

Global

Ocean

Observing

System



**Intergovernmental Oceanographic Commission**

*Reports of Meetings of Experts and Equivalent Bodies*

## **First GOOS USERS' Forum**

November 2000

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**Abstract**

This report presents a summary of the topics discussed at the First GOOS Users' Forum. The objectives of the Forum were to (i) ensure that the design and implementation of the coastal component of GOOS reflects the priorities of national and regional GOOS programmes and the needs of user groups represented by these programmes; (ii) strengthen national and regional GOOS programmes by facilitating the exchange of information on new technologies, approaches and knowledge among participating nations; and promote the global scale implementation of all components of GOOS. Background information on GOOS was provided. Representatives from 17 countries participated and provided presentations on national and regional GOOS activities. The Forum discussed 1) mechanisms to involve user groups in the design, implementation and operation of the coastal ocean observing system; 2) how national and regional priorities could be met by the observing system? and 3) what processes should be used to enhance capacity. Recommendations to these questions were provided from three breakout groups.

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## **1. OPENING**

### **1.1 WELCOMING REMARKS**

Professor Manuel Murillo welcomed the meeting participants to the Centro de Investigación en Ciencias del Mar y Limnología (CIMAR) of the University of Costa Rica. Manuel Murillo stressed that the Global Ocean Observing System (GOOS) is an ambitious undertaking by the Intergovernmental Oceanographic Commission (IOC) and the other sponsors of GOOS – The World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP) and the International Council for Science (ICSU). He emphasized that GOOS will require a coordinated, cooperative interaction between nations, to create a true “globally interlinked” system, for the gathering and distribution of all useful kinds of marine data and the generation of products. For developing countries the ocean is often considered 2nd or 3rd priority and there would be a particular need for building technological and educational capacity in those countries in order for them to participate and benefit fully from GOOS. Much effort will be required to make sure that IOC Member States fully understand that GOOS is an essential sister system for the oceans to the global meteorological observation and prediction network. Manuel Murillo hoped that the meeting would provide guidance and a step forward in the development efforts of GOOS.

Worth Nowlin, Chairman of the GOOS Steering Committee thanked Manuel Murillo for his warm welcoming remarks and CIMAR for hosting this meeting. On behalf of the sponsors of GOOS he welcomed the participants and thanked them for taking time out of their busy schedules to attend this First GOOS Users' Forum.

Colin Summerhayes, Director of the GOOS Project Office, welcomed the participants. He thanked UNEP, the US National Oceanic and Atmospheric Administration (NOAA) and the US GOOS office at Texas A&M University for providing financial support for this meeting.

### **1.2 ADOPTION OF THE AGENDA**

The agenda was adopted as in Annex I.

### **1.3 OVERVIEW OF GOOS**

Worth Nowlin provided a brief overview of GOOS.

The United Nations Conference on Environment and Development (UNCED) called in 1992 for the creation of a global system of ocean observations to enable effective and sustainable management and development of seas and oceans, and prediction of future change. The establishment of such a system was also urged by the Second World Climate Conference in 1990 to provide the oceanographic data needed by the Global Climate Observing System (GCOS).

The overall objectives of GOOS are:

- To specify in terms of space, time, quality and other relevant factors, the marine observational data needed on a continuing basis to meet the common and identifiable requirements of the world community of users of the oceanic environment and ocean knowledge;
- To develop and implement an internationally coordinated strategy for the gathering or acquisition and the archiving of these data and synthesizing them for common use and practical application;

- To facilitate the development of uses and products of these data, and encourage and widen their application in the sustainable use and protection of the marine environment;
- To facilitate means by which less developed nations can increase their capacity to contribute, acquire and use marine data;

GOOS measurements are characterized in that they are:

Long term	- continue indefinitely
Relevant	- selected with products and users in mind
Systematic	- scales, accuracy and precision aimed at specific objectives
Cost effective	- select efficient, economical methods
Routine	- carried out in operational manner

