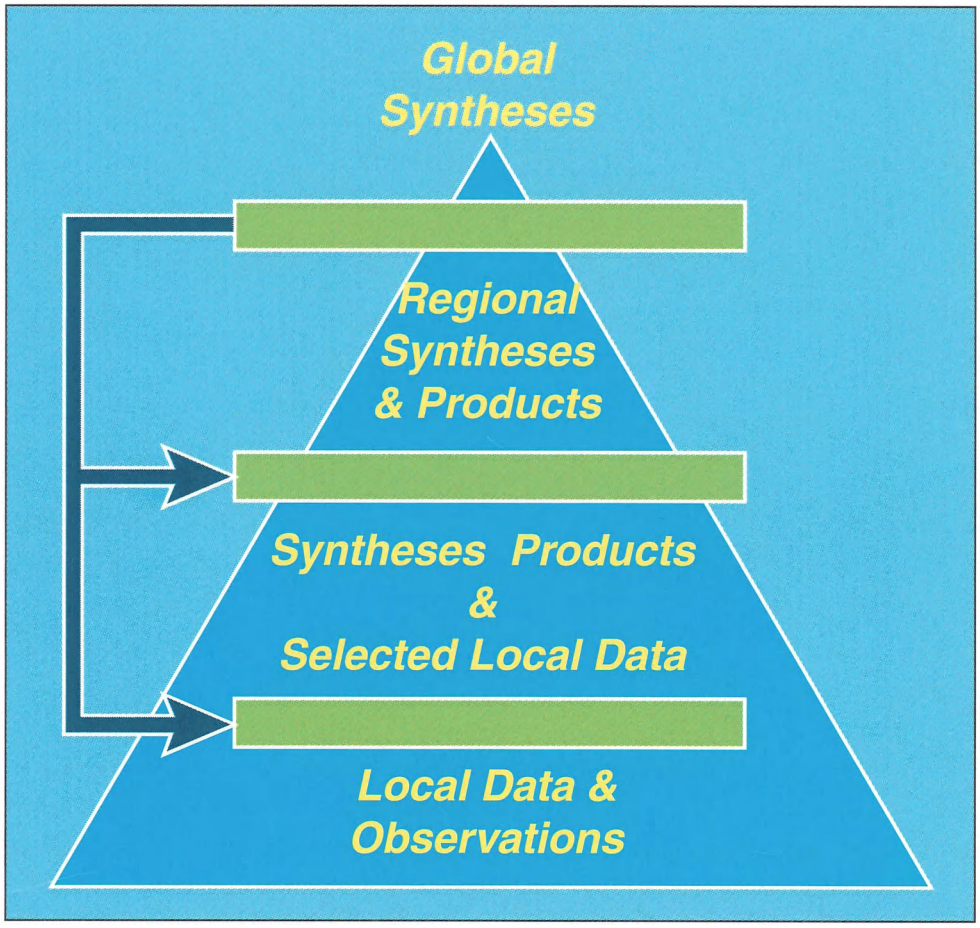
LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE (LOICZ)

Core Project of the
International Geosphere-Biosphere Programme: A Study Of Global Change (IGBP)
of the International Council of Scientific Unions (ICSU)



LOICZ DATA AND INFORMATION SYSTEM PLAN

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LOICZ REPORTS & STUDIES NO. 6

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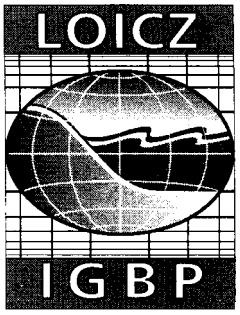

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Cover: Extract from the overview of LOICZ data and information flow.

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1. EXECUTIVE SUMMARY

As noted in IGBP Report No. 30 (IGBP, 1994), each Core Project of the International Geosphere-Biosphere Programme - a study in Global Change (IGBP) will need to develop its own data system plan, incorporating guidance on data quality and availability, management, exchange and applicability in global syntheses and modelling activities. The Land-Ocean Interactions in the Coastal Zone (LOICZ) Core Project of the IGBP has identified this as a high priority task in the implementation of LOICZ. The LOICZ Implementation Plan (Pernetta and Milliman, 1995), outlines in detail the scope and intention of the Data and Information System Plan under Task F.3.1. The LOICZ Data and Information System Plan presented here represents the initial response of the Core Project Office to the requirement for guidance on data and information management.

As a result of the breadth of LOICZ research the global syntheses that are the long-term goals of the Project will necessitate the acquisition of a wide diversity of data types that will need to be interfaced at different organisational levels. This diversity of data needs and organisational levels presents unique challenges to the implementation of the LOICZ Data and Information System. This Plan attempts to encompass both the nature of the data to be used in achieving LOICZ goals and objectives, and the management process involved in acquiring, quality controlling, compiling, analysing, synthesising and archiving the required data. It also identifies the various organisational levels and their rights and responsibilities as users of and contributors to the system.

There are already a number of international projects and programmes concerned with data and information collection, management and distribution. To make best use of limited LOICZ resources and to maximise the possibilities of interchange between LOICZ and these on-going projects and programmes, it will be essential to establish a close collaboration with these initiatives. This Data and Information System Plan identifies a number of linkages and suggests modalities of operation for such linkages. As a means of promoting such linkages this plan contains a large number of useful references to coastal zone information holdings. It also identifies a number of data requirements that must be addressed by contributions from LOICZ participants to the global research of LOICZ.

In keeping with the overall concept of LOICZ as a collaborative project involving scientists at all levels, (local, national and regional) the Data and Information System Plan has been, and will continue to be, developed in full consultation with the LOICZ network of corresponding scientists. Management of the system will involve full consultation and involvement of these organisational levels and the Data and Information System Plan lays out a framework for the establishment of strong working relationships, in the implementation of the data and information components of the LOICZ Project.

2. INTRODUCTION

2.1 Overview of LOICZ Research

The Land-Ocean Interactions in the Coastal Zone (LOICZ) is the Core Project of the International Geosphere-Biosphere Programme (IGBP) that focuses on the area of the earth's surface where land, ocean and atmosphere meet and interact. The general goals of this Core Project are described in the LOICZ Science Plan (IGBP, 1993) as: "... to determine at regional and global scales: the nature of that dynamic interaction [between land, ocean and atmosphere in the coastal zone]; how changes in various compartments of the Earth system are affecting coastal zones and altering their role in global cycles; to assess how future changes in these areas will affect their use by people; and to provide a sound scientific basis for future integrated management of coastal areas on a sustainable basis." This document describes how the data and information requirements can be met.

In comparison with the relatively uniform environment of the sunlit zone of the open ocean, or the rapidly mixed environment of the atmosphere, the spatial and temporal heterogeneity of the world's coastal zones is considerable. There are as a consequence considerable methodological problems associated with developing global perspectives of the role of this compartment in the functioning of the total earth system. Identifying and quantifying this role and developing scenarios of change in the coastal compartment under anthropogenic and geocentric driving forces of change will require a considerable body of data, information and research.

As laid out in the LOICZ Implementation Plan (Pernetta and Milliman, 1995) there are four major research Foci within the LOICZ Project:

- Focus 1: The effects of changes in external forcing or boundary conditions on coastal fluxes;
- Focus 2: Coastal biogeomorphology and global change;
- Focus 3: Carbon fluxes and trace gas emissions; and,
- Focus 4: Economic and social impacts of global change in coastal systems.

This document deals with the data and information requirements for these high priority areas of coastal zone research.

2.2 LOICZ Approach to Data and Information Management

To successfully achieve useful global syntheses and models of the functioning of the world's coastal zones that are the long-term goals of the LOICZ Project, it requires the direct availability of and ready access to data and data products derived from a vast spectrum of measurements, observations, models, documents and other types of data and at a variety of scales. These include key physical, chemical and biological properties of the land-ocean interface such as the distributions of main vegetation and animal (including human) communities and associated geomorphological structures, data on the fluxes of materials in the coastal zone between land, ocean and atmosphere as well as socio-economic data and information. Basic data requirements range on the one hand from satellite data providing world-wide coverage of sea surface temperature to the sensitivity to tourism of a characteristic atoll somewhere in the Pacific Ocean on the other. In addition to the large diversity of data types required, for any particular parameter there is a wide range of spatial and temporal resolutions of interest. Detailed information of daily tidal range may be required to resolve nutrient fluxes in a tropical bay whereas general tidal patterns may be all that is required to characterise exchanges between the coastal and oceanic waters at the shelf break for larger geographic regions. While locally and regionally this vast range of field data will be used to develop generalised models of the relevant processes, the output of these models processed according to an agreed method or "recipe" into high level data products will also form inputs for global modelling and syntheses.

A LOICZ Data and Information System (LDIS) must be comprehensive enough to handle the different data requirements of its users as well as to allow useful contributions of data and information. In addition it must also be able to meet the immediate and future requirements of the LOICZ user community for gaining access to information. In this context, data" are defined as numbers, measurements, observations including derived data products and model outputs, while 'information' refers to knowledge, experience, ideas in a textual, documentary form.

The LOICZ Data and Information System must include guidance on the management of related informational items such as: information on current and planned LOICZ-related activities, references to descriptions of recommended methods for acquisition, analysis and data exchange, listings of LOICZ-related scientific and meeting reports, lists of relevant experts, etc. The LDIS would be seen as a global network for LOICZ-related data and information exchange where reference to existing data and information initiatives plays a vital role. This implies that several of the aforementioned information items will be included in the LDIS only as a reference since they have been compiled successfully elsewhere and are being maintained operationally by other agencies or initiatives.

In addition to the diversity in data and information, the relevant community of users and providers of data and information is far from homogeneous. In keeping with the overall concept of LOICZ as a collaborative project involving scientists at all levels (local, national, regional, global), the LDIS will be developed and implementated with the active interaction and participation of the LOICZ network of corresponding scientists. Operational performance of the LDIS will only be possible after in-depth consultations with this network and with the full support of participants at the various levels of research and data management.

Within the IGBP the levels of activity may include nationally funded research projects (subject to national priorities), approved LOICZ research projects and the various other IGBP Core Projects and their own Core Project Offices (CPO's) (see Annex 1 for listing and contact information). Furthermore, within the context of IGBP, close co-ordination and collaboration will be maintained with the Framework Activities of the IGBP:

- Data and Information Systems for the IGBP (IGBP-DIS);
- Global Analysis, Interpretation and Modelling (GAIM); and,
- the System for Analysis Research and Training (START).

The Plan also needs properly established working relationships with agencies outside of the IGBP. For many years now - in some cases decades - a number of international projects and programmes have been active in the field of collection, management and distribution of coastal data and information for various purposes and applications. The experience acquired as well as the actual data and information held could be highly relevant to LOICZ, and the tools and methods developed within these projects and programmes could, possibly in an adapted and upgraded form, effectively be applied within the LDIS.

To make best use of the limited LOICZ resources it will be essential to collaborate closely with these projects and programmes in order to maximise the compatibility with the data already held, to minimise the overlap between the LDIS and these projects and programmes and to profit from their experience. Outside the IGBP the list of organisations and agencies with interest, data and or initiatives in the coastal zone is extensive. A detailed list of references is included in Annex 2.

The need to successfully interact and exchange with such a large number of organisational levels presents unique far-reaching challenges to the system to be developed and implemented.

2.3 Purposes of the LOICZ Data and Information System Plan

As stated in the LOICZ Implementation Plan the development of global syntheses, models and scenarios are key activities of LOICZ that are data dependent. To achieve the long-term goals of LOICZ a clearly formulated plan for data acquisition, quality control, management and exchange is required.

The LOICZ Implementation Plan (Pernetta and Milliman, 1995) outlines the overall objectives of the LDIS development as a Framework Activity of LOICZ under Task F.3.1 as to :

- identify existing sources of data required for LOICZ hence obviating the need for *ab ovo* data collection in some instances;
- assemble the necessary datasets, from existing sources and from on-going national and regional LOICZ research, which are required to address the overall goals of LOICZ;
- prepare regional and global syntheses of data needed for modelling at different scales;
- prepare and distribute directories of existing data and information where these exist and are required for LOICZ research activities within the different Foci; and,
- facilitate the access of LOICZ researchers to data held in existing international systems for purposes of modelling and synthesis within the context of LOICZ.

Within these overall objectives the Implementation Plan describes a number of specific objectives as to:

- determine the nature of appropriate products in relation to the users of the system;
- outline the nature of the overall databases required in support of the preparation of global syntheses and LOICZ models;
- identify existing data sources that meet the needs of LOICZ research activities;
- formulate guidelines for the acquisition, quality control and exchange of data within the LOICZ Project;
- determine, in close collaboration with IGBP-DIS and other international agencies currently involved in the acquisition and archiving of relevant data, the appropriate mechanisms for LOICZ acquisition and manipulation of such data sets as are required from time to time; and,
- identify the specific, remotely sensed and *in situ* data sets required by LOICZ research activities.

The purpose of this LOICZ Data and Information System Plan is to address these objectives by describing the various aspects of LOICZ data and information requirements in a concerted and co-ordinated fashion. This Plan attempts to encompass both the nature of the data and information required to achieve the LOICZ research goals and objectives, and deals with the whole process of acquiring, quality controlling, compiling, analysing, synthesising, archiving as well as making this data and information available in the required form to the LOICZ community of researchers. Furthermore this report identifies the rights and responsibilities of the data providers, the data users and the managers of the system at the various levels. As a means of promoting linkages with the other organisational levels in the LOICZ Project this Plan contains a large number of useful references to coastal zone information holdings. It also identifies a number of data requirements that must be addressed by contributions from LOICZ participants to the global research of LOICZ. The information in this report is intended to assist scientists and centres participating in LOICZ in preparing their contributions to LOICZ. The LDIS will perform the role of a mediator amidst existing data and information systems thus making a maximum use of these systems for the benefit of LOICZ and avoiding unnecessary duplication.

2.4 Priorities

It must be recognised that this document is the initial response to the recognised need for a data and information system plan for LOICZ and it attempts to describe a System in as much detail as possible given the current state of LOICZ research priorities. Nevertheless the full coverage of data and information types on the scales required by LOICZ presents a unique challenge of unequalled scope and impact. Full implementation and operation of the LDIS will require not only major investment in manpower but also major contributions of data and information from participating scientists and organisations. Therefore a careful and phased approach is recommended to organise the provision of data and information to LOICZ and to gradually develop and implement the required mechanisms. For the purposes of this Plan, within the context of the four LOICZ Research Foci, four high priority areas of research have been identified that require immediate guidance on data and information management:

- River Discharge to the Sea (a Global River Index: GLORI) (Milliman *et al.*, 1995);
- Coastal resources assessment, including socio-economic aspects (Turner and Adger, 1996);
- Biogeochemical Modelling in the coastal zone (Gordon *et al.*, 1996); and,
- Groundwater discharge in the coastal zone.

These priorities are based on the present state of LOICZ research and will change as the LOICZ project expands to include additional participants and resources. As each of these priority areas are developed, a detailed list of specific variables will be compiled from the total list of possible data requirements (see Annex 3). LOICZ research will also produce global and regional data products that will be circulated and supported by the LDIS. Although the present document focuses on the needs of only four research areas, it attempts to provide sufficient scope for expansion to include additional research areas as they become active in LOICZ.

The present development and implementation of the LDIS includes the following elements:

- development and implementation of a LOICZ World Wide Web (WWW) Home Page (Annex 4) as one of the means to interact with part of the LOICZ community thus forming a basis to identify in more detail the types of data and information required by LOICZ research activities. In addition, the LDIS will provide access via telephone and fax for those who have no access to Internet;
- provision of references to basic (background or reference) information and data via the LDIS; this relates to data and information identified as being of a general and common interest to all LOICZ research activities;
- establishment of a platform for regular interaction with relevant organisations and agencies outside IGBP which will help to identify existing sources of data and information that meet the needs of LOICZ research activities; this may necessitate the establishment of MOU's with some of these organisations and agencies;
- development and implementation of the general the LDIS user interface including - for each of the required data products - recommended procedures for referral, acquisition, quality control, modelling, product generation and exchange. Where possible existing tools and systems will be adopted and modified as needed to cater for the specific LOICZ requirements;
- providing access on appropriate time scales to a selection of baseline measurement databases and related information on global and regional scales being held by operational organisations and agencies outside LOICZ and IGBP; and,
- demonstration of the performance of the LDIS by handling data and information from a regional LOICZ research activity in the form of a regional demo/pilot project.

This list includes activities both related to information and to data. The information related activities can be seen as services provided by the LDIS to the LOICZ community.

It may be expected that in due time and with sufficient resources, the LDIS will expand its scope to full global coverage and to all four research Foci.

The above steps to be taken directly by LOICZ, also need to be accompanied, supported and strengthened by regular training opportunities in coastal zone data and information management. These could be prepared and organised through START and in collaboration with other relevant organisations and agencies. These courses should not be confused with training opportunities in coastal zone management which deal with a quite different community of participants and with quite different topics.

With regard to marine environmental data, a practical concept for such courses could be found in the training courses on marine data and information management periodically organised by the Intergovernmental Oceanographic Commission (IOC) in various parts of the world. START, World Meteorological Organisation (WMO) and other organisations offer similar opportunities. As with data and information management LOICZ will closely collaborate with these training initiatives.

3. CONCEPTUAL FRAMEWORK FOR THE LDIS

The development of the LDIS will be governed by the requirements of the LOICZ project and its users. However, as research and technological capabilities evolve, so too requirements will change accordingly. Therefore this Plan strives for a flexible modular design for the LDIS in order to realise as cost-effective a development and implementation as possible within the shortest time-span, while at the same time being able to cater for future requirements with a minimal investment.

3.1 Participants

Figure 1 summarises the management framework of the LOICZ Core Project as proposed in the LOICZ Implementation Plan. The following users and user communities would be involved:

LOICZ Researchers: It is anticipated that there will be several categories of LOICZ Researchers, reflecting the degree and extent of the individuals involvement in the LOICZ Core Project as a whole. In general, however, Principal Investigators of designated LOICZ Research will form the backbone of the LOICZ network. Following submission of the LOICZ research project proforma (Annex 5) and receipt of approval from the LOICZ Scientific Steering Committee (SSC), LOICZ researchers would be expected to follow the guidelines of the Data and Information System Plan and fully support it with data and models as appropriate.

National IGBP Committees/LOICZ National Focal Points and Committees: (see Implementation Plan Appendix 3 for listing) IGBP National Committees provide the formal interface between researchers in participating countries and the international structure of the IGBP. They are expected to assist with national planning and co-ordination; to contribute to the conceptual and practical development of the IGBP as a whole; and to arrange for payment of the national contributions towards the central costs of the programme. At the end of 1995 there were 72 National Committees in all.

National LOICZ Committees have responsibility for assembling descriptions of national projects, planned or underway, that they consider to be appropriate for designation as LOICZ research (IGBP, 1994). To assist in this information gathering exercise, National Committees are encouraged to set up working groups or sub-committees matching the Core Projects that are of greatest national interest. A listing of the LOICZ focal points appointed by National Committees as of September 1994 can be found in Appendix 3 of the Implementation Plan.

LOICZ Research Nodes: Research nodes will be centres of excellence in a particular field of LOICZ research interest such as biogeochemical modelling, near-shore ecosystem modelling, river catchment modelling, or environmental economics for example. They would be responsible, under the overall guidance of the LOICZ-SSC and in close collaboration with the Core Project Office, for *inter alia*:

- the development of a specialist global network under the umbrella of LOICZ;
- taking the lead in providing guidance and assistance to the wider LOICZ network in developing appropriate standards, methodologies and data management protocols;
- the development of specialist observation networks, such as coastal stations collecting carbon data;
- organising appropriate workshops to develop regional and global products;
- disseminating results to the wider scientific community; and,
- issues of scaling from local to regional and global.

In identifying such operational research nodes, careful consideration will be given to the individual's, institution's or organisation's existing capacity:

- to support the envisaged programme of work;
- the nature of additional investment in manpower and financial terms required to meet the objectives of the node as laid down by the LOICZ-SSC;
- to the proposed nodes' existing international research linkages; and,
- to its existing record of excellence in the research field concerned.

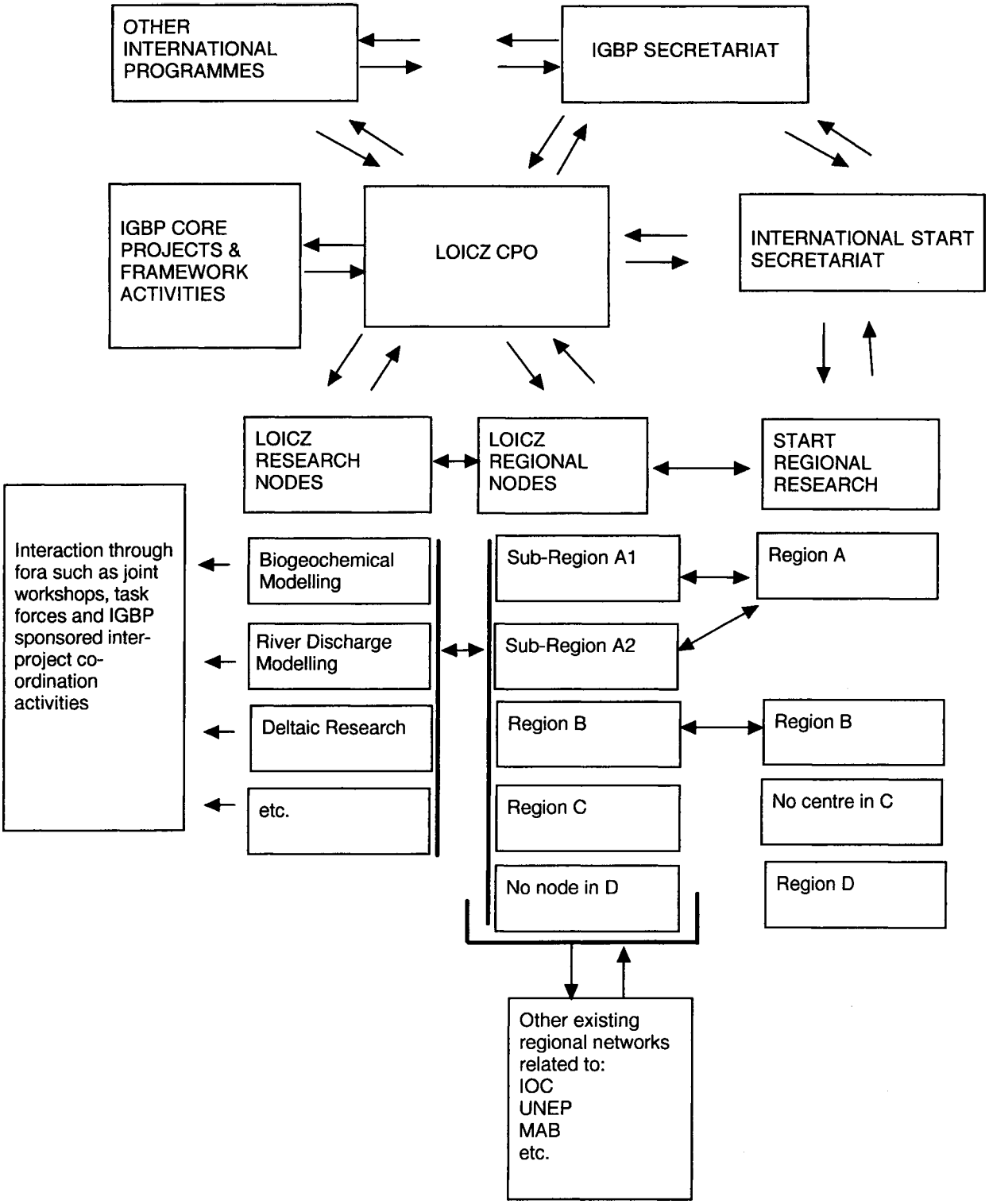

Figure 1. Management framework for the LOICZ Core Project indicating relationships between proposed LOICZ nodes and existing management structures for Global Change Research.

The LOICZ Research Nodes will, in many cases, not reside at the LOICZ Core Project Office but will take advantage of resources and facilities at other institutions. As such they will function in co-operation with the LOICZ CPO as the LOICZ Data and Information System Management Unit (LDIS-MU) in that they will deal directly with achieving LOICZ goals in global modelling and synthesis.

A number of LOICZ Research Nodes have been identified for :

- River Discharge Node - The goal of this Node is to compile all available data on river freshwater discharge and suspended sediment load for rivers with basin areas greater then 1000 km^2. The data are identified and or provided by individual researchers, institutes and published documents. The data undergo quality control checks before being entered into the database and are fully referenced to the source of the data whether it is a published in a refereed journal or in technical reports. Additional details on the database are available in Milliman *et al.* (1995). The contact for the River Discharge Node is:

  Dr. J.D. Milliman
  School of Marine science
  College of William and Mary
  Gloucester Point, VA
  23062, United States
  E-mail: Milliman@back.vims.edu Fax: 1-804-642 7009

- Deltaic Research Node - This Node is establishing a global network of "deltaic specialist" under the umbrella of the LOICZ Core Project. It will take the lead in providing guidance and assistance to the wider LOICZ network in developing data-related protocols and methodologies for the study of deltaic hydrodynamics, river hydraulics, coastal morphodynamics. The contact for the Deltaic Research Node is:

  Prof. A. Sanchez-Arcilla
  Maritime Engineering Lab (LIM/UPC)
  International Centre for Coastal Resources Research (CIIRC)
  Catatonia University of Technology
  c/ Gran Capita, s/n, modul D-1
  08034 Barcelona, Spain
  E-mail: arcilla@etseccpb.upc.es Fax: 34-3 280 60 19

- Biogeochemical Modelling Node - This Node provides a focus for the aggregation of biogeochemical budget model outputs. The goal of this Node is 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. Additional details on the data and methodologies to be used in this Node can be found in Gordon *et al.*, 1996. The two contacts for the Biogeochemical Modelling Node are:

  Dr. Stephen V. Smith
  Department of Oceanography
  University of Hawaii
  1000 Pope Road
  Honolulu, Hawaii USA 96822
  Fax: 1-880-956 7112
  E-mail: svsmith@soest.hawaii.edu

  Dr. Fredrick Wulff
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  Stockholm University
  S-106 91, Stockholm
  SWEDEN
  Fax: 46-8 158 417
  E-mail: fred@system.ecology.su.se

LOICZ Regional Nodes: Regional nodes, as their name suggests, will serve as a regional focus within the global network for the co-ordination of LOICZ research within a defined geographic region. In most instances such nodes will be co-incident with the START Regional Centres, although in regions where START centres do not exist or where alternate considerations arise, alternative sites may be identified. Where possible they would be required to maintain close liaison with the appropriate START Centre. In the case of Africa, for example, the particular research issues of interest to LOICZ differ considerably along the East and West African coasts, hence, if research activities are to be developed in these regions, then networking would be facilitated by the presence of both an East and a West African LOICZ Regional node, both of which would then be expected to maintain close collaborative links with the START SAFCOM Centre when established.

START Regional Research Centres: The components of each START Regional Research Node (RRN) include a Regional Research Centre (RRC) and a number of affiliated Regional Research Sites (RRSs). The RRC serves as an information centre for the RRN and provides co-ordinating functions both within and outside the region. The RRC offers a multidisplinary setting for the various sciences of global change to synthesise the results of research into a policy-relevant regional framework. Providing access to regional and global databases dedicated to global change research will be another important function of the RRC.

RRC's are institutes in the region with specialised expertise that allows them to carry out research on important components of the core projects of the three major global change research programmes: IGBP,IHDP and WCRP. By linking such diverse sites and facilities within their regions, the START RRNs can contribute work within the different disciplines and disparate facilities to achieve a common purpose.

LOICZ Research: Many on-going coastal zone research projects will relate to LOICZ goals. To make maximum use of ongoing research and to facilitate the linkage between local, national, regional and global LOICZ research, the LOICZ SSC has initiated a process of identifying and classifying research according to its scientific relevance to LOICZ. Researchers are asked to submit forms describing their research and their contributions to the global LOICZ research for reveiw by the SSC (Annex 5). Designated core research within LOICZ will contain substantial investment in the development of appropriate methodologies, data collection, handling and management procedures and modelling techniques. These activities will be closely co-ordinated with international agencies and where appropriate, existing internationally agreed standards and methodologies will be adopted. During the initial stages of LOICZ implementation such studies will be given priority and an area for much fertile research in this regard is found at the interface between the natural and social sciences in executing Focus 4, and modelling the influence of human populations as agents of environmental change and environmental change as a driving force for socio-economic change.

LOICZ Core Project Office: The LOICZ Core Project Office (CPO) is established at the *Nederlands Instituut voor Onderzoek der Zee* (Netherlands Institute of Sea Research, NIOZ), Texel, the Netherlands (see Annex 1 for full contact information). The Core Project Office assists the LOICZ Scientific Steering Committee in planning and carrying out new scientific research; it also serves as a much-needed channel of communication between scientists working in different countries on various aspects of global change in the coastal zone. An important early task of the Core Project Office is to assist the SSC in collating information on national and regional programmes of coastal research - to ensure that there is no unnecessary duplication of effort, and that the LOICZ project makes effective use of existing knowledge in its analysis of coastal processes and change at global scales.

The general tasks of the LOICZ Core Project Office relevant to the data and information system plan are as follows:

- co-ordination of research efforts, and planning and co-ordinating research campaigns and field programmes;
- maintaining needed connections with relevant national and regional projects;
- ensuring effective co-ordination with other components of the IGBP, and other relevant international research programmes;
- disseminating information and research results; and,
- co-ordinate the setting up of databases for the LOICZ project, either at the site of the Office or through a networking system.

IGBP Core Projects: The bulk of the IGBP's research activities will be carried out in eight broadly discipline-oriented projects, covering such topics as atmospheric science, terrestrial ecology, oceanography, hydrology, and links between the natural and the social sciences (see Annex 1 for full listing and contact information). The focus for the scientific activities and ensuring the implementation of the approved science plans, are the Core Project Offices (CPO) that have been established for each project to assist in co-ordinating the international research effort. The CPO's and SSC's of these Core Projects will provide structures for the co-ordination and promotion of research in support of their goals. In some cases the goals of the other IGBP Core Projects will border on the LOICZ goals and in those cases, both projects may benefit from the development of common research activities.

IGBP Framework Activities: In addition to the Core Projects, the IGBP has approved three framework activities that are intended to provide an over-arching chapeau and integrative forum for the individual Core Projects. The three framework activities of the IGBP, listed above in section 2.2, deal with data, modelling, and support for regional research, to facilitate the incorporation of scientific results into a holistic global picture. They will also play an important role in providing linkages within and beyond the IGBP Programme.

External Data Agencies: As stated above there are numerous national, regional and global data and information management initiatives that can provide valuable data and experience to the LOICZ Data and Information System Plan.

The interests of these participants will range from individual variables to complex eco-socio-economic processes, and in time scales from the past (what was the situation?) via the present (what is the situation?) to the future (what will the situation be?). In this respect LOICZ will only deal with the generation and distribution of high-level data products on global and regional level but might be able to provide references to important more detailed datasets. To ensure clearly defined roles for the external data providers the formal establishment of agreements, such as in the Memorandum-of-Understanding (MOU) model, might be considered.

In order to be able to carry out its functions, the LDIS would be established in conjunction with the LOICZ CPO and maintain a close contact with all of the participants in the LOICZ community using personal contacts, mail, fax and electronic communications (electronic mail, bulletin boards, Internet/WWW). This forms an integrative element of LOICZ Framework Scientific Networking activities identified in the Implementation Plan as F1.1.

3.2 Data

In view of the wide range of subjects, geographical and time scales covered by LOICZ an initial rigid definition of data formats would be limiting and therefore undesirable. The aims of LOICZ in terms of global and regional synopses and forecasts can be translated into a combination of specific measurement and model data required to meet these aims. The LDIS, in close contact with LOICZ CPO and other relevant IGBP components (IGBP-DIS, GAIM, START), will facilitate the develoment of models or "recipes" required to generate the higher-level data products from local, national and regional level data and make these available via the LDIS.

The data (collected *in-situ*, remotely sensed and from models) and the information needed for LOICZ would cover many different types and various spatial and temporal scales. Examples are given below of required data types and preferred temporal scales based upon the requirements identified by the LOICZ Implementation Plan:

- terrestrial data: from seasonal to interannual (land cover and use, soil map, coastal morphology, hydrological data, river runoff, geology, geophysics, etc.);
- marine data: from yearly, for slow processes, up to twice daily, for processes changing with tides, (waves, current, tide, temperature, productivity, bathymetry, biology, chemistry, pollution, etc.);
- atmospheric data: from seasonal to daily (wind, temperature, humidity, cloud cover, chemistry, etc.);
- infrastructure: yearly (location and characteristics of population centres, commercial ports, marinas, aquaculture plants, industrial complexes, etc.);
- socio-economic data: yearly (population density and composition, means of living, income per capita, market prices, etc.).

A more detailed and extended list of variables possibly required for LOICZ research is included in Annex 3 together with an indication of possible sources of these data. The priority research areas mentioned in Section 2.4 will only deal with a subset of this list.

The LOICZ goals of predicting expected future conditions based on past and present global and regional level observations, demands an integrative approach combining existing historical databases, current and planned operational measurement networks and systems, models and remote sensing. The LDIS will have to connect to the relevant sources in these domains and provide the users with access to these sources of data enabling them to generate the required integrated high-level data products.

In view of their ready availability, the following databases will be included in the LDIS as basic reference data: General Bathymetric Chart of the Oceans (GEBCO); coastline and coastal maps (Digital Chart of the World); catchment description and river runoff (GLORI); selected socio-economic variables (Socio-economic Data and Applications Centre (SEDAC)); soil maps (FAO) (see Annex 6 for contact information).

Although the goals of LOICZ for analyses, comparisons and forecasts are regional and global, local processes (describing causes and consequences) form the basis for these, and since the local processes use a spatial scale of the order of square kilometres, the input data would have to be collected and archived locally according to such a scale to achieve the required results. This would be particularly important in the initial stages of the project where specific models of the processes under study would not yet be available. As the project developed appropriate models would become available allowing for input data to be:

- collected less densely in both time and space;
- more specifically focused to the important variables; and,
- more generally applied to other geographical areas that are not so well studied.

3.3 Information

Under the LOICZ DIS, information is defined as the higher-level data products that result from the application of models to data with finer temporal and spatial resolution. It is proposed that initially the LDIS would include a range of options and tools to generate these products or information that meet the aims of LOICZ from the available basic data. A selected number of these *ad-hoc* products could eventually develop into regular 'standard' LOICZ products either because of their applicability in other or wider geographic areas, or because of a periodic operational requirement for the same product.

For each required entity or parameter a model or tool (algorithm, "recipe") would have to be developed that allows the generation of high-level data products from past and present data. Tools would include guidelines prepared as written documents such as the LOICZ Biogeochemical Modelling Guidelines (Gordon *et al.*, 1996) and the LOICZ Coastal Resources Assessment Guidelines (Turner and Adger, 1996). Another example of high level products would be estimates of future groundwater level changes that could be computed from present water levels, land use, evaporation, rainfall and river input. These variables could be obtained from past and current field measurements, models and remote sensing.

Tools would also include software packages such as COSMO (developed by the Netherlands Rijkswaterstaat - RIKZ) to investigate coastal zone management scenarios and/or make syntheses of specific types of data. These would meet the requirements of a number of high level users of the LDIS on scientific and managerial levels. These and similar tools are available from many sources in various different countries and from international organisations. Through the LDIS they could be made more widely available to LOICZ researchers world-wide.

These tools could be used on the level of the individual researcher or national committee for processing research data into a first level synthesis. This product would then be passed on to a regional centre and merged with other syntheses from different sources and used as a basis for a regional product. Finally regional products would be used to generate a global product either by the CPO or by LOICZ Research Nodes.

In addition to the databases and tools for the generation of high level data products, a number of useful basic information products would be made available to the LOICZ community on the LDIS. These would include:

- inventories of LOICZ related persons (scientists, researchers), institutes, organisations, current and planned LOICZ-related research projects, including descriptions of the data acquired;
- list of acronyms;
- meeting schedules and meeting reports; and,
- sources of relevant remote sensing data, relevant literature.

This aspect closely meets the aims of LOICZ Framework activities 1.2. and 1.3.

The availability of specific expertise or other interests could provide an incentive for specific organisations or institutions to act as operational providers of specific 'standard' data or information products to the LOICZ community through the LDIS. It is recommended that LOICZ stimulate the development and operational implementation of such services.

3.4 Centralised Versus Decentralised

In view of the coverage, scope and expected volume of the LDIS, a fully centralised approach would not be feasible. Moreover this model would not be desirable in view of the required flexibility, adaptability and speed of response. However, a number of data and information activities would benefit from a central rather than a decentralised management, especially those relating to regional and global inventories, references, syntheses and overviews. Also some level of central management would be needed to manage the system, ensure proper input and usage and initiate new developments, adaptations and modifications in order to meet emerging requirements. Therefore a hybrid approach combining centralised and decentralised elements is recommended for the LDIS (Figure 2). Such a hybrid approach could be further developed and implemented in conjunction with START Regional Research Centres.

In this context, the data component of the LDIS will be mostly decentralised with participating researchers collecting, analysing and archinving their own data and information. The main reasons for this are:

- the size of a combined data archive would be impossible and impractical to manage centrally in the LDIS, whereas, when decentralised, the resources required would be distributed throughout the participating organisations; and,
- the expertise required to manage data sets of specific variables or data types is already available in the specific contributing centres and the LDIS could rely upon this expertise.

This however, does not imply that participants of the LDIS would need to 'shop around' for data and data products in many different centres and then would be confronted with the inevitable problems of differences in methods, formats and typology. The data and data products accessible through the LDIS would meet strict requirements with regard to format, documentation and annotation and could therefore be merged automatically. The LDIS would provide the necessary tools for searching and merging of datasets based upon existing tools such as those developed by International Oceanographic Data Exchange of IOC (IODE), JGOFS and others, and possibly adaptated to cater for the wide range of data types of LOICZ.

Where possible the LDIS would use state-of-the-art technology such as provided by Internet and similar systems. However, when needed the LDIS would provide data products and information (metadata) in a printed form or another appropriate format to its users.

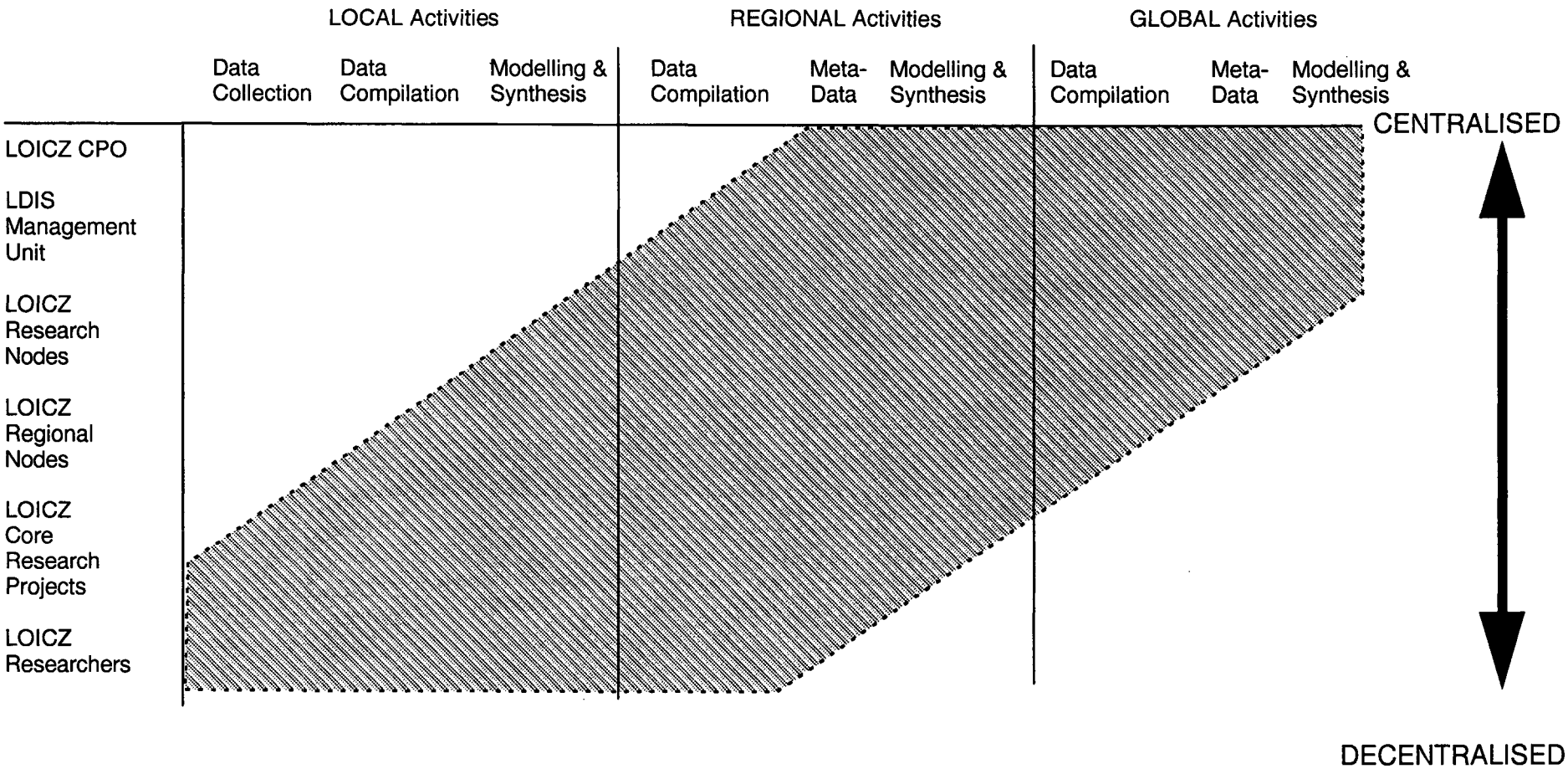

Figure 2. The conceptual framework for the LOICZ Data and Information System showing the responsibilities of the different levels of participants in a hybrid approach of using centralised and decentralised roles.

3.5 Contributing to the LDIS

Experience by organisations such as IOC, ICES, WMO, UNEP and the European Union has shown that to collect and assemble environmental and other data on the scale and in the form required by LOICZ is a major task. Recent developments with regard to access to data from meteorological satellites further illustrate the problems in this context. Three main obstacles can be identified:

- the reluctance of individual scientists to distribute data before having it analysed and published (scientific competition);
- the reluctance of organisations and institutes to make data available free of charge when collection and processing has been achieved at great cost, and this data perhaps could be 'sold' to outside customers thus resulting in 'income' (commercial competition); and,
- the extra effort to be made by the provider to submit data in a required form and format (infrastructure, resources).

This latter obstacle could be dealt with relatively easily by the LDIS by providing tools and mechanisms to the providers to minimise the extra effort needed to contribute data products to LOICZ. However, the first two obstacles are of a much more fundamental character and need a different approach. In this respect four issues are of importance:

- creating awareness that shared data could have more scientific value than an isolated data set;
- underlining that sharing data through LOICZ implies access to additional data and modelling expertise and thus could enhance scientific research capacity;
- creating awareness that data sets even while sitting idly in an archive consume considerable resources for maintenance and management; and,
- providing incentives to the providers both at the level of institutes and at the individuals level. These could, for example consist of the provision by LOICZ to its potential providers of facilities and tools to analyse and process data as well as to access the LDIS.

In this context Appendix 7 of the LOICZ Implementation Plan "Benefits and Obligations of Participation in the International LOICZ Project of the IGBP" provides a useful framework. Table 1 in this document summarises these points for a number of the participants in the LDIS.

The level and character of data management in the various centres in the world contributing to LOICZ is essentially different. Therefore the LDIS would have to identify and develop specific relationships with the participants identified in Section 3.1. These relationships would differ in type and content: some centres would be able to provide data and information regularly and in the required form to the LDIS, others would initially require support to be able to contribute to the LDIS.

While for certain LOICZ centres electronic communication using Internet has become a daily fact of life, other centres do not even have reliable telephone connections. In the final phase, only reliable electronic communication could ensure the operational performance and continuity of the LDIS. Therefore LOICZ should be prepared, in close co-operation with relevant international and intergovernmental activities and programmes, to actively promote and practically support the application and usage of electronic communications via Internet by LOICZ scientists and researchers. In this context, START might be invited to consider providing operational facilities for world-wide satellite communications (such as INMARSAT-M) to facilitate access to local and regional LOICZ communities in those parts of the world where, at present, access to Internet or fax is difficult or impossible.

The LDIS would provide a dynamic framework for the distribution of data and information products. A basic set of requirements would need to be fulfilled in order to feed data or information into the LDIS and these would be related to compatibility and adequate documentation. Consequently a LDIS central management unit (LDIS-MU) would ensure that all contributions fulfilled these requirements and become available to the users within the agreed time limits. As th LDIS is successfully implemented, it is expected that specific data products of interest to a wider LOICZ community will be made available through the LDIS-MU by making use of specific contributing centres with a special expertise.

4. RIGHTS AND RESPONSIBILITIES

The LOICZ Implementation Plan provides a number of statements on rights and responsibilities for the different partners in LOICZ (Project Management, pp. 153-162 as well as Appendix 7, p. 201). For the LDIS to perform according to expectations and specifications, these rights and responsibilities would have to be clearly identified and accepted. The four main categories of participants are considered to be:

- users/consumers of information and data;
- specific LOICZ data providers;
- external data providers to LOICZ; and,
- the LDIS Management Unit (LDIS-MU).

It may very well be that some organisations or individuals belong to more than one category, providing data to the LDIS at one moment while using data or information from the LDIS at another. A specific category of providers-only would be made up of organisations, institutes and agencies outside LOICZ where valuable data and information already exists and could be made available to the LDIS.

Table 1 contains an overview of the rights and responsibilities of each category of the LDIS participant. In the following subsection these aspects are further developed and expanded taking into account the different roles of the participants.

4.1 Users/Consumers Of LOICZ Data

Access to LOICZ data and information would have to be available at minimal or no charge in order to ensure that the data and information held in the LDIS could be applied effectively. Any attempt to arrange for selective access for specific groups or to introduce charges for usage for specific applications would undermine and dilute the fundamental aims of LOICZ. In order to increase the chances of obtaining high quality and original applications of data and stimulate scientific competition, an open data policy would have to be practised, which is also in accordance with the stated aims of ICSU and the IGBP (Annex 7). In this way individual researchers could experience an enhanced scientific research capacity as a result of the low cost access to regional and global data and data products as well as to the related expertise.

The LDIS will implement a staged release of data in the sense that LOICZ researchers may have the preferential access to data. That is, in some cases full LOICZ participants will have the possibility of accessing certain data six months after inclusion in the LDIS while non-LOICZ scientists would obtain this access only one year after data submission. However, it should be realised total exclusion of outsiders from data distributed via Internet, or other methods of data transfer, cannot be guarantied.

Users/consumers would be obliged to include a reference to LOICZ and to the data originator (provider) when publishing using data or information obtained from the LDIS. Where no such acknowledgement was given the LDIS would reserve the right to formally exclude such users/consumers from early access to data in a staged release approach. No other limitations on the usage and publication of data or data products obtained from the LDIS would be made as further regulations could be deemed counterproductive.

National IGBP Committees, LOICZ Regional and Research Nodes would have similar rights of access to the LDIS and LOICZ data (products) as individual researchers and have similar benefits. In addition National IGBP Committees thus obtain an opportunity to fulfil their IGBP commitments to global research while Regional and Research Nodes could obtain additional resources directly from or indirectly through LOICZ activities and promotion.

LOICZ Regional Nodes and Research Nodes will play a valuable role in identifying specific data and information needs at both national and regional levels because of their unique position in specific countries or regions and their close links with the scientific community. These needs would then be transmitted to the LDIS management unit for evaluation and possible implementation. This feedback will be essential for LOICZ to keep abreast with changing requirements.

Table 1. LOICZ Data and Information System Participants and the benefits, rights and responsibilities associated with their participation.

	Individual Researchers	National Committees	Nodes (Research/Region)	LOICZ Management Unit
Number	≈2000 in 130 Countries	≈ 80	≈20	1
BENEFITS	♦ enhanced scientific research capacity as a result of access to additional data and modelling expertise ♦ to enhanced access to regional/global data	♦ enhanced scientific research capacity as a result of access to additional data and modelling expertise ♦ opportunity to fulfil IGBP commitments to global research	♦ enhanced scientific research capacity as a result of access to additional data and modelling expertise ♦ additional resources directly from or indirectly through LOICZ activities and promotion	♦ ability to carry out global analyses and syntheses of coastal information
RIGHTS	♦ to preferential access to LOICZ data ♦ to direct (preferential?) access to LOICZ regional and global analyses and syntheses output	♦ to direct access to LOICZ data ♦ to direct access to LOICZ regional and global analyses and syntheses output	♦ to direct (data and modelling expertise) and indirect (help in developing proposals for third party support) support from LOICZ	♦ to the support from LOICZ participants for data and modelling expertise
RESPONSIBILITIES	♦ to provide access to LOICZ data within 1 year of collection or finalisation ♦ to properly reference LOICZ contributions to research ♦ to provide modelling and synthesis expertise upon request	♦ to facilitate access to LOICZ data within the country ♦ promote the development and co-ordination of LOICZ research within the country and region ♦ to provide input to CPO as requested	♦ to facilitate access to LOICZ data ♦ to encourage and facilitate access to global analyses, modelling and syntheses expertise ♦ to provide input to CPO as requested	♦ to provide access to LOICZ data and metadata ♦ to co-ordinate the global analyses and syntheses of LOICZ data ♦ to promote and co-ordinate the development of regional and global LOICZ research activities

In regions with poor communication facilities National IGBP Committees, LOICZ Research Nodes and START Regional Research Centres could be instrumental in facilitating access to LOICZ data for their national or regional community, for example by implementing specific infrastructure such as an Internet client/server or satellite communications facilities (INMARSAT-M).

4.2 Specific LOICZ Data Providers

Research Projects wishing to be recognised as official LOICZ projects are required to submit a proforma (Annex 5) for approval by the LOICZ Scientific Steering Committee. Similar to the requirements placed on EC MAST Projects described in their Code on Data Management (Annex 8) LOICZ will require approved LOICZ research projects to provide for appropriate data management. As one of their obligations to LOICZ they would be required to inform the LDIS when data had been acquired for LOICZ. The CSR (Cruise Summary Report) and MEDI (Marine Environmental Data Inventory) procedures of IOC/IODE, possibly assisted by the relevant utilities included in the OCEAN-PC package of IOC, could very well be used for this purpose (Annex 9).

Data would have to be submitted promptly in order to ensure that the LDIS served the LOICZ community effectively. A maximum period of 12 months after acquisition and final correction of the dataset seems realistic to allow scientists to process their data, to publish and to submit the data product to the LDIS. In cases where inadequate infrastructure caused delays beyond this deadline, LOICZ could consider giving appropriate aid in close co-operation with START and other relevant organisations.

The data provider would remain responsible for proper archiving of data collected and submitted to LOICZ. The LDIS would not impose standards for local archiving but would provide guidance and advice based upon the relevant experience available from organisations such as the International Council of Scientific Unions - World Data Centres (ICSU/WDC), IOC, ICES and UNEP. Rather than focusing upon 'hard' standardised formatting, the LDIS would seek to promote that at least extensive documentation is included with the data. This would be much easier to implement than a standard format and would, in the long run, be of greater value.

National IGBP Committees as well as LOICZ Regional and Research Nodes, where necessary, could provide valuable support to individual scientists in fulfilling their obligations to LOICZ and the LDIS. In addition the National Oceanographic Data Centres of IOC/IODE or similar centres related to ICSU/WDC and UNEP/GRID could also be invited to contribute. In a number of cases these centres would already be involved in similar or comparable national or regional tasks and activities. Involving these centres in LOICZ would improve the cost-benefit of the national funding for these centres and would, at the same time, ensure the flow of data and information among the LOICZ researchers.

Consideration should be given to providing the individual scientists involved in LOICZ with effective and novel tools for processing, analysing and presenting their data. Basic examples for such tools can be found in the OCEAN-PC package of IOC (Annex 9), mentioned earlier, and in the ASAP (A System for Assessment of Pollution) package developed in The Netherlands by MARIS (Marine Information Service) and Delft Hydraulics. ASAP was initially developed for UNEP (United Nations Environment Programme) to be used in Kuwait to assess the environmental effects of the oil spill and the burning wells and to set priorities for mitigation measures.

National IGBP Committees, LOICZ Regional and Research Nodes could assist in the compilation of appropriate regional evaluations, syntheses, bibliographies, reviews of past research, etc. to be made available as data or information products via the LDIS.

4.3 External Providers to LOICZ

LOICZ will attempt to make full use of existing data and information systems and intends not to duplicate current efforts and activities in coastal zone data acquisition and management. It is obvious that a large part of the initial LOICZ requirement for data and information could be met by accessing currently available data- and information bases and referring to data- and information systems already in existence.

Some examples of relevant self contained data and information sources are:

- ArcWorld /Digital Chart of the World (shoreline);
- IOC/GEBCO Bathymetry of the World (bathymetry);
- TerrainBase CD-ROM (elevation);
- World Ocean Atlas 1994 (oceanographic data);
- Global River Index (GLORI), river runoff data; and,
- FAO Global Soils Map.

Contact information for these sources is given in Annex 6.

To assist in evaluating the usefulness of external data sources to LOICZ, the most relevant large-scale international, regional and global systems and programmes for coastal and related data and information are listed below with a short description. Annex 2 provides a list with full contact information. The LDIS would provide its users with full references to these data- and information holdings as one of its first activities. Current users of these systems would be given a reference to the LDIS.

- Centre for Earth Observation (CEO): European effort managed by the European Joint Research Centre (JRC) to improve access to earth observation data. This programme is intended to cover both space and airborne remote sensing data as well as *in-situ* environmental data. CEO will form an open European marketplace for providers and consumers of earth observation data and information;
- European EUREKA programme, specifically its components: ENVINET, EUROMAR (Seawatch) and EUROTRAC. ENVINET includes the development of tools for monitoring and managing different aspects of the non-marine environment. Seawatch is a marine monitoring and forecasting system originally designed for the North Sea but has later developed to be implemented in other parts of the world. EUROTRAC is a scientific research project aimed at the physical and chemical processes in the lower atmosphere. EUROMAR is the EUREKA component dealing with marine science and technology.
- Global Resource Information Database (GRID) of the United Nations Environment Programme (UNEP): covering environmental reference data from a wide range of sources around the world in GIS format and forming a part of the Global Environmental Monitoring System (GEMS) of UNEP;
- Global Data Runoff Centre (in collaboration with WHO, GEMS-Water Programme) For the development and verification of atmospheric and hydrologic models, the Global Runoff Data Centre (GRDC), located in Germany, has compiled a global data base of stream flow data. The data base, which is updated continually, contains daily and monthly discharge data information for over 2,900 hydrologic stations in river basins located in 143 countries. GRDC disseminates data and additional data products on request. A catalogue with updated information and a standard set of tables, statistics and graphic displays can be provided to data users for selected stations
- International Council for the Exploration of the Seas (ICES): regional organisation for a wide range of marine data and information concerning the Baltic, the North Sea and the Northern Atlantic Ocean. Its main task relates to the assessment of fish stocks in these sea areas. To support its tasks ICES has developed a wide range of procedures for information and data archival and exchange and maintains close contacts with IOC/IODE;

- International Geosphere-Biosphere Programme - Data and Information System (IGBP-DIS): The role of IGBP-DIS is to assist, as needed, IGBP Core Projects in the development of their individual data system plans; help provide an overall data system plan for IGBP; carry out activities leading directly to the generation of data sets; ensure the development of effective data management systems and act, where appropriate, to ensure the meeting of the data and information needs of IGBP through international and national organisations and agencies.
- International Oceanographic Data and Information Exchange (IODE) system of the Intergovernmental Oceanographic Commission (IOC): world-wide network of national and regional oceanographic data centres, oceanographic and coastal data, methods for acquisition, processing, archival and exchange;
- Mediterranean Action Plan of UNEP: The MAP centre is responsible for the acquisition, processing and presentation of Mediterranean marine pollution data as acquired under the MED POL monitoring programme. A specific list of parameters is acquired at specific sites at specified time intervals, transmitted to the MAP centre and archived. Further processing steps include quality control, statistical processing and presentation in a GIS environment.
- Regional Seas Programme of UNEP: works through regional secretariats; collects and publishes reports covering synoptic marine and coastal data and information from different sea areas in the world;
- Socio-economic Data and Applications Centre (SEDAC) of CIESN (Consortium for International Earth Science Information Network): provides catalogue services and analysis services on socio-economic data. The information is accessible through information guides, communication services and via on-line access;
- UNESCO International Hydrological Programme working in the field of global and regional ground water research and management. The programme initiates and supports regional and global research programmes as well as develops the necessary supporting tools and infrastructure (databases, communications, sensors and systems);
- Food and Agricultural Organisation of the UN (FAO): some relevant activities are: maintaining a global soil map, setting up a world-wide vegetation index derived from satellite data and managing a literature reference system on aquatic sciences and fisheries;
- World Data Centre (WDC) system of the International Council of Scientific Unions (ICSU), consisting of a number of centres around the world relating to different geophysical disciplines. The holdings cover mostly meta-data but also some measurement data. A part of the WDC system (especially oceanography) is possibly relevant for LOICZ;
- World Ocean Circulation Experiment (WOCE) of the World Meteorological Organisation (WMO); The World Ocean Circulation Experiment (WOCE) is an unprecedented effort during 1990-1997 by scientists from more than 30 nations to study the large-scale circulation of the ocean. WOCE will employ several satellites, dozens of ships, and thousands of instruments to obtain a basic description of the physical properties and circulation of the global ocean during a limited period. In addition, WOCE is supporting regional experiments, the knowledge from which should improve circulation models, and it is exploring design criteria for long-term measurements with which to assess the representativeness of the global "snapshot." This knowledge will help unravel the role of the ocean circulation in decadal-scale climate change; the data obtained will help develop models for the prediction of such change.

4.4 The LDIS Management Unit

In order for the LDIS to be in operation within the set time frame it is recommended that sufficient manpower resources be allocated to the initial phases of the development and implementation of the LDIS (see Section 5). The establishment of an the LDIS Management Unit (LDIS-MU) (figure 3) at the LOICZ CPO is recommended to oversee the initial implementation of the system and to set up an efficient service which would attract users and providers and obtain their full support and collaboration. The Management Unit could also ensure flexibility of the system at this initial stage which would allow for any future changes, adaptations, modifications and extensions to be incorporated.

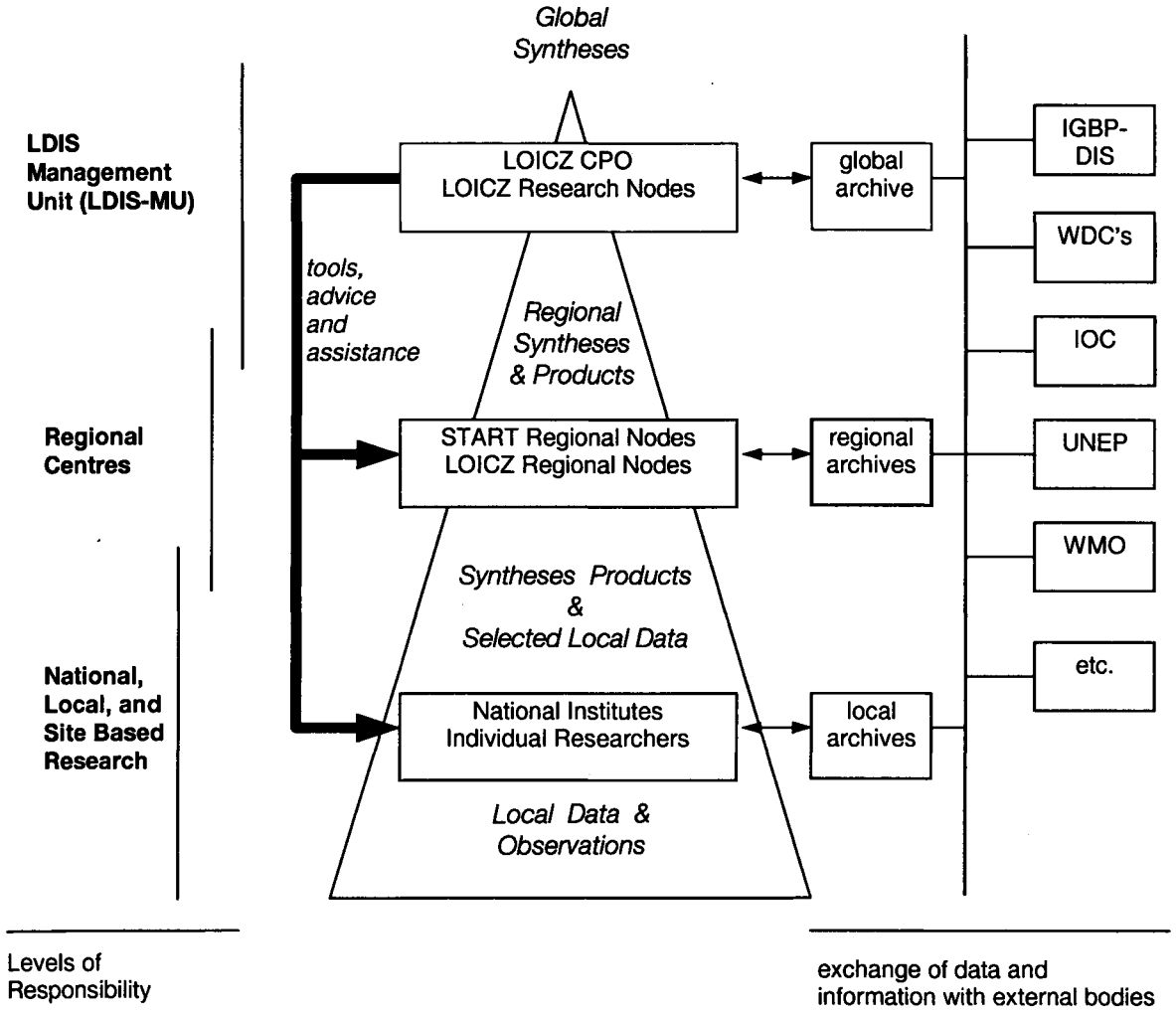

Figure 3. Data and information flows from local site based data and observations to LOICZ global synthesis.

The LDIS Management Unit (LDIS-MU) would have the following responsibilities:

- WWW Home Page, dial-up system: maintenance and management;
- acquisition and distribution (periodic: updates!) of basic reference data and information;
- close and regular interaction with users and providers;
- development and implementation of "recipes" for the generation of global and regional syntheses;
- management and maintenance of a system for data and information distribution (also using WWW and GIS as appropriate);
- general quality assessment of contributions;
- training and awareness activities (with START and IGBP-DIS);
- support for various levels of access to the LDIS; and,
- handling of contributions and requests from non-Internet connected countries, centres, and individuals.

5. TECHNICAL ASPECTS

It should be emphasised that the LDIS intends to involve and complement existing systems in the field of data and information rather than build a completely new system. From the point of view of both users and providers it is desirable to strive for a uniform global system for environmental and related data and information, integrating the presently existing systems.

5.1 Media

In view of the large differences in the levels of technical infrastructure within the LOICZ community, the LDIS - at least during the first five years - should be prepared to handle a wide range of media both for inputs and for outputs. These would range from Internet high-speed communications to telex lines as well as printed material, floppy disks, direct dial-in digital communications, faxes and ordinary mail. This implies extra infrastructural and manpower investment but this investment would in turn lead to an improved involvement in LOICZ of all relevant individuals and centres throughout the world.

5.2 Data Level

The decentralised structure for the LDIS combined with the priority within LOICZ for regional and global products implies that most of the processing of raw detailed data will be carried out at national and regional levels. LOICZ would not impose limitations at this level of data processing, since this clearly would not be in the interest of the users and would only slow down the influx of data and data products. Rather the LDIS would define models or "recipes" for the generation of specific higher level data products to be submitted to LOICZ through the LDIS.

As an example, the average sea surface temperature of a specific coastal area (high level data product) would be derived from individual satellite observations (raw data), *in-situ* observations (raw data) and atmospheric data (raw data) distributed over the area and the month using a specific, agreed model (algorithm) to generate the best approach of this parameter. The required model would be provided through the LDIS although it is most likely that an accepted and already developed model (e.g. from WMO, ECMWF or Eumetsat) will be adopted and adapted where needed. This type of data product would be applied in the context of the LOICZ typology that is described as Framework Activity 2 in the Implementation Plan.

As another example different variables such as river flows, sea level changes, water mass exchange between basins (monthly data - an intermediate data product - derived from momentary measurements or series: the raw data) could be combined in a model generating information on monthly and yearly phosphorus fluxes (high level data product). This product is required by the LOICZ biogeochemical modelling activities (see Gordon *et al.* 1996 for details).

As a final example, in the context of the Global River Index (GLORI) specific raw data obtained in the field by local, momentary measurements (such as flow, suspended solids, dissolved solids) would be processed with an agreed model to provide the same variables but then on a yearly basis. The latter type of data product is required for GLORI and LOICZ (see Milliman *et al.* 1995 for details).

After a number of years as these models or "recipes" stabilise it may be expected that regular, well developed and defined data products on specific variables would be made available by specific centres, serving a wide range of users in and outside LOICZ. This would greatly facilitate the work of the LOICZ community since it would remove the burden of repeated re-processing of basic raw data for a similar but time-shifted application.

The internal reference system of the LDIS would include a designation of the level and method of processing of the datasets referred to. This designation would be given on the basis of information provided by the source holder in the form of data documentation.

5.3 Formats

The LDIS will be established to serve the LOICZ scientific community by actively contributing to the process of making data and information available and accessible. This would justify the specific investment of resources and infrastructure for the LDIS. For the sake of flexibility and speed of response the LDIS would accept inputs not only in ASCII but also from different wordprocessors, spreadsheets, databases and GIS environments. However, this will necessitate extra manpower to be allocated for the LDIS-MU.

Experience (i.e. ICES, IOC, UNEP) has shown that imposing rigid format schemes on a scientific community does not provide the desired results. But since the data products and information in the LDIS would be of essential value to the whole LOICZ scientific community it would be expected that an agreement on a basic level of format standardisation could be reached for these products as demonstrated by JGOFS.

For numerical data this is greatly facilitated by the georeferenced (GIS) character of the LDIS: basically a contribution consists of a position (latitude, longitude, depth), a time, a parameter indicator and a value. For the LDIS a precise format of data contributions would not really be necessary but plain ASCII tables (columns, rows) would be recommended and are already in use in the OPCPLOT GIS package used in the oceanographic community and promoted through IOC as a part of its OCEAN-PC package. A summary description of OPCPLOT including a format description is presented in Annex 9. A similar approach of using ASCII files and tools for exchanging data with existing formats has been taken by JGOFS. The JGOFS data structures allow easy handling of data for single stations and for data collected along transects. Similar approaches could be developed within the LDIS for the required environmental as well as socio-economic data.

The flexibility of the format of OPCPLOT - developed with an intent of exchange of data via e-mail - allows for values on a spot, iso-lines (distributions), vertical profiles and vectors. Therefore it seems excellent to cater for all data products envisaged to be relevant for LOICZ. Therefore it is proposed to promote this format as the preferred format for data submissions to the LDIS.

The LOICZ Home Page, apart from distributing information and documentation, could also be used for data distribution. Data files could be attached to this Home Page as references (metadata level) and/or could be downloaded to the user upon his request in OPCPLOT format. This system could be used for image data (such as processed remote sensing data in the form of isolines) and non-image data (such as data on aquaculture production).

For the various information elements of the LDIS, specific format agreements could be devised based upon the form of the desired output product or presentation. Close co-ordination would be maintained with already existing and accepted international formats developed within organisations such as ESA, European Union, FAO, GRID, ICES, IOC, UNEP, WMO and Worldbank, and adopting these formats as much as possible. With regard to meta-data and meta-information, the Spatial Data Transfer Standard and the recommendations concerning the European Geographical Information Infrastructure could be of particular and fundamental value to the LDIS.

5.4 Data Quality Assurance

In order to use the LDIS data responsibly the user would have to be aware of the 'quality' of this data. The term 'quality' would include aspects such as precision, accuracy, reliability, representation, compatibility. An assessment of these qualities would need to be made in order to be able to select the most appropriate data for specific applications.

Although in principle a centralised structure for the LDIS would ensure better control of all data, the central management of the LDIS would be unable to assume responsibility for the quality of individual datasets contributed to the LDIS for two main reasons:

- the immense amount of time and resources that would be required especially on a global scale;
- the lack of the necessary expertise within the LDIS management with regard to specific types of data.

In view of this and taking into account the priority of LOICZ for global and regional data products, the following approach is proposed:

- the LDIS would provide the originators of data products for LOICZ with a model or "recipe" for generating the required data product. As this model is standardised and its proper application is assumed no further documentation is required with the resulting data product;
- where needed the LDIS will develop the required models for data product generation in close collaboration with the relevant scientific community. This would improve their acceptance and proper implementation;
- the LDIS will provide references to internationally agreed guidelines and procedures for data acquisition and measurement as well as on processing and archival; and,
- where necessary the LDIS would provide the tools to providers to assess the internal and external quality of their data and to almost automatically generate data documentation in the required format

Examples of tools as meant in the last paragraph for marine data are included in the OCEAN-PC package of IOC. This software package includes a number of tools for marine information and data processing such as generating reports, quality assessment and control, a GIS/ mapping environment (OPCPLOT) and archival in a standardised data format. For further details see Annex 9.

The tools included in OCEAN-PC could easily be adopted for use in LOICZ and be applied to a wider range of environmental data implementing only minor adaptations. However, the inclusion of socio-economic data might require additional modifications: a specific effort needs to be devoted to this subject.

IOC has developed a Quality Control Manual for marine data (IOC 1993) in close co-operation with the EC-MAST Programme. This would serve well as a reference for marine data quality control procedures. Similar references might be identified for terrestrial (UNEP, FAO), atmospheric (WMO) and socio-economic data. Where they do not exist, such references should be developed.

In addition, through its access to many datasets distributed over time and space, the LDIS would be able to develop data 'climatologies' for certain areas and variables. These could serve as a crude test as to whether new contributions were plausible or not. Also these tools would be made available to the participating scientists by the LDIS. However, such tests will not cover unforeseen changes of high frequency and therefore would have to be applied with care.

With a number of datasets identified as of critical importance to LOICZ research, the LDIS Management Unit may have to play a lead role in verifying the quality. As much as possible this will be carried out in conjunction with the data provider.

5.5 Geographic Referencing

A system of georeferencing provides the most effective means for storing and processing environmental data of largely different types and origins. Therefore the data component of the LDIS would be constructed around a GIS/mapping environment allowing both vector and raster inputs as well as a time dimension. This would allow for the inclusion of:

- data measured on a specific place for a certain time and processed into weekly or monthly means, for example flow or atmospheric phosphorus input;
- averaged horizontal and vertical distribution data per month or season, for example primary production in coastal waters; and,
- processed satellite data, for example weekly, monthly and seasonally composites of vegetation index.

The above data would always be generated using the models or recipes provided by the LDIS.

5.6 The LDIS Technical Set-up

To fulfil its mission and the need for continuous operational access, the central the LDIS management unit for technical and communications infrastructure would have to be completely independent, self-reliant and full-time accessible (time differences!). The following elements should as a minimum be included:

- Pentium PC/Workstation with sufficient hard-disk size (> 1 Gbyte), CD-ROM reader, A4 scanner and high-speed connection to Internet (ISDN recommended);
- direct modem dial-in capabilities (up to 10 lines);
- PC fax facility and stand-alone fax both directly accessible from outside;
- direct telex link;
- direct telephone access; and,
- adequate facilities would be for high-quality colour printing of data products.

It is assumed that START, through its regional networks and contacts, would ensure that an appropriate structure would be developed and implemented enabling the LOICZ scientific community to access the LDIS. This relates both to the technical infrastructure and to the identification and submission of the required data and information.

The technical set-up of Nodes interacting with the LDIS will fully depend upon their local situation. Although the central configuration as proposed above would certainly be adequate for Nodes with a high throughput, some Nodes will not be able to meet these requirements. While in due time the activities of START could result in an improvement of this situation, for the first years the central the LDIS unit will have to be prepared to provide assistance to Nodes with respect to data and information handling and to deal with a large variety of data and information formats.

6. WORK PLAN AND TIMETABLE

6.1 Workplan

The following tasks for the LDIS development and implementation can be identified. These should be carried out by the LDIS-MU, primarily in close co-ordination and collaboration with START and IGBP-DIS and with relevant outside organisations and agencies. In view of the long standing experience of IODE in the field of marine data and information management and the relevance of this experience for LOICZ, a special close relation will be established between LOICZ and IODE. Within the context of ICSU and the IGBP, the World Data Centres will also play a lead role in helping to implement the LOICZ Data and Information System. These packages do not necessarily need to be implemented consecutively. Work on Task 1 has already started.

- Task 1: development, implementation and maintenance of a LOICZ Internet Home Page (http://www.nioz.nl/loicz/) as one of the means for efficient interaction with the LOICZ and IGBP community as well as with the relevant organisations and individuals outside IGBP. This would form a basis for identifying the data and information required by LOICZ research activities and for locating relevant data and information already available. The initial layout of the LOICZ Home Page is included as Annex 4;
- Task 2: creation jointly with START and other relevant organisations (such as National Science Foundation (NSF), UNDP, International Development Research Centre (IDRC) of Canada, AAAS) of alternative access procedures to the LDIS in those cases where Internet is not (yet) available (INMARSAT-M? direct dial-up to central LDIS server?);
- Task 3: development and implementation, in close concert with IGBP-DIS, GAIM, IOC, WDC's, UNEP and other relevant partners, of a generalised LDIS user interface including procedures for referral, acquisition, submission, quality control, product generation ("recipes"), archival and exchange for each of the required variables;
- Task 4: provision of access through the LDIS to basic reference information and data such as bathymetric maps (GEBCO); world coastline and coastal maps; geomorphologic maps of coastal zones including catchment areas and river runoff (GLORI, historical); selected socio-economic variables (CIESN/SEDAC); soil map (FAO); this relates to data and information identified as being of a general and common interest to all LOICZ research activities;
- Task 5: organisation with START, IGBP-DIS and other relevant parties (IOC) of training courses on coastal zone data and information management contributing to capacity building on a local and regional level and promoting LOICZ, the LDIS and its capabilities;
- Task 6: provision on appropriate time scales (weekly, monthly, seasonally, yearly) of relevant LOICZ data and information products on a global and regional scale and generated according to the LOICZ requirements and procedures;

The collaborative effort required to further develop and implement the LDIS could well be initiated by a technical workshop involving experts from all relevant organisations and agencies, including IGBP-DIS and START, GAIM, IOC/IODE, UNEP, ICES and the WDC's.

It is strongly recommended to focus the initial stages of the LDIS implementation on one regional pilot project to test the various elements and tune their development in the field. This pilot project should be linked to a regional LOICZ research activity such as the approved core research in the south-east Asian region that is jointly supported by the Netherlands Foundation for the Advancement of Tropical Research (WOTRO), SARCS and LOICZ. Other pilot projects could also be developed in conjunction with IOC's activities such as those in the Gulf of Guinee, Coastal Resource Database in East Africa and the Black Sea.

This activity aims at investigating the biogeochemical and socio-economic processes of coastal tropical ecosystems and offers ample opportunities to develop and test the LDIS concepts, including the generation and provision of data products to several user communities in conjunction with the START RRC that has been established at Chulalongkorn University, Bangkok Thailand. This activity requires a well developed data and information system. Such a pilot project when agreed would require a separate detailed planning in close collaboration with the relevant national and regional communities.

After satisfactory and successful completion of the pilot project an expansion of the LDIS system scope to full global coverage could be implemented provided the necessary resources and infrastructure are available.

6.2 Timetable

Below a provisional timetable is presented concerning the Tasks of Section 6.1.

Task	Start	Duration
1	started	continuous
2	a.s.a.p.	continuous & upon request
3	a.s.a.p.	6 months
4	a.s.a.p.	6 months
5	after Task 4	continuous
6	after Tasks 4 and 5	continuous

7. LDIS REQUIREMENTS

The required manpower for the LDIS central Management Unit to carry out and provide guidance to the development and operational implementation of the LDIS is estimated as percentage of full time employees at:

Experienced academic level: Responsible for the management the LDIS-MU and the LDIS implementation, external organisational contacts	25%
Experienced technical/systems analyst level Responsible for the development of systems concepts, tuning with existing systems, external technical contacts, maintenance Home Page and related pages, handling of requests	60%
Programmer/technician Responsible for the implementation of developed concepts, testing, technical maintenance, technical support LOICZ CPO and the LDIS-MU, handling of requests	80%
Administrative support Responsible for all administrative support tasks related to the LDIS-MU	5%

Additional support for specific subtasks could be realised through appropriate ad-hoc contracts.

The LDIS-MU will need to remain active during the full period covered by the Tasks.

Additional resources for the central the LDIS-MU would be required to cover:

- Travel for personnel to promote and co-ordinate the LDIS functions;
- Technical infrastructure investment for purchase of necessary equipment; and,
- Technical infrastructure cost associated with communications and data transfer.

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Vol. 3, Standard Subsets of GF3
Vol. 4, User's Guide to the GF3-Proc Software, UNESCO, 1989
Vol. 5, Reference Manual for the GF3-Proc Software
Vol. 6, Quick Reference Sheets for GF3 & GF3-Proc, UNESCO, 1989.

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IOC. 1995. IOC-ICSU-CEC Regional Workshop for Member States of the Mediterranean: GODAR IV (Global Oceanographic Data Archaeology and Rescue) Project: 25-28 April 1995, IOC Workshop Report No. 110.

Milliman, J.D., C. Rutkowski and M. Meybeck. 1995. *River Discharge to the Sea: A Global River Index (GLORI).* LOICZ Reports & Studies No. 2 (draft version).

Pernetta, J.C. and J.D. Milliman (eds.). 1995. *Land Ocean Interactions in the Coastal Zone Implementation Plan.* IGBP Report No. 33. Stockholm Sweden. 215 pp.

Turner, K. and N. Adger. 1996. *Coastal Zone Resources Assessment Guidelines*. LOICZ Reports & Studies No. 4. 101 pp.

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UNESCO. 1985. Guide to IGOSS Data Archives and Exchange (BATHY and TESAC), Revised Edition. IOC Manuals and Guides No. 1.

UNESCO. 1985. Marine Environmental Data Information Referral Catalogue. 2nd Edition. IOC Manuals and Guides No. 16.

UNESCO. 1987. User Guide for the Exchange of Measured Wave Data. IOC Manuals and Guides No. 18.

UNESCO. 1990. Global Temperature Salinity Pilot Project (GTSPP) Quality Control Manual, IOC Manual and Guides No. 22.

UNESCO. 1991. IODE Handbook, IOC.

UNESCO. 1991. Manual on International Oceanographic Data Exchange (Fourth Edition). IOC Manuals and Guides No. 9.

UNESCO. 1995. OceanPC Manual (with 2 diskettes), IOC.

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S-104 05 Stockholm, Sweden
Tel: 46-8 16 64 48
Fax: 46-8 16 64 05
E-mail: sec@igbp.kva.se
WWW: http://www.igbp.kva.se/igbpint.html/

IGBP CORE PROJECT OFFICES

Biospheric Aspects of the Hydrological Cycle (**BAHC**)
Core Project Office
Potsdam Institute for Climate Impact Research
P.O. Box 601 203
Telegrafenberg
Potsdam, 14412
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Tel: 49-331 288 2543
Fax: 49-331 288 2547
E-mail: bahc@pik-potsdam.de
WWW: http://www.pik-potsdam.de/bahc

Global Change and Terrestrial Ecosystems (**GCTE**)
Core Project Office
CSIRO, Division of Wildlife & Ecology
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Lyneham, ACT 2602
Australia
Tel: 61-6-242 1748
Fax: 61-6-241 2362
E-mail: w.steffen@dwe.csiro.au
WWW: http://xtreme.gsfc.nasa.gov/igbp1/corep/gcte.html

Global Ocean Euphotic Zone Study (**GLOBEC**)
Secretariat
University of Massachusetts Dartmouth
285 Old Westport Road
North Dartmouth,
United States
Tel: 1-508-999 8004
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International Global Atmospheric Chemistry Project (**IGAC**)
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Joint Global Ocean Flux Study (**JGOFS**)
Core Project Office
Center for Studies of Environment and Resources
High Technology Centre
University of Bergen
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Land-Ocean Interactions in the Coastal Zone (**LOICZ**)
Core Project Office
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Land Use and Cover Change (**LUCC**)
Core Project Office
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WWW: http://pathfinder-www.sr.unh.edu/lucc/

Past Global Changes (**PAGES**)
Core Project Office
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Tel: 41-31-312 31 33
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WWW: http://www.ngdc.noaa.gov/paleo/pages.html

IGBP FRAMEWORK ACTIVITIES

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Data and Information Systems for the IGBP (**IGBP-DIS**)
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E-mail: Szejwach@cnrm.meteo.fr
WWW: httlp://www.meteo.fr/cnrm/igbp/

International Global Change System for Analysis, Research and Training (**START**)
Secretariat
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ECMWF, Shinfield Park, Reading RG2 9AX, England, Tel:44-1734-499000,
Fax: 44-1734-869450, WWW: http://www.ecmwf.int/.

EEA, Kongens Nytorv 6, DK 1050 Copenhagen K, Denmark, Tel: 45-33-367100,
Fax: 45-33-367199, WWW: http://www.eea.dk/eionet/eionet.html.

EROS, WDC-A for Remotely Sensed Land Data, US Geological Service, EROS Data Center, Sioux Falls, South Dakota, 57198 USA, Tel: 1-605-594-6151, Fax: 1-605-594-6589,
WWW: http://cdiac.esd.ornl.gov/cdiac/wdca/land.html.

ESRIN, Via Galileo Galilei, 0044Frascati, Italy, Tel: 39-6-941801, Fax: 39-6-94180361,
WWW: http://www.esrin.esa.it/htdocs/esrin/esrin.html.

ETI, Expert System for Taxonomical Identification, P.O. Box 4766, 1009 AT Amsterdam, The Netherlands, Tel: 31-20-5257239, Fax: 31-20-5257238, WWW: http://145.18.162.199/.

European EUREKA programme, specifically its components: ENVINET, EUROMAR (Coastwatch) and EUROTRAC, Avenue des Arts 19H, Boite 3, B-1040 Brussels, Belgium.
Tel: 32-2-2170030, Fax: 32-2-2187906.

European Space Agency (ESA), 8-10 Rue Mario Nikis, Paris, France, Tel: 33-1-53697155, Fax: 33-1-53697690, WWW: http://www.esrin.esa.it/htdocs/esa/esa.html.

European Union, Directorate General for Science Research and Development, Joint Research Centre, 200 Rue de la Loi, B-1049 Brussels, Belgium, Tel: 32-2-295 11 11,
Fax: 32-2-296 30 24.

Food and Agricultural Organisation of the United Nations (FAO), Via delle Terme di Caracalla, Rome, Italy, E-mail: chris.newton@fao.org.

GLOSS, c/o IOC, 7 Place de Fontenoy, 75700 Paris, France, Tel: 33-1-45684008,
Fax: 33-1-40569316.

Global Resource Information Database (GRID)
GRID-Arendal (Norway), TK-Senteret, Longum Park, PO Box 1602, Myrene, N-4800 Arendal, Norway, Tel: 47 37 03 5850, Fax: 47 37 03 5650, E-mail: grid@grida.no,
WWW: http://www.grida.no.

GRID-Bangkok (Thailand), Outreach Building, Asian Institute of Technology, PO Box 2754, Bangkok, 10501, Thailand, Tel: 66 2 516 2124, Fax: 66 2 516 2l25, E-mail: grid@ait.th.

GRID-Ottawa (Canada), Canada Centre for Remote Sensing Surveys, Mapping & Remote Sensing Sector, Room 335, 3rd. Floor, 588 Booth St., Ottawa, Ontario
K1A OY7, Canada, Tel: 613 947-1227, Fax: 613 947-1382, E-mail: campbell@ccrs.emr.ca.

GRID-Esbjerg (Denmark), Spangsbjerg Kirkeveg 111, Esbjerg, DK 6700 Denmark,
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GRID-Geneva (Switzerland), 11 chemin des Anemones, CH-1219 Chatelaine, Geneva, Switzerland, Tel: 4122 979 9294, Fax: 4122 979 9029, GRID-CH,
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GRID-Nairobi (Kenya), GRID Headquarters, Box 30552, Nairobi, Kenya, Tel: 254 2 230800 ext. 4186, Fax: 254 2 226491, E-mail: meszarol@unep.no.

GRID-San Jose dos Campos (Brazil), Instituto Nacional de Pesquisas Espaciais, Av. dos Astronautas, 1758-Sao Jose dos Campos, Brazil, Tel: 55123 418977, Fax: 55123 218743, E-mail: danton@dpi.inpe.br.

GRID-Sioux Falls (USA), EROS Data Center, US Geological Survey, Sioux Falls, SD 57198, United States, Tel: 1-605 594 6107, Fax: 1-605 594 6589, E-mail: grid@grid1.cr.usgs.gov, WWW: http://grid2.cr.usgs.gov/grid/grid.html.

GRID-Tsukuba (Japan), Centre for Global Environmental Research, National Institute for Environmental Studies, Japan Environment Agency, 16-2 Onogawa, Tsukuba, Ibaraki 305, Japan, Tel: 81298 516111 ext. 380, Fax: 81298 582645, E-mail: snishiok@nies.go.jp.

GRID-Warsaw (Poland), ul. Jasna 2/4, 00-950 Warsaw, Poland, Tel: 48 22 264231 ext. 331, Fax: 48 22 270328, E-mail: dridw@plearn.bitnet.

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WWW: http://www.cais.com/gewex/grdc.html.

ICLARM, MCPO Box 2631, 0718 Makati City, Philippines, Tel. 63-2-817 5163/5255,
Fax. 63-2-816 3183, WWW: http://www.worldbank.org/html/cgiar/directory/iclarm.html.

International Council for the Exploration of the Sea (ICES), Palaegade 2-4, DK 1261 Copenhagen K, Denmark, Tel: 45-33 15 42 25, Fax: 45-33 93 42 15,
E-mail: harry@server.ices.inst.dk.

Intergovernmental Oceanographic Commission (IOC), 7 Place de Fontenoy, 75700 Paris, France, Tel: 33-1-45684008, Fax: 33-1-40569316, E-mail: j.withrow@unesco.org,
WWW: http://www.unesco.org:80//ioc.

International Oceanographic Data and Information Exchange (IODE) system of the Intergovernmental Oceanographic Commission (IOC), 7 Place de Fontenoy, 75700 Paris, France. Tel: 33-1-45684008, Fax: 33-1-40569316, E-mail: i.oliounin@unesco.org.

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Fax: 39332789034, E-mail: vittorio.barale@jrc.it.,
WWW: http://me-www.jrc.it/OCEAN/ocean.html/

Marine Information System (MARIS), P.O. Box 5807, 2280 HV Rijswijk, The Netherlands, WWW: http://www.regionlink.com/north-holland/maris/

Mediterranean Action Plan of UNEP, Vas. Konstantinou 48, P.O. Box 18019, 11610 Athens, Greece, Tel: 30-1-7253190-5, Fax: 30-1-7253196-7, E-mail: unopmodu@compulink.gr.

NOAA, Room 100, World Weather Building, Washington DC 20233 USA,
Tel. 1-310-763 8111/8400, E-mail: sdsdreq@sdsd.ncdc.noaa.gov.

Regional Seas Programme of UNEP: UNEP OCA/PAC, Box 30552, Nairobi, Kenya
Tel: 254-2-230800, Fax: 254-2-226491.

Rijkswaterstaat (RIKZ). The Coastal Zone Management Centre, c/o National Institute for Coastal and Marine Management/RIKZ, P.O. Box 20907, 2500 EX THE HAGUE, The Netherlands, WWW: http://www.minvenw.nl/projects/netcoast/info/info.htm#CZMCentre.

Socio-economic Data and Applications Centre (SEDAC) of CIESN (Consortium for International Earth Science Information Network), 2250 Pierce Road, University Center, MI 48710 USA. Tel: 1-517-797-2799, Fax: 1-517-797-2622, E-mail: ciesin.info@ciesin.org, WWW: http://www.ciesin.org/home-page/ciesin-home.html.

UN Environment Programme (UNEP), Box 30552, Nairobi, Kenya, Tel: 254-2-230800, Fax: 254-2-226491.

UNESCO International Hydrological Programme, 7 Place de Fontenoy, 75700 Paris, France, WWW: http://www.unesco.org/ch-extern/science/resource/hydro.html.

World Data Centre system of the International Council of Scientific Unions (ICSU) The following is a list of World Data Centre that are responsible for LOICZ related data:

World Data Center A:

Dr. Anne M. Linn, WDC-A Coordination Office, National Research Council, HA 372, 2001 Wisconsin Ave, N.W., Washington, DC 20007, United States, Tel: 1-202-334 2744, Fax: 1-202 334 1377, E-mail: alin@nas.edu.

Dr. Michael S. Loughridge, Director, WDC-A for Marine Geology and Geophysics, NOAA Code E/GC3, 325 Broadway, Boulder, CO 80303-3328, United States, Tel: 1-303-497 6338, Fax: 1-303-497 6513, E-mail: msl@mail.ngdc.noaa.gov.

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Dr. Jonathan Overpeck, Director, WDC-A for Paleoclimatology, NOAA/NGDC Code E/GC3, 325 Broadway, Bolder, CO 80303, United States, Tel: 1-303-497 6227, Fax: 1-303-497 6513, E-mail: info@mail.ngdc.noaa.gov, WWW: http://www.ngdc.noaa.gov/paleo/paleo.html.

Dr. William C. Draeger, Director, WDC-A for Remotely Sensed Land Data, U.S. Geological Survey, EROS Data Centre, Sioux Falls, SD 57198, United States, Tel: 1-605-594 6151, Fax: 1-605-594 6589, E-mail: eros@erosa.cr.usgs.gov.

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Dr. Vyacheslav I. Smirnov, WDC-B1 for Meteorology and WDC-B1 for Oceanography Research Institute for Hydrometeorological Information, 6 Korolev Str., Obninsk., Kaluga 249020, Russia, Tel: 7-08439 25 925, Fax: 7-095 255 2225, E-mail: wdcb1m@sovamsu.sovusa.com.

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Prof. Baron Paul J. Melchior, Director, WDC-C for Earth Tides, Observatoire Royal de Belgique, Ave Circulaire 3, Brussels, B-1180, Belgium, Tel: 32-2 373 0267, Fax: 32-2 374 9822, E-mail: melchior@oma.be.

Dr. Hans van Baren, Director, WDC-C for Soil Geography and Information, International Soil Reference and Information Center, P.O. Box 353, 6700 AJ Wageningen, The Netherlands Tel: 31-8370 71716, Fax: 31-8370 24460, E-mail: isric@rcl.wau.nl.

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Prof. Wang Guangfu, Director, WDC-D for Geophysics, Institute of Geophysics, Chinese Academy of Sciences, Beijing, 100101, P.R. of China, Tel: 86-10 201 1118, Fax: 86-10 203 1995.

Prof. Chen Lian-Shou, Director, WDC-D for Meteorology, National Meteorological Center 46 Baishiqiao Road, Beijing, 100081, P.R. of China, Tel: 86-10 831 2277, Fax: 86-10 832 7390.

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Prof. Sun Jiulin, Director, WDC-D for Renewable Resources and Environment, Commission for Survey of Natural Resources, Chinese Academy of Sciences, P.O. Box 767, Beijing, 100101, P.R. of China, Tel: 86-10 491 4910, Fax: 86-10 491 4230.

World Meteorological Organisation (WMO), Geneva, Swiss, Tel: 44-22-730 8315; Fax: 44-22-733 0242; WWW: http://www.wmo.ch/.

Worldbank Headquarters, New York, United States,
WWW: http://www.worldbank.org/html/welcome.html.

ANNEX 3. REQUIRED VARIABLES FOR LOICZ AND POTENTIAL SOURCES.

VARIABLE	SOURCE[1]
accretion rates in mangrove	FAO, UNEP
administrative/legislative/institutional context	Worldbank
air-sea CO_2 exchange	JGOFS, WMO, ECMWF
alkalinity	IODE
along coast boundary exchange	IODE
amount of fine/coarse suspended river sediment	IHP, FAO
aquaculture sites	FAO
areal extent of habitat types	FAO, ETI
aridity	IHP
atmosphere deposition	IGAC, WMO, EEA
atmosphere-terrestrial/fresh water fluxes	BAHC, WMO, EEA
basin wide circulation	IODE
bathymetry/bottom topography	GEBCO
below ground biomass	FAO
biodiversity	UNESCO/ETI
biogeochemical cycling	FAO
biogeochemical processes	FAO
biological production	FAO
biomass burning	LUCC, FAO, UNEP
C - dissolved organic fractions	
carbon	WMO
carbon in coastal waters	ICES, IODE
catchment area	IHP
CH_4	
chemical attributes of river borne C, N, P	GEMS, IHP, FAO
chemical contaminants - assimilation capacity	GEMS, IODE
chemical controls of C, N, P river movements	IHP, FAO
chlorophyll	FAO, ICES, NOAA
climate	WMO
climate fields	WMO, ECMWF
climatic variables	WMO, ECMWF
climatic zonation	WMO
CO_2	
coastal erosion - terrigenous inputs	EEA
coastal zone colour	NOAA, ESRIN, JRC
concentration of DOC in coastal water	ICES, IODE
coral reef accumulation	FAO, UNEP, ICLARM
coral reef community structure	FAO, UNEP, ICLARM
coral reef export	FAO, UNEP, ICLARM
coral reef production	FAO, ICLARM
cultural diversity and rate of change	Worldbank
currents	IODE
demographic characteristics	Worldbank, SEDA
development indicator	Worldbank
dimethysulphide (DMS)	
distribution of DOC in coastal water	ICES, IODE
DOC - Dissolved organic carbon	IODE

[1] See Annex 1,2, 4 and 7 for contact information

VARIABLE	SOURCE
economic and social features	Worldbank
economic potential	Worldbank
ecosystem response to anthropogenic change	Worldbank, GCTE
endogenous sediments - supply, retention, ...	
environmental quality	EEA, UNEP
erosion - shore & bottom	FAO
erosion rates	FAO, EEA
exchanges at the shelf edge	ICES, IODE, JGOFS
fertiliser use	LUCC, FAO
fisheries production	FAO, ICES
flocculation rate in river	IHP, FAO
flushing	IODE
fluxes between neighbouring coastal regions	ICES, IODE
food chain dynamics	FAO
forestry species and size class	FAO
freshwater runoff	IHP, FAO, BAHC
geology	WDC
geomorphology	WDC
groundwater	IHP
groundwater discharge	WMO, FAO, IHP
habitat type information	FAO, ETI
heavy metals	GEMS, IODE
high resolution photographic images	NOAA
human use & disturbance	UNEP
hydrological processes	IHP
hydrology	IHP
indicator of dependence on coast	Worldbank
inorganic C (concentration) in sediments	
land cover	LUCC, FAO, EEA, UNEP
land use	LUCC, FAO, EEA, EROS, NOAA, SPOT
level of welfare indicator	Worldbank
levels of primary production	FAO
litter fall	
local Redfield ratios	
mangrove distribution	UNEP, ETI
mangrove Forest above ground biomass	FAO, UNEP
mangrove primary production	FAO, UNEP
mean rainfall	WMO
mean temperature	WMO, ECMWF
measure of "naturalness"	
monthly maps of carbon sink/source	
N - dissolved nutrients in coastal water	ICES, IODE
N - dissolved organic fractions	
N_2O	
nephelometers	IODE
NH_4 - dissolved nutrients in coastal waters	ICES, IODE
nitrate input from rain	WMO, UNEP, IHP
nitrogen	
nitrogen in coastal water	ICES, IODE
nutrient cycling	
nutrient input	FAO
nutrients	ICES, IODE
nutrients - assimilation capacity	

VARIABLE	SOURCE
organic C (concentration) in sediments	
organic carbon	
organic carbon - assimilation capacity	
P	
P - dissolved nutrients in coastal water	ICES, IODE
P - dissolved organic fractions	
palaeography	PAGES
palaeographic reconstruction	PAGES
pCO_2	
pCO_2 - free dissolved CO_2	IODE
pH	IODE
phenology tree density and latitude	FAO, UNEP
photosynthesis	
photosynthesis rate in water column	
physical controls of C, N, P river movements	IHP, FAO
POC - Particulate Organic carbon	IODE
pollution	IODE
pollution monitoring	IOC/IODE
population growth rates	Worldbank, CIESIN
population size	Worldbank, CIESIN
Q - river discharge	IHP, FAO, GLORI, BAHC
quantity of river borne C, N, P	IHP, FAO
rate of change of climate	WMO
ratio of CZ importance to overall national economy	Worldbank
reef distribution	FAO, UNEP, ICLARM
remineralisation rate of organic C	
respiration	
respiration rate in water column	
river C, N, P	IHP, FAO
river total dissolved solids	IHP, FAO
river-estuary-shelf fluxes	EEA, JGOFS
salinity	IODE
saltmarsh distribution	UNEP
sea level	IODE, GLOSS, TOPEX
sea surface temperature	IODE, NOAA
seabed sediment characteristics	ICES, IODE
seagrass distribution	FAO, UNEP, ETI
seasonality of DOC	
sediment	ICES, IODE
sediment accumulation	
sediment delivery of rivers	IHP, GLORI
sediment input	IHP, FAO, GLORI
sediment loading	IHP, UNEP
sediment trap data	ICES, IODE
sedimentation rates	
sediments - total suspended matter (concentration)	ICES, IODE, GLORI
sensitivity of coastal ecosystems	UNEP
shelf width	GEBCO
shoreline configuration	UNEP
silicon/silicate	
snow cover	WMO
soil variables	FAO
soil types	FAO
soils	EEA, FAO
species and associations	ETI
subsidence rates	GLOSS

VARIABLE	SOURCE
surface ozone concentrations	WMO, ECMWF
suspended matter	ICES, IODE
suspended matter - (concentration)	ICES, IODE
suspended matter - chlorophyll	ICES, IODE
suspended matter - Inorganic C concentration	
suspended matter - POC concentration	ICES, IODE
suspended sediment	ICES, IODE
synthetic organic compounds	
tidal measurements	IODE
tidal range	IODE
tidal regime	IODE
tide	IODE
timing sequences for river borne C, N, P	IHP, FAO
topography	UNEP
total inorganic dissolved C	
total sediment transport	IHP, FAO
tourist carrying capacity	Worldbank
tourist density	
trace gas emission	WMO
trace metals	ICES, IODE
tributary chemistry	BAHC
tributary hydrology	IHP, FAO
TSS - total suspended sediments	IODE (marine),GLORI (river)
turbidity	IODE
type of seasonal boundary conditions	WMO, IODE
vegetation	FAO
vertical particle flux	IODE
waste water inputs	FAO, UNEP, IHP
water temperature	IODE
wave dominance	IODE
wetlands	UNEP, ETI

GLOBAL CHANGE

ANNEX 4.
LOICZ WWW HOME PAGE
http://www.nioz.nl/loicz/

Land-Ocean Interactions in the Coastal Zone (LOICZ)

This is the World Wide Web Home Page of the Land-Ocean Interactions in the Coastal Zone (LOICZ) Project of the International Geosphere-Biosphere Programme (IGBP) of the International Council of Scientific Unions (ICSU).

The Land-Ocean Interactions in the Coastal Zone (LOICZ) Project is the Core Project of the International Geosphere-Biosphere Programme (IGBP) that focuses on the area of the earth's surface where land, ocean and atmosphere meet and interact. The overall goal of this project is to determine at regional and global scales: the nature of that dynamic interaction; how changes in various components of the Earth system are affecting coastal zones and altering their role in global cycles: to assess how future changes in these areas will affect their use by people; and to provide a sound scientific basis for future integrated management of coastal areas on a sustainable basis.

The project commenced in 1993 with the establishment of the Core Project Office (CPO) at the Netherlands Institute for Sea Research (NIOZ), Texel - The Netherlands. The Office is financially supported by the Netherlands Government. Like all IGBP projects, LOICZ is scheduled to run for 10 years. The Implementation Plan (IGBP Report No. 33) lays out the scientific goals and objectives and charts a course towards their achievement based on the co-ordination of nationally funded research. This co-ordination will require the continued leadership of the LOICZ Scientific Steering Committee (SSC) and strong management on a day to day basis through the CPO. Over 400 scientists were involved in developing the Science Plan published in 1993 and this network has already been extended to 2,000 scientists in 130 countries. The LOICZ Project has produced a number of publications in two series: Report and Studies and Meeting Reports that are available through the CPO.

To access sources of Coastal Zone Data available on the WWW please click here

To see examples of current Coastal Zone Research activities please click here

To see examples of Agencies with interests/activities in the Coastal Zone please click here

To see examples of Tools for use in the Coastal Zone Research please click here

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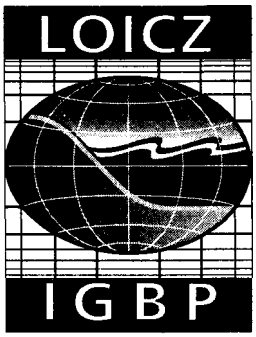
This page is maintained by the LOICZ CPO

Please feel free to send questions or comments to loicz@nioz.nl



GLOBAL CHANGE
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LOICZ Core Project Office

The LOICZ Core Project Office (CPO) is established at the *"Nederlands Instituut voor Onderzoek der Zee"* (Netherlands Institute for Sea Research (NIOZ)), Texel, the Netherlands. The CPO assists the LOICZ Scientific Steering Committee (SSC) in planning and carrying out new scientific research. It also serves as a channel of communication between scientists working in different countries on various aspects of global change in the coastal zone.

The Staff of the LOICZ Core Project Office is:

Vacant, Executive Officer (Advertisment)
BOB BUDDEMEIER, Visiting Scientist
PAUL R. BOUDREAU, Project Scientist
CYNTHIA PATTIRUHU, Office Administrator
MARTIJN VAN DER ZIJP, Junior Data Analyst
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Professor John Field

Professor Andrew S. Goudie

Professor Bengt-Owe Jansson

Professor Stephan Kempe

Professor Jean-Marie Martin

Professor John D. Milliman

Dr Scott W Nixon

Professor Henk Postma

Dr William A Reiners

Dr Jeffrey E. Richey

Professor John J Walsh

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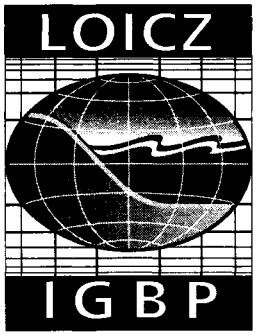

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LOICZ Publications

At the present time, there is only one LOICZ document available in electronic form: the Executive Summary from the Implementation Plan (IGBP Report No. 33).

The following is a list of reports published by the LOICZ Core Project Office.

LOICZ REPORTS & STUDIES SERIES (available from the LOICZ Core Project Office.)

The Reports and Studies Series is intended to include a mixture of scientific reviews of LOICZ Science, Guidelines, datasets such as GLORI, and scientific planning documents such as the typology. They are intended for wide circulation among coastal zone researchers.

Kempe, S. 1995. Coastal seas: a net source or sink of atmospheric carbon dioxide? LOICZ/R&S/95-1, vi + 27 pp. LOICZ, Texel, The Netherlands.

Milliman, J.D., C. Rutkowski, & M. Meybeck 1995. River Discharge to the Sea: A Global River Index (GLORI). LOICZ Reports & Studies No.2. (draft version - limited copies available).

LOICZ. 1995. LOICZ Typology: Preliminary version for discussion. LOICZ Reports & Studies No.3. (limited copies available).

Turner, R.K. and W. N. Adger. 1996. Coastal Zone Resources Assessment Guidelines. LOICZ/R&S/96-4, iv + 101 pp. LOICZ, Texel, The Netherlands.

D.C. Gordon, Jr., P.R. Boudreau, K.H. Mann, J.-E. Ong, W.L. Silvert, S.V. Smith, G. Wattayakorn, F. Wulff and T. Yanagi. 1996. LOICZ Biogeochemical Modelling Guidelines. LOICZ/R&S/96-5, vi +96 pp. LOICZ, Texel, The Netherlands.

LOICZ RELATED IGBP REPORTS (available from the LOICZ Core Project Office or from the IGBP.)

IGBP 1990a. The International Geosphere-Biosphere Programme: A Study of Global Change. The Initial Core Projects. IGBP Report No. 12. Stockholm.

IGBP 1990b. Coastal Ocean Fluxes and Resources. (ed) P.M. Holligan. IGBP Report No. 14, Stockholm.

IGBP 1993. The LOICZ Science Plan. IGBP Report No. 25, Stockholm.

* LOICZ. 1995. Report of The Fourth Scientific Steering Committee Meeting, Quezon City, Philippines, April 1995. LOICZ/SSC.4. Meeting Report No. 8.

* LOICZ. 1995. Report of the First LOICZ Executive Committee Meeting. Texel, the Netherlands, September 1995. LOICZ/EXCOMM.1. Meeting Report No. 12.

Hopkins, T.S. & Kinder, C.A. (eds.) 1993. International Geosphere-Biosphere Programme, First IGBP/LOICZ Core Project Meeting. 18-21 May 1993, Raleigh North Carolina.

JGOFS/LOICZ. 1994 Report of the JGOFS/LOICZ Task Team on Continental Margin Studies. JGOFS Report No 15.

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IGBP 1994. IGBP in Action : Workplan 1994-1998. IGBP Report No. 28, Stockholm.

IGBP 1995. Land-Ocean Interactions in the Coastal Zone Implementation Plan. IGBP Report No. 33, Stockholm.

LOICZ MEETING REPORTS SERIES
(reports marked with * are out of print)

The Meeting Reports Series is intended for circulation primarily amongst participating scientists and serves as a record of discussion and decisions on which the project management is based. These are technical reports and are generally of less scientific interest, and hence are not widely circulated. To receive available reports interested persons should contact the LOICZ Core Project Office

* *LOICZ. 1994. Report of the Workshop Focus 4: Economic and Social Impacts of Global Change on Coastal Systems. Amsterdam, March 1994. LOICZ/WKSHP/94.1. Meeting Report No. 1.*

* *LOICZ. 1994. Report of the Workshop Focus 2: Mangrove Biogeomorphology. Townsville. May 1994. LOICZ/WKSHP/94.2. Meeting Report No. 2.*

* *LOICZ. 1994. Expert Meeting on Coral Reef Monitoring, Research and Management. Bermuda. October 1994. IOC-IUCN-LOICZ/WKSHP/94.4. Meeting Report No. 4.*

* *LOICZ. 1994. Report of the Workshop Focus 1: LOICZ Modelling. LOICZ. Sapporo, November 1994. LOICZ/WKSHP/94.5. Meeting Report No. 5.*

* *LOICZ. 1995. Report of the Workshop on Economic Methods for Coastal Zone Research. Amsterdam. March 1995. LOICZ/WKSHP/95.6. Meeting Report No. 6.*

* *LOICZ. 1995. Report of SARCS/WOTRO/LOICZ workshop on economic methods for coastal zone research, Quezon City, Philippines. LOICZ/WKSHP/95.7. Meeting Report No. 7.*

LOICZ. 1995. Second LOICZ Open Science Meeting: The Dynamics of Global Change and the Coastal Zone. Quezon City, Philippines. Meeting Report No. 9.

LOICZ. 1995. Report of the WOTRO/LOICZ Workshop: LOICZ in Africa. Nairobi, Kenya, August 1995. LOICZ/WKSHP/95.8. Meeting Report No. 10.

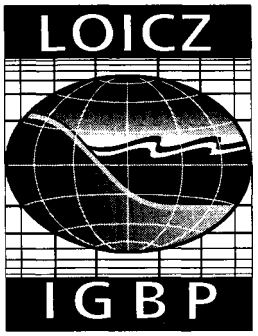
* *LOICZ. 1995. Report of the LOICZ Workshop: Biogeochemical modelling for coastal zone research. Dartmouth, Canada, September 1995. LOICZ/WKSHP/95.9. Meeting Report No. 11.*

* *LOICZ. 1995. LOICZ Workshop: Planning for the International Symposium on Groundwater Fluxes to the Coastal Ocean. LOICZ/WKSHP/95.10. Meeting Report No. 13.*

LOICZ. 1995. Report of the SARCS/WOTRO/LOICZ Coastal Modelling workshop, Merbok, Malaysia, November 1995. LOICZ/WKSHP/95.11. Meeting Report No. 14.

* LOICZ. 1993. LOICZ Scientific Steering Committee Second Meeting. Texel, The Netherlands, 7-10 December, 1993. LOICZ/SSC.2.

* LOICZ. 1994. Report of the Third Scientific Steering Committee Meeting. Texel. June 1994. LOICZ/SSC.3. Meeting Report No. 3.



ANNEX 5. LOICZ PROJECT SUMMARY FORM

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GUIDELINES FOR COMPLETING THE LOICZ PROJECT SUMMARY FORM

The Land-Ocean Interactions in the Coastal Zone (LOICZ) Project is the Core Project of the International Geosphere-Biosphere Programme (IGBP) that focuses on the area of the earth's surface where land, ocean and atmosphere meet and interact. The LOICZ Scientific Steering Committee is soliciting the interest of coastal researchers in participating in this Project. The attached summary form is to be completed and submitted to the:

LOICZ Core Project Office
Netherlands Institute for Sea Research (NIOZ)
P.O. Box 59
1790 AB Den Burg, Texel
The Netherlands
Fax: 31-222 369430
E-Mail: loicz@nioz.nl

Submissions will be used solely for the evaluation and screening of projects by the Scientific Steering Committee for acceptance into the LOICZ Core Project. Notification will be provided to the principal investigator upon acceptance.

Please observe the following guidelines when completing the summary form:

- The layout of the summary form is to be followed. Additional information can be submitted on extra pages but the total submission should be kept as short possible. The final form should not be more than three pages including maps.
- Project Costs (in local currency) should show total expenses from start to completion of the project.
- The Number of Scientific Personnel should show both professional and technical staff and should be expressed in units of full time employees (FTE).
- Funding status is either a **Proposal** for Submission to a funding agency, **Submitted** to a funding agency or with approved **Funding**.
- In describing project objectives, it is essential to identify the specific LOICZ activities and tasks, as listed in the LOICZ Implementation Plan (available from the above address), that will be carried out. For example, if the project is to develop a sediment budget for the East China Sea, the Project Objectives should include the reference "(Task 2.1.1)" in the description.
- The Summary Project Description should clearly describe the following:
  1. The type of observational data to be collected or used in the project. For example, it should describe whether the project will analyse existing data or will collect new data. If new data are being collected, it should indicate the methods to be used (for example, remote sensing, ships, buoys, census, etc.).
  2. The variables and or processes to be studied. For example, variables to be measured could include suspended particulate matter, dissolved organic carbon, nitrate, phosphate, etc., while processes to be studied could include coastal erosion, primary production, denitrification, etc.
  3. The spatial and temporal scales of the research. For example, the description should include the spatial boundaries of the study area, the number and location of sampling sites, and at what frequency will data be collected, etc. It is requested that as much of this information as possible be summarised in a map.
  4. The application of data products. For example, how will the results be used to develop improved numerical models, what kind of models will be developed, how will the results be integrated to develop new syntheses of information at the regional and global scales, how will the results be applied to addressing socio-economic issues, etc.

LOICZ PROJECT SUMMARY FORM

COUNTRY:
PROJECT TITLE:
Principal Investigator Name: Title: Postal Address: Phone Number: Fax Number: e-mail:
Start Date (year): Expected Completion Date (year):
Project Costs: (local currency): No. of Scientific Personnel (FTE):
Funding Status: ☐ Proposed ☐ Submitted ☐ Funded
Project Objectives and Specific LOICZ Activity Task to be Addressed:
Summary Project Description:
Collaborating Countries/Institutions:

ANNEX 6. CONTACT INFORMATION FOR GLOBAL DATA SETS.

ArcWorld /Digital Chart of the World
Environmental Systems Research Institute (ESRI)
380 New York St.
Redlands, CA 92373-8100
United States
WWW: http://www.esri.com/free/free.html

FAO Digitised Soil Map of the World
Distribution and Sales Section
Food and Agriculture Organisation of the United Nations
Viale delle Terme di Caracalla
00100 Rome, Italy
Fax: 39-6-5225 3152
E-mail:publications-sales@fao.org

Global River Index (GLORI), river runoff data
LOICZ Core Project Office
Netherlands Institute for Sea Research (NIOZ)
P.O. Box 59
1790 AB Den Burg, Texel
The Netherlands
Tel: 31-222 369404
Fax: 31-222 369430
E-mail: loicz@nioz.nl

IOC/GEBCO Bathymetry of the World
British Oceanographic Data Centre
Proudman Oceanographic Laboratory
Bidston Observatory
Birkenhead, Merseyside
L43 7RA
United Kingdom
WWW: http://www.nbi.ac.uk/bodc/bodcmain.html

SEDAC Location
Consortium for International Earth Science Information Network (CIESIN)
2250 Pierce Road
University Center, Michigan 48710
United States
Tel: 1-517-797 2727
Fax: 1-517-797 2622
E-mail: ciesin.info@ciesin.org

TerrainBase CD-ROM
United States Department of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data and Information Service
Boulder, Colorado
80303-3328
United States

World Ocean Atlas 1994
United States Department of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data and Information Service
National Oceanographic Data Center
Ocean Climate Laboratory
Washington, DC 2023, United States

ANNEX 7. DATA POLICY AND THE IGBP

An outline for discussion prepared by IGBP-DIS

International Data Principles

Since the International Geophysical Year (1957/58) the International Council of Scientific Unions (ICSU) has maintained a World Data Centre (WDC) system, which serves to collect, store, process as appropriate and redistribute data in the solar-geophysical-related environmental scientific areas. The essential ICSU guidelines for international exchange of data are as follows.

- ICSU programs shall include data management plans that provide details on which data, and in which formats, shall be submitted by participants to the WPC's so that all data may be shared not only by participants but by all scientists.

- It is implicit in the agreements by adhering bodies to the ICSU that national participation in an ICSU program includes the agreement to submit data according to the data management plan.

World Data Centre System

The WDC's are operated and supported by national organisations, which agree to observe the following ICSU WDC principles:

- The WPC's shall operate on a long-term basis. If for any reason they must be terminated, the data holdings will be transferred to another appropriate WDC.

- The WPC's will exchange data among themselves, as mutually agreed, so that data availability and processing for higher order data products will be facilitated.

- Data will be provided to any scientist, in general, on an exchange basis or, at most, at a cost not to exceed cost of copying.

- WPC's will accept any scientist as a visitor to work on site with the data holdings.

- WPC's will prepare and publish catalogues of data holdings.

- WPC's will, insofar as practical, help a scientist locate and access related data not held in the WDC system.

IGBP and ICSU

In 1990, in accordance with established ICSU policies on open and unrestricted data and information exchange, data policies were proposed for the IGBP-DIS. These include the statements: "The IGBP places high priority on establishment maintenance, validation, description, accessibility, and distribution of high-quality long-term global data sets, including the synthesis or generation of new global data sets," and, "Full and open sharing of the full suite of global data sets, and other data sets needed for global change studies, is the primary objective of the IGBP-DIS." (IGBP Report No. 12). The statements go on to list the necessary characteristics of the IGBP-DIS; these are similar to the US data policies.

As recognised in this broad statement of IGBP data policy, the IGBP programme includes scientific areas not now included in the WDC system but which are possible to support if a request is made by the IGBP planners. Therefore, it is important that IGBP develop data-archiving and exchange arrangements for such areas as atmospheric chemistry, land surface properties, biospheric properties, and hydrology, as related to the IGBP projects.

Proposed Data Management Policy for IGBP

In the recent strategy document for IGBP-DIS (IGBP Report No. 30) the relative roles of the Core Projects and Framework Activities and those of IGBP-DIS were outlined with respect to data and information activities in IGBP. One particularly important and timely issue was raised at the recent IGBP-DIS Standing Committee Meeting in Paris in November 1994, namely the responsibilities of IGBP in making its data sets available. These responsibilities would seem to be easily derivable from the following:

1. IGBP is an ICSU program and ICSU has adopted a number of principles concerning data. In essence these principles relate to open access and exchange of scientific data. ICSU through its World Data Centre System has been quite successful in ensuring the access to data by scientists especially with respect to geophysical data.

2. IGBP (especially through DIS) has argued strongly for access to data (especially from Space Agencies) at lower than normal commercial costs because of their importance for scientific purposes. It has had some substantial successes in this regard. Moreover it seems essential for the future success of IGBP's activities that data are provided at the lowest possible costs because of the tightness of all or our budgets.

3. Data sets of wide scientific importance and relevance will be generated in ever increasing quantities as a result of IGBP's activities. Many users apart from those in the IGBP family will want access to these data.

Relying on the ICSU and WDC principles the following more detailed data policy principles based on the statement in IGBP Report No. 12 were proposed and accepted at the IGBP-SC in Australia in December 1994.

- The IGBP requires an early and continuing commitment to the establishment, maintenance, validation, description, accessibility, and distribution of high quality, long-term data sets.
- Full and open sharing of the full suite of global data sets for all global change researchers is a fundamental objective.
- Preservation of all data needed for long-term global change research is required. For each and every global change data parameter, there should be at least one explicitly designated archive. Procedures and criteria for setting priorities for data acquisition, retention, and purging should be developed by participating agencies, both nationally and internationally. A clearing-house process should be established to prevent the purging and loss of important data sets.
- Data archives must include easily accessible information about the data holdings, including quality assessments supporting ancillary information and guidance and aids for locating and obtaining the data.
- International and where appropriate suitable national standards should be used to the greatest extent possible for media and for processing and communication of global data sets.
- Data should be provided at the lowest possible cost to global change researchers in the interest of full and open access to data. This cost should, as a first principle, be no more than the marginal cost of filling a specific user request. Agencies should act to streamline administrative arrangements for exchanging data among researchers.
- For those programs in which selected principal investigators have initial periods of exclusive data use data should be made openly available as soon as they become widely useful. In each case the funding agency should explicitly define the duration of any exclusive use period.

Implications for IGBP of Data Policies

1) IGBP needs to adhere to principles of open access to data sets and availability at low cost, because it is part of ICSU and because if it inhibits the availability of its own data, this could seriously undermine the arguments used to obtain data at lower than normal costs from others.

2) Data sets falling under the above principles will likely include a wide variety of products including field data, processed remotely sensed data and model outputs. This places major responsibilities on IGBP scientists.

3) IGBP needs to consider a number of issues to determine the full implications of these policies;

- How will Core Project decide which data sets will be made available and in what the form they will be distributed?
- What mechanisms will be used for data distribution?
- How will long term archiving be achieved?
- What will be the relative roles of IGBP-DIS and the Core Projects in these activities?
- What other agencies/organisations might be involved to take on some of these responsibilities (e.g. World Data Centre System, WMO Centres)?
- What are the cost implications?
- The responsibilities of IGBP with respect to data supplied by others which has usage/copyright restrictions need to be clearly understood.
- There may be significant problems associated with IGBP programs using data whose distribution may be restricted by copyright: specifically to what extent can IGBP carry out its scientific programme if it has to rely on data, which can not be freely distributed to substantiate the scientific conclusions.
- What should be the privileges of IGBP scientists and programmes with respect to any periods of exclusive use for data collected in the name of IGBP ?
- What will be the process by which the above questions will be answered and when will IGBP be in a position to answer them and establish a data policy ?

Appendix: CEOS principles

Principles, similar to those proposed for the IGBP supporting global change climate, and environmental research using satellite monitoring, have also been endorsed by the CEOS.

The CEOS adopted a resolution on data exchange principles at its December 1991 plenary meeting. These principles were proposed by the US, based on the US Data Management for Global Change Research Policy Statements.

The CEOS recognised that "maximising the use of satellite data is a fundamental objective" and requires an exchange/sharing mechanism among CEOS members.

The CEOS principles call for preservation of all relevant data; easily accessible archives with appropriate supporting information; use of international standards for media, processing, and communication of data sets; elimination of any period of exclusive data use beyond an initial checking and calibration period not to exceed 3 months and harmony among criteria and priorities for data acquisition, archiving, and purging.

ANNEX 8. CODE ON DATA MANAGEMENT IN MAST PROJECTS.

3rd revision

This code on project data management was developed to ensure a common approach to data management of all MAST projects,

first, for the benefit of the scientist of MAST projects as well as of the community of marine researchers,

second, for making effective use of the funds allocated by the EC,

third, to ensure that properly documented and quality controlled data sets are available for public use after the end of each project.

The code refers to three issues "reporting", "handling" and "property'. The latter issue refers mainly to legal matters which are set in General Conditions of the research contracts.

The technical means mentioned below, for example for reporting, are parts of the daily practice of MAST. The Cruise Summary Reports[1] are the usual means for reporting on field experiments to National Oceanographic Data Centres (NODC) and International Council for the Exploration of the Sea (ICES). The European Directory on Marine Environmental Data (EDMED), a supporting initiative of MAST, is built on information provided on EDMED-forms.

The following code draws on today's understanding of "best practice" on how to combine scientific self-determination, public awareness and legal issues. Future experience as well as particular circumstances of single projects will give the chance to improve this code further and will guide its appropriate implementation.

This is the third revision of the code which shall apply to research undertaken in the programme Marine Science and Technologies MAST-III (1994-1998).

For enquiries, please contact the MAST office (Tel: 32-2-2956787) or
M- Bohle-Carbonell (Tel: 32-2-2958111).

(I) Reporting on data collection in MAST projects

1) A copy of the Cruise Summary Report forms[2] of each field experiment (e.g. cruise) should be sent to the project co-ordinator within one week after the end of the field experiment.

2) A copy of the experiment report (cruise report) including station lists etc., should be sent to the co-ordinator within one month after the end of the field experiment.

3) Inventories of continuous observations should be updated regularly and copied to the co-ordinator

4) The co-ordinator adds the copies of the Cruise Summary Report forms and inventories to his regular management reports.

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[1] *or ROSCOP forms, developed by the Committee on International Oceanographic Data and Information Exchange (IODE) of the Intergovernmental Oceanographic Commission (IOC) of UNESCO.*

[2] *The original CSR form should be sent to the data unit or the data centre as specified in the contract of the project. The data unit of the data centre then ensures that ICES receives a copy of the CSR within one month. ICES then will forward the CSR to data centres co-operating within IODE*

(II) Managing data handling issues in MAST projects

1) The leading scientists within a project (e.g. the co-ordinator or the steering committee) have to identify persons and/or institutions who have jointly the duty:

- *to receive the raw data including its documentation, to correct for instrumental errors and to safeguard the corrected and documented data as close as possible to internationally agreed standards as far as they exist*
- *to take care of quality assurance and quality checking of the data (all levels of processing).*
- *to take care of preliminary banking of data for project use,*
- *to take care of final banking or publishing of the data for public use.*

2) A data management plan has to be a part of the task description and the financial planning of the project. The data management plan shall describe work and responsibilities concerning collecting, quality checking, banking or publishing of data. Institutions involved in the banking and quality checking but not participating in the project have to be contracted formally.

3) The leading scientists of the project (e.g. the co-ordinator or the steering committee decide not only on technical matters of data handling (e.g. time delays) but take care of the interests of the data originators. In particular the leading scientists ensure that the people and institutions in charge of handling the data serve the needs of the data originators and project scientists.

4) The inventories of the preliminary banked quality checked data are updated 6 monthly and copied to the co-ordinator who adds them to his regular management report. The final project report will state that the banking of the data is in accordance with the data management plan. EDMED forms are included in the report describing the final data sets produced by the project.

(III) Property rights on data

1) Data originated within MAST are understood to be a property having the legal status of "foreground information" as this term is defined in the contract (articles 14 -19 of II enclosure) in that sense the contract sets the basic rules for sharing of data within the project, among different MAST projects, with other Community undertakings and with third parties.

2) Data disposed for final banking are flagged for limited access for a period preferably not longer than 6 months after the formal end of the project[3] . The access limitations cannot be more restrictive than those on the sharing of "foreground information".

[3] *or 2 years after the field experiment.*

ANNEX 9. DESCRIPTION OF OCEAN-PC AND OPCPLOT.

OVERVIEW

Ocean-PC is an Intergovernmental Oceanographic Commission (IOC) project to organise a system of free or inexpensive software for processing of oceanographic data principally oceanographic profile data) on IBM-compatible microcomputers. Using Ocean-PC, you can: 1) Key enter various types of oceanographic observations from your own files; 2) Merge your own data with historical data from other ships and nations to create a local or regional Oceanographic Atlas; 3) Analyse, display, print, and plot the merged data; and 4) Exchange data with oceanographers and National Data Centres around the world. OCEAN-PC accommodates the wide diversity of data types, formats, and applications of oceanographic data. A wide variety of improvements to OCEAN-PC are desirable, particularly more flexible interfacing between large, standard systems. Users are encouraged to contact IOC if they have special needs for software or data sets, or can contribute software to the system. Within the original project constraint of providing a reasonably sized, low cost system, the project team will work toward incorporating additional components into succeeding versions of OceanPC.

ACKNOWLEDGEMENTS

The following people participated in the assembly of the OceanPC system:

Dr. Murray Brown, U.S. Minerals Management Service
Dr. Harry Dooley and Mr. Garry Hopwood, International Council for the Exploration of the Seas
Dr. Doug Milan, Chairman U.S. ON Centre for Ocean Analysis and Prediction
Mr. John Withrow, Ocean PC Programme Officer, Intergovernmental Oceanographic Commission 7 Place de Fontenoy, 75700 Paris, France. Tel: 33-1-45684008,
Fax: 33-1-40569316, E-mail: j.withrow@unesco.org

SYSTEM INFORMATION

HARDWARE

OCEAN-PC has been designed for low cost operation on XT and AT microcomputers with the MS-DOS operating system (versions 3.x and higher). All but one of the utilities has been written to run on a CGA monitor (or a monochrome monitor running in CGA-emulation mode). Only the GENERAL OCEAN MAPPING utility is written to require an EGA monitor (or better). A desirable optional hardware item is a CD-ROM reader for access to large data sets.

SOFTWARE

The system assumes only that the user has MS-DOS, but the following software additions are desirable:

QUICKBASIC Version 4.5 - To enable the user to modify existing utilities or create new ones compatible with OceanPC code. The QBASIC Interpreter that is included with DOS 5.1 is also useful.

SURFER - A commercial gridding and contouring program; can accept oceanographic data and coastline geographic data files from OceanPC utilities (Golden Software, Inc. 1990).

ATLAST the public domain oceanographic data analysis package (Rhines 1991) available from the Jet Propulsion Laboratory in California.
Any word processing program that can import HPGL plotter files into documents, such as WordPerfect. This allows the user to produce publication-quality graphics from the GENERAL OCEAN MAPPING utility.

SECONDARY DISTRIBUTION

The complete OceanPC system is being distributed as both executable codes and source codes (see below). The IOC requests that primary users share the system with secondary users ONLY if the programs have remained unchanged. If primary users have changed any of the programs, they are asked to refer potential new users to the IOC OceanPC Program Officer (see above) for system diskettes, or to the INTERNET locale for file downloading.

QUALITY CONTROL & UTILITIES.

A major function of any environmental data management system is quality control. Decades of experience with marine data have led ICES to the development of the utilities included below. Through various sorting and display methods, the user can visualise and organise the data in ways that emphasise inconsistencies or specific patterns indicative of error. There is no general "plan" that will always identify erroneous data, rather the user is advised to become familiar with these utility programs and to try them out on a test data set in order to recognise the formats and usages of the outputs.

LIST FILES A utility is provided that lists the files in the current directory.

SORT DATA A utility is provided that performs hierarchical sorting of a ICES Format file to a new (user-named) file. Sorting can occur by year, country, ship, date, time, or station number. Files with up to 15,000 stations can be handled irrespective of station size

INDEX DATA A utility is provided that can create an index to a Standard Profile file. This is useful in speeding up the EXTRACT DATA utility described below.

SUMMARISE STATIONS IN FILE A utility is provided that summarises (station by station) the contents of a Standard Profile file and checks the structure of the file for consistency. Appropriate screen warning messages are issued if a problem is encountered. A report file is also produced summarising the "cruises" by different ships, etc.

SUMMARISE DATA IN FILE A utility is provided that produces a detailed summary of all the data in a Standard Profile file, down to the individual parameters measured at each station/depth. Optionally, it can also produce a report file summarising the "cruises" by different ships, and/or an automatic digital ROSCOP III file.

CHECK DATA A utility is provided that checks for a number of common errors and problems. This utility produces an output file (*.ERR) compatible with the system file editor (see EDIT A FILE below). Thus records failing the tests can be corrected or flagged as necessary.

PLOT X-Y DATA A utility is provided that lets the user examine one or more scatterplots, to see patterns in the data. Depending on the options employed, the user can flag "outlier" data points for later examination by an edit utility.

EDIT DATA A utility is provided that edits ICES Format data records. To use this utility, the user must already know the record number(s) of questionable data. This can be obtained by use of any of the following other OceanPC utilities:

PLOT X-Y DATA - Use of this utility results in a *.ERR error file that "flags" suspect data.

CHECK DATA - Use of this utility results in a *.ERR error file that "flags" suspect data.

SUMMARISE STATIONS IN FILE and SUMMARISE DATA IN FILE - Use of this either of these utilities allows the user to visually spot questionable data records. Using the *.ERR error tag file as a guide, the user can examine, correct, or discard the questionable oceanographic data in a ICES Format file.

EXTRACT DATA. A utility is provided that allows the user to extract a subset from any ICES Format file, based on year, position, or location within a user-defined "corridor." This later

concept is important in creating synthetic data sections, for instance to be used by the ATLAST program described below.

DISPLAY DATA. OceanPC provides several methods to display the oceanographic data, as station maps, oceanographic profiles, or contoured property plots.

ICES - DATA DISPLAY

FORMATTED DATA LIST A utility is provided that reformats a *.ICE file into a visually pleasing form for subsequent printing or publication.

FIND DATA LIMITS A utility is provided to examine an ICES Format file to determine the minimum and maximum values for the geographic co-ordinates and for all of the parameters present in the data.

MAKE COASTLINE FILE. A utility is provided that allows the user to create a coastline file in the SURFER format, for use with the MAKE STATION MAP utility, below.

MAKE STATION MAP. A utility is provided that allows the user to create screen maps of the station locations in ICES Format data file. Coastlines can be drawn on the maps, using the SURFER coastline data format (see above) and the relevant geographic limits (see above).

SEARCH DIGITAL. A utility is provided that allows users to search for the existence of historical oceanographic cruises of interest. Files of digital ROSCOP entries for the years 1980-1989 are included in the OCEAN-PC system. Additional ROSCOP entries can be obtained through INTERNET, as described above.

INQUIRIES

To make inquiries, obtain additional copies of this manual, or obtain a set of 3 1/4-inch high-density system installation diskettes, please write to:
OceanPC Project Officer, IOC/UNESCO
1 rue Miollis
75732 Paris Cedex
FRANCE

OBTAINING OceanPC THROUGH INTERNET
OceanPC is maintained on the Public Unix server on the ICES computer in Copenhagen, and is therefore retrievable over INTERNET - anonymous file transfer protocol (ftp). To obtain OceanPC by this means, the following procedure is recommended, but note that all instructions are case sensitive:
ftp server ices inst dk or ftp 129.142.180.10
USER: ftp
PASSWORD: [your mail address]
ftp> cd /dist/oceanpc
ftp> binary
ftp> ls
ftp > prompt off
ftp > mget * [where * is/are the desired file(s)]
ftp > bye

OPCPLOT

INTRODUCTION

OPCPLOT is a simple marine charting utility written in QUICKBASIC that has grown into a general-purpose mapping and charting utility for all the earth sciences. The program uses ASCII data files in a simple, standard format (Appendix A) and several other ASCII formats to draw charts of any part of the globe between 85 N latitude and 85 S latitude. Because the program contains a complete global database, charts of any land or water region can be produced. The charts contain notations and symbols depicting the locations of sampling sites or cruises, as well as ocean fronts, buoy trajectories, and other useful information. The program offers a simple way to communicate charts of marine research activities and of ocean features important to the scientific community.

OPCPLOT grew out of an informal drifting buoy data distribution method originated by Dr. Robert E. Lee Pickett in 1989. Dr. Pickett shared drifting buoy trajectory data with users of the GULF.MEX electronic bulletin board, as well as a simple, 70-line GWBASIC program that plotted the data on a map of the Gulf of Mexico. A more elaborate charting program was subsequently developed by the author, published as the GULFPLOT Program (Brown, 1991). The OPCPLOT program code (now about 6000 lines in length) extends the features of GULFPLOT to the entire globe, and introduces new capabilities.

SYSTEM REQUIREMENTS FOR OPCPLOT

The following equipment and operating system are required:

An EGA or VGA monitor
DOS 5.0 (or higher)

OPCPLOT is a DOS application that can be run under WINDOWS. Experiments with Windows-NT have been generally successful.

OPCPLOT COORDINATE SYSTEM

In accordance with the latest Federal Information Processing Standards relating to geographic information, OPCPLOT uses latitude and longitude in "signed decimal degrees" format; for instance, -93.34478 is an acceptable longitude value. Further, the OPCPLOT globe extends (left to right) from -180 (W Longitude) to +180 (E longitude), centered on the Prime Meridian; and (top to bottom) from +90 (N Latitude) to -90 (S Latitude), centered on the equator.

Even for those data sets that may wrap over the International Date Line (where -180 W Long and +180 E Long coincide) the above conventions must be observed; e.g., a chart of the Pacific Ocean has positive longitudes on the left and negative longitudes on the right. The internal logic of the OPCPLOT code recognizes and handles the special transformations required, and no substitutions or coordinate conversions are necessary.

OPCPLOT FILE FORMAT

In 1990, the Minerals Management Service Gulf of Mexico OCS Region published and widely circulated the first version of a computer software program called "GULFPLOT." The program, written in BASIC (specifically GWBASIC), is a simple "electronic notepad" that draws charts of the Gulf of Mexico and overlays them with plots of near-real-time data displays, ocean fronts, station locations, and other features of interest to marine scientists. It is based on an earlier program informally distributed in 1989 by Dr. Bob Pickett of (then) NOARL that draws drifting buoy trajectories. This successor program, OPCPLOT, is intended as a management tool to assist in the rapid, cost-effective dissemination of information about oceanographic research and ocean conditions anywhere in the world. The data files used by OPCPLOT to draw the requisite charts can be disseminated via electronic mail, as ASCII files, or sent through the mails on diskettes.

BASIC STRUCTURE.

Each OPCPLOT data file consists of a variable number of ASCII lines, each containing five fields. Although there is some flexibility, the usual order of the fields is as follows:

First Field: Platform or station I.D. (Default = "D")
Second Field: Date and/or time; (Default = "T")
Third Field: The longitude.
Fourth Field: The latitude.
Fifth Field: Plotting instructions/data.

These fields must be delimited by commas, for example:

RV Pelican,910612, -82.0156 ,24.4468 ,P
RV Pelican,910613, -82.21236 ,24.433827 ,L
RV Pelican,910614, -82.38555 ,24.333091 ,L
RV Pelican,910615, -82.79521 ,24.578802 ,L
RV Pelican,910616, -83.09259 ,24.331513 ,L

DETAILED FORMAT INSTRUCTIONS:

FIELD DESCRIPTORS:

The first field is provided for a string that identifies the source of the data, such as a "station number" or a vessel call sign.

The second field is provided for date/time information, preferably in YYMMDDhhmm format.

The third field is the longitude of a location to be plotted, in decimal-degrees format. Longitudes in the western hemisphere are given as negative numbers.

The fourth field is the latitude, in decimal-degrees format. Latitudes in the southern hemisphere are given as negative numbers.

The fifth field is an ASCII string (called Z$ in the program) that contains directions to the program and (sometimes) data. The very first position in the string is a "flag" that tells OPCPLOT what to draw on the screen, as follows:

POINT	P
LINE	L
CIRCLE, fixed radius, small label, horizontal right	D
CIRCLE, fixed radius, no label	C
LINE-TO-CIRCLE, line from previous point to circle, fixed radius, optional small label, horizontal right	B
CIRCLE, variable radius, no label	G xxxx
COLOR, set for plotting	K xx
COLOR, fill polygon(s)	F xx yy
LABEL, small, horizontal right	S xxxxxxxxxxxxxxxxx
LABEL, medium, horizontal right	M xxxxxxxxxxxxxxxxx
LABEL, large, horizontal right	H xxxxxxxxxxxxxxxxx
LABEL, small, vertical down	A xxxxxxxxxxxxxxxxx
LABEL, medium,vertical down	E xxxxxxxxxxxxxxx
LABEL, large, vertical down	J xxxxxxxxxxxxxxxxx
VECTOR, toward which	V xxxx xxxx xxxx xxx xxx xxx

ANNEX 10. ACRONYM LIST

AAAS	American Association for the Advancement of Science
ASAP	A System for the Assessment of Pollution
ASCII	American Standards Committee for Information Interchange
BAHC	IGBP Core Project - Biospheric Aspects of the Hydrological Cycle
CD-ROM	Optical disk
CEO	Centre for Earth Observations (EC)
CEOS	Committee for Earth Observation Satellites
CIESIN	Consortium for International Earth Science Information Network
COMAR	UNESCO Interregional Project on Research and Training on Integrated Management of Coastal Systems
COSMO	Coastal Zone Management simulation software package produced by the Netherlands Rijkswaterstaat
CPO	Core Project Office
CSR	IOC/IODE cruise summary report
E-mail	electronic mail - usually Internet
EC	European Commission
ECMWF	European Centre for Medium Range Weather Forecast
EEA	European Environment Agency
ENVINET	Environmental Programme on contaminants of EUREKA
ESA	European Space Agency
ESRIN	ESA centre for user information
ETI	Expert system for Taxonomic Identification (UNESCO)
EUMETSAT	European Meteorological Satellites Organisation
EUREKA	Europe wide network promoting market-drive R&D projects in all fields of advanced technology
EUROMAR	EUREKA projects on the marine environment
EUROTRAC	European Experiment on Transport and Transformation of Environmentally Relevant Trace Constituents over Europe
FAO	Food and Agriculture Organisation of the United Nations
GAIM	IGBP Programme Element-Global Analysis, Interpretation, and Modelling
GCTE	IGBP Core Project - Global Change and Terrestrial Ecosystems
GDRC	WHO/GEMS Global Data Runoff Centre
GEBCO	Global Bathymetric Chart of the Oceans
GEMS	Global Environment Monitoring System (UNEP)
GEMS/WATER	Global Programme on Freshwater Quality Monitoring
GIS	Geographic Information System
GLOBEC	IGBP Core Project - Global Ocean Ecosystem Dynamics Project
GLORI	LOICZ Global River Discharge Index
GLOSS	Global Sea Level Observing System
GRDC	Global Runoff Data Centre
GRID	Global Resource Information Data Base
IHDP	International Human Dimensions Programme
ICES	International Commission for the Exploration of the Seas
ICLARM	International Centre for Living Aquatic Resources Management
ICSU	International Council of Scientific Unions
IDRC	International Development Research Centre of Canada
IGAC	IGBP Project - International Global Atmospheric Chemistry Project
IGBP	International Geosphere-Biosphere Programme of ICSU
IGBP-DIS	IGBP Programme Element - Data and Information Systems
IHP	International Hydrological Programme (UNESCO)
INMARSAT-M	World-wide satellite communications system
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange (IOC)
ISDN	Integrated Services Digital Network
IUCN	The World Conservation Union
JGOFS	IGBP Project - Joint Global Ocean Flux Study
JRC	European Joint Research Centre, Ispra, Italy

LDIS	LOICZ Data and Information System
LDIS-MU	LOICZ Data and Information System Management Unit
LOICZ	IGBP Core Project - Land-Ocean Interaction in the Coastal Zone
LOICZ-SSC	LOICZ Scientific Steering Committee
LUCC	IGBP Core Project - Land Use and Cover Change
MAB	Man and the Biosphere Programme (UNESCO)
MARIS	Marine Information Service
MAST	Marine Science and Technology programme of EC
MEDI	Marine Environmental Data Inventory
MOU	Memorandum-of-Understanding
MU	Management Unit
NIOZ	Netherlands Institute for Sea Research
NOAA	National Oceanic and Atmospheric Administration (United States)
NSF	National Science Foundation of the United States
OCEAN-PC	IOC software package for marine data and information handling
PAGES	IGBP Core Project - Past Global Changes
PC	Personal Computer
ROSCOP	Report on Observations and Samples Collected during Oceanographic Programmes (IOC)
RRC	START Regional Research Centre
RRN	START Regional Research Node
RRS	START Regional Research Sites
SARCS	START South East Asian Research Centre
SEDAC	Socio-economic Data and Applications Centre
SPOT	Systeme pour l'Observation de la Terre
SSC	Scientific Steering Committee
START	IGBP Programme Element - System for Analysis, Research and Training
START SAFCOM	START South African Committee
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WCRP	World Climate Research Programme
WDC	ICSU World Data Centre
WHO	World Health Organisation
WMO	World Meteorological Organisation
WOCE	World Ocean Circulation Experiment
WOTRO	Netherlands Foundation for the Advancement of Tropical Research
WWW	World Wide Web


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