing with depths less than 200 meters. Open ocean studies off the shelf are likely to fall into the purview of JGOFS. With this general division, most neritic studies, especially those in coastal areas are more likely to be related to LOICZ than to JGOFS. Projects on the mid-shelf or spanning the entire shelf are strong candidates to be considered joint JGOFS/LOICZ efforts.

JGOFS and LOICZ have developed separate procedures for the categorisation of research contributing to the two Core Projects, hence it would be cumbersome and overly bureaucratic to consider continental margin research using the procedures of both projects in parallel. The CMTT will, therefore, function as the formal review body on behalf of both Projects for the designation of individual research projects or activities as joint JGOFS/LOICZ research.

Following procedures determined at the national level, projects and proposals should be submitted by the Principal Investigators to the National LOICZ and/or JGOFS Committee(s). Following identification of the research as being concerned with continental margin studies, the recipient core Project Office will submit the research proposal to the co-chairs of the CMTT for consideration. The CMTT will decide if the project should be designated as joint JGOFS/LOICZ. In the event that the CMTT decides that a project is not joint, then the submission will be returned to the appropriate Core Project Office for consideration and categorisation as research relating to that Core Project alone.

4. FACILITATION OF COMMUNICATION BETWEEN JGOFS AND LOICZ

There are two major points to communication between these projects:

- * Data and databases within each of these projects should be managed in such a way that it can be shared readily between the projects. This is a relatively straightforward consideration, but explicit consideration and planning with Data Information Services (DIS) can ensure that this is readily accomplished. (LOICZ Data & Information System Plan, Boudreau et al. 1996).
- * Information should be circulated freely between the two projects, concerning national or regional programmes dealing with continental margin research. As a first step towards implementing this point, Annex I of the publication arising from this report will contain programmes we are aware of at the publication time. A preliminary version of that Annex is available in this report; it will be edited into a consistent format which includes project name, short description, contact person (address, phone, fax, email). The CMTT will work with the LOICZ and JGOFS CPOs to develop this list into a WWW Home Page (<http://keep.oc.ntu.edu.tw/cmtt>) which will be maintained and updated by the CMTT and cross listed on the JGOFS (<http://ads.smr.uib.no/jgofs/jgofs.htm>), LOICZ (<http://www.nioz.nl/loicz>) home pages.

5. JGOFS/LOICZ COLLABORATION

JGOFS field work is currently planned to be completed by the year 2000. LOICZ is just beginning. This suggests that the major initial collaboration between these two projects should be "intellectual collaboration" in the form of data synthesis, model development, and interaction between the modelling groups in each project.

This will be initiated with a small workshop in Lagos in October 1996. The aim of this workshop is to gain a better understanding of fluxes between the Continental Margins and the Open Ocean and the rates of processing of material in the continental margin.

The specific objectives are:

- * Using four areas as case studies, participants will attempt to develop a consensus on the C, N and P fluxes based on the available data. The case study sites will be the East China Sea, Chile/Peru coast, North Sea and the Gulf of Guinea.
- * Participants will also consider the utility of LOICZ nutrient budgeting guidelines as a common framework for the overall aim.

The outputs from the workshop will be a draft report which will include a consensus paper from each of the case study regions and a technical overview.

This report will be used as the primary background document for a much broader Continental Margins Workshop at the LOICZ Open Science Meeting which will be held in the Netherlands in 1997.

6. REFERENCES

- Boudreau, P.R., P.J.F. Geerders and J.C. Pernetta. 1996. LOICZ Data and Information System Plan. LOICZ/R&S/96-6, ii + 62 pp. LOICZ, Texel, The Netherlands.
- IGBP/SCOR. 1992. Joint Global Ocean Flux Study: Implementation Plan. Published jointly by the International Geosphere and Biosphere Programme, IGBP Report No. 23 and the Scientific Committee on Ocean Research, JGOFS Report No. 9.
- Pernetta, J.C. and J.D. Milliman (eds.). 1995. Land Ocean Interactions in the Coastal Zone Implementation Plan. IGBP Report No. 33. Stockholm Sweden. 215 pp.

ANNEX 1. LISTING OF CMTT RELATED RESEARCH

The following list of projects have been forwarded to the joint JGOFS/LOICZ Continental Margins Task Team by the contact people for JGOFS and LOICZ in each country, following a request for information on Continental Margins Research in each country.

This material is also available on the following world wide web site: www.ncor.ntu.edu.tw/cmtt/

If you would like to update or add to this information please contact:

Julie Hall, NIWA, P.O. Box 11115, Hamilton, NZ, Fax: 64 7 856 0151, j.hall@niwa.cri.nz

AUSTRALIA

Project: Tropical River-Ocean Processes in Coastal Settings

Description: The TROPICS project is a joint Australian, USA, PNG (and possibly Indonesian) project to study the terrestrial input of several large rivers of the island of New Guinea, (e.g. Sepik, Fly) to coastal waters and tropical waters of the Pacific Ocean. Major objectives of work to be done by CSIRO Oceanography would be to investigate the supply of nutrients, organics and trace metals to the equatorial region from the Sepik River.

Contact: Programme Co-ordinator - Gregg Brunskill, Australian Institute of Marine Science,, PMB 3, Townsville, MC, QLD 4810, Australia, g.brunskill@aims.gov.au.

Physics/Geology - George Cresswell, CSIRO Division of Oceanography, GPO Box 1538, Hobart, TAS 7001, Australia, george.cresswell@ml.csiro.au

Chemical/Biological - Denis Mackey, CSIRO Oceanography, GPO Box 1538, Hobart, TAS 7001, Australia, denis.mackey@ml.csiro.au.

Project: Oceans-EEZ

Description: Description, based on data analysis and modelling, of the physical state of the Australian Exclusive Economic Zone. Products range from atlases of physical parameters to operational 3-dimensional, data-assimilating and primitive-equation models.

Contact: John Wilkin, CSIRO Division of Oceanography, GPO Box 1538, Hobart, TAS 7001, Australia., john.wilkin@ml.csiro.au

Project: ASEAN Regional Ocean Dynamics Current Metering Experiment

Description: Measurement of water fluxes through the Indonesian Archipelago

Contact: George Cresswell, CSIRO Division of Oceanography, GPO Box 1538, Hobart, TAS 7001, Australia., george.cresswell@ml.csiro.au

Project: Marine Living Resources

Description: Studies of the role of ocean currents in determining the cross-shelf fluxes of crustacea larvae and post-larvae, particularly in the western and southern rock lobster and northern prawn fisheries.

Contact: Dr's Alan Pearce and David Griffin, CSIRO Division of Oceanography, GPO Box 1538, Hobart, TAS 7001, Australia., alan.pearce@per.ml.csiro.au, david.griffin@ml.csiro.au

Project: Geological Evolution of the Australian Continental Margin

Description: AGSO is undertaking a comprehensive investigation of the geological evolution of the Australian Continental Margin to: provide information to encourage and support petroleum exploration; to support Australia's territorial claims under the UNCLOS; to support negotiations on the delineation of sea bed boundaries with neighbouring territories; and to provide geological advice in relation to the delineation of marine parks and protected areas.