The planning and implementation of GOOS is being overseen by the GOOS Steering Committee (GSC). The design of GOOS was initially carried in five modules under the GSC: Coastal (C-GOOS); Living Marine Resources (LMR); Health of the Ocean (HOTO); Climate (Ocean Observing Panel for Climate: OOPC) and Marine Meteorological and Oceanographic Services. By the end of 2000, the initial strategic design plans for the C-GOOS, LMR and HOTO modules will have been completed, at which time the GSC has determined that the HOTO, LMR and C-GOOS efforts will be merged to formulate integrated design and implementation plans. GOOS will then develop through two related and convergent components: (i) a basin-scale component concerned primarily with monitoring, forecasting and understanding marine surface conditions and climate variation (OOPC) and (ii) a coastal component concerned primarily with natural and anthropogenically-induced change in coastal and estuarine environments and their impacts on the ecosystems, including humans (Coastal Ocean Observations Panel). This approach is summarized in *The GOOS 1998 Prospectus*, (<http://ioc.unesco.org/goos/Prospe98/Contents.html>).

An Intergovernmental Committee for GOOS (I-GOOS) assists in gaining intergovernmental support and approval for the design and implementation. Participation in the I-GOOS Committee is open to all countries.

The practical implementation of GOOS began in 1998 with the creation of the GOOS-Initial Observing System (GOOS-IOS) from a number of pre-existing observing systems. Some of these are exclusively contributions to GOOS; others evolved for different purposes, but also address, are compatible with, and satisfy GOOS requirements. In principle, the latter can provide contributions to GOOS as well as to the original group of clients for whom they were initiated.

Although the implementation of GOOS through the GOOS-IOS has begun by exploiting existing systems, it is expected that the existing systems will be adapted to meet the design requirements. New components will be added as appropriate and in accordance with GOOS designs.

Additional information about the GOOS organization, terms of reference for steering committees and working groups and the GOOS-IOS can be found at the GOOS web-site (<http://ioc.unesco.org/goos>).

Following Worth Nowlin's introduction, Colin Summerhayes explained that GOOS could be thought of as a tripartite system including (i) an observing subsystem; (ii) a data and information management and communication subsystem; and (iii) a modelling and

applications subsystem that developed products for users. He noted that besides being in existence largely in the open ocean through the GOOS-IOS, it was also being developed both by nations and by regional GOOS bodies in coastal seas, giving as a working example the Baltic Oceanographic Observing System (BOOS). BOOS already comprises a comprehensive and integrated observing system, with elements ranging from weather observations to river discharges and fish stocks. These data are processed through operational modelling tools, with its final goals including water quality and ecological models. BOOS has a broad range of physical, biological, and chemical products designed to satisfy a broad range of users. More information about BOOS is available at [www.boos.org](http://www.boos.org).

Colin Summerhayes stressed the fact that while much of our present capability in implementing GOOS is directed at physical observations (sea surface temperature, wave height and so on), because they are relatively easy to make, the number and type of biological and chemical observations are growing to reflect widespread interest in the ecosystem approach to management. He showed an example of Continuous Plankton Recorder (CPR) output from the North Sea (the CPR is part of the GOOS-IOS), which shows declines in zooplankton and phytoplankton from the 1950s to 1980, followed by a recovery. This pattern is driven by the regional circulation, in particular by the Gulf Stream, which in turn is modulated by the North Atlantic Oscillation. He used this example to illustrate the point that GOOS at the global or basin scale is extremely important as the basis for understanding and forecasting the behavior of resources in coastal seas. In this context he noted that the Argo project to seed the ocean with 3000 profiling floats would provide for the very first time a global picture of the temperature and salinity of the upper ocean, which - when integrated with the global coverage of sea surface temperature obtained from satellites - would provide coastal managers with yet more valuable information on regional controls as the basis for coastal forecasts.

Finally, he stressed the importance of capacity building as a means of helping developing countries to participate in, contribute to, and benefit from GOOS, and called on the presenters in the Forum to make their capacity building needs known so that they could be addressed by the first meeting of COOP.

Tom Malone, Chairman of the Coastal GOOS panel and Chairman of the Coastal Ocean Observations Panel, provided an overview of the *Coastal GOOS Strategic Design Plan* (<http://ioc.unesco.org/goos/CGOOSPLANver7.doc>).

The coastal zone is a unique environment in that it is the only place on the globe where terrestrial, oceanic, atmospheric, and human inputs of energy and matter all converge. It also supports the greatest concentration of living resources and people on the planet. As the number of people living, working and playing in coastal ecosystems increases, the demands on these systems to provide commerce, recreation, and resources and to receive, process, and dilute the effluents of human society will increase. Likewise, the risk that natural hazards pose society also increases. Coastal ecosystems are experiencing unprecedented changes from habitat loss (tidal wetlands, sea grass beds, coral reefs), oxygen depletion, harmful algal blooms, fish kills, and declining fish stocks to beach closures, coastal erosion and flooding. The resulting conflicts between commerce, recreation, development, the utilization of natural resources, and conservation will become increasingly contentious, politically charged, and expensive. Resolving these conflicts in an informed, timely and cost-effective fashion requires a significant increase in our ability to detect and predict the changes that are occurring in coastal ecosystems. This is the purpose of the coastal component of the Global Ocean Observing System.

The strategic design is being developed based on the following observations: (i) most of the changes occurring in coastal ecosystems are local in scale and are globally ubiquitous; (ii) physical processes structure the pelagic environment and are of fundamental importance to changes in the physical, biological and chemical characteristics of coastal ecosystems; and (iii) changes in these characteristics are related through a hierarchy of interactions that can be represented by robust models of ecosystems dynamics (e.g., numerical models of physical processes and coupled physical-biological models).

The coastal GOOS strategy will build on, enhance and supplement existing observing programmes to develop a sustained and integrated observing system that provides the data and knowledge required to:

- manage and restore healthy coastal ecosystems and living resources;
- enable safer and more cost-effective marine operations;
- forecast and mitigate the effects of storms;
- detect and predict the effects of climate change; and
- protect public health.

In order to address these needs, the observing system must ultimately provide information on a broad spectrum of environmental changes that reflect interactions between natural variability and human activities in a complex environmental setting. Differentiating the effects of human activities from the effects of natural processes requires knowledge of the coherence of changes that are occurring locally on global scales and comparative analysis of such changes in the context of larger scale forcings.

Detection and prediction depend on the development of an integrated and sustained observing system that provides effective linkages between measurements and data analysis for more timely access to data and delivery of environmental information. The system must be integrated to provide multi-disciplinary (physical, chemical and biological) data and information to many user groups. The system must also be sustained to capture the scales of variability that characterize the changes of interest and to provide continuity in the data streams and resulting data products. There are no systems that are integrated (multi-disciplinary observations servicing the needs of many user groups), sustained and global in scope.

Programmes that are relevant to the development of coastal GOOS are: (i) operational programmes, (ii) pre-operational pilot projects, and (iii) enabling research. Operational programmes provide products to user groups that are in demand and are made possible by sustained data streams and data management systems that guarantee data quality. Pilot projects and enabling research are organized, planned sets of activities with focused objectives, a defined schedule, and a finite life time that are expected to produce results that significantly benefit the global ocean observing system in general and C-GOOS in particular. An important function of pilot projects is to demonstrate the utility of the GOOS “end-to-end, user-driven” approach. Enabling research develops the technologies and knowledge (e.g., sensor and models) required to detect and predict changes.

Coastal GOOS will come into being by selectively enhancing, networking and supplementing existing programmes. It is expected that coastal GOOS will develop along two tracks:

- (i) the building of an initial global network through the incorporation of existing operational elements that meet GOOS design requirements; and



- (ii) the implementation of pre-operational pilot projects that demonstrate the utility and cost-effectiveness of the “end-to-end, user-driven” approach and contribute to the development of the global network and regional enhancements. Pilot projects will also be an important vehicle for the incorporation of new scientific knowledge and technologies into the observing system (transformation from research applications to operational modes). Both pilot projects and enabling research programmes will be essential to capacity building and the scientific advances required to grow the system into a fully integrated and operational observing system. In this regard, mechanisms are needed to enable the exchange of information and technologies among pilot projects so that they may learn from each other’s successes and failures and to insure the incorporation of GOOS design principles and the development of common techniques, models, and data processing strategies. This is particularly important for the data management subsystem if data and data products are to be exchanged in a timely fashion on regional to global scales.

Although government funding will be essential, especially for large capital-intensive components of the observing system such as satellites, funding from the private sector will be required in the long term. In these regards, the importance of National and Regional GOOS Programmes cannot be overemphasized. These programmes are vehicles for implementation. They provide important means for facilitating the user input required to implement and enhance the core programme and for institutionalizing mechanisms for sustainable funding.

#### **1.4 GOALS OF GOOS FORA AND EXPECTATIONS FROM THIS FORUM**

Worth Nowlin explained the objectives of the GOOS Forum.

One of the key tasks for the Coastal Ocean Observations Panel (COOP) will be to devise mechanisms for interacting with stakeholders, so as to derive information about user requirements. It would be impossible for COOP to interact directly with all user groups, most of which are private entities, national organizations, or multinationals with local (national level) needs. As a start, three mechanisms have been suggested for identifying user needs and for consulting users on the emerging GOOS design; other mechanisms may emerge in due course.

GOOS Users Fora. Proposed is an annual forum attended by members of COOP and representatives of National GOOS Coordinating Committees (or Steering Committees) and of regional GOOS bodies (e.g., EuroGOOS, NEAR-GOOS, MedGOOS, etc.). These two latter sets of organizations are closest to the user community and are in any case charged with identifying user needs. Thus they represent proxies for broad groups of users.

Dialog meetings. These are meetings of GOOS representatives with representatives of the user community (a mechanism used by ICES). These would be regional and focused on specific regional interest(s). The organization of such meetings could be the responsibility of interested professional associations (e.g., regional organizations such as PICES or trade associations).

Marketing activities. These are activities designed to match user requirements with GOOS developments by making opportunistic use of existing groups and meetings.

The objectives of the GOOS fora are to:

- Regularly communicate user needs to COOP, and COOP developments to users;

- Strengthen the GOOS network through interactions and the trading of information between GOOS bodies;
- Strengthen individual National GOOS Coordinating Committees by exposing them to activities of other nations and regions and by recognizing their central role in assembly of user needs;
- Link the COOP to the national and regional operations of GOOS.

## **2. GOALS, PRIORITIES, AND STATUS OF CURRENT NATIONAL AND REGIONAL GOOS EFFORTS**

Representatives from national GOOS committees (Argentina, Canada, Chile, China, Colombia, Costa Rica, Cuba, Greece, Mauritius, Norway, Peru, Poland, Russia, Spain, Trinidad and Tobago, USA and Venezuela) and regional GOOS programmes (EuroGOOS, MedGOOS, BOOS, IOCARIBE-GOOS, Pacific GOOS and NEAR-GOOS) provided reports on national and regional GOOS activities. The reports are listed in Annex III. (Dr. Zhouwen Yu, China was not able to participate in the Forum but had provided reports on Chinese and NEAR-GOOS activities).

Following the presentations by the national and regional GOOS representatives, Colin Summerhayes provided information on some of the international Conventions and regional environmental treaties, which could be potential users of GOOS products. This report is listed in Annex IV.

## **3. ISSUES AND PRIORITIES TO BE ADDRESSED BY COOP**

Recognizing that there were a number of common threads running through the various national and regional presentations, it was agreed that a sensible way to capture this information for the members of COOP would be to ask groups of national and regional participants to work to distil their views into succinct advice by having them consider three key questions.

The participants were divided into three working groups:

- Group A: Narayanan (Chairperson), Troisi, Perez, Tsiavoz, Vargas, Gajewski, Smirnov, Fogarty, Cullen (Rapporteur) and Harris;
- Group B: Johannesen (Chairperson), Ñáñez, Garcia, Salinas, Lavrenov, Hall, Bowen (Rapporteur), Thompson, Moloney, Kawamura and Harrison;
- Group C: Parilla (Chairperson), Soldi, Nieto, McShine, Piechura, Summerhayes (Rapporteur), Depledge, Shuval, Botello, Calliari.

Each of the three working groups was asked to discuss the following three questions:

- QUESTION 1:       What mechanisms can be used to involve user groups in the design, implementation and operation of the coastal ocean observing system?
- QUESTION 2:       How are national and regional priorities to be met by the observing system?
- QUESTION 3:       What processes should be used to enhance capacity?

Following the break out session each of the three working group rapporteurs presented a synthesis of their respective working group discussions.

### **Group A**

S.Narayanan (Chairperson) and Cullen (Rapporteur)

The group discussed extensively some fundamental issues in the design and implementation of coastal GOOS. Communication and capacity building figured prominently. Other issues related to implementation and operations were also discussed.

#### *Communication*

It was recognized that dialog between users and COOP will drive the design phase. Information must flow *from the users to COOP*. Procedures must be established to identify their needs, capabilities, and willingness to work toward the implementation of COOP objectives. It is quite a challenge to collect information from a very broad range of potential users from many different regions, and harder yet because many potential users of a coastal GOOS are unfamiliar with what it might offer them. Consequently, effective communication *from COOP to potential users* is also essential to design and implementation. Users must be informed about opportunities that exist, the technologies that might be used, and the range of data products that can be provided. Further, COOP must provide guidance and structure for the design process.

The all-important dialog between COOP and users must be conducted through mediators who know the users, are familiar with the principles of GOOS, and who can communicate effectively with COOP. Discussions and consultations with user groups should be conducted on scales appropriate to the issues: local, national, regional, global. This will require a range of approaches and structures for communication. The group felt that the issue of two-way communication between COOP and users would be best addressed at the national level. This does not mean that activities must be conducted at the national level; rather, the responsibilities for communications should be assigned to representatives or representative bodies at the national level.

Countries would have offices or officers responsible for coordinating the flows of information between COOP, users, and the general public. As appropriate, national representatives would coordinate local efforts within a country, or join with other countries to conduct efforts regionally.

#### *Coordination of design, implementation and operation*

Countries should also be responsible for coordinating the design and implementation of their components of coastal GOOS, as part of regional groups as appropriate. This is not the same as the communications component, but clearly it should be coordinated with it. Much work will be required to secure funds and to establish procedures for data management and distribution. Agreements must be developed on local to regional and global scales, coordinated at the national level. During the operations phase, procedures must be established for periodic review and revisions of the plan.

### *Capacity building*

The benefits of GOOS will be realized broadly only through capacity building throughout the world. Even at the design stage, there is a great need to provide information and training to potential users, so they can participate in planning for observation systems that will meet their needs. Capacity building goes hand in hand with the communications component of COOP, with an added level of technology transfer between countries. The group felt that capacity building should be driven by needs, which are tied to issues that are shared at local, national and regional levels. So, as with communications, the national level is key in coordinating capacity building.

It was felt that efforts toward capacity building could be coordinated with or added to well-established international programmes, several examples of which were mentioned. Lessons that have been learned should be remembered, though. Training and capacity building should address concrete problems on the local or national level: new skills and tools should address real needs. In turn, training is only useful if the new skills and tools can be put to use by the participants in the homework environments. This requires investments in infrastructure (e.g., equipment) with adequate and lasting commitments for supplies and repairs. One approach to capacity building for GOOS would include collaborative visits between countries - internships during which personnel from less developed countries would be trained, and reciprocal visits during which experienced personnel would work with local personnel on implementation at new sites.

### *Technical Standards*

Some of the properties to be measured by a coastal GOOS will be quantified by different groups using different methods (possible examples include estimation of zooplankton biomass by net tows vs. acoustics and measurement of light penetration with a Secchi disk vs. radiometer), so there will be a need to establish standards and procedures for reconciling comparable observations. Much of the work has already been accomplished by other international programmes, but more must be done. It is very important that the process be sensitive to regional needs and local capabilities. Participation in the standardization process could be part of capacity building, and it would benefit all whom contribute.

### **Group B**

Johannessen (Chairperson) Bowen (Rapporteur)

The group addressed the three assigned questions in order but suggested an enhancing modification to Question 1. As regards mechanisms to effectively involve the user community in the design, implementation and operation of the COOP system, the Working Group argued that the process of continual evaluation should be added to the list to ensure that COOP would appropriately evolve over time in response to ongoing assessments of its programmatic successes and failures. With user community relationships built around the ***design, implementation, operation*** and ***evaluation*** in mind, the group provided the following responses.

- There exists the need for a free, open, honest and continual dialog with the user community designed toward the development of a long-term partnership. In initiating user dialog GOOS/COOP should provide an initial template characterizing a scientific view of the relationship between critical environmental parameters, proposed GOOS/COOP activities and user interests. This approach was viewed as a more effective

and structured strategy than one that begins with open-ended questions asking the user community to identify their GOOS/COOP related needs.

- By providing such a template GOOS/COOP would provide the information needed for a structured and informed response from users and would be in a better position to develop a broad and shared understanding with its user community.
- One early mechanism to establish a shared understanding is the use of “Charettes” – a tool to facilitate the building of common perceptions on commonly held design problems<sup>1</sup>. Charettes have been successfully used in the past to maximize the likelihood that the process will begin with a shared vision for the future and a set of commonly held goals.
- Three fora were identified as holding the greatest promise to begin dialog with the user community:
  - The design process for COOP Pilot Projects,
  - The design of reporting products for specific user groups,
  - Descriptions of historically important catalytic events where GOOS/COOP information could have mitigated or prevented unwanted consequences.
- The generation of GOOS/COOP reporting products should be of real and direct value to the user community and should take fullest advantage of graphic display, information management and animation technologies. GOOS/COOP should take greater advantage of a “market analysis” perspective to determine user needs, in general, and to design reporting products, in particular.
- GOOS should actively develop partnerships and programmes to enhance the use of GOOS data and results as educational tools. Educational efforts should be broadly focused to include, *inter alia*, the cooperative development of video and other multimedia forms, the building of classroom curricula for all ages, and, the establishment of cooperative agreements with aquariums and science museums with an eye towards the development of compelling public education exhibits and programmes.
- Regional Analysis Networks/Regional Analysis Centres (RAN/RAC) should be established to extend to critical work of GOOS data management into the equally critical areas of data synthesis, analysis and analysis products, capacity building educational programmes, and the facilitation of within region partnerships/exchanges. Part of the mission of these RAN/RACs should be to ensure that user and scientific needs are met at local, national, regional and global scales. Accordingly, GOOS should also work to establish globally focused centers (with broad data management, analysis and modelling missions) to ensure that the global mission of the programme is guaranteed.
- GOOS/COOP should also build data analysis partnerships with private firms as a vehicle to meets specific user needs.

## **GROUP C**

Parilla (Chairperson), Summerhayes (Rapporteur)

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<sup>1</sup>The term *charette* comes from the architecture community and is classically described as an exercise wherein architecture students are given a common task and are asked to create a plan in response. The exercise is time limited and is used to show how different visions can emerge from a common theme. More recently and more broadly the American Institute of Architects has used the idea to sponsor community *charettes* where stakeholders are brought together to work out a common vision for community development. The concept has also been used to create a common, stakeholder driven response to environmental issues. In the COOP context it is used to convey the idea that different visions can be sought in response to the common theme of stakeholder needs with the goal of allowing the *charette* participant to hear and consider those alternative views, or "visions", and to achieve a sense of consensus.

QUESTION 1: Identify mechanisms to involve user groups in the design, implementation and operation of the coastal ocean observing system.

Countries should be encouraged to form National GOOS Coordinating Committees, which should bring together all stakeholders to steer the development of GOOS at the national level. These committees could be parallel to or subsets of National Oceanographic Committees, the difference between them being that NOCs do not usually include representatives of all major stakeholders.

A range of mechanisms should be used to raise awareness of GOOS so as to attract potential users and stakeholders. These could include for example:

- (i) public meetings with local communities around major port or tourist complexes where there are many potential users and possible conflicts of interest;
- (ii) seminars or workshops targeted at particular users groups, such as the fishing industry, or the tourist industry, or port and harbour authorities;
- (iii) demonstration projects involving investment in (say) coastal HF radar for port authorities, with results provided free for a period then at some cost (as with the US PORTS project);
- (iv) attracting NGOs to help to identify the full range of users, and to work in support of establishing GOOS for particular purposes (e.g. marine conservation), recognizing in addition that NGOs can often form very effective political lobbying agents;
- (v) advertising GOOS and its potential products via TV, radio and the press (a method used with success to identify new user communities in Peru);
- (vi) working through education programmes, like the Train-Sea-Coast programme (as applied for instance in Brazil), which raised awareness and gained potential customers (like port authorities).

Much greater use should be made of basic marketing techniques, which work through dialogue with potential users (a) to find out what their needs are and what they do now to meet them, and (b) to show them what can be done by the GOOS approach to meet the same needs more efficiently and effectively. This type of approach might be especially useful for industries like tourism, where the users have a low level of technical experience.

Economists should be entrained in the process at the national level to help to determine the costs and benefits of doing GOOS locally.

QUESTION 2: How are national and regional priorities to be met by the observing system?

To start with the national agencies involved in producing information needed to meet priorities should be linked into a network the aim of which should be to raise the level of communication and reduce the level of duplication. Within the network efforts should then be made to link parallel data streams, for example physical oceanography and ecotoxicology, to demonstrate the interdependence of many measurements and to exploit the potential of taking an interdisciplinary approach. Within the network it would be profitable to identify critical national centers capable of pulling information together and integrating it to produce the higher-level products users might need. The operators of the network and the centres would be expected to identify with users the products required to meet the priorities, and to package data and information in different ways for different users (and priorities).

Much the same process would be needed at the regional level, which could be considered as relying on a network of national networks. In some the need for higher level information centres might be best met at the regional rather than the national level (or one national centres might double as a regional centre). The European Centre for Medium Range Weather Forecasting (ECMWF), in the UK, is an example of a regional centre. In Baltic GOOS it has been agreed that centres in one or two countries will produce certain types of forecasts (e.g. wave forecasts) on behalf of all, because there are not sufficient skills to do this in all Baltic countries.

Meeting national and regional priorities (and user needs) would probably require the provision of data and information at different levels for different purposes or users. For example, some users might want raw data (level zero); others might want raw data that had been through basic processing (level 1); yet others might want simple products like maps of sea surface temperature (level 2); others might want products integrating data from a variety of sources (satellite and *in situ*) (level 3).

Meeting some priorities (e.g. for health and safety) would require alerts, early warnings, and other forecasts – for example early warnings of the development and trajectory of a harmful algal bloom. After a bloom had become established, authorities might require status reports, for instance as the basis for health warnings to tourists, or as the basis for closing beaches or shellfisheries.

Addressing priorities for information might lead to development of a variety of delivery mechanisms, including TV, radio, and press for the general public, as well as telephone, fax or internet information services, with the provision of information on CD-ROMs to meet the priority needs of particular user groups.

QUESTION 3:           What processes should be used to enhance capacity?

Capacity could be enhanced through three avenues.

- (i) In developed and developing nations alike, capacity could be enhanced through the application of new technologies, such as Argo. Investment in the development of new technologies is essential to enable observations to be collected faster and cheaper in future, and to make new kinds of observations.
- (ii) To enable developing countries to participate in, contribute to, and benefit from GOOS, they need their capacities built in the following areas, depending on their level of development.
  - (a) Technical capacity: this includes technology transfer (where technology means processes as well as equipment); plus the deployment of equipment and training in its use; PLUS (commonly neglected) provision for the continued operation of the equipment and its maintenance after installation;
  - (b) Human capacity: this includes a full range of educational and training programmes, which nowadays should capitalize on the use of the internet and other media for distance learning, not forgetting that to be fully effective distance learning has to be backed up by one-on-one or group tutorials. Training in modelling was regarded as very important, since modelling provides a means of adding value to data.
  - (c) Organizational capacity: this involves building appropriate institutions, which could mean networking present ones, strengthening or adapting present ones, or

building new ones. It would benefit from the development of centres of excellence, which could be regional or national centres of education, training, or operations covering all of marine science or focusing on particular aspects of it. Regional GOOS institutions could help to build awareness at national levels across the region.

- (d) Processes: this should be taken to mean the development of regional or national capacity through participation in the research or operational process, for example the EuroGOOS task team for the South Atlantic, or the Mediterranean pilot projects on forecasting (MFSPP) or on data archaeology (MEDAR). Ideally regional projects should be long term, for example like the eight yearlong CARIPOL project dealing with oil pollution in the Caribbean.
  - (e) Long term: *Ad hoc* courses now and then are NOT ideal. What is needed is commitment to building capacity on a broad front over a long period, so that the nation or region can go it alone in due course.
  - (f) Partnerships: while the IOC's TEMA (training, education and mutual assistance) programme has worked well in some respects, it might be more effective if it worked in close partnership with the marine capacity building programmes of UNEP and WMO. This is likely to happen in future with WMO under the banner of JCOMM.
  - (g) Best practice: the Users' Forum should be continued as one means of passing on best practice. Other mechanisms include through publication of reports and other information on the GOOS web page, and through the networking of national and regional GOOS bodies through the contact listings on the GOOS web page.
- (iii) Resources are required to underpin both (1) and (2) above. This requires dialogue with donors, to bring them on board, and to get them to accept local priorities. It also requires careful consideration to be given to packaging – to meet donor interests (e.g. the GEF's focus is on climate change). Alternatively, new programmes can be made to focus on donors' interests and to build capacity just in those areas they are willing to fund.

Following the presentations from the working group sessions, The Forum discussed the reports.

In the discussion of how to establish useful dialogue between users and the COOP, it was suggested that GOOS Users' Fora should be organized with rather narrow regional or thematic foci. Another suggestion was to use the *GOOS Products and Services Bulletin*, which will have space for user feedback.

Another issue raised concerned the marketing of GOOS. Although many examples of products and user needs have been given to justify physical measurements, examples of products and user needs based on biological and chemical measurements are few and more are needed.

Attention also was drawn to the fact that measurement protocols (e.g., standards and calibration methods) should be established. It should be made clear who will be responsible for developing needed new procedures. It was noted that, although measurement protocols exist for many areas (e.g., those recommended by the ocean color community, the IOC and JCOMM), those for some areas are missing and others are in need of update.



In summary, the chairman noted first that the presentations by individual countries and by regional GOOS groups had shown that while many nations and regions are now trying to implement GOOS principles and practices, there is a common need for more clear design advice and for more capacity building. He observed that the three strategic design plans produced for the COOP meeting would provide more initial guidance than had previously been available, and that over the next year to eighteen months, COOP would improve that advice yet further. As far as capacity building is concerned it is clear that there is much still to be done.

The chairman noted the common threads that had emerged from the deliberations of the three working groups. He did not propose to summarize this information, all of which would be used in the following three days as advice from the user community to the members of the first session of COOP. It would be the task of COOP to take this advice from users and use it to best advantage in developing the next phase of the design. The input on capacity building would be useful to COOP in the design of pilot projects, and to the capacity building panel of GOOS in developing its plans. He expressed himself pleased with the outcome, which showed a considerable degree of unanimity among the various participants as to what was required for the future.

Colin Summerhayes noted that even though implementing GOOS is a multi year effort the meeting had showed that GOOS is starting to take form at the national and regional level. This is very encouraging news.

#### **4. CLOSURE**

On behalf of the sponsors of GOOS, Worth Nowlin thanked all the participants who attended the Forum. He also thanked Manuel Murillo and his staff for their hard work and excellent logistical and social arrangements for this meeting. He closed by wishing the COOP members success in their efforts.

## ANNEