LOICZ

ANNUAL REPORT
2000

LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE

Contents

About LOICZ

The world's coastal zone forms a long narrow boundary between land and ocean that is highly valued by human societies. The Land-Ocean Interactions in the Coastal Zone (LOICZ) core project of the International Geosphere-Biosphere Programme (IGBP) on Global Change studies this heterogenous, relatively small but highly productive, dynamic and sensitive area of the earth's surface. The LOICZ International Project Office is hosted by the Netherlands Institute for Sea Research (NIOZ) and funded by the Netherlands government.

Major questions that LOICZ addresses on a global scale are:

- Is the coastal zone a sink or source of CO_2?
- What are the mass balances of carbon, nitrogen and phosphorus in the coastal zone?
- How are humans altering these mass balances, and what are the consequences?
- How do changes in land use, climate and sea level alter the fluxes and retention of water and particulate matter in the coastal zone and affect coastal morphodynamics?
- What is the role of the coastal zone in trace gas (e.g., DMS, NO_X) emissions?
- How can knowledge of the processes and impacts of biogeochemical and socio-economic changes be applied to improve integrated management of the coastal environment?

The focus of LOICZ research is on horizontal material fluxes and scaling of processes through environmental and socio-economic sciences. LOICZ depends on national programmes of research and contribution from individual scientists, and works with researchers to develop collaborative and multidisciplinary projects to meet the goals. While directed research is initiated to fill gaps in knowledge, LOICZ aims to value-add to the global knowledge base through focussed workshops in which experts address issues relating to the project questions. The LOICZ Implementation Plan (1995) describes in detail the approaches and purpose of LOICZ.

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1. Chair's Report

With the new century also a new era started for LOICZ. Following other IGBP examples, it was decided at the LOICZ-SSC meeting in Arcachon, October 2000, to start our first synthesis phase and to aim for a book to be published at the end of the first LOICZ decade in 2003. In this book we will try to answer the principal LOICZ questions as comprehensively as possible, using coastal information from all around the world. Six chapters have been defined and the preparatory work has started. Many scientists have already shown their interest to contribute. A highlight at the SSC meeting in France was the day with French coastal zone researchers. Many new contacts and plans for future co-operation were made.

The hard work at the IPO, mainly funded by several Dutch agencies and hosted at NIOZ, continued. With great success, an array of regional workshops was organised. Chris Crossland and Hartwig Kremer travelled all around the world to initiate many new activities and to give guidance to many ongoing ones. Cynthia Pattiruhu decide to leave the office after 4 years of organising many meetings and travel arrangements and answering thousands of e-mails. Hester Whyte took her place and is now trying to keep track of all the many LOICZ activities. Mildred Jordan became mother of a healthy son.

LOICZ members actively participated in the IGBP forward-looking workshops, and many new ideas about the future of both IGBP and coastal interactions on a global and regional scale were discussed.

A Basins synoptic approach using common methodology was developed which will feed into the typology framework (LOICZView). New projects for Delta systems, human dimensions in coastal zone island states, sea level evaluations, valuation of coastal zone ecosystem changes, and European basins were started. With logistic and financial support from IHDP, IOC, UNEP, EU, APN and several agencies, LOICZ workshops were organised in South Asia, Europe, East Asia and Africa. With START, special attention was given to more capacity building. Together with IGBP-BAHC, collaborative research on river systems and the impacts on the estuaries was continued.

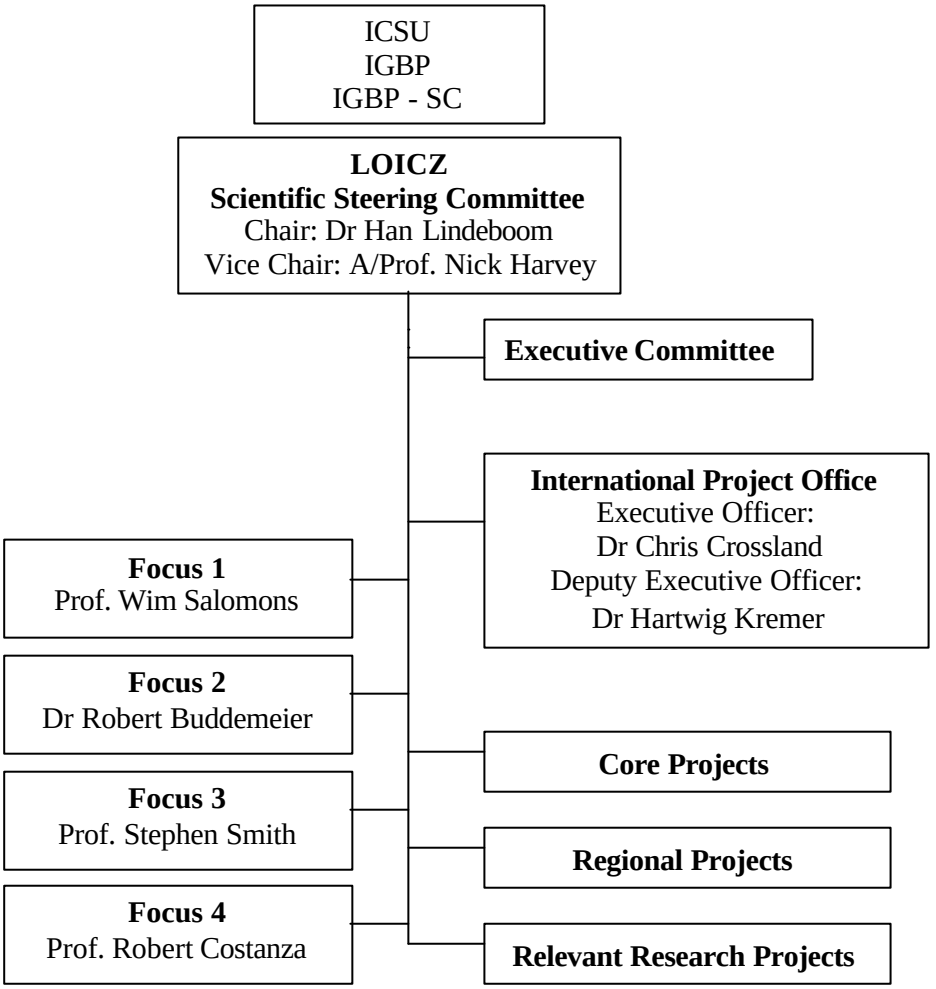
There has been an increasing number of published LOICZ science reports and papers in peer-reviewed literature. And the network of scientists contributing and collaborating is still increasing. It also became clear that LOICZ-type research, and the way in which we approach the global problems on a regional scale, will remain a basic part of the future IGBP, following the end of our current phase in December 2002.

In all, it was a successful year for science, integration and idea building.

Han Lindeboom
Chair
LOICZ Scientific Steering Committee

2. Structure and Organisation

The core project, Land-Ocean Interaction in the Coastal Zone (LOICZ), was established by IGBP in December 1992 with the adoption of the LOICZ Science Plan (IGBP Report No. 25), and became the sixth core project of IGBP (itself a programme of ICSU).



LOICZ Organisation Schema (2000)

The **Scientific Steering Committee (SSC)** provides scientific guidance and oversees the development, planning and implementation of the LOICZ Core Project. The SSC was established by the IGBP Science Committee (IGBP-SC) which is also responsible for the appointment of the Chair, Vice-Chair and members.

SSC Membership

Dr Han Lindeboom (Chair)	Netherlands Institute for Sea Research, The Netherlands
A-Prof . Nick Harvey (Vice-Chair)	University of Adelaide, Australia
Dr Larry F. Awosika	Nigerian Institute for Oceanography, Nigeria
Dr Robert W. Buddemeier	University of Kansas, USA
Prof. Peter Burbridge	University of Newcastle, UK
Prof. Shu Gao	Nanjing University, China
Dr Silvia Ibarra-Obando	CICESE, Mexico

Dr Jozef Pacyna	NILU, Norway
Dr Gerardo M.E. Perillo	Instituto Argentino de Oceanografica, Argentina
Prof. Wim Salomons	GKSS Research Centre, Germany
Prof. Stephen V. Smith	University of Hawaii, USA
Dr James Syvitski	Institute of Arctic and Alpine Research, Colorado, USA
Dr Liana Talaue McManus	Marine Science Institute, University of the Philippines, the Philippines
Prof. Frederik Wulff	Stockholm University, Sweden
Prof. Jahara Yahaya	University of Malaya, Malaysia

The SSC met once on 3-4 October, 2000 at Arcachon, France, and held a joint meeting on 5 October, 2000with members of the French PNEC.

The **Executive Committee** (EXCOMM) is a subcommittee of the SSC that, at the direction of the SSC, deals with special issues and reports to the SSC with recommendations. The EXCOMM comprises the SSC Chair, Vice-Chair and the four Focus Leaders.

The EXCOMM met once on 13-14 March, 2000 at LOICZ IPO, Texel, The Netherlands.

The **Foci** are the four key programme activities of LOICZ (see Section 3) coordinated by the Focus Leaders. **Core Projects** directly address goals of the LOICZ Science Plan and are coordinated by the SSC. **Regional Projects** are closely linked to the Science Plan (but may have additional aims) and are coordinated at regional levels. **Relevant Research Projects** make a scientific contribution to LOICZ, often at local or thematic levels. Activities of the project research elements of LOICZ are outlined in Section 3.

The **LOICZ International Project Office** (IPO) is responsible for the administration of the project on a day-to-day basis, under the long-term guidance of the SSC. The IPO role includes: coordination, planning, communication, advocacy and provision of a technical secretariat. It is located at NIOZ, Texel, The Netherlands.

The LOICZ secretariat comprises: Executive Officer (Dr Chris Crossland), Deputy Executive Officer (Dr Hartwig Kremer), Office Manager (Ms Cynthia Pattiruhu to 13 October 2000; Ms Hester Whyte from 26 October 2000) and P/T Adminstrative Officer (Ms Mildred Jourdan). A Liaison Officer (Maarten Scheffers) is located at the RIKZ Coastal Zone Management Centre, The Hague.

3. Status Reports

The scientific activities of LOICZ are directed at two major thrusts. The first is the description of horizontal material flux in the water conituum from continental basins through regional seas to continental margins. A small effort is directed at vertical flux descriptions at global scales. This work aims to improve our global understanding of biogeochemical processes and to provide data and knowledge about coastal ecosystems and habitats and the human dimension. The second is the scaling of the material flux models at spatial scales from local to global and across temporal scales.

LOICZ activities are organised through focal groups (Foci), particularly for integrative and developmental action on thematic issues and often through workshops involving global researcher expertise. Core projects of on-going work address global scale issues and cross-Foci objectives. Regional project research involves large spatial-scale questions, often cross-boundary and multidisciplinary. Relevant research projects contribute information crucial to LOICZ objectives but at local or short temporal scales; this information is brought together through thematic or regional workshops initiated through the Foci.

In 2000, the major priority and effort by the Foci was placed on further determining biogeochemical budgets (Focus 3), developing methods for coastal typologies and scaling to global spatial dimensions (Focus 2), and integrating catchment basin process understanding within a framework of the DPSIR model, and the human dimension (Foci 1 and 4). Work to date has been mainly of an assessment and analysis nature, however, LOICZ has started planning and implementing the integration and synthesis phase. This latter emphasis will increase during 2001-2 and the intention is to publish a globally integrated report addressing the LOICZ questions and objectives by the end of 2002. Funding opportunities were pursued to support the project activities.

3.1 LOICZ FOCI

3.1.1 Focus one

Effects of changes in external forcing or boundary conditions on coastal fluxes

Focus Leader: Prof. Wim Salomons

Work in Focus 1 aims to describe and model the status and changes of horizontal fluxes of water, nutrients, carbon and, to a limited extent, contaminants into the coastal sea through river catchments, the atmosphere, and exchange processes along continental margins. Natural and human forcing are key elements, and the DPSIR model is used as a framework for the major thrust of the BASINS studies. Emphasis is given to the dynamics and delivery of materials from the global catchment basins. The core project activities of the LOICZ/JGOFS Continental Margins Task Team (CMTT; see section 3.2.4) provides the main route towards understanding shelf margin transfers.

In 2000, the BASINS task activity was the main thrust of work, with the development of tools for a unified approach to assessment, planning and implementing regional workshops, contributions to project concepts and design with science user agencies, and a continuation with efforts in capacity building.

Recognising the global assessment goal of LOICZ and from discussions in earlier workshops, effort has been put into further developing and applying a set of methods and tools to assess coastal state change and make predictions of future trends under various natural and human forcing of the water cascade. Catchment are dynamic in short, and long terms. In the short term, there is the need for scientific tools that predict the impact of point sources of nutrient or chemical loads and of sudden events like weather extremes. Equally important is the prediction and assessment of long term changes of pressures (e.g., population

growth/migration, land use change, urbanisation) that impact on horizontal material fluxes along the water pathways and ultimately affect coastal goods and services and environmental health. These management responses and associated long-term investments influence the ecological status of surface waters and also the quality of ground water - these issues are at the catchment or sub-catchment level, but are embedded in global change scenarios. Therefore, in order to allow global comparison of the regional BASINS assessments, emphasis is placed on using a standardised procedure and process for information. Recent workshops held in Europe, South America (1999) and Africa (2000) have closely followed the DPSIR (Driver-Pressure-State-Impact-Response) framework. Taking biogeochemical as well as socio economic factors into consideration, these have developed a descriptive set of indices to quantify the observations and expected trends. Coastal impact/issues and land-based drivers and pressures are being categorised and ranked for subsequent comparison and upscaling, using the LOICZ typology approach. A set of standardized assessment tables and matrices have been developed as a tool in the BASINS approach and are being used in the regional synthesis workshops.

On a global scale, BASINS regional assessment workshops are gathering and integrating scientific state of the art information on how coastal change reflects catchment-based pressures. One workshop was held in Africa (July 2000; see section 3.2.2). In 2001, the BASINS approach will be extended to further workshops - South American BASINS II in May, Caribbean BASINS II in June, African BASINS II in August, and to an Australasian assessment meeting in December. The Oceania island assessment desk study currently underway at the University of Adelaide will follow the same lines.

A major project - EUROCAT project (http://www.iia-cnr.unical.it/EUROCAT/project.htm) was approved and funded by the EU. This will address the human and biophysical dimensions of major European rivers and the coastal sea. The project, which is an outcome of the earliest BASINS efforts supported by LOICZ, will serve both the advancement and synthesis of European land-ocean interaction science as part of the ELOISE cluster, and the phase one synthesis of LOICZ on global scale.

A broad applied project following closely the LOICZ BASINS approach and related modelling efforts such as MONERIS has reached its first final state in late 2000. The PORT project is dealing with the environmental quality of the harbour sludges in Rotterdam and future trends in the context of management options and cost benefit analysis. It is an interdisciplinary study providing scenario analysis for a coastal issue against user needs (http://w3g.gkss.de/i_a/dredged_material/index.html). It takes into consideration the management and its improvement of the whole Rhine catchment and the achievements of the International Commission for the Protection. The BASINS approach was part of the presentations invited to the 50th anniversary of the Rhine Commission in Rotterdam in November 2000.

Training and capacity building activities have continued to underpin LOICZ regional workshops, and effort has been made to contribute more widely within IOC and elsewhere. IHDP, along with START, are collaborators in workshop and training activities that address coastal zone issues. LOICZ provided support and personnel for the IHDP international training course in Bonn in September 2000 that focused on the human dimensions of coastal change. Together with about 30 selected participants from developing countries issues addressed, for example, the integrated modeling approach taken in the SARCS WOTRO LOICZ project, and the relevance of catchment scales (land based processes) to coastal change. Special emphasis was on the younger scientific questions in LOICZ such as application of the DPSIR framework for development of scenarios and cost benefit approaches.

In July 2000 LOICZ also supported the Leonardo da Vinci Summer School in Bologna, Italy, which in this year focused on Coastal Management issues and change. The presentations given by LOICZ addressed all major questions of coastal change on global scales across the four LOICZ foci. As a direct flow on, there was good opportunity to enhance the networking specially with young scientists two of which have participated in the UNEP/GEF and EEU supported Mediterranean and Black Sea Budgeting workshop in February 2001 in Athens.

3.1.2 Focus two
Coastal biomorphology and global change

Focus Leader: Dr Robert W. Buddemeier
supported by A/Prof. N. Harvey (sea-level issues) and Drs G. Perillo & J. Syvitski (sediment studies)

Focus 2 addresses the role of ecosystems in determining coastal morphodynamics under varying environmental conditions and coastal biomorphological responses to human activities. The response of systems such as coral reefs, mangroves and sea grasses to changing environments, sea level change, and groundwater implications for coastal habitats, sedimentary processes, and the development of classification systems (typologies) are areas emphasised in this Focus. A key issue is how to deal with spatial and temporal scales of change in the coastal zone.

During the past year, a number of initiatives have matured. Sea level issues have been pursued and developed by A/Professor N. Harvey, and the sediment transport aspects of coastal geomorphology and biogeochemistry have been increasingly addressed through the medium of the IGBP Water Group (see Prof. J. Syvitski's report on sediment transport workshop and outcomes – Section 3). Earlier work done on coral reef issues under the aegis of LOICZ Focus 2 has been summarized, and the integrated LOICZ-type approach to coastal science endorsed, in the US National Assessment of Climate Change Impacts on the United States (http://www.nacc.usgcrp.gov/; also published by Cambridge University Press). Seagrass-related activities have gradually expanded, fueled by interests and collaborations inside and outside the LOICZ organization. Liaison with the SCOR-LOICZ Working Group 112 (Submarine Groundwater Discharge) has continued (see separate report by Prof. W. Burnett, WG chair – Section 3).

Major developments have occurred in the area of the Typology core activity. Workshops were held in March (Lawrence, KS) and October (Solomons, MD) to prepare for the first regional synthesis workshop, which will be held in Brisbane in January 2001, covering Asia-Australasia and addressing the theme of hydrologic variability. Prof. Bruce Maxwell and his student have substantially refined the LOICZVIEW geospatial clustering package, with added capabilities including the ability to accept direct upload of external files. The program can now be accessed remotely via the WWW, moving us much closer to the ideal of a widely accessible standardized tool for environmental classification. Close cooperation with Focus 3 (Prof. S. Smith) has continued as an essential part of the lead-up to global synthesis, and communication with the catchment basins initiative (Focus 1) has greatly increased. This latter point, in conjunction with the cooperation established with C. Vorosmarty (IGBP BAHC) in terms of shared hydrologic data for inputs to the coastal zone, has laid the groundwork for a smooth, consistent scientific and organizational linkage between the terrestrial hydrology and the coastal inputs. In addition, the Solomons typology workshop, hosted by Prof. R. Costanza provided a good start on the challenging process of incorporating human dimension variables and methods into the typology approach.

A major impetus for the overall effort was provided when the US NSF (through the National Ocean Partnership Program) funded a project headed by Prof. D. G. Fautin (with R. W. Buddemeier as co-investigator) on the biogeography of hexacorals. This links the LOICZ

typology database and classification approach to organismal and taxonomic databases, and has provided substantial resources for the environmental effort that is common to the two projects (see www.kgs.ukans.edu/Hexacoral/, which provides links to the developing Typology web pages).

The major focus of attention for the coming year will be the series of regional and global synthesis workshops and products associated with the UNEP-GEF project. These are scheduled to culminate in a report on the first-cut estimates of the coastal zone role in global C, N and P fluxes, in early 2002. This will, of course, contribute substantially to the overall LOICZ synthesis effort. However, other related and spin-off activities will be pursued. A river basin typology workshop is under discussion as a possible activity in Fall 2001, and a number of initiatives have been undertaken to expand both the applications of the developmental funding for the LOICZVIEW clustering program. It seems certain that the coming year will offer unprecedented accomplishments and opportunities; taking advantage of the latter will require continued growth of the LOICZ science community in terms of both extent and integration.

3.1.3 Focus three
Carbon flux and trace gas emissions

Focus Leader: Prof. Stephen V. Smith

Supported by Prof. Fred Wulff and Dennis Swaney (web site development)

The emphasis of Focus 3 is on the development of a suite of global sites describing the biogeochemical budgets for carbon, nitrogen and phosphorus fluxes and processes in estuaries and coastal seas. This follows an approach developed by LOICZ during the early phase of the project as way to deal limited data at sites within a heterogeneous area of the globe(LOICZ R&S No. 5, 1996). A key goal is determining the relative autotrophy and heterotrophy of the coastal zone i.e., is the coastal zone a net source or sink for CO2? A watching brief is maintained on the development of knowledge about the net vertical flux estimations for trace gases in the coastal zone.

Focus 3 has been active in conducting workshops developing local C,N, and P budgets in various regions of the world, supported by UNEP and GEF funding. During 2000, biogeochemical budget workshops were conducted in South Asia (Goa, India), East Asia (Hong Kong, China); and the Sub-Saharan Africa region (Zanzibar, Tanzania). A further joint workshop on biogeochemistry-human dimensions modelling was held in South Asia (Colombo, Sri Lanka), supported by APN and the regional LOICZ committees. Approximately 50 scientists from these regions participated in the workshops, and three focal points (South Africa, Mexico and the Philippines) serve as regional mentor centres that provide training and contacts within the regions.. Several Focus 3 personnel have also participated in two typology workshops during 2000. Two technical reports and two refereed papers have been published during 2000; 4 papers from the Open Science Meeting are in press.

In addition to the budgeting workshops themselves, teaching and research materials were developed and posted on the LOICZ budgeting web site, included:

- CABARET software (Computer Assisted Budget Analysis for Research, Education, and Training, developed by Dr L. David, University of the Philippines);

- LOICZ Biogeochemical Procedure: A Tutorial Pamplet (Edited and prepared by Dr L. David, Dr M. San Diego-McGlone, Dr C. Crossland and Prof. S.v. Smith),and

- PowerPoint presentations on the following topics: Budgeting overview (Prof. S. V. Smith, University of Hawaii), budgeting details (V. Dupra and Prof. S. V. Smith, U. Hawaii), runoff calculations for budgeting (Dr L. David, University of the Philippines), waste load calculations for budgeting (Dr M. San Diego-McGlone, University of the Philippines). Several of these presentations have been translated to Spanish by Dr V. Camacho (Autonomous University of Baja California, Ensenada).

General web page (http://data.ecology.su.se/MNODE) development and expansion has continued by D. Swaney (Cornell University), supported by Prof. Fred Wulff, University of Stockholm. The biogeochemical budgets web site is not only an archibval reference point, but it is increasingly used as an interactive tool, both receiving site contributions and acting as a training and scientific information source for the wider community. Multi-scale and process analyses and development of proxy information are key actions in the web site operations and development.

A desk study of the significance of the coastal zone in trace gas exchange was commissioned from NILU, Norway.

In 2001, LOICZ scientists will continue to contribute C-N-P site budgets to the database, assisted by resource scientists and regional mentors on global centres (Latin America, Africa, the Philippines). Additional modelling and training workshops are expected to address the Mediterranean-Black Sea and polar regions. Up-scaling of the local and regional biogeochemical site budgets will be approached by the LOICZ typology methodology (see Focus 2) with UNEP and GEF support by a series of regional integration workshops (Asia-Australasia, the Americas, Africa-Europe) along with a global synopsis workshop. Synthesis of the biogeochemical data will be strongly pursued leading into the LOICZ integration process and publication for 2002; here, as well as scaling issues, trend analyses, proxies for processes, and patterns of nutrient metabolism will be some of the subject of inquiry.

3.1.4 Focus four
Economic and social impacts of global change in coastal systems
Focus Leader: Prof. Robert Costanza

This Focus addresses the two human dimensions in the coastal zone, looking at the co-evolution of coastal systems under different scenarios of global change (essentially the impacts of humans), and the effects of changes in coastal systems on social and economic activities. The first element aims to link natural and social scientists in researching key coastal issues to describe and model socio-economic pressures driving coastal changes in the use of coastal space and how this influences material fluxes and ecosystems. The second element seeks to develop tools and measures for producing regional and global forecasts of the effects of coastal changes on the human dimension, particularly through coupling natural science and economic models. This work involves the building of a database on economic valuation and cost-benefit approaches, within a context of community and wider stakeholder evaluations, in order to assess the vulnerability of coastal systems and human populations to global changes.

In 2000, a project was commenced to assess the economic value of biogeochemical changes in the coastal zone. This work is based at the University of Maryland.

The Typology work (see Focus 2) extended into development of databases including social and economic variables within the context of the LOICZ half-degree resolution global information system. While limited in number and extent, the socio-economic descriptor have been applied to some questions raised in the typology development in regional workshops. On-going work, allied with Focus 1 and in collaboration with several global initiatives (e.g.,

IOC, Millenium Ecosystem Assessment) will see further development of variables and proxies to approximate measures of change in societal and economic valuation of the coastal zone.

The Basins approach of Focus 1 addresses the human dimension as a core element of regional river basins within the DPSIR framework. Regional workshops in Africa and the Caribbean have extended the application of this enterprise. Further workshops in Latin America, Africa, and regions of Asia will extend this integrative work during 2001.

Climate change and sea-level rise are major issues for management for coastal regions, especially in small island states such as the Caribbean, Oceania, and the Maldives. With APN support, a project led by A/Prof Nick Harvey was started in 2000 to investigate recent sea-level change and its coastal implications in Oceania. The work will bring together and synthesise existing data and will collect additional data on recent sea-level changes in the Oceania island. These scientific findings on coastal response to sea-levels will be incorporated into management and policy strategies and options by collaborative involvement with regional coastal managers and policy makers.

3.2 LOICZ CORE PROJECTS

The LOICZ core projects address global issues, either by production and testing of widely applicable models of change in the coastal zone or by providing wide geographic syntheses of information about coastal properties, coastal fluxes or coastal processes and their rates of change.

Eight core projects are established in LOICZ (see web-page **www.nioz.nl/loicz/)**.

Title	Related Foci
Biogeochemical Budgets and Modelling	3
Coastal Typology Development	2
Continental Margins Task Team (CMTT)	1&3
River Catchments and Basins	1,2&4
Deltaic Processes and Management	1,2&4
ELOISE	1 to 4
Submarine Groundwater Discharge (LOICZ/SCOR)	1,2&3
SARCS/WOTRO/LOICZ Southeast Asia Research	1,3&4

3.2.1 Biogeochemical Budgets and Modelling

The biogeochemical budgets project aims to compile regional carbon/nitrogen/phosphorus data and budget models for numerous coastal areas of the world that can be used to produce global syntheses models of their flux in the coastal zone. The LOICZ strategy to deal with estimating these CNP fluxes for the global coastal zone is to develop a global inventory of these budgets. To date, about 170 sites have been budgeted, and a total number of 200 seems to be a feasible final number.

The project uses a robust, widely applicable, uniform methodology that has minimal data requirements and that can work with secondary data (Gordon et al. 1996). In broad summary, water and salt budgets are used to estimate water exchange in coastal systems. Nutrient budgets (as a minimum, dissolved inorganic phosphorus and dissolved inorganic nitrogen) are also developed, and departure of the nutrient budgets from conservative behaviour is a measure of net system biogeochemical fluxes. Nonconservative flux of dissolved inorganic phosphorus, scaled by an estimate of the carbon:phosphorus ratio of the reacting material, is used to estimate primary production minus respiration (p-r). The discrepancy between the

observed nonconservative flux of dissolved nitrogen, scaled by the N:P ratio of the reacting organic matter, is used as an estimate of nitrogen fixation minus denitrification (nfix-denit). While this is clearly a great simplification of the details of processes and reaction pathways in ecosystems, it provides some insight into possible net reactions accounting for nutrient uptake and release. This approach is preferred to estimates based on carbon flux, because carbon data are available for relatively few systems. Similarly, "direct estimates" of production, respiration, nitrogen fixation, and denitrification are difficult to obtain at system scales.

A global "typology" (or classification) of the coastal zone, or perhaps a series of typologies, will be used to extrapolate from the budget sites to the remainder of the coastal zone. Literature research, workshops, and information sharing via the World Wide Web (http://www.data.ecology.su.se/MNODE) are the major tools being used to share and develop the budget database. The web site also provides software and methods for model/budget development, and powerpoint tutorials.

In 2000, three regional workshops were held (South Asia, East Asia, Sub-Saharan Africa), new tutorials and tools were developed for budget estimation, the web site continued to be expanded and new site data added, and the network of resource and contributing scientists was greatly expanded (see section 3.1 Focus 3). Several publications were produced and further articles are in press. Three Regional Mentor nodes have been very successfully established in the Philippines, Mexico and South Africa to assist as contact and training foci. Initial applications of typology assessments have begun, and the network is commencing "synthesis" for the LOICZ publication next year. UNEP-GEF and LOICZ have funded the global workshop series as part of a commissioned project.

Further workshops will be held in 2001 (Mediterranean-Black Sea, Polar regions) and integration and synthesis will be a major focus in 2001, through linked regional typology workshops and work of the scientific network.

3.2.2 River Catchments and Basins

Major work of the project deals with the impact of human society on horizontal transport of to the coast. Pathways under consideration comprise surface run-off as well as groundwater. The coastal impact of these mass transports is being assessed, in particular their change under natural and human forcing, and aims to provide feasible management options within a context of analysis of success and failure of past regulatory measures. Since the changes in fluxes are mostly land or river catchment based, the BASINS approach treats the catchment-coastal sea as one unit – a water continuum. Applied to coastal impacts or issues, this scale means that in addition to economic activities (e.g., agriculture, fisheries, urban development, industry, transport, tourism), morphological changes (e.g., damming) have to be taken into account as driver/pressure settings affecting the fluxes.

In particular the parameters assessed are

- material flow of water, sediments, nutrients and priority substances, such as contaminants (past, current and future trends);
- socio-economic drivers which have changed or will change the material flows;
- indicators for the impact on coastal zone functioning and to derive from them
- "critical load" estimates for the coastal zone.

The global assessment of river basins (see section 3.1 Focus 1) will continue with a regional approach based on the DPSIR framework as a tool for integrating human dimensions, biogeochemical state changes and environmental impact assessment at various spatial scales. The teams involved also will aim to develop a better understanding of how key indicator parameters influence critical thresholds of environmental functioning and health. This effort ultimately aims to fit into the critical load concept (as has been done for atmospheric pollution

abatement) for a cost-benefit analysis of management options. Scenario building is an integral part of this analysis.

In 2000, the BASINS project continued its regional studies program with an African workshop (AfriBAS I) held in July 2000 in Nairobi and supported by PASS - the Pan African START secretariat. Some 25 presentations from African scientists on catchment-coastal sea provided a first regional baseline analysis from sub-regional working groups on North Africa, West Africa and East/Southern Africa, and explored the potential for future projects. Representatives of scientific "user" agencies" also participated e.g., UNEP, GEF and World Bank for instance was underpinned. UNEP/ROA (Regional Office for Africa). Prof Olasumbo Martins, Nigeria has taken the lead in drafting the AfriBAS I interim report and TOR for the second phase meeting. In parallel the AfriBAS network has continued to investigates potential synergies and supplementation with intergovernmental or global efforts such as GIWA, IOC-ICAM, GOOS.

The European EUROCAT project (http://www.iia-cnr.unical.it/EUROCAT/project.htm) started in 2000 funded by EU. It is addressing the human and biophysical dimensions of major European rivers with the coastal sea and is to apply the LOICZ BASINS assessment approach to provide *inter alia*, a first European region baseline study of the state of the art understanding of these issues.

The BASINS task contributed to the PORT project which is dealing with the environmental quality of the harbour sludges in Rotterdam and future trends in the context of management options and cost benefit analysis. It is an interdisciplinary study providing scenario analysis for a coastal issue (http://w3g.gkss.de/i_a/dredged_material/index.html), taking into account the management and its improvement of the whole Rhine catchment and the achievements of the International Commission for the Protection.

The BASINS approach along the DPSIR framework was identified as a sound scientific framework for the design of a pilot project for the Volga River Basin, to be part of UNESCO's new rivers program. It is expected that the LOICZ contribution will lead to enhanced networking in the East and Eastern central Europe which together with the Russian Arctic (LOIRA) can become a new and additional area for collaboration.

Future regional workshops to provide the input to the first phase LOICZ synthesis are are planned for East Asia (February 2001), South American (SAMBAS II, May 2001), the Caribbean (CariBAS II, June 2001), Africa (AfriBASINS II, August 2001), and an Australasia assessment in December. An Oceania islands assessment desk study underway at the University of Adelaide will be finished in 2001.

3.2.3 Coastal Typology Development

LOICZ has as one of its primary goals the characterising of the role of the coastal zone in material fluxes – in coastal estuaries and seas, and in terrestrial catchments and river basins. Recognising that the world coastal zone is complex heterogeneous and largely unstudied, this functional globalisation is being carried out by upscaling biogeochemical and human dimensions data and generalising from well-studied areas to similar but less well-known regions. This activity is being pursued with two integrated elements. First, the collection of validated and consistently expressed coastal biogeochemical budgets (section 3.2.1) and river catchment information (using the DPSIR framework; section 3.2.2). Second the classification of coastal systems by typology.

Typology (the study of, or analysis or classification based on, types) provides a strategy to use available or derived geospatially referenced data, and to search for the patterns and connections within. The approach divides the world coastal zone into land, coast and sea cells half a degree on a side, and is populating those cells with data for many variables

ranging from air temperature to population density and from bathymetry to soil texture (data base development). The various populations of cells can be statistically clustered to identify similarities and differences (clustering analysis)-- which will in turn be examined for their ability to explain or describe the distribution of types of biogeochemical budgets and basins in the coastal database. Once data selection, weighting and tuning has resulted in a set of typologies that are robustly predictive of the coastal systems, the process of extrapolating to regional and global coast zone function can be started.

While there are many possible ways, both conceptually and methodologically, to classify and extrapolate coastal characteristics, LOICZ has selected and is applying a consistent method. The LoiczView geospatial clustering software package, has been developed by Dr Bruce Maxwell (Swarthmore College) specifically for this application (www.palantir.swarthmore.edu/~maxwell/loicz). The software currently runs on UNIX and LINUX platforms, and is adapted for deployment on the Internet. It is being actively used for a variety of applications (http://www.kgs.ukans.edu/Hexacoral/Workshops).

In 2000, the typology project advanced on three fronts (see section 3.1 Focus 2) – the refinement and development of databases, the evolution of the LOICZView clustering tool, and the trial and application of the methods to regional questions. The database development was geospatially referenced to the global coastal zone at 0.5^{o} resolution (from 1^{o} resolution); additional databases were added, to cover a suite of physical, chemical, biological and socio-economic parameters; and application were conducted particularly through the evolving web site. A working integration has been developed for the LOICZ coastal grid and database with the BAHC (Biospheric Aspects of the Hydrologic Cycle) river basin flux typology. The project is looking forward to linking to the activities and products of LUCC (Land Use and Cover Change) and GLOBEC (Global Ocean Ecosystem Dynamics).

LOICZView was extended to provide increased statistical and other outputs from the clustering assessment, additional user-friendly analytical options were added, and a software developed to "fuse" the data base elements with the cluster analysis tool. The total package has been rendered portable for use in tutorial and applications workshops. Tutorial materials, examples of applications, and training of resource people were effected, and several manuscripts are "in press" in peer-reviewed literature. The work has attracted strong interest from a number of scientific agencies, and the activities are supported by a number of sources e.g., a UNEP-GEF project, NSF (for allied taxonomic typology assessment), and LOICZ.

Four regional and global workshops are planned to apply the typology approach to assessment of the LOICZ biogeochemical budgets at regional and global scales. Other applications, within LOICZ and outside, are to be addressed. Further refinement in the methodology and databases is expected.

3.2.4 CMTT

The Continental Margins Task Team (CMTT) is a joint activity with JGOFS addressing material fluxes and processes at the interface between the ocean realm and the continental shelf. The 6-member Team includes three scientists (Prof. Shu Gao, co-chair; Dr Liana McManus, Dr Larry Atkinson) nominated by LOICZ and three from IGBP JGOFS, and draws on and coordinates relevant research and skills in the global community.

In 2000, the CMTT established a program of regional workshops to be run over 2000-2001 to address, in particular, the carbon flux issues associated with the global boundary currents, and divided the task up into sub-groups: eastern and western boundary systems, polar margins, tropical margins and marginal seas. The eastern and western boundary systems group met in November 2000 in Norfolk, Virginia, USA; the outcome of the meeting was the design of the synthesis chapter and recommendations to LOICZ and JGOFS regarding issues of coverage.

A global "synthesis" book is planned for end 2002 and work has started on its preparation. Several publications were contributed to global literature. Work in 2001 will continue with workshops on polar seas, and marginal and tropical seas. Funding support is provided by UNESCO's IOC, JGOFS and LOICZ.

3.2.4 Deltaic Processes and Management

Earlier efforts of LOICZ addressed some deltaic processes; a new project linked to management of deltas has been established in 2000.

Deltas are the centre of gravity of the catchment areas. In deltas fresh and salt water meet, creating gradients that are of great importance for the existence of a variety of ecosystems. Deltas also attract economic activities, like industry, transport and agriculture, but also people. This results in an increased pressure on the delta, its adjacent river basin, the coastal zone and the sea. The relation between deltas and river basins can be explained from the need for energy, fresh water (creation of large reservoirs), the need building material (i.e. timber) and its natural systems relation with water, sediment, and ecology. Due to the growing economic interests and increasing population the vulnerability to pollution and natural hazards is increasing. Beside this the impacts of climate change and other external factors should be added to the already existing problems. These pressures require the urgent development and application of adaptive solutions.

In the past a great number of measures were taken and constructions were build for the development of deltas. Not all of them were successful and on the contrary caused a lot of problems to the population and to the environment. There is a need for an international information exchange network on the planning and management of deltas. During the LOICZ Open Science Meeting in Bahia Blanca, Argentina, this was clearly indicated.

The aim of this project is to learn from past experiences in the development of deltas and see how we can develop deltas in a sustainable manner with respect to nature and humans. Information about deltas and an assessment of the lessons learned from management practices will be published on the Web. Key questions include:

- What are or will be the most important changes in deltas?
- How are the fluxes of nutrients and sediment in deltas altered by human interventions?
- What information is available about best management practices in deltas? Are they being evaluated? What can we learn from these?
- Which concepts and tools are available for supporting delta management? Have they been applied?

Products from the project include:

1. Network of people involved in delta issues
2. Active web-site on deltas
3. Assessment report addressing the questions

The project will develop a website as an information and archive tool and, initially, use a questionaaire to build information and encourage global participation in the assemblage of case studies and discussion among contributors. Links are being established with the LOICZ BASINS project and the DPSIR framework development and applications, and the LOICZ typology project.

The project has started with the building of a network of contributing scientists, managers and policy makers. A web site is under development and will include information contributed through an initial questionaire to address case studies and discussions within the network contributors. A workshop is planned for August 2001 and information is expected to contribute to the Third Water Forum meeting in 2003.

3.2.6 ELOISE

The European Land-Ocean Interaction Studies (ELOISE), is an action (called "Thematic Network" or "Project Cluster") supported by the European Commission. Coastal zone research projects in the Commission are combined, with additional support, to focus on the important question of how the land-ocean interaction operates and how this is influenced by human activities. ELOISE started under the 4th RTD Framework Programme of the EU as an initiative of the Environment & Climate and the MAST (Marine Science and Technology) Research Programmes, acting in concert with the Programme for International Co-operation (INCO) and the research programmes of the Member States. It continues under the Fifth Framework Programme.

ELOISE aims at developing a coherent European coastal zone research network of high scientific value and relevance to human society. It is intended that, in addition to the value of the basic science produced, ELOISE will contribute to other activities of the Commission in the fields of integrated coastal zone management and of spatial planning. Further information can be found on the WWW page of ELOISE (http://europa.eu.int/comm/dg12/eloise/eloise-h.html) or from the individual coordinators.

In 2000, 14 of the original 29 projects were completed, and an additional 16 were approved. A key aspect of the programme as a whole was discussion and planning as to how best to synthesise the regional outcomes. LOICZ will continue to assist in this process through its global network and communication measures as well as through scientific and personal input to the ELOISE annual meetings and working groups, which are:

- WG 1: Biogeochemical Fluxes and Cycles
- WG 2: Ecosystem Structures and Functioning, Human Impacts
- WG 3: Modelling and Data Management
- WG 4: Coastal Zone Management and Integration of Natural and Socio-Economic Science

An initial workshop aimed at contributing to the program synthesis is planned for February 2001, contributing to the 4th Annual ELOISE Open Science Meeting scheduled to be held in Calabria, Italy in September 2001.

3.2.7 SCOR/LOICZ Working Group 112 Workshop: Global assessment of submarine groundwater discharge

The overall goal of the project is to define more accurately and completely the magnitude of submarine groundwater discharge (SGD) and how it may influence chemical and biological processes in the global coastal ocean. To this end, three task areas address the following goals: Calculation and Modeling; Measurement; Sampling, and Experimental Design; and Typology, Integration and Globalization.

In 2000, the Working Group met once and initiated a number of activities, including:

- Development of a submarine groundwater methodological intercomparison field program, measurement and management project with the Intergovernmental Oceanographic Committee (IOC);
- An informal SGD assessment inter-comparison experiment in Florida
- Participation in the development of a Cooperative Research Program (CRP) with the International Atomic Energy Agency (IAEA) and UNESCO's International Hydrological Program (IHP);
- WG-112 meeting in association with "Hydro-2000" Meeting in Perth, Australia, November, 2000; and
- A large-scale SGD inter-comparison experiment in Perth, Australia, November-December, 2000;

Products and progress is listed in the web site (http://www.jhu.edu/~scor/WG112.html). A number of publication are in press in peer-reviewed journals, and a special issue volume for a leading journal is planned. A meeting of the Working Group is planned for June 2001 in association with the IAEA-IHP's Isotope Hydrology Group and Marine Environment Laboratory. Sicily. One issue will be the future activities of the network, recognising that next year is the scheduled conclusion date of the SCOR-LOICZ-sponsored activities, and the strong interest of international agencies in the successful outcomes of the Group.

3.2.8 SARC-WOTRO-LOICZ (SWOL)

The SWOL project (Economic Evaluation and Biogeochemical Modelling in South East Asia) Phase I final report was finalised and is in preparation for publication. The SWOL team further developed four proposals – one from each participating country team (Malaysia, Philippine, Thailand, Vietnam). These aim to expand the economic evaluation and biogeochemical modelling to additional study sites in the region with the aim of validating the modelling tools developed in Phase I, and to integrate the data regionally by a typological approach. The proposals are under consideration by WOTRO and APN for cosponsored funding.

Other Core Project activities are reported in Workshops (section 4) and elsewhere in this report.

3.3 LOICZ REGIONAL PROJECTS

Regional projects contribute to LOICZ global issues within a regional framework.

Two new regional projects were accepted viz., th coastal zone, estuary and waterways management project from the CRC Coasts in Australia, and the EU-funded EUROCAT project in Europe. Current projects are listed below and further information is available from the LOICZ webpage (www.nioz.nl/loicz/).

Title	Investigator	Location
Great Barrier Reef	Terry Done	Australia
Coastal zone estuary and waterway management	Roger Shaw	Australia
Land-ocean interactions in southern South America	J-L Probst	European Union
AFFORD	W. Ebenhoeh	Germany
Ecology of tropical coastal systems: mangrove dynamics and management: MADAM	Ulrich Saint-Paul	Germany
European catchment assessment :EUROCAT	Wim Salomons	Germany
Sustainable use of coastal ecosystems : EUROBASIN	Wim Salomons	Germany
Lower Volta mangrove project : Phase 1 Assessment of environmental, economic and social factors	Christopher Gordon	Ghana
Integrated coastal zone management in Banten Bay, Indonesia	A. Nontji	Indonesia
Carbon and nutrient fluxes and socio-economic studies of the Merbok mangrove ecosystem	Ong Jin-Eong	Malaysia
Studies for integrated coastal zone management	Maria Snoussi	Morocco
BOA research theme on tidal areas	Herman Riderinkhof	Netherlands
Economic and technological aspects of	H. Verbruggen	Netherlands

internationally coordinated strategies		
EROS 2000 Black Sea	Peter Herman	Netherlands
Sustainable management of the coastal area of SW Sulawesi	Pieter G. E. F. Augustinus	Netherlands & Indonesia
Sustainable use of international river Basins: definitions, criteria and assessment	W. P. Cofino	Netherlands
Economic evaluation and biophysical modelling of the marine environment of Bolinao: supporting sustainable use (SWOL)	Liana Talaue-McManus	Philippines
Key processes of ocean flux in the East China Sea (POFLECS)	Dunxin Hu	P R of China
Land-ocean interactions in China seas and their impacts on coastal marine environments, ecosystems and living resources	Dunxin Hu	P R of China
Land-Ocean interactions in the Russian Arctic (LOIRA)	V. Gordeev	Russia
Economic evaluation and biophysical modelling of impacts of shrimp farming on mangrove systems in Ban Don Bay (SWOL)	Gullaya Wattayakorn	Thailand
Land-ocean interaction study (LOIS)	Graham Leeks	United Kingdom
Synthesis and upscaling of sea-level rise vulnerability assessment studies (SURVAS global project)	Robert Nicholls	United Kingdom
Economic evaluation studies of mangrove conservation and rehabilitation in Nam Ha Province, Vietnam (SWOL)	Nguyen Hoang Tri	Vietnam

3.4 LOICZ RELEVANT RESEARCH PROJECTS

The relevant research projects are contributed by chief investigators and institutions, and usually involve local- or national-scale studies. The database of projects is continually updated, and the annual review of the detailed status of each project is in progress. Recognising this dynamic, the following listing is representative rather than comprehensive and project listings and support information are available on the LOICZ webpage (www.nioz.nl/loicz/).

Chief Investigator	***Project Title***	***Country***
Prof. F.I. Isla	Coastal dynamics and comparative evolution of the eastern and southern barriers of Buenos Aires.	Argentina
Prof. F.I. Isla	Coastal evolution of the eastern barrier of Buenos Aires.	Argentina
Prof. F.I. Isla	Morphological characterization of the coast of Tierra Del Fuego, between San Sebastian and San Diego Capes.	Argentina
Dr S. Appleyard & Dr.J. Turner	Role of groundwater discharge in causing environmental degradation in the coastal marine environment, Perth, Western Australia.	Australia
Mr C. Ajuzie	Monitoring for the presence of harmful microalgae in the Lagos and Lekki Lagoons, Nigeria.	Belgium
Dr M. Frankignoulle	Biogas transfer in estuaries (BIOGEST).	Belgium
Dr M. Frankignoulle	Carbon fluxes in coral reefs.	Belgium
Dr E. Hong	A study on the transportation and sedimentation patterns of sediments in the Tseng-Wen River deltaic	China ROC

	system.	
Dr J.J. Hung	Fluxes and biogeochemical processes of carbon and heavy metals in the Tseng-Wen estuarine and coastal environment.	China ROC
Dr J.T. Liu	Sediment dynamics of the Tseng-Wen River coastal dispersal zone - numerical model and GIS application.	China ROC
Dr K. T. Shao & Dr S. R. Kuo	The role of fish communities in the coastal dispersal of Tseng-Wen River (II) – feeding ecology.	China ROC
Dr Yung-Chi Chen	Trace element biogeochemistry in mangrove swamp.	China ROC
Dr T. Dalsgaard	Nitrogen cycling in estuaries (NICE).	Denmark
Prof. B.v. Bodungen	Transport and turnover in the Pomeranian Bight (TRUMP).	Germany
Mr S. Dick	TRANSWATT subproject: transport processes.	Germany
Dr P. Hupfer	Contribution to the knowledge of climate impact on the German coast of the Baltic Sea.	Germany
Prof. Dr. L.A.Meyer-Reil	Interdisciplinary research project, OKOBOD.	Germany
Mr A. Mueller	SWAP-modelling of some abiotic and biotic aspects in the Sylt-Rømø Bight.	Germany
Prof. Dr. Rullkoetter	PAKOMIN Subproject: sedimentation, conservation and diagenesis of organic matter under the influence of high sediment accumulation.	Germany
Prof. Dr. J. Sündermann	KUSTOS: Coastal mass and energy fluxes – the land sea transition in the south eastern North Sea.	Germany
Dr A.L. Paropkari	Eastern Arabian sea marginal exchange processes (EASMEX).	India
Dr N. Ramanujam	Monitoring and modelling of groundwater behaviour and cliff recession in relation to wave climate in the coastal belt.	India
Dr K. N. Rao	Remote sensing studies on coastal biogeomorphological environments in the Godavari Delta region.	India
Dr T. Miyagi	Organic material and sea-level changes in mangrove habitat.	Japan
Dr M.K.W. Osore	Assessment of marine pollution in a former mangrove creek.	Kenya
Dr Gi Hoon Hong	Inner continental shelf in the southern sea of Korea: processes and products (INCOSPR).	Korea
Dr E. Shumilin	Trace elements in coastal sediments of Baja California Peninsula, Mexico.	Mexico
Dr R. Akkerman	Marine Monitoring System 2000+ for the North Sea Region.	Netherlands
Dr R.P.M. Bak	Dynamics and diversity of coral reefs.	Netherlands
Dr R.P.M. Bak	Gradients in coastal reefs and adjacent systems.	Netherlands
Dr R.P.M. Bak	Small food web/benthos studies.	Netherlands
Dr Ir. A.G. Brinkman	Modelling the impact of climate change on the Wadden Sea ecosystem.	Netherlands
Prof. D. Eisma	Fluxes of ^{210}Pb and associated radioisotopes in coastal seas (North Sea, Adriatic).	Netherlands
Prof. D. Eisma	Transport and deposition processes of inorganic and organic suspended material in the North Sea.	Netherlands
Prof. D. Eisma	Transport and deposition processes of suspended matter in several west European estuaries.	Netherlands

Dr H.G. Fransz	Effects of nutrient supply on plankton primary and secondary production and species composition.	Netherlands
Dr H.G. Fransz	Particulate matter in theNorth Sea: semi-empirical algorithm development.	Netherlands
Dr W.W.C. Gieskes & Dr J. Stefels	Entangled sulphur and carbon cycles in *Phaeocystis* dominated ecosystems (ESCAPE).	Netherlands
Prof. C.H.R. Heip	Impacts of nematodes on physical properties of sediments.	Netherlands
Dr P. Hoekstra	Morphodynamics of wave-dominated coastal environment in Teluk Banten: managing deltaic shorelines and reef systems.	Netherlands
Dr P. Hoekstra	Three-dimensional flow patterns and sediment fluxes in Teluk Banten.	Netherlands
Dr J. Middelburg	Carbonate dissolution in vegetated and bioturbated estuarine and coastal sediments.	Netherlands
Dr J. Middelburg	Methane and nitrous oxide emission, production and consumption rates.	Netherlands
Dr W.A. Oost	PROMARIS	Netherlands
Dr J. van der Plicht	Origin and characterisation of suspended and sedimental organic matter by means of carbon isotopes.	Netherlands
Prof. G. D. Vogels	Carbon cycling in the coastal zone of Tanzania.	Netherlands
Dr J. Voogt	Morphological and ecological effects of sea-level rise on the Wadden Sea.	Netherlands
Prof. W.J. Wolff	Ecological research to support the development of management strategies for West African estuaries.	Netherlands
Dr E.I.C. Agwu	Developing methodologies for integrated socio-economic and natural science research of changes in the Imo River Estuary.	Nigeria
Prof. J. S. Gray	Key coastal processes in the mesotrophic Skagerak and oligotrophic north Aegean (KEYCOP).	Norway
Prof. Yngvar Olsen	Comparative analysis of food webs based on flow networks: effects of nutrient supply of structure and function of coastal plankton communities (COMWEB).	Norway
Prof. G. Fang	Studies on impacts of climate and land environmental changes to the hydrographic structures in the Bohai Sea.	P.R. China
Prof. H. Hong	The biogeochemical processes of C, N and P in the Taiwan Strait related to the pelagic fishery resources.	P.R. China
Dr F. Li	Impact of human activities on ecological environment in the Yellow River estuary and its adjacent sea.	P.R. China
Dr Xie Qinchun	Behavior of fine sediment in Jiaojiang Estuary.	P.R. China
Dr W.W.S. Yim	International Geological Correlation Program Project No.396: 'Continental shelves in the Quaternary	P.R. China
Dr W.W.S. Yim & Prof. P. Li	Holocene record of typhoons in coastal sediments of southern China.	P.R. China
Dr W. Campos & Dr R. Baleña	An oceanographic survey of Philippines Archipelagic waters: 1. Central Philippines.	Philippines
Prof. Dr. C. Borrego	AMAZOC – Atmospheric environment in coastal zones: assessment of ecosystem load capacity.	Portugal
Prof. N.I Alekseevsky	Regime and dynamics of river mouth on the coast of the Caspian Sea under the influence of large-scale sea-level changes.	Russia

Dr V.N. Korotaev	Investigation of estuarine-deltaic systems morpholithodynamics.	Russia
Prof. V.N. Mikhailov	Delta forming processes and their mathematical modelling.	Russia
Prof. V.N. Mikhailov	Mixing of river and sea waters at the nearshore zones.	Russia
Dr E.S. Povalishnikova	Seawater intrusion into rivers and its mathematical modelling.	Russia
Mr A.N. Voronov	Pollution transport to the Baltic Sea via groundwater runoff.	Russia
Mr I. Wright	The Quaternary evolution of the northern KwaZulu-Natal coastal plain using the Kosi Lake/Estuary.	South Africa
Dr H. Holden	Remote sensing of shallow submerged coral reefs: identifying areas under stress.	Singapore & Indonesia
Dr D. Taylor	Rapid environmental changes in central Sumatra: ecological and socio-economic impacts in coastal environments.	Singapore
Dr A. Polonsky	Hydrometeorological and hydrographic field variability over the Black Sea coastal zone.	Ukraine
Dr M. J. Bray	Environmental changes and management of coastal systems.	United Kingdom
Dr A.J. Edwards	Evaluation of uses and the relative cost effectiveness of remote sensing technologies for coastal resources assessment and mapping.	United Kingdom
Dr. T. Jickells	Air-sea exchanges of trace elements particularly nitrogen and trace metals.	United Kingdom
Dr T. Jickells	Nutrient and metal cycling in estuaries and coastal environment.	United Kingdom
Dr I. G. Littlewood	River mass load estimation techniques (LOIS).	United Kingdom
Prof. R.F.C. Mantoura	Marine organics.	United Kingdom
Dr D.C. Mason	Inter-tidal digital elevation models using satellite data.	United Kingdom
Prof. J. Orford	The morpho-sedimentary response of gravel-based coastal barriers to sea-level rise.	United Kingdom
Prof. J. Orford	The impact of climate change and relative sea-level rise on the environmental resources of European coasts.	United Kingdom
Prof. J. Orford	Variation in coastal forcing and its coastal response along the European Atlantic shoreline.	United Kingdom
Dr J.M.C. Plane	Land-Ocean Interaction Study (LOIS)-RACS (Atmosphere).	United Kingdom
Dr C. Reynolds	Long-term assessment of physical and biological components in the waters of the Windermere catchment.	United Kingdom
Prof. I. Shennan	Land-Ocean Interaction Study (LOIS)-Land-ocean evolution perspective study (LOEPS).	United Kingdom
Prof. J.H. Simpson	Land-Ocean Interaction Study (LOIS) – Shelf edge study (SES).	United Kingdom
Prof. R.K. Turner	Integrated coastal zone management framework.	United Kingdom
Prof. R.K. Turner & Dr S. Crooks	Coastal environmental science and management.	United Kingdom
Prof. D.E. Walling	Sediment sources, sediment delivery and longer-term sediment responses of RACS river Basins.	United Kingdom
Dr E.M. Young	Integrated lagoon management in coastal Ghana	United Kingdom

Prof. F.T. Mackenzie	Model analysis of global change in coupled C-N-P-S biogeochemical cycles in the land-coastal margin atmosphere ecosystem.	United States of America
Prof. F.T. Mackenzie	Biogeochemical controls of post-glacial carbon cycle and rise in atmospheric CO_2.	United States of America
Dr H. Echezuria & Dr E. Bilbao	Geo-environmental characterisation of the Orinoco Delta.	Venezuela
Dr F. Muller-Karger, Dr R. Varela, Dr R. Thunell, Dr M. Scranton & Dr Y. Astor	Carbon retention in a coloured ocean (CARIACO)	Venezuela & United States of America
Dr Tran Duc Thanh	Sediment budgets and influence of moving and closing the inlets on the Tam Giang Lagoon ecosystem.	Vietnam

4. Workshops

4.1 LOICZ WORKSHOPS

4.1.1 IOC-SCOR-LOICZ Submarine Groundwater Discharge- Intercalibration of Methods: project development workshop. Paris, France (2-4 February 2000)

Direct discharge of groundwater into the ocean can be an important component in coastal budgets not only of water but also of chemical constituents. The problem coastal zone managers face is: (1) they may not be fully aware of the the importance of SGD; (2) if they are aware, they may not know how to decide whether or not SGD is relevant to their situation; and (3) if they do decide this is important to them, they may not know how to quantify it.

The joint SCOR-LOICZ-IOC-IHP working group meeting at the Intergovernmental Oceanographic Commission, Paris, in accordance with an earlier IOC Assembly decision, aimed to formulate a program to address these three issues. An important aspect of the methodological intercalibration project was ability to disseminate the results widely in the hopes that national authorities will encourage the scientific community to investigate this phenomena properly, in all likely locations. Such information could ultimately be compiled into a database and/or an atlas. The crucial design objectives were to gain ability to better define and test the SGD measurement tools. While it is relatively easy to produce numbers, it is very difficult to assess the quality of these estimates.

To meet the growing consensus within the scientific community working on SGD that some type of intercalibration program is needed to resolve the measurement issues, the workshop addressed: (1) the site selection; and (2) the selection of techniques and the experimental design of the actual intercomparison. For example, while some sites may have lower flows, the impact of SGD may be greater because of high nutrient concentrations. About four to five sites that span a broad range of conditions were identified, emphasising the need for the involvement of local expertise (both scientific and managerial) and some provision for training be made part of the dissemination effort.

The proposal was adopted by the IOC Executive Committee in May, 2000. The first intercalibration study under the aegis of the project was carried out in Perth, Western Australia in November-December 2000.

4.1.2 LOICZ UNEP Biogeochemical Estuarine Budgets and Modelling Workshop – South Asia Region. Goa, India (14-17 February 2000)

LOICZ has developed over 180 site budgets describing the net metabolism and models of nutrient flux in estuarine and coastal lagoon systems globally, using the LOICZ approach developed earlier in the life of LOICZ. The target of an array of settings, in excess of 200 site descriptions, is needed if we are to make a first assessment of global changes in material fluxes and the coastal system responses across the salinity interface.

A workshop in India was hosted by the National Institute of Oceanography in Goa and addressed ecosystems in the South Asia region. Representatives from India, Bangladesh and Sri Lanka joined in the workshop of tutorial and plenary activities to train and use a variety of recently developed modelling tools, and to develop coastal site models using existing data. Relatively unimpacted to highly polluted systems were considered as working examples. It is expected that participants will continue to make contribution to the wider LOICZ effort by further assessments of nutrient transfer and fluxes in additional coastal systems from the region. This effort was complemented by the SASCOM II modelling workshop held in Sri Lanka in September 2000 (see below) which added to further capacity building in the region and a focus on new project developments.

4.1.3 LOICZ UNEP Biogeochemical Estuarine Budgets and Modelling Workshop – East Asia Region. Hong Kong, China (13-15 June 2000)

A group of 14 researchers met in Hong Kong to develop C-N-P nutrient budgets and models for estuarine systems in the East Asia region. The workshop was hosted by Prof. Ming Wong and staff from the Hong Kong Baptist University. Participants from Russia, China, Korea, Japan and Taiwan took part in plenary and tutorial discussions which addressed various modelling and budgetary tools developed to assist the application of the LOICZ biogeochemical assessment approach to describing the global coastal zone.

The hands-on elements of the workshop applied the tools and ten site budgets were fully developed. Issues of scaling, submarine ground water discharge and regional forcing (including human factors) were considered. Two additional tutorial "tools" were developed in the workshop, including a way to estimate the estuarine mixing volume across the open boundary in the absence of a salt gradient and an approach for additional understanding of horizontal mixing in 2-layer box model systems. The region appears to be relatively data-rich and existing research programs are making further contribution to understanding nutrient transformations, changing loads and fluxes, and applying the scientific understanding to coastal environmental management issues. Addition sites were identified and further budgets were developed after the workshop to increase the number of local descriptions of coastal lagoon and estuarine ecosystems and regional sea nutrient processes.

The workshop outomes and additional site budgets were published in LOICZ R&S Report No. 16, 2000 and entered in the LOICZ biogeochemical modelling website.

4.1.4 LOICZ-START AfriBasins I: Workshop on Catchment/Coastal Fluxes and Human Dimensions. Nairobi, Kenya (25-27 July 2000)

LOICZ held its first AfriBASINS workshop in Nairobi, hosted by UNEP Regional Office for Africa and jointly sponsored by KNAS/IGBP, LOICZ, PASS, START, and UNEP/ROA. In this third regional BASINS workshop some 25 scientists representing all major African geographical provided a regional overview on:

- fluxes of nutrients, sediments and other material through the whole catchment/coast cascade,
- how people and economic factors as well as other global change pressures affect those fluxes, and
- how the changes observed in the environmental and social states feed back on the anthropogenic system (human dimensions of change).

A scientific and institutional network was established, including representatives of GEF (Biodiversity and Land Degradation) , the World Bank (African Water Resources Management Forum Interim Task Force) and UNEP/DEIA&EW and the Division of Policy Development and Law. Divided in three sub-regional working teams representing the heterogeneous features of North Africa, West Africa and East/Southern Africa, the network concentrated on establishing a data and information base by considering the existing knowledge and the major gaps in "catchment – coastal sea" interaction issues. The DPSIR (Drivers, Pressure, States, Impacts, Response) scheme proved a practical framework for review of drivers of change at the catchment level, and the identification and first efforts to categorise key pressures on the coastal systems.

As in other regional BASINS meetings the African group identified possible demonstration sites in each region for which to start the development of project proposals. The objective is to address a representative range of regional sites through interdisciplinary studies allowing for the development of indicators for sustainable use of coastal zones. Following the critical load concept, they are aimed at reflecting the human dimensions of catchment processes and coastal zone response. The projects will employ standardised assessment and modelling tools in both the biogeochemical and socio-economic field developed by LOICZ.

A major criteria for the site selection is in their potential for upscaling, i.e., to address a set of systems that represent a reasonable coverage of "types" of DPSIR scenarios and related coastal issues allowing comparison on regional and broader scales. While valuable to the LOICZ typology effort, this approach has considerable potential for co-operation with other global IGBP projects such as BAHC,

LUCC and PAGES. Besides their contribution on aspects of global change analyses, the studies are expected to be relevant for the issues of ICAM processes in Africa.

The regional assessment group will continue to develop a synthesis of horizontal material fluxes and changes of African coastal zone resources and characteristic system functions, and how they link to pressures on the catchments. Following a classification of pressure - state scenarios as well as trend analysis on expected change, a set of indices are being developed where possible to allow regional and global upscaling of the information.

A draft report is in preparation for discussion and resolution at the follow-up AfriBASINS workshop planned for August 2001, and contribution to the LOICZ 'synthesis" activity.

4.1.5 LOICZ UNEP Biogeochemical Estuarine Budgets and Modelling Workshop – Sub-Saharan Africa Region. Zanzibar, Tanzania (12-14 September 2000)

Sixteen scientists from sub-Saharan Africa were hosted by the Institute of Marine Science, University of Dar es Salaam on Zanzibar, 12-14 September. The new computer version of CABARET for budget calculations, supported by a tutorial booklet, provided a base for the training sessions. Nutrient budgets for 13 estuarine systems from Tanzania, Kenya, Cameroons, Guinea and South Africa were developed during the workshop. A number of other systems were identified as having necessary data available and the workshop participants have subsequently extended the site description work more widely in their countries and within the region.

The developed budgets and the regional extension of the network of researchers are vital elements for LOICZ; these and continuing scientific assessments will be key contributions to the integration activities in the Africa-Europe thematic workshop planned for mid-2001. Prof Howard Waldron, University of Cape Town took up the role as Regional Mentor-Africa, to continue as a focus point for "budgeteers" from the region. Dr Amani Ngusara has accepted a LOICZ UNEP scholarship in Manila and Hawaii for 2001, to build further on the budgeting and modelling capacities.

The new budgets will be posted to the LOICZ Biogeochemical Budgets and Modelling web site, and a workshop report is in preparation as part of the LOICZ R&S series.

4.1.5 APN-START-LOICZ Regional Training Workshop on Biogeochemical Budgeting and Socio-economic Modelling. Colombo, Sri Lanka (18-22 September 2000)

With the support of APN, START and LOICZ, the Sri Lanka IGBP Committee hosted a second SASCOM workshop on biogeochemical budgeting and socio-economic modelling for coastal scientists in Colombo, 18-22 September 2000.

The objectives of the workshop were to train coastal scientists in the use of current methodologies including computer models, enabling them to:

- Achieve a better understanding of the processes and improved capability of modeling sediment dynamics and biogeochemistry of coastal systems comprising estuaries including deltas and lagoons,
- Assess the economic and social impacts of global climate change in the coastal aquatic systems and the extent to which measures for mitigation and adaptation to such impacts would affect the coastal human populations,
- Assess the impacts of human activities of economic importance being undertaken in the coastal zones, on the coastal environs and ecosystems, and the biogeochemical budgets, and
- Integrate the natural sciences with the socio-economics for proper management of coastal zones.

This training workshop built on an earlier meeting in 1999, and addressed biogeochemical budgetting and analysis for nutrients and sediments and economic-environmental modelling. The 20-plus regional scientists, from India, Bangladesh, Pakistan, Mauritius, Maldives and Sri Lanka, were augmented by local management agency and NGO representatives during plenary sessions. Both plenary and tutorial sessions were highly interactive and the tools and approaches are being applied to local and regional issues. In addition, 9 estuarine budgets were partially developed for sites in the region, with more research activities underway to complete and to extend these examples. These will provide a crucial contribution to LOICZ understanding in the region and will contribute to the wider thematic workshop addressing Asia that is planned for 2001.

The participating scientists are encouraged to form a nucleus to establish a regional research network among active coastal researchers in the South Asian region, which is one of the goals of START.
A regional research program was developed by participants and has been submitted for funding.

4.1.6 IGBP LOICZ Water and Sediments Processes Workshop. Boulder, Colorado, USA (25-27 September 2000)

A subset of IGBP Water Group (representatives from BAHC, LOICZ, PAGES) augmented by invited researchers met at the Institute of Arctic and Alpine Research, University of Colorado, Boulder 25-27 September 2000. The workshop participants discussed anthropogenic influences at the global scale, on the supply and flux of sediment along hydrological pathways. Key issues included:

1. Sediment flux to the coast, presently, in the past, and under pristine conditions. River systems evolve through time, and as such existing river systems are strongly influenced by past conditions within the watershed as well as modern conditions. Understanding the discharge of sediment across a broad time-scale will allow better predictions for the future. The trapping efficiency of terrestrial reservoirs, both man-made and natural, is important to understanding the future discharge of sediment to the coastal oceans.

   1.1 *Present Flux to Coast*

   Current estimates put the annual sediment flux to the global ocean between 18×10^9 to 24×10^9 metric tons.

   1.2 *Paleo Flux and Pristine Conditions*

   Fluvial systems evolve along with the landscape, and much of the sediment yield we see today is influenced by the paleo-systems.

   1.3 *Future Sediment Flux*

   The main understanding needed is the balance of increased sediment versus decreased sediment due to the influence of man and/or climate change on biological consequences such as burial of benthic biota.

   1.4 *Sediments in River Basins*

   It is understood that the erosion of bedrock by rivers takes place almost entirely in the headwaters of the catchment. Newly eroded sediment must then be transported to the coastal zone. How long it takes for this transport and how sediment makes the journey are two vital questions.

2. Global Change & Sensitive Areas
3. Data - Typology (upscaling, downscaling)

The workshop participants developed a set of recommendation, emphasising research and assessment needs for further evaluation of water-sediment processes, including:

- Global mapping of sediment sources and/or sensitivity to disturbance; to allow for a better understanding of the affect of change on the system.
- Creation of an index to understand sediment transit times within basins. This needs inclusion of smaller river basins, as transit times are expected to be much shorter than that

for the larger rivers. This infers that changes occur much more rapidly in smaller basins than larger ones.
- Determination of how long before river loads fill up the terrestrial sediment traps, and what the subsequent impacts will be downstream (e.g., within the coastal zone).
- Research the balance between increasing and decreasing sediment loads due to human and/or climate change.
- Coastal sediment budgets need to be linked to terrestrial sediment budgets; to allow a bridge between the data from upstream gauging station and the coastal ocean, taking into account the interaction within estuaries.

A full report is being prepared for publication published as a special issue of Global and Planetary Change.

4.1.7 LOICZ CariBas regional assessment and synthesis workshop in Trinidad Tobago (7-9 December 2000)

Following the recommendations of the LOICZ global BASINS and Islands working group held as part of the 4th Open Science Meeting in Bahia Blanca, Nov. 1999, a regional assessment of the horizontal fluxes to the coastal zones and their effect on coastal change in the Wider Caribbean was commissioned to the University of South Carolina under leadership of Prof. B. Kjerfve. The study is part of the global LOICZ BASINS effort aimed to evaluate the riverine and island run off characteristics under natural and anthropogenic forcing.

Hosted by the University of the West Indies, the CariBas working group held its first meeting in December 2000, compiling mainly existing information on material fluxes and coastal impacts in this island dominated region. Information included was mainly coming from more than 15 years of work within the CARICOMP network of scientific institutions and will in a second step be synthesised against the key LOICZ questions including the human dimensions of change and scenario simulation.

In a second phase CariBas will conclude its regional assessment in a meeting planned for the first half 2001, in collaboration with IOC. This will follow the standardised BASINS assessment approach. The study is expected to generate a sound scientific information base on changes and trends in the Caribbean coastal zones which can be incorporated in the global BASINS synthesis and add provide further insight into hot spots of impact and change which are to be addressed through future integrated assessment science. The respective proposals form the second set of products expected from CariBas.

4.2 ASSOCIATED WORKSHOPS

4.2.1 SURVAS - Synthesis and Upscaling of Sea-level Rise Vulnerability Assessment Studies Workshops, 2000

SURVAS activities throughout the year 2000 were primarily focussed on the development of the SURVAS network of international experts interested in vulnerability and adaptation studies and the organisation of four workshops on these issues:

- The Methodological Workshop, January 2000, Trent Park, Middlesex University, London, UK;
- The European Regional Workshop, June 2000, ZMK, Hamburg University, Germany;
- The African Regional Workshop, November 2000, NARSS, Cairo, Egypt;
- The APN/SURVAS/LOICZ Joint Conference on Asia/Pacific, November 2000, Kobe, Japan.

In **January 2000**, the **Methodology workshop** focussed on identifying and clarifying key indicators for the assessment of coastal natural susceptibility and socio-economic vulnerability and resilience to impacts of climate change particularly accelerated sea-level rise

(ASLR). It also considered the practical implementation of these ideas embraced in the SURVAS package, which was sent to all participants at the three regional workshops held in 2000.

This resulted in:

- a first appraisal of data available through a range of global datasets primarily obtained via on-line sources,
- the improvement of the SURVAS package. This included modification of a number of tables and questionnaires on the nature and the use of the coastal zone, current coastal management problems and potential impacts

The SURVAS package was subsequently tested and further improved using three national case studies with contrasting situations (Germany, Poland and India).

Through each regional workshop the SURVAS network has been growing, and over 200 international experts have participated in the project to the end of 2000, including coastal planners, managers and engineers, natural and social scientist, governmental officials, NGOs and the media.

In **June 2000**, the **European workshop** took place in Hamburg, Germany. most coastal European countries were represented. This will produce several publications, including the *Proceedings* of the workshop (available at the project web site http://www.survas.mdx.ac.uk/) and a theme issue of the *Journal of Coastal Research* on "European vulnerability and adaptation to impacts of accelerated sea-level rise". Importantly, this Workshop acted as a catalyst for a number of countries to initiate work on national vulnerability assessment for sea-level rise (e.g., Norway, Turkey, and to a certain extent, Portugal). Another outcome is the setting up of closer academic links and exchange. The Estonian and Turkish delegates will visit the Flood Hazard Research Centre, Middlesex University, UK over summer 2001.

In **November 2000**, the **African workshop** took place in NARSS, Cairo Egypt. Although the geographic coverage of the African coast was restricted due to a number of problems (including limited funds, non-attendance or non-availability), 15 countries from each major African region were represented at the event. The delegates insisted on the need to foster greater research opportunities, collaboration and technology transfer and at their instigation, produced a Workshop statement. A group of African experts on sea-level rise (chair: Dr. Isabelle Niang-Diop, Senegal) was also established to further efforts to understand the potentially serious implications of sea-level rise for Africa. Most of the participating countries have already produced or initiated vulnerability assessment studies and the data will be compiled and added to the final SURVAS database, and a *Proceedings* will be placed on the SURVAS Web page in spring 2001

Again in November 2000, the **APN/SURVAS/LOICZ Joint Conference** was based in Kobe, Japan. The Asia Pacific Network, Ibaraki University and the Science Council of Japan were part of the organisation committee of the conference. Over 50 delegates participated in the event, which combined national perspective on vulnerability and adaptation to impacts of sea-level rise, with state of art research on coastal zone issues based in the Asia Pacific region. A detailed *Proceedings* is being prepared, and important data for the SURVAS database was identified.

On-going SURVAS activities include:

- The theme issue of the *Journal of Coastal Research* on "European vulnerability and adaptation to impacts of accelerated sea-level rise" is being completed. Thirteen national papers and two overview papers on impacts and adaptation, respectively, are in review/revision. Final submission to the *Journal* is planned for mid-July 2001.

- Preparation of the Cairo Workshop *Proceedings*. In parallel, Ibaraki University, Japan is currently putting together the *Proceedings of the APN/SURVAS/LOICZ Joint Conference*. Both documents will be available in hard and soft copies, including the SURVAS web site.
- Preparation of a brochure on steps to complete the SURVAS Matrix of indicators of vulnerability and adaptation to impacts of sea-level rise. This will include the varied experiences from the three regional workshops held to date.
- Synthesis of national Vulnerability Assessment data and construction of the SURVAS database.
- Preparations for the Overview Meeting which will take place in London, in June/July 2001.
- Preparation for the **Americas Regional Workshop**, which was originally scheduled to be held in March 2001 at Lamont-Doherty Observatory, New York, USA. However, due to insufficient funds being available it has been postponed and it is anticipated that this important Workshop will take place between September 2001 and 2002 (i.e., after the SURVAS Project ends). Participating countries have been identified and a network of interested partied has been built and some funds have been committed. Meetings to explore finding the balance of the required funds will take place at Lamont during spring 2001, while Dr Robert Nicholls is a Senior Visiting Scientist with CIESIN.

4.2.2 Global Change and Continental Aquatic Systems. Stockholm, Sweden (7-9 February 2000)

The workshop, which was organized in conjunction with the Royal Swedish Academy of Sciences and the Swedish Agricultural University, was also supported by the Millenium Committee of Sweden and the Foundation for Strategic Environmental Research, Sweden.

Focusing on global change and continental aquatic systems (CAS) i.e., fluvial pathways, groundwater transport through the catchments and the coastal zones, the workshop sought to answer the leading question: "Are the changes observed in continental aquatic systems over the last 50 years and foreseen for the next 50 years caused by global climate change or by anthropogenic drivers?" Emphasis was placed on the multiple impacts on land and water use generated through changes of physical, hydrological, chemical and biological processes affecting the occurrence and fluxes of water resources.

In four working groups (Water Quality, Biogeochemical Cycles, Suspended Sediment Fluxes, Global Changes), the 20 participants from the wider IGBP community and projects such as HELP, ORSTOM (IRD), and IHP addressed 5 subset questions:

- How have water resources evolved since the development of agriculture?
- How have water resources been modified by human activities?
- How have these changes affected the coastal zone?
- How will climate change and anthropogenic changes affect future water resources?
- How have biogeochemical cycles been, and how will they be affected by changes of river and groundwater fluxes?

Major findings of the meeting pointed out that human activities seem to encompass the most prominent drivers of environmental changes rather than climate. The cumulative changes observed in the hydrological cycle at a global scale are significantly driven by damming, water diversions and withdrawals. These modify the physical components of aquatic environments, particularly in river systems in terms of, for example, sediment retention and reduction of water flow. Land-use changes through engineering, constructions, deforestation and agriculture, which have been of increasing influence for over the last 2000 years, now are proceeding at an accelerated rate and leading, for example, to severe deforestation in the humid tropics and desertification in the arid tropics. Increasing water demand for irrigation is expected and has been seen to cause severe drops in water quality through salinisation of surface and ground waters.

Thus, global climate change might not be the most immediate critical issue, partly because it follows a moderate timeline compared to human-induced changes. However, it cannot be neglected that in areas where specific geomorphologic settings are more sensitive to changes in the water balance, global climate change exerts a major pressure and is the primary cause for system function and services changes. Such areas include the coastal zones where saltwater intrusion will affect the coastal aquifers following sea-level rises.

A full report of the workshop shall be published in Science journal in April/May, 2000.

4.2.3 Third Workshop on Land Ocean Interactions in the Russian Arctic (LOIRA). Moscow, Russia (5-8 December 2000)

The third LOIRA workshop held in Moscow, Russia (5-8 December 2000) provided a new window into research findings relating to the Arctic coastal zone of Russia. The workshop was attended by more than 50 LOIRA and other related scientists plus interested members of the Institute of Oceanology.

Natural science issues ranged across river catchment science to river and estuarine fluxes and processes to coastal seas of the Arctic Ocean. Geographical distribution of work extended across the entire polar coast including the Barent, Kara and East Siberian Seas and their subsidiary sea elements, notably the Pechora, Laptev and White Seas. Characteristics of river flows, loads and changes were considered in light of earlier evaluations. Advances in coastal and deltaic biogeochemical processes in major systems were described with new information on seasonal characteristics or winter and summer conditions. A joint German-Russian program studying the Laptev Sea provided new information on coastal circulation and material transport, particularly demonstrating use of an acoustic *in situ* sensor whose results raised some tantalising questions about linked biology and physical processes under surface ice conditions. The Pechora Sea is a major focus for land-ocean studies encompassing nearly every issue familiar to coastal scientists. Socio-economic research and program developments also were highlighted – here a key issue is the development of gas and oil exploration/extraction and how to achieve appropriate wise use of the relevant coastal regions to advantage of all stakeholders.

4.3 OTHER WORKSHOPS

In 2000, LOICZ scientists were involved in the presentation of materials, activities and preparation of scientific publications in a number of key workshops held by related agencies addressing coastal research, and the transfer of scientific knowledge to coastal managers, policy and industry sectors, including:

- IGBP Synthesis Workshop: Global Change and Continental Aquatic Systems. Stockholm, Sweden 7-9 February 2000.
- IGBP SC 15th Meeting and IPO Executive Officers Meeting, Cuenacava, Mexico 22-26 February 2000.
- LOICZ Typology Development Workshop. University of Kansas, USA 4-6 March 2000.
- International Workshop on Deltas: their Dynamics, Facies and Sequences. Tsukuba, Japan 16-17 March 2000.
- IOC Coastal GOOS Planning Meeting. Gdansk, Poland 2-6 May 2000.
- UNESCO IOC Volga Basin workshop. Nizhny Novgorod, Russia 3-6 May 2000.
- ASLO annual meeting, Copenhagen June 2000.
- IGBP Terrestrial Futures Workshop. Stockholm, Sweden 21-23 June 2000.
- IOC Executive Council meeting. Paris, France June 2000.
- Large Deltas and their Impacts on the Coastal Zone. Ispra, Italy 5-7 July 2000.
- Processes in the Coastal Zone: Links to Management Issues. Leonardo da Vinci International Advanced School, summer course. Bologna, Italy 3-14 July 2000.

- IHDP-START International Human Dimensions Workshop 2000. Bonn, Germany 14-16 September 2000.
- IGBP-SCOR Marine Futures Meeting. Plymouth, UK 23-25 September 2000.
- International Training Workshop on Integrated Coastal Area Management and its Integration with Marine Sciences. St. Petersburg, Russia 25-30 September 2000.
- International Seagrass Congress. Sardinia, 28 September- 1 October 2000.
- Typology Development Workshop and Train-the-Trainers Meeting. Maryland, USA 15-17 October 2000.
- Rotterdam Harbour workshop. Rotterdam, The Netherlands November 2000.
- SCOR-LOICZ-IOC Submarine Groundwater Discharge Workshop and Field Campaign. Perth, Australia 25 November-8 December 2000.

5. Collaboration

LOICZ has actively sought collaboration throughout 2000, building on and extending earlier relationships both internally in the IGBP "family" of projects, and externally with international agencies and science "users". The extended global network of scientists associated with LOICZ is the engine of the project. The LOICZ network has been sustained and more than 2400 people and key agencies are involved in the activities and science delivery.

A major element of the project is the support provided through national governments and their research agencies and universities, often involving a national LOICZ associated with a national IGBP Committee. Many research actions and projects are developed and implemented through these arrangements, and outcomes contribute to thematic and regional synthesis work of the LOICZ program. In 2000, the Dutch research agencies approved a US$3.5 million project to support LOICZ focussed research by Dutch institutions over the next 4 years; proposals will be called for early in 2001. The utility of the LOICZ typology methods was recognised by in the US National Oceanographic Partnership/Alfred P. Sloan Foundation and associated research work was funded (Biogeoinformatics of Hexacorallia) for a global taxonomic database linked to the typology tools. Major national research initiatives, such as the CRC for Coastal Zone, Estuary and Waterway Management in Australia, are also allied to LOICZ.

Major regional programmes also are part of LOICZ, including projects with varying degrees of integration which provide regional assessments of the LOICZ key questions. There has been increased opportunity and collaboration in this area during 2000, through the EU supported UK initiative for the SURVAS addressing sea level vulnerability using a common methodology, the implementation of the Russian LOIRA project, and the UNEP GEF project on nutrients. Further collaborative actions within the EU-funded ELOISE program are providing regional and thematic research outcomes, and collaborative regional synthesis work is being developed with the JRC ELOISE coordination office in Ispra. Here, the newly approved EUROCAT project is a vital step forward, and a joint EU- ELOISE/LOICZ workshop is planned for Athens in early 2001. A number of agencies, notably IASC, and nations are supporting early stages of the LOIRA project that will shed valuable light on processes and changes in the Arctic region.

LOICZ is building an association with UNEP and other global programs beyond the current GEF-funded biogeochemical project. The BASINS task in LOICZ is a catalyst in this arena, with the AfriBASINS I workshop in Nairobi proving a platform for discussions and directions of collaborative opportunities, and links with the Global International Waters Assessment project (GIWA).. Further effort will be invested throughout 2001 to find ways of linking more closely both at an operational level and in integration and dissemination of science.

Within IGBP, LOICZ has further developed joint work with the terrestrial and other marine projects, notably BAHC (through typology and basins research), GLOBEC (for joint typology interests), JGOFS (by the joint CMTT activities) and PAGES (with initiatives in sea level assessment). Additional collaboration has resulted from contributions to the IGBP cross-cutting projects, such as assessments of global changes in carbon (participation in synthesis and evaluation workshops) and water (water group workshop in Boulder, Colorado). LOICZ values its close working relationship with the START project on capacity building and regional assessment. Training in regions was enhanced by jointly organising workshops during 2000, for example, the modelling workshop in Sri Lanka, AfriBASINS, and the Bonn ICZM workshop (IHDP-START as major sponsors). These initiatives, and the developing contacts with other agencies pursuing capacity building projects (e.g., IOC, the Inter Americas Institute, the Asia Pacific Network) are continuing.

LOICZ research continued to gain support from the Asia Pacific Network, both for co-funded workshops and for research activities. Three major APN-funded activities were approved in 2000, including: Recent sea-level change and coastal management implications for Oceania; Training workshop for capacity building and networking in the area of biogeochemical budgeting and socio-economic modelling in the coastal systems of South Asia; and APN/SURVAS/IGBP joint conference on coastal impacts of climate change and adaptation. A close association with the SCOR global programme has been sustained e.g., the jointly-sponsored Working Group (112) on Submarine Groundwater Discharge, and involvement in the IGBP/SCOR Ocean Futures workshop in Plymouth. A closer working association with the International Human Dimensions Programme (IHDP) has been developed and is being extended. In 2000**,** the IPO met with the IHDP Secretariat to discuss program objectives and activities, and a number of common interest areas were identified and are being followed up.

A major goal for LOICZ is to ensure that the scientific research is made available to coastal zone managers and policy makers. LOICZ has sustained a strong and close working association with the Intergovernmental Oceanographic Commission (IOC), and continues to develop accords with other international bodies that can act as science "brokers", such as the European Commission. With IOC, a focus since 1998 has been towards joint actions and consultation on integrated coastal area management (ICAM), developments of the Coastal-GOOS plans, and capacity building in world regions. In 2000, LOICZ and IOC have continued with many joint actions and broadened our relationship, including: as: book authorships, extension of research studies (e.g., submarine groundwater field evaluations for inter-calibration of methods), project design and methodologies (e.g., Volga basin, Global Water initiative of UNESCO), and regional network building workshops (e.g., Africa, Latin America & the Caribbean). These "brokering" and application initiatives are being extended through additional links and joint actions with RIKZ Coastal Zone Management Centre (e.g., the new Deltas task) and the Netherlands Institute for Sea Research (NIOZ).

While these internal and external institutional arrangements are vital to the success of LOICZ, it is the individual scientists, coastal managers and policy-makers that ensure the operational products and the achievement of LOICZ goals (e.g., the PORTS project for Rotterdam Harbour). Networking and collaboration with global researchers continues to gain success. Of particular note, is the successful establishment and activities of three Regional Mentor foci (Mexico, the Philippines, South Africa) as part of the coastal biogeochemical modelling project supported by UNEP GEF. The Regional Mentors are extremely effective in training, deriving scientific products and skills from their regions, extending the science network and enthusiasm for the LOICZ project, and ensuring a broad global constituency of involved researchers.

6. Communication

Personal contacts within workshops and LOICZ research activities are a key part of the interactions between "members" of the LOICZ community. But, communication within and beyond LOICZ is also vital to the effectiveness and success of the project. Increasingly, we are meeting these needs through electronic media – web sites and interactive pages, a network of email contacts, and transfer of information. However, we recognise that people are the key resource and that while electronic media provides for broad contacts, not all scientists and science-users have the same level of access to cyberspace. Hence, LOICZ tries to disseminates information by a mix of printed and electronic publications. Indeed, a programmatic approach is being developed to increase communication and awareness of LOICZ scientists. A communications strategy is being developed and a small task force of professional science communicators is planned to be establish 2001 - in the short term to aid in transfer of the "synthesis' outcomes, in particular, and in the longer term to accompany all activities.

In 2000, LOICZ has continued to use a mix of media spread its findings and to promote the network of players, internally and with users.

Newsletter

Four editions of the LOICZ Newsletter (Nos. 13-16) were produced and each was distributed to about 2400 people and agencies. Generally, each Newsletter contained at least one scientific article, along with news and updates on the LOICZ project activities, and provided notice of the calendar of relevant meetings and workshops within and associated with the project.

Brochures and Posters

LOICZ brochures (published in four languages - English, French, Portuguese, Spanish) have continued as a useful tool for awareness and promotion of the project.

LOICZ Web Site

The LOICZ web site (www.nioz.nl/loicz/) is of increasing importance as a means of communication and as an archive. The web site was upgraded through 1999 and revised and redesigned site is in preparation for posting in 2001. Copies of new LOICZ printed materials are available through the site, links are provided to other coastal science sites, and new publications are listed which deal with coastal research and coastal zone management.

The LOICZ web site provides direct and indirect access to LOICZ databases and tools, especially for biogeochemical budgets and typology. Additional thematic web-pages, e.g., BASINS task, are being developed to address LOICZ core projects.

Publications

Numerous scientific publications have been produced from research projects contributing to LOICZ Core, Regional and Relevant Research projects. Special issues of peer-reviewed journals are in final stages of preparation – Journal of Sea Research, Regional Environmental Change – which will contain a spectrum of LOICZ science. The water –sediment group is expecting to publish in a special issue of Global and Planetary Change. A thematic review of trace gases in the coastal zone is nearing completion, and contributions of topical chapters on land-ocean interactions have been made to key publications in the Dahlem Workshop series and to IOC.

LOICZ publishes a Reports & Studies series encompassing regional integration of thematic issues, usually derived from workshops. These are listed on the LOICZ web site. LOICZ has been placing increased effort on integration and publication of its science across a range of

peer-reviewed journals and media. This will continue as a major activity. Examples of science and key workshop publications and media in 2000 include:

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Gordeev, V.V. 2000. River input of water, sediment, major ions, nutrients and trace metals from Russian territory to the Arctic Ocean. In: *The Freshwater Budget of the Arctic Ocean*, Lewis, E.L. and others (eds.), pp. 297-322. Kluwer Academic Press. The Netherlands

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Liu, K.K., Atkinson, L., Chen, C.T.A., Gao, S., Hall, J., Macdonald, R.W., Talaue McManus, L. and Quinones, R. 2000. Exploring continental margin carbon fluxes on a global scale. *Trans. American Geophysical Union* (EOS) **81**(52):641-644.

LOICZ 2000a. LOICZ biogeochemical budgeting procedure: a tutorial pamphlet. David, L.T., San Diego-McGlone, M.L., Crossland, C.J. and Smith, S.V. (eds.). Marine Science Institute, University of the Philippines, 29p.

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Smith, S.V., Renwick, W.H., Buddemeier, R.W. and Crossland, C.J. in press. Budgets of soil erosion and deposition for sediments and sedimentary organic carbon across the conterminous United States. *Global Biogeochemical Cycles*.

Webster, I.T, Parslow, J.S. and Smith, S.V. 2000. Implications of spatial and temporal variation for biogeochemical budgets of estuaries. *Estuaries* **23**:341-350.

Websites

LOICZ:

http://www.nioz.nl/loicz

Biogeochemical Modelling and Budgets:

http://data.ecology.su.se/MNODE

SURVAS:

http://survas.mdx.ac.uk

Typology:

http:/www.kgs.ukans.edu/Hexacoral/Workshops
http://palantir.swarthmore.edu/~maxwell/loicz

7. Funding

The Netherlands government generously continues to support the LOICZ International Project Office and core activities during this second phase of the project, 1998-2002. This funding is received from the NWO and RIKZ, supplemented with support from IGBP for meetings of the LOICZ Scientific Steering Committee.

In addition to major core funding support for the IPO and project from the Netherlands government, in 2000, LOICZ (and associated projects) gained significant project funding from UNEP GEF, APN, USNOPP/Alfred P. Sloan Foundation, EU. The European Union has provided support funding for a workshop project and ELOISE projects.

Funding support for regional activities has come from IOC, IAI, NSF, KNAW, WOTRO and APN. Working collaboration has been established with other core projects of IGBP and jointly-funded activities have been engaged especially with BAHC, PAGES and START.

In-kind support, especially from NIOZ and RIKZ, and many national government agencies continues to underpin LOICZ activities. In particular, the support from NILU (Norway), University of the Philippines, Institute of Arctic & Alpine Research Colorado, and Japanese institutes have contributed to global activities. The LOICZ SSC and the activities of member are supported by a range of universities and national agencies, notably the Universities of Hawaii, Kansas, Maryland and Stockholm, and GKSS (Germany).

In addition, national and international agencies support the Regional and Relevant Research projects listed in Section 3; these financial contributions are not included here.

The income funding stream for LOICZ (including cash to IPO only) in Years 1 - 3 of **Phase 2** is listed below with indicative figures for Year 4 (2001)

	1998	**1999**	**2000**	**2001 (projected)**
LOICZ Phase 2 (1998-2002)	**Year 1**	**Year 2**	**Year 3**	**Year 4**
(Dutch Guilders)				
Cash				
Core support	890 000	887 000	895 000	890 000
Additional support	65 500	436 200	745 000	740 000
subtotal	955 000	1 323 200	1 640 000	1 630 000
Inkind				
NIOZ and RIKZ	260 000	260 000	260 000	260 000
Additional support	183 000	540 000	725 000	680 000
subtotal	443 000	800 000	985 000	940 000
TOTAL	**1 398 000**	**2 123 200**	**2 625 000**	**2 570 000**

8. Abbreviations list

APN	-	Asia Pacific Network
BAHC	-	Biospheric Aspects of the Hydrological Cycle (IGBP core project)
CICESE	-	Centro de Investigación Cientifíca y de Educación Superior de Ensenada
DPSIR	-	Drivers-Pressure-State-Impact-Response framework
EALOICZ	-	East Asia LOICZ Committee
ELOISE	-	European Land-Ocean Interaction Studies
EU	-	European Union
GLOBEC	-	Global Ocean Ecosystem Dynamics
GOOS	-	Global Ocean Observing System
IAI	-	Inter America Institute
IASC		International Arctic Science Committee
ICAM	-	Integrated Coastal Assessment and Management
ICSU	-	International Council of Scientific Unions
IGBP	-	International Geosphere-Biosphere Programme
IHDP		International Human Dimensions Program on Global Environmental Change
IHP		International Hydrological Program
IOC	-	Intergovernmental Oceanographic Commission of UNESCO
JGOFS	-	Joint Global Ocean Flux Study (IGBP core project))
JRC	-	Joint Research Centre (EU Com.)
KNAW	-	Netherlands National Academy of Sciences
LOICZ	-	Land-Ocean Interactions in the Coastal Zone (IGBP core project)
LOIS	-	Land-Ocean Interaction Study, United Kingdom
LUCC	-	Land-Use Cover Change (IGBP core project)
MAST	-	Marine Science and Technology
NILU	-	Norwegian Institute for Air Research, Oslo
NIOZ	-	Netherlands Institute for Sea Research, Texel
NSF	-	National Science Foundation, USA
OSM	-	Open Science Meeting (e.g., LOICZ OSM4, Argentina)
PAGES	-	Past Global Changes (IGBP core project)
SARCS	-	Southeast Asia Regional Committee for START
SASCOM	-	South Asia Regional Committee for START
SCOR	-	Scientific Committee on Oceanic Research
SOPAC	-	South Pacific Applied Geoscience Commission
START		Global Change System for Analysis Research and Training (IGBP core project)
SWOL	-	SARCS/WOTRO/LOICZ
UNEP GEF		United Nations Environment Programme and Global Environment Facility
UNESCO		United Nations Educational, Scientific and Cultural Organisation
USNOPP		United States National Oceanographic Partnership Program
WOTRO	-	Netherlands Foundation for the Advancement of Tropical Research