Contact: C. Pigram, Australian Geological Survey Office, GPO Box 378, Canberra ACT 2601, Australia., cpigram@agso.gov.au

Project: GEOMEEZ

Description: An integrated Marine Geological and Oceanographic computer model for management of Australia's EEZ (GEOMEEZ). The objectives are to integrate marine geoscience and physical oceanographic information to provide an insight into seafloor processes. Key products would include (1) a classification scheme of Australia's Ocean Territory using sediment mobility and dominant energy regime as classification criteria: and (2) a computer model of seabed processes for use in predicting pollution dispersal, seafloor stability and habitats.

Contact: P.T. Harris, Antarctic CRC, University of Tasmania, GPO Box 252C, Hobart, TAS 7001, Australia., p.harris@antarc.utas.edu.au

Project: Predicting Variability of Physical Ocean Processes

Description: This project emphasises physical processes, water mass movement and sea surface oscillations on tropical coasts and continental margins and particular attention is given to possible links with biological, chemical, sedimentary processes, and stability of man-made structures. The unifying concept is based on the idea of fluxes and balances of mass, energy, and momentum in various time and space scales. There are three sub-projects dealing with three groups of problems:

(1) Modelling ocean circulation in northern Australian seas (D. Burrage, dburrage@aims.gov.au);

(2) Modelling coastal and reef wave dynamics (S. Massel)

(3) Remote sensing of tropical waters (W. Skirving)

Contact: Stan Massel, Australian Institute of Marine Science, PMB 3, Townsville MC, QLD 4810, Australia., s.massel@aims.gov.au

Project: Coastal Zone Programme (CZP)

Description: This project involves studies of the Derwent River estuary and also tropical rivers in Queensland. Studies have recently started on the Huon Estuary south of Hobart.

Contact: Graham Harris, graham.harris@cbr.for.csiro.au

BANGLADESH

Project: Sedimentation on the Continental shelf off the coast of Bangladesh

Description: The project will examine the sediment transport processes on the continental shelf off the coast of Bangladesh. The northern part of the shelf near the Bengal Delta is directly impacted by the sediment-water discharge through the Ganges and Brahmaputra rivers and their tributaries. The project will examine how and where the fine-grained sediments are deposited and how the sands are being separated from the fine-grained sediments and where they (sands) are being finally deposited. The study will examine the origin and mechanism of formation of sand ridges, shoals and sedimentary islands on the continental shelf. The project will try to delineate the source of huge amounts of sand on the eastern shelf and their dynamics, specially how they will be affected by possible rise of sea level. The study will try to identify the source of heavy mineral depositions in off-shore islands and coastal areas. The project will also examine the evolution of the continental shelf off Bangladesh and how this shelf has been impacted by the plate tectonics activities of the area and the rise of Himalayas.

Contact: Mahmood Alam, Dept of Geology, Dhaka University, Dhaka - 1000, Bangladesh.

BELGIUM

Project: Production, Transport and Sinks of Organic Matter and Associated Elements in Marine Systems

Description: The present research constitutes a part of the Belgian Impulse Programme "Global Change", a national contribution to the International Geosphere-Biosphere Programme (IGBP). It is mainly focused on continental margin boundary fluxes.

The project is designed to quantify the most important fluxes and processes affecting the behaviours of components of the carbon cycle in the coastal zone and, more specifically, at the ocean margins. The final goal of this project is to develop models allowing the evaluation of various fluxes involved in the biogeochemical cycles of the elements considered in the water column. It is also an essential step to understand the importance and effects of the anthropogenic perturbations.

It is a co-ordinated effort among the Universite Libre de Bruxelles, the Vrije Universiteit Brussel and the Universite de Liege. These university teams benefit also from the technical assistance of the Management Unit of the Mathematical Model of the North Sea and the Scheldt Estuary (MUMM).

Contact: Roland Wollast, Laboratoire Oceanographie Chimique, Unversite Libre de Bruxelles, Campus de la Plaine - C.P. 208, Boulevard du Triomphe, B-1050 Brussels, Belgium., rwollast@ulb.ac.be

Also see under Europe an Economic Community

BRAZIL

Project: Land-ocean interactions in tropical regions: Significance of mangrove areas for carbon and nitrogen biogeochemistry of the Brazilian continental margin (8 - 24S).

Description: The project was designed to study land-ocean interactions in tropical regions by biogeochemical process studies in the Brazilian continental margin and the adjacent mangrove areas to date and in the late Quaternary. The biogeochemistry of carbon and nitrogen is studied with respect to the small river discharge, the flat and narrow shelf and the mangrove-dominated coastline. The results should improve knowledge on terrigenous matter input to the ocean, its effects on productivity of coastal waters and carbon fixation in continental margin sediments and the relevant processes in tropical regions.

Contact: Venugopalan Ittekkot, Institute of Biogeochemistry and Marine Chemistry, University of Hamburg, Bundesstrasse 55, D-20146, Hamburg, Germany.

CANADA

Project: Shelf Models

Description: Work on the Labrador Sea, shelf and NE Newfoundland shelf was described. Data have been collected by several programmes / agencies on currents and water properties (CASP, LIMEX, etc), and are being used to ground-truth numerical models (3D). Models include such things as ice-ocean interactions, heat and salt fluxes, wind and mixed-layer thickness. Focus is on the exchange at the shelf edge with the ocean's interior.

Contact: Charles Tang, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, NS, B2Y 4A2, Canada.

Project: Continental Shelf Processes

Description: Work on the eastern continental shelf margin sediments (JGOFS) was outlined. The particular focus is on carbon budgets. The importance of continental shelf / margin regions to global carbon budgets was outlined. This project focused on the processes leading to production transport and burial of carbon from varied sources.

Contact: B. Sundby, Dept de Oceanographie, Universite de Quebec a Rimouski, 310 des Ursulines, Rimouski, PQ, G5L 3A1, Canada.

Project: IOS Projects

Description: IOS projects of interest include particle supply, exchange at the shelf edge, hydrocarbon geochemistry, vertical particle flux, transport and sources of water from the shelf, and

modelling. Other work at IOS is being done under BASE (Carmack) and PERD (Melling). It was also mentioned that there was ongoing work in the Canadian West Coast on the delivery of materials including particulates and contaminants to the Georgia Basin.

Contact: R. Macdonald, Institute for Ocean Sciences, Department of Fisheries and Oceans, P.O. Box 6000, Sidney, BC V8L 4B2, Canada.

Project: Under-ice physical oceanographic processes

Description: The long term objective is to develop a clearer understanding, through field work, data analysis and modelling, of the physical oceanographic processes occurring under a complete or partial sea ice cover. In spite of several years of research activity, our knowledge of the dynamics in the upper water column under the sea ice-water interface is still inadequate. To achieve these objectives, a number of specific problems that have evolved out of recent work will be investigated. In regard to plume dynamics under sea ice, we will describe the salinity, velocity and turbulence regime of the Great Whale River plume under landfast sea ice in Hudson Bay over a wide range of river discharge values and develop a numerical model of the plume dynamics. Future applications of this research include assessing the influence of predicted effects of both hydroelectric development and predicted global warming on runoff, ice cover and coastal circulation on plume dynamics. In collaboration with C. Lin, a high resolution numerical model of Hudson Bay and surrounding waters will be developed. In a field study, we will study the generation and dissipation of internal solitons both in Monitounuk Sound and in Resolute Passage. Earlier field work showed their potential importance for mixing and upward nutrient flux in Arctic waters. In the Gulf of St Lawrence, objectives are to characterise the mixed layer over the year and determine interannual variability. The study will provide improved input to sea ice models. Analysis of field data taken recently in and adjoining the NEW polynya (NE Greenland) will be undertaken. In many of the above projects, co-operative research with biologists will allow for continuation of studies on the importance of the physical regime in controlling marine productivity.

Contact: Grant Ingram, Dept of Atmospheric and Oceanic Sciences, McGill University, 805 Sherbrooke St W. Montreal, PQ, H3A 2K6, Canada.

Project: Open Ocean / Continental Shelf Exchanges

Contact: Kenneth L. Denman, Institute of Ocean Sciences, Department of Fisheries and Oceans, P.O. Box 6000, Sidney, BC, V8L 4B2, Canada.

Project: Regeneration versus burial of organic and inorganic carbon in continental margin sediments of Western Canada

Contact: Bjorn Sundby, I.N.R.S. Oceanologie

Project: Palaeo-pCO₂ Determination by GC/C/IRMS of C₃₇ Alkenones in Sediments and Phytoplankton

Contact: Michael J. Whiticar, University of Victoria, Victoria, Vancouver Island, BC, Canada.

CHILE

Project: JGOFS/SAREC - Eastern Boundary Current Programme

Description: The biological and chemical component, which is mainly developed by Chilean scientists, contemplates the measurement of primary production, bacterial biomass and production, zooplankton biomass and grazing, community respiration, dissolved oxygen, phosphate, nitrate, nitrite, ammonium, chlorophyll a and other pigments. The programme also includes a meteorological component where special emphasis has been put in the comparison of coastal data with concurrent ocean data at station COSMOS and OCEMUS.

Contact: Jose Rutllant, Chilean Chairman of the JGOFS/SAREC Study, Departamento de Geofisica, Universidad de Chile, Santiago., Fax: 56 2 6353951; Gary Shaffer, European Co-

ordinator JGOFS/SAREC Study, Department of Geophysics, University of Copenhagen, Denmark.,
Fax: 45 35 822565.

Project: Primary production and its fate in the trophic chain, and CO₂ exchange between the ocean and the atmosphere in the upwelling ecosystem off Antofagasta.

Description: The study area is a grid located in the north part of Chile off Antofagasta. The grid has an area of 5400 nm² and is positioned between the coast and 90 nm offshore (latitudinal position: 22 40' S and 2400 S'). During 1996 and 1997 the programme will carry out two 25 days long cruises in the study area. The main goal of the programme is the study of carbon fluxes and their relationship with the upwelling. In order to do so a process study with simultaneous measurements of several biological, chemical and physical measurements will be conducted, such as: primary production, zooplankton ingestion and excretion (total and size fractionated), community respiration (micro and zooplankton, total and size fractionated), bacterial secondary production, phytoplankton biomass, zooplankton biomass, bacterial biomass, ocean-atmosphere CO₂ dissolved and particulate organic carbon, nutrients, currents and hydrographic variables.

Contact: Humberto Gonzalez, Instituto de Biología Marina, Universidad Austral de Chile, Chile,
Fax: 56 63 212953.

CHINA (Beijing)

Project: The formation and evolution of the radial sand ridges on the Yellow Sea floor, funded as NSFC Key Project (1993-1996).

Description: The radial sand ridges are formed by reworking on the convergent tidal waves. Study of the formation and evolution of the sand ridges and channels between them is important for understanding river-ocean interaction and evolution of the sand bodies and accumulative shelf. Sedimentary sequence of the sand ridges can provide important information of the global environment changes. This project covers four themes:

- (1) analysis and modelling of the erosion and accumulation of the sandy sediments;
- (2) geomorphological and sedimentary properties and evolutionary patterns of the sand ridges;
- (3) formation and evolution of the radial sand ridges in Qianggang Harbour area after glacier epoch;
- (4) remote sensing of instability of the radial sand ridges.

Contact: Ying Wang, Nanjing University, 22 Hankou Road, Qingdao, Shandong, China.

Project: The exchange of water and nutrient between shelf and the Kuroshio in the East China Sea, funded by NSFC (1994-1996)

Description: This project comprises three parts:

- (1) Main processes of water exchange between shelf and the Kuroshio and their seasonal variations;
- (2) Role of Kuroshio frontal eddies in the water exchange between shelf and the Kuroshio;
- (3) Transport pattern of the nutrient at the shelf edge of the East China Sea.

Contact: Binghuo, GUO, First Institute of Oceanology, SOA, Hongdao Road, Qingdao, Shandong 266071, China.

Project: Key processes of ocean flux in the East China Sea (POFLECS), funded as NSFC Key Project (1996-1999)

Description: This project has been funded as one of the first five key projects in Earth Science of NSFC for the next five year plan starting from January 1996. It involves four studies:

- (1) Transport processes of materials from the Yangtze River and generated on the shelf of the East China Sea to the Okinawa trough.
- (2) Key processes of vertical fluxes of carbon and other relevant biogenic elements in the cold eddy area at the weakest horizontal advection and in the middle shelf with significant horizontal advection.
- (3) Sediment dynamics in the cold eddy area south east of Cheju Island.
- (4) Estimation of the capability of carbon fixation in the East China Sea.

Contact: Dunxin Hu, Institute of Oceanology, CAS, 7 Nanhai Road, Qingdao Shandong 266071, China.

Xiankun Lu, Ocean University of Qingdao, 5 Yushan Road, Qingdao Shandong 266003, China.

Project: Study of water and nutrient exchanges of the shelf and the Kuroshio water in the East China Sea

Contact: Binghuo Gup, First Institute of Oceanography, SOA, Hongdao Rd Qingdao, Shandong 266071, China.

Project: Study of Carbon Flux in the South China Sea

Contact: Wuying Han, South China Sea Inst. of Oceanology, CAS, 7 Nan-Hai Rd, Qindao, Shandong 266071, China.

Project: Margin Flux in the East China Sea

Contact: Dunxin Hu, Institute of Oceanology, CAS, 7 Nan-Hai Road, Qingdao 266071, China.

CHINA (Taipei)

Project: The Kuroshio-East China Sea Shelf Exchange Processes KEEP II

Description: The major contribution from Taiwan to the international JGOFS program at present is the Kuroshio-East China Sea Shelf Exchange Processes study, which is the second phase of the Kuroshio Edge Exchange Processes program (KEEP-II). KEEP-I (1989-1994) was originally developed out of the interest of Taiwanese oceanographers in the water exchange across the Kuroshio frontal zone in the East China Sea northeast of Taiwan and the concomitant biogeochemical fluxes. As the significance of carbon fluxes at the continental margins was increasingly recognised, KEEP had been included in the JGOFS implementation plan and the second phase was developed and supported by the National Science Council located in Taipei. The goals of KEEP-II are three fold:

- (1) To observe and determine the water and material (especially, carbon) exchange fluxes between the Kuroshio and the East China Sea shelf;
- (2) To assess the biological resources in the East China Sea;
- (3) To trace the transport of sediments and anthropogenic materials in the East China Sea.

There are 26 projects in this program, which is expected to continue until 1997. The third phase of the program, i.e., KEEP-III, is currently under planning. The titles and principal investigators of the KEEP-II projects are listed below:

1. The Kuroshio-East China Sea Shelf Exchange Processes: the Service project.

Kon-Kee Liu, Institute of Oceanography, National Taiwan University, P.O. Box 23-13, Taipei, kkliu@ccms.ntu.edu.tw

2. Current field on the southern boundary of East China Sea

Tswen-Yung Tang, Institute of oceanography, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., tyt@ccms.ntu.edu.tw

3. Satellite remotely sensing the sea surface dynamics of East China Sea and its relationship with environment of fishing grounds.

Chen Shih-Chin, Taiwan Fisheries Research Institute., Fax: 886 2 462 9388

4. A study of particle transport in the shelf of East China Sea by a moored transmissometer.

Cheng-Han Tsai, Department of Oceanography, National Taiwan Ocean University, P.O. Box 23-13, Taipei, R.O.C., chtsai@ntou66.ntou.edu.tw

5. Distributions of chemical hydrography, chlorophyll and primary productivity in the East China Sea

Gwo-Ching Gong, Department of Oceanography, National Taiwan Ocean University, P.O. Box 23-13, Taipei, R.O.C., gcgong@ntou66.ntou.edu.tw

6. Particle dynamics and transport processes in the East China Sea.

- Ching-Ling Wei, Institute of oceanography, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., weic@ccms.ntu.edu.tw
7. Transport and Flux of Particulate in the KEEP II area: Radiogeochemistry of particulates and sediments (II).
- Yu-Chia Chung, Institute of Marine Geology, National Sun Yat-Sen University, Kaohsiung, 80424, R.O.C., ycchung@mail.nsysu.edu.tw
8. Geochemical Fluxes of Particulate Matter in the East China Sea (II). Studies in the Southern ECS.
- Jia-Jang Hung, Institute of Marine Geology, National Sun Yat-Sen University, Kaohsiung, 80424, R.O.C., hungjj@mail.nsysu.edu.tw
9. Distribution of dissolved metals in the East China Sea
- Tong-Ming Hsiung, National Taiwan Ocean University, Keelung 202-24, R.O.C., thsiung@ntou66.ntou.edu.tw
10. A biogeochemical study of new production, bacterial production, organic carbon and iodine in the East China Sea.
- Kon-Kee Liu and Frank Shiah, Global Change Research Center, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., kkliu@ccms.ntu.edu.tw, fkshiah@iodecl.oc.ntu.edu.tw
- 11 Primary Production and New Production in Waters off northeast Taiwan.
- Yuh-Ling Lee Chen, Department of Marine Resources, National Sun Yat-Sen University, Kaohsiung, 80424, R.O.C., yll@mail.nsysu.edu.tw
12. The estimation of phytoplankton growth rate and its roles in the carbon cycle in southern East China Sea using the dilution culture method.
- Jeng Chang, Institute of Marine Biology, Taiwan Ocean University, Keelung 202-24, R.O.C., b0176@nout66.ntou.edu.tw
13. Trophic dynamics of plankton in East China Sea shelf waters
- H.Y. Chen, Institute of Marine Biology, Sun Yat-Sen University, Kaohsiung, 80424, R.O.C., nychen@mail.nsysu.edu.tw
14. Estimation of zooplankton biomass from shipboard acoustic Doppler current profiler
- S.P. Yeh, Department of Aquaculture, National Pingtung Polytechnique Institute, Fax: 886 8 774 0225
15. Interaction of East China Sea Ichthyoplankton with the Kuroshio Current.
- Tai-Sheng Chiu, Department of Zoology, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., tshiu@ccms.ntu.edu.tw
16. Oxic and anoxic organic carbon respiration rate in the East China Sea sediments (IK) - anoxic sulphate reduction rate and organic carbon deposition rate.
- Sawwood Lin, Institute of Oceanography, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., swlin@ccms.ntu.edu.tw
17. The partitioning of trace elements in seawater particulates and sediments from the East China Sea (II).
- Fei-Jan Lin, Institute of Oceanography, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., Fax: 886 2 362 6092
18. Distribution of fatty alcohols and sterols in sediments off north-eastern Taiwan.
- Woei-Lih Jeng, Institute of Oceanography, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., wljeng@iodecl.oc.edu.tw
19. The study of the benthic biological activities in the sediment Northeast of Taiwan.
- I-Jiunn Cheng, Institute of Marine Biology, National Taiwan Ocean University, P.O. Box 23-13, Taipei, R.O.C., b0107@nout66.ntu.edu.tw
20. ZKEEP II/WOCE/South China Sea-Carbon Flux Study (II).
- Chen-Tung Arthur Chen, Institute of Marine Geology, Sun Yat-Sen University, Kaohsiung, 80424, R.O.C., ctchen@mail.nsysu.edu.tw
21. Study of the sea surrounding Taiwan using Synthetic Aperture Radar images.

- Ming-Kuang Hsu, Department of Oceanography, National Taiwan Ocean University, P.O. Box 23-13, Taipei, R.O.C., hsumk@ind.ntou.edu.tw
22. d13C-POC and d13C-CO₂aq of seawater in KEEP region.
David D. Sheu, Institute of Marine Geology, National Sun Yat-Sen University, Kaohsiung, 80424, R.O.C., ddsheu@mail.nsysu.edu.tw
23. Fishing ground formation in the north-eastern waters of Taiwan by the satellite and acoustic method.
Ming-Anne Lee, Department of Fishery Science, National Taiwan Ocean University, P.O. Box 23-13, Taipei, R.O.C., xtuser@lee.fd.ntou.edu.tw
24. Studies on phytoplankton distribution in relation to oceanographic conditions in the East China Sea.
Kuo Ping Chiang, Department of Fishery Science, National Taiwan Ocean University, P.O. Box 23-13, Taipei, R.O.C., b0173@nout66.ntou.edu.tw
25. Distribution, Post-Mortem Transportation and Sedimentary Flux of Calcareous Nannoplankton in the Kuroshio Edge Exchange area off northern Taiwan (1995-1998)
Kuo-Yen Wei, Department of Geology, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., weik@cc.ntu.edu.tw
26. Study of the seafloor northeast of Taiwan using 3.5 kHz echo sounder
Ho-Shing Yu, Institute of Oceanography, National Taiwan University, P.O. Box 23-13, Taipei, R.O.C., yu@moonzo.oc.ntu.edu.tw

CUBA

Project: The Climatic Changes and Variations in the Shelf's Coastal Sea of Cuba and their Impact.

Description: The Ocean-Atmosphere interaction is considered to moderate or intensify the climatic changes, but at least it will always be a modifier. The main purpose for predicting the Global Change is to estimate its impact in different regions. The islands and archipelago areas are considered among the most vulnerable regions of the world surface to the impacts of climatic changes. Some of them, like Cuba, have extensive shelf areas. Coastal seas are the link between the ocean and the coast in which the climatic changes exert strong and rapid influence because there are more actives and variables than the ocean. The necessity to know and understand what the climatic change and variations annual, decade and their interrelations with the ocean, will generate in the coastal sea and their impact mainly in the species and fisheries, is the main objective of this project.
Contact: Carlos J. Garcia, Fisheries Research Center, 5th Ave and 248 Barlovento, Sta Fe, C. Havana, Cuba.

EAST AFRICAN REGION

Project: Structure, function and dynamics of mangrove ecosystems in Kenya

Project: Interlinkages between Coastal Marine Ecosystems in the East African Region

Project: The Netherlands Indian Ocean Project and Marine processes in the Kenyan Coastal Waters.

Contact: E. Okemwa, Director - Kenyan Marine & Fisheries Institute, P.O. Box 81561, Mombasa, Kenya., Fax: 254 11 472 215

Project: Dynamics and Assessment of Kenyan Mangrove Ecosystems

Description: The association of coastal lagoon and mangrove forests along the Kenyan coast constitutes unique environments sustaining enhanced biomasses of several commercial fish, shellfish and crustaceans species as compared to coastal and open sea environments. The lack of appraisal of the status of Kenyan mangrove forests has been limitation on the formulation of an adequate management and conservation policy. Therefore, the project was designed as an

interdisciplinary scientific co-operation between Kenya, The Netherlands, Italy and Belgium to gather basic information on the structure and functioning of a selected Kenyan mangrove ecosystem, Gazi-Bay, situated 50 km south of Mombasa. The research work focused on the following: (i) Assessment of the different components of the ecosystem, in terms of biodiversity, biomass and productivity. (ii) estimation of nutrient and energy flows through the ecosystem and mathematical modelling.

Contact: P. Polk, Laboratorium of Ecology, Free University of Brussels, Pleinlaan 2 B-1050 Brussels, Belgium.

Project: Coastal changes in Eastern Africa: Sedimentation and erosion

Description: Much of the shoreline of the eastern African region is highly dynamic with beaches, mangroves and wetlands being eroded, and in some areas accreting. The present causes of the widely observed coastal erosion are not well understood, and neither are the possible trends in relation to increasing sea level. Anthropogenic actions, including clearance of mangroves and degradation of reef environments may play an important role in reducing the biogeomorphological processes which stabilise shorelines.

The project has the objectives of: (1) characterising and quantifying the vulnerability of different coastal environments to erosional processes driven by natural and anthropogenic forcing;

(2) quantifying the capacity of individual coastal ecosystems to supply and retain sediments;

(3) assessing riverine flux of sediments to the coastal zone; determining recent, past trends in shoreline evolution;

(4) determining the quantities and physical-chemical characteristics of the sediments delivered to the coastal zone and their temporal variation, and quantifying the relationship between hydrodynamic conditions and sediment fluxes within and between coastal systems.

Contact: A.K. Semesi, Department of Botany, University of Dar-es-Salaam, P.O. Box 35060, Dar-es-Salaam, Tanzania.

EUROPEAN ECONOMIC COMMUNITY

Project: Multidisciplinary Oceanographic Research in the Eastern boundary of the North Atlantic (MORENA) from the EU

Description: MORENA objectives are to measure, understand and model shelf-ocean exchange in a typical coastal upwelling region in the eastern boundary layer of the subtropical ocean. A multidisciplinary approach aims at the quantitative understanding of the physical, chemical and biological processes involved in the transfer of matter (salt, particulates, nutrients, organic compounds, biomass), momentum and energy across and along the shelf, the shelf break and the slope, in the Iberian region of the European Atlantic.

Contact: A. Fuiza, Instituto de Oceanografia, Faculdade de Ceocias, Universidade de Lisbon, Rua Ernesto de Vasconcelos, Campo Grande, 1700 Lisbon, Portugal

T.J. Sherwin, UCES, University of Wales School of Ocean Sciences,, Menai Bridge, Bangor LL59 5EY, U.K.

Project: Ocean Margin Exchange (OMEX)

Description: The aim of the Ocean Margin Exchange (OMEX) project, supported by the European Commission in the framework of the MAST programme, is to gain a better understanding of the physical, chemical, and biological processes occurring at the ocean margins in order to quantify fluxes of energy and matter across this boundary. The objective is to provide a more accurate picture of the biogeochemical interactions between the coastal zone and the open ocean. This information is essential for the development of predictive models required to evaluate the response of the shelf and slope to global environmental changes. The physical studies are mainly focused on the determination of advective and diffusive transport processes at the European shelf edge boundary using field measurements and theoretical analyses. Prognostic models are being

developed to estimate fluxes of water and particles in characteristic but contrasting systems of the North-eastern Atlantic European shelf edge. Special efforts have been devoted to the understanding of the various components of the carbon cycle and associated elements (nutrients and oligo-elements). This includes the study of the temporal and spatial variability of production, consumption, transport and burial of organic matter. Ecological models are developed in order to assess the population dynamics in relation to the food flux with special emphasis on the pelagic-benthic coupling. The distribution, properties, transport and rate of accumulation of sediments in the selected areas are determined with particular consideration on the role of the nepheloid layer. The physical chemical and biological aspects of the utilisation or burial of organic and inorganic carbon in the sediments are investigated by examining the vertical distribution of dissolved and particulate matter. Finally the ocean margins often characterised by upwelling and enhanced biological activity, are essential areas for the evaluation of fluxes of gaseous components between the ocean and atmosphere. Determinations of rates of exchange of CO₂, CH₄ sulphur biogases are performed. There are 41 principal investigators from Belgium, Denmark, France, Germany, Great Britain, Ireland, Norway, Spain and Portugal. All data collected during OMEX is being assembled at the British Oceanographic Data Centre, (BODC) to facilitate the interchange of data among the project's scientists and to enable a comprehensive project data set to be published. An overview of the OMEX Data Management regarding OMEX cruises and data events can be obtained from the World Wide Web (<http://www.nbi.ac.uk/bodc/omex.html>).

Contact: Roland Wollast, Lei Chou, Bernard Avril, Laboratoire d'Océanographie Chimique, Université Libre de Bruxelles, Campus de la Plaine - C.P. 208, B-1050 Brussels, Belgium.

Sub-Project Leaders: Physics

John Huthnance, Bidston Observatory, Proudman Oceanographic Laboratory, Birkenhead, Merseyside L43 7RA, UK, Fax: 44 151 6536269, jmh@ua.nbi.ac.uk

Biological Processes

Paul Wassmann, Norwegian College of Fishery Science, University of Tromso, PO Box 3083 Guleng, 9001 Tromso, Norway, Fax: 47 83 71832, paulw@nfh.uit.no

Biogeochemical Cycles

R. Fauzi C. Mantoura, Plymouth Marine Laboratory, Prospect Place, West Hoe, Plymouth PL1 3DH, UK, Fax: 44 1752 633101, rpcm@wpo.nerc.ac.uk.

Benthic Processes

Tjeerd C.E. van Weering, NIOZ, PO Box 59, 1790 AB Den Burg, Texel, The Netherlands, Fax: 31 222 319674, haas@noiz.nl

Carbon Cycling and Biogases

Soren Larsen, Department of Meteorology and Wind Energy, RISO National Laboratory, 400 Roskild, Denmark, Fax: 45 46 755619, metsol@risoe.dk

Project: EUROMARGE NB

Description: EUROMARGE is the European extension within the EC Marine Science and Technology-MAST II programme which addresses these topics on a larger scale. Participating countries are France, Spain, United Kingdom, Italy, Greece and Switzerland. The major objective is to determine some of the fundamental features of particle transfer across ocean boundaries from the comparison of several typical regions across the Mediterranean. This has been realised in different trophic environments, from the mesotrophic north-western to the oligotrophic eastern Mediterranean.

Besides this large programme activities, we currently maintain a long-term monitoring in the Gulf of Lions; particle fluxes are measured on a monthly basis since 1993 and intended to obtain at least a 5 year time series.

Project: MATER

Description: Regarding the near future, a new large integrated research programme will start during the coming year (1996) within the EC MAST III programme. This project, called MATER (Mass

transfer and Ecosystem Response), federates around 60 European Laboratories and focuses on two main research axes;

- (1) general circulation, seasonal and interannual variability;
- (2) biogeochemical cycling and budgets between different compartments.

Since the Mediterranean is a marginal basin, many of the proposed activities could directly relate to the joint effort in the field of Continental Margins programmes.

Contact: Andre Monaco, University of Perpignan, France, 52 Ave de Villeneuve, 66820, Perpignan, France.

FRANCE

Project: EMIR (Exportation de Carbone sur une Marge Insulaire Recifale) - Carbon Export on an Island Reef Margin

Description: Coral reefs, known as one of the most productive ecosystems of the world, develop in an oligotrophic oceanic environment. The export of organic and inorganic carbon by reef ecosystem have been seldom investigated. In particular, the carbon export towards the ocean has never been quantified until now. This is the general aim of the EMIR project, supported by the French Coral Reefs National Programme (PNRCO). The main objectives of the EMIR project are:

- (1) to quantify the carbon flux in the coastal ocean and to identify its nature and composition
- (2) to determine the respective contributions of lagoons and island bays, the role of the outer reef slope, and the importance of the vertical and advective components of the carbon flux.
- (3) to evaluate the future of the carbon flux.

The EMIR strategy is to track the carbon flux from the source points, either lagoons or bays, to the definitive export destination, in a multidisciplinary approach of the hydrological, geochemical, sedimentological and biological processes.

Contact: Bruno Delesalle, Laboratoire de Biologie Marine et Malacologie, EPHE, URA 1453 CNRS, 52 Avenue de Villeneuve, F-66860 - Perpignan Cedex, France.

Project: ECOMARGE (Ecosystemes de MARGE continentale)

Description: ECOMARGE is a multidisciplinary programme which aims to determine the origin, composition and transport of particulate matter and associated elements on continental margins, as well as the benthic response to such transfers. Field work is mainly performed through time series observations and seasonal surveys.

The integrated results from the first phase in the Mediterranean in the Gulf of Lions were published in Continental Shelf Research (10, 1990). In order to draw up mass and element budgets for the whole margin, research in this area was coupled with studies on coastal accumulation and river discharge, in the frame of the PNOG (Programme National d'Océanographie Cotière) / ECOCOT (ECOSystème COTier).

GERMANY

Project: The ESTOC (European Station for Time-series on the Ocean, Canary Islands)

Description: The ESTOC (European Station for Time-series on the Ocean, Canary Islands) station is located 60 nautical miles north of Gran Canaria and Tenerife in the eastern boundary current region of the subtropical north Atlantic gyre. The project is based on a Spanish-German collaboration with the following participating institutions: On the Canary Islands the Instituto Canario de Ciencias Marinas (ICCM) and the Instituto Espanol de Oceanografia (IEO), and in Germany the Marine Physics group at the Institut für Meereskunde in Kiel (IFM) and the Marine Geosciences group at the University of Bremen (UB). Monthly cruises to the station began in February 1994. Once or twice a year joint process studies are carried out in the region to investigate the mesoscale variability near the station and to check for the representativeness of the station for a larger region.

Contact: Susanne Neuer, Geosciences FB 5, Univ. of Bremen, Klagenfurter Strabe, 28359, Bremen, Germany.

Project: Coastal Upwelling off Chile: Source or Sink for CO2?

Contact: G. Wefer, Geosciences Department, University of Bremen, Klagenfurterstr., D-28359 Bremen, Germany., Fax: 49 421 218 3116..

GREECE

Project: Physical Oceanography of the Aegean and Ionian Seas POEM

Description: The Eastern Mediterranean is of great interest because of the occurrence of powerful physical processes. A series of different-scale phenomena, such as the thermohaline circulation, the water mass formation and the eddy field activity are among the most important object to be studied in the area. The Aegean and the Ionian are two of the four major Eastern Mediterranean seas. Each one presents unique characteristics and plays a significant role in the general hydrography and dynamics of the Mediterranean. The goal is to increase knowledge in the fields of physical, chemical and biological oceanography, as well as in the interactions of the sea with the atmosphere, the topography and the coasts. Within this framework, an extensive programme in Physical Oceanography has been established and is operating in order to reach the ultimate knowledge of the phenomenon, to understand the dynamics, the general mesoscale circulation and to study water mass formation and dispersion processes, upwellings, fronts etc, in relation to the driving mechanisms.

Contact: A. Theocharis

Project: Hydrodynamics and geochemical fluxes in the Strait of Otranto

Description: The major scientific objectives of the research are to improve knowledge about the hydrodynamics of the Strait of Otranto and to evaluate the water and particle fluxes across this Strait at synoptic, seasonal and interannual time scales. A long-term (15 months) monitoring of currents (with current recorders) and sediment fluxes (with sediment traps) in the Strait will be performed. Seasonal surveys in the area of the strait, including one general survey of the entire basin (covering the southern Adriatic and northern Ionian Seas), will complement the above observation. The synoptic shipboard measurements will include C.T.D. casts, as well as water sample collection for the determination of nutrients and of dissolved and particulate elements. The results of the experimental plan will provide a unique data set both for the validation of the models and for the assessment of complementary programmes.

Contact: E. Papageorgiou

Project: Pelagic-benthic coupling in the oligotrophic Cretan Sea (NE Mediterranean). CINCS

Description: Recent hydrological investigations in the Cretan Sea have revealed the occurrence of intermediate and deep water formation processes. It is generally accepted that these processes influence pelagic-benthic coupling mechanisms significantly. This is also one of the most oligotrophic regions in the world (nutrient concentrations have been found to be very low, with phosphorus being the main limiting factor), characterised by a stratified, two-layered water column, which is considered to be dominated by a pelagic microbial loop type of food chain, that restricts energy transfer to the deeper layers.

The main objective of the proposed research will be to detect and quantify the transfer of shelf and surface derived organic matter to the benthos of the shelf, shelf break and slope on a seasonal, bathymetric and interannual basis.

Contact: G. Chronis

JAPAN

Project: MASFLEX: Marginal Sea Flux experiment in the West Pacific

Description: The MASFLEX project is a multi-disciplinary research project on marginal sea flux study, to clarify processes of flux and cycling of carbon, other biogenic materials and terrigenous materials in the East China sea and to evaluate the role of marginal seas on global changes. Seven scientific cruises in the East China Sea are planned in the programme. This research is conducted as a Japan-China joint programme on material flux in the East China Sea.

Contact Persons Hajime Katayama, Ocean Development Division, Science and Technology Agency, 2-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100, Japan; Kazuo Iseki, Seikai National Fisheries Research Institute, Kokubu 49, Nagasaki 850, Japan.

MEXICO

Project: Physical-Biological Interactions in California's Current.

Description: This project is proposed to adjust a model of the California stream flow to a poblational model to investigate some of the physical-biological interactions which occur in California's current ecosystem.

Contact: Alejandro Parés Sierra, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: Variability of low frequencies on the General Circulation of the Gulf of California.

Description: This project contemplates the advance on the understanding of the dynamic of low frequencies of the circulation of the Gulf of California.

Contact: Silvlo Guldo Marinone Moscheto, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: Influence of Circulation Related to Ties over the Horizontal Distribution of Turbidity on the North of the Gulf of California.

Description: To obtain fields of velocity and elevation by ties using a bi-dimensional numerical model. Also to obtain turbidity (radiance) spaced distributions from digital images (multi-spectral scanner. MSS or Thematic mapper, TM); and comparative diagrams on turbidity distribution and tie currents, residual currents and dissipation of energy in live and death ties.

Contact: Luis Gustavo Alvarez Sánchez, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: Measurement of Currents in the Northern Region of the Gulf of California

Description: The main objectives of this project are to quantify the interchange of water through channels East and South-east of Angel de la Guarda Island and to complement measurements with current meters which will be made North of the Gulf. The general objective of measurements in North Gulf is to measure directly the seasonal circulation of that region.

Contact: Juan Manuel López Mariscal, CICESE, Oceanography Dept., Ensenada B.C. Mexico.

Project: Hydrography and Dynamic of the Mexican Tropical Pacific Gulf of Tehuantepec

Description: Broaden knowledge about mechanisms ruling superficial composition and dynamic of the Oriental Tropical Pacific; advance in the study of formation of swirls induced by wind, and study the spreading of swirls generated by the wind in the Gulf of Tehuantepec, as well as the interchange of momentum, mass and heat between the coast and adjacent ocean.

Contact: Armando Transvia Castro, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: Hydrography and Dynamic of the Mexican Tropical Pacific: Oceanic Transitional Area Adjacent to the Gulf of California.

Description: Describe the hydrography and dynamic of the oceanic region adjacent to the Gulf of California to design strategies to study phenomena of smaller spaced and temporary scales.

Contact: Armando Trasviña Castro, CICESE, Oceanography Dept., Ensenada, B.C. Mexico

Project: Physical Oceanography, Fertilisation and Primary Production of the Todos Santos, B.C. Bay

Description: The global objective of this project is to describe the seasonal pattern of circulation, the hydrographic structure (temperature, salinity, nutrients biomass and productivity of the fitoplancton) and the flux of heat in the BTS.

Contact: M.C. José-María Robles Pacheco, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: Effects of Advection over Stratification in Frontal Areas.

Description: To establish how the advection induced by wind and by the distribution of mass field affects the geographic generation and position of frontal zones; to develop numerical models which include advection effects, and to analyse hydrographic conditions in frontal areas during an annual cycle.

Contact: Ma. Luisa Argote Espinoza, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: Circulation System in the Northern Region of the Gulf of California

Description: The general objective is to increase the knowledge of mechanisms which determine the circulation system of the northern region of the Gulf of California.

Contact: Miguel Fernando Lavín Peregrina, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: CANEK: Interchange of Yucatan's channel

Description: The objectives of this project are centred in the careful determination of interchanges through Yucatan's channel.

Contact: Antoine Badan Dagon, CICESE, Oceanography Dept., Ensenada, B.C. Mexico.

Project: Primary productivity in Adjacent Waters to Mexico: from samples in situ to the sensors orbiting in satellites.

Description: The objectives are related to aspects of use of data generated by remote sensors and the algorithms to estimate the primary organic productivity based on this data: Characterise temporary-space variation of phytoplankton biomass and its relation to the physical phenomenology on seas adjacent to Mexico; characterise the variation of parameters of phytoplanktonic communities and their relation to the physical phenomena; characterise profiles of phytoplanktonic biomass to associate its geometry to satellite data; and to apply algorithms from remote sensors for the estimate of the primary productivity and compare the results with historic data form incubations with 14C with calibration purposes.

Contact: Saul Alvarez Borrego, CICESE, Ecology Dept., Ensenada, B.C. Mexico.

Project: Ecological Processes of Plankton from the Gulf of California and the Occidental Coast of B.C.

Description: Characterise bio-optical properties and organic carbon fluxes in central region of the Gulf of California, to evaluate the role of marginal seas on carbon cycle and its relation to the climatic variability in stationary and interannual scales; and also characterise the stationary and interannual variability of zooplankton on the occidental coast of B.C. and its relation to the climatic changes at such scales.

Contact: Rubén Lara Lara, CICESE, Ecology Dept., Ensenada, B.C. Mexico

NEW ZEALAND

Project: Nearshore Offshore Exchanges

Description: The Nearshore Offshore Exchanges programme aims to describe, understand, and model the processes by which water masses, sediments, nutrients and organic matter are exchanged between the nearshore and offshore regions of New Zealand's northeast coast - an area of presently low land sediment input and apparently frequent intrusion of oceanic waters. Specific projects

address: the causes, physical and biological characteristics, and inter-annual and seasonal variability of oceanic water intrusions; sediment activity on the continental shelf; the rate of any net shoreward flux of sand to the beaches from the inner continental shelf; and the role of energy convergence on water flows and sediment transport past headlands.

Contact: D.M. Hicks, NIWA, P.O. Box 8602, Christchurch, New Zealand., m.hicks@niwa.cri.nz

Project: Biological Effects of Cross-Shelf Water Transfer

Description: This programme focuses on the consequences of cross-shelf water transfer for the planktonic biology of coastal waters along the Northland east coast (Hauraki Gulf) region. The overall hypothesis posed is that the supply of nitrogen to the coastal waters, and how the consequent planktonic biomass is produced, fractionated, metabolised and sedimented, is independent of the character and timing of such water transfer.

Contact: John Zeldis, NIWA, P.O. Box 14-901, Kilbirnie, Wellington, New Zealand, jrz@niwa.cri.nz

POLAND

Contact: Ryszard B. Zeilder, Institute of Hydroengineering of the Polish Academy of Sciences, Kosciarska 80953, Gdansk, Poland,

ROMANIA

Project: Structure, sedimentation and evolution of the north-western continental margin of the Black Sea

Description: Characterisation of the depo-environments (deposition, non-deposition, erosion) of the north-western Black Sea continental margin. In particular, the role of fluvial discharge into the deep sea zone (Danube deep-sea fan complex) was studied.

Morphological mapping, examination of distribution of sedimentary units, reconstruction of the paleo-environments.

Sediment and pollutants transport and fluxes, including mass transport processes as well as confirmed and unconfirmed flows.

Contact: How Kin Wong

Institute of Biogeochemistry and Marine Chemistry, University of Hamburg

Bundesstrasse, 55, 20146 Hamburg, Germany, Nicolee Panin, Romanian Center of Marine Geology and Geo-ecology, Dimitrie Onclul Street 25, Bucharest 70318, Romania.

Project: European River-Ocean system (EROS-2000), phase III - the system River Danube - Black Sea.

Description: To contribute to the identification of the present-day structure and functioning of the macrogeosystem River Danube - Danube Delta - Black Sea (North-western sector) and its ecosystems and understanding of the mechanisms that led to the observed dramatic environmental degradation of the region.

To determine the response of coastal sea in the perspective of global change and consequences of human impact through pollution, eutrophication and physical disturbance on land-sea interactions in the coastal zone. To assess the fluxes within the coastal zone and over the continental shelf and slope.

Contact: Jean-Marie Martin, Joint Research Centre, Environment Institute, 1-21020, Ispra, Varese, Italy; Nicolee Panin, Romanian Center of Marine Geology and Geo-ecology, Dimitrie Onclu 25, Bucharest 70318, Romania.

Project: Integrated land-sea study of the Danube Delta, continental shelf and Danube deep-sea fan complex: the impact of the global changes on the processes of sedimentation, state of ecosystems and biodiversity

Description: (1) assessment of the genesis and evolution of the delta and adjacent continental margins;

(2) study of the geological scale records of the global changes impacts on the development of the delta, of the coastal zone, of the state of particulate matter fluxes, of ecosystems and biodiversity.

Contact: Serge Berne, IFREMER - Centre Oceanologique de Brest, 29280 Plouzane, France; N. Panin, Romanian Centre of Marine Geology and Geo-ecology, Dimitrie Onclul Street 25, Bucharest 70318, Romania.

RUSSIA

Project: Global fluxes and the cycles of production. CO₂ and O₂ fluxes in the ocean

Description: The main goal is to evaluate the material fluxes in conjunction with bioproductivity in the ocean including continental margins. Sedimentary traps, remote sensing satellite data and ecosystemic modelling are used widely. The fluxes of aerosols are included mainly in the Russian Arctic and North Atlantic.

Contact: A.P. Lisitzin, P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Krasikova St. 23, 117218, Moscow, Russia., Fax: 7 095 124 5983.

Project: Black Sea

Description: The combined studies of the ecosystem of the Black Sea near Caucasus zone included the assessment of the environment parameters, fluxes and distribution of natural material and contaminants (petroleum products, pesticides, metals), the status and nature of changes of various groups of biota.

Contact: Kasimir, M. Shimkus, P.P. Shirshov, Institute of Oceanology, Russian Academy of Sciences, Kraikova St. 23, 117218, Moscow, Russia.

Project: Ecological System and fluxes of material in the Baltic Sea

Description: Fluxes of sediments and cycles of organic carbon and chemical elements in the Baltic Sea ecosystem.

Contact: Emil M. Emelyanov, P.P. Shirshov Institute of Oceanology, Atlantic Department, Prospect Mira, 1, Kaliningrad, 236000, Russia.

Project: Assessment of influence of terrigenous and biogenic sources on material fluxes in the Far Eastern Seas

Description: Studies of terrigenous and Biogenic sources of material (river discharge, bottom erosion, plankton degradation and pollution) and fluxes of sediment and organic matter in estuaries, shelf zones and open areas of the Japan, Okhotsk and Bering Seas.

Contact: V.V. Anikiev, P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Kraikova St. 23, 117218, Moscow, Russia.

Project: Cycles of suspended sediments, organic carbon and heavy metals in the seas of arid zone (South Russia) and in the Barents and Norwegian Seas

Description: Cycles of suspended sediments, organic carbon and heavy metals in the seas of arid zone (South Russia) and in the Barents and Norwegian Seas.

Contact: Yu. P. Khrustalev, Restov/Don State University, Zorge 40, Rostov/Don 344090, Russia.

Project: Land/Ocean Interactions in the Russian Arctic 1996.

Description: The forthcoming project under the IASC umbrella will be modelled on the LOICZ Project principles.

Contact: V. Gordeev, P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Kraikova St 23, Moscow 117218, Russia., Fax: 7 095 124 5983.

SOUTH AFRICA

Project: Benguela Ecology Programme

Contact: J. Field, Marine Biology Research Institute, University of Cape Town, Rondebosch 7700, South Africa, jgfield@ucthpx.uct.ac.za; , F. Shillington, Oceanography Department, University of Cape Town, Rondebosch 7700, South Africa, shill@physci.uct.ac.za; L. Hutchings, Sea Fisheries Research Institute, Private Bag X2, Rogge Bay 8012, South Africa, lhutchin@sfri.sfri.ac.za

Project: Benguela Ecology Programme: Biogeochemical processes

Contact: T Probyn, Oceanography Department, University of Cape Town, Rondebosch, 7700, South Africa, probyn@physci.uct.ac.za; C. Moloney, Sea Fisheries Research Institute, Private Bag X2, Rogge Bay 8012, South Africa, cmoloney@sfri.sfri.ac.za; B. Mitchell-Innes, Sea Fisheries Research Institute, Private Bag X2, Rogge Bay 8012, South Africa, bminnes@sp.sfri.ac.za

Project: Benguela Ecology Programme: Remote sensing

Contact: F. Shillington, Oceanography Department, University of Cape Town, Rondebosch, 7700, South Africa, shill@physci.uct.ac.za

Project: Biogeochemical Processes

Description: This project has three main objectives. It seeks to investigate the interaction between physical and biological factors in determining the structure of pelagic food webs in pulsed and strongly stratified shelf environments. In doing so, the project wishes to determine the long scale and seasonal patterns of new production in the shelf seas off South Africa and to ascertain if satellite imagery can provide reliable estimates of water column total primary production and new production.

Contact: J.G. Field, Marine Biology Research Institute, University of Cape Town, Rondebosch 7700, South Africa., jgfield@ucthpx.uct.ac.za

Project: Soil erosion and land use change in southern Africa (SELUCSA)

Description: The project aims to assess the role of human activities in impacting soil erosion, sediment production and land degradation in southern Africa during the late Holocene. Several key lines of evidence are utilised, including the physical, chemical and biological analysis of sediment cores from the offshore mudbelt. Preliminary findings suggest that the sediments accumulating in the Namaqualand mudbelt are a valuable source of information on the changing rates of sediment supply from the Orange River and other fluvial systems which flow into the Atlantic Ocean in southern Africa. In this way they can yield information on the effects of human activity on terrestrial ecosystems. The sediments also yield clues as to the productivity of marine life during the depositional period. Other forms of evidence are based on terrestrial sediments and satellite and other remotely sensed imagery.

Contact: Michael E. Meadows, Department of Environmental & Geographical Science, University of Cape Town Rondebosch 7700, South Africa., meadows@enviro.uct.ac.za

UNITED KINGDOM

Project: Measurement and modelling of cross and along-margin flux of suspended particulate matter at the shelf break

Contact: S.E. Jones & C.F. Jago, University of Wales, School of Ocean Sciences, Menai Bridge, Bangor, LL59 5EY, U.K.

Project: Material flux across the shelf slope and the role of marine snow

Contact: R.S. Lampitt, Institute of Oceanographic Sciences, Southampton University, Empress Dock, Southampton, SO14 3ZH, U.K., rsl@soc.ac.uk

Project: Modelling the shelf break ecosystem

Contact: R. Proctor, Proudman Oceanographic Laboratory, Bidston Observatory, Birkenhead, Merseyside, L43 7RA, U.K.; M.R.J. Fasham, James Rennell Centre, Southampton University, Empress Dock, Southampton, SO14 3ZH, U.K.; P.B. Tett, Napier University, 10 Colinton Rd, Edinburgh, E10 5DT, U.K.

USA

Project: U.S. Ocean Margins Programme

Description: Presently, the OMP is the major U.S. integrated multidisciplinary research programme for:

- * quantifying the ecological and biogeochemical processes and mechanisms that affect the cyclone, flux, and storage of carbon and other biogenic elements at the land/ocean interface, and;
- * defining ocean-margin sources and sinks in the global carbon cycle.

The OMP is contributory to the Joint Global Ocean Flux Study (JGOFS) and the Land-Ocean Interactions in the Coastal Zone (LOICZ). It supports university and national-laboratory scientists to conduct molecular to global-scale studies to understand the physical, biogeochemical, plant, animal, and microbial mechanisms and interactions that affect the input, assimilation, and transformation of carbon in coastal waters and sediments. In addition, the OMP supports projects that develop new instrumentation to obtain high frequency in-situ measurements of the environmental and biological factors affecting carbon fluxes in the ocean. During 1993, the DOE launched a new molecular biology initiative within OMP to determine how biological processes are regulated and controlled by genetic limitations and environmental variables.

During 1996 and 1997, scientists within OMP will conduct a field experiment in the coastal waters near Cape Hatteras, North Carolina.

Contact: Curtis R. Olsen, Office of Health and Environmental Research, ER-74, GTN, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, USA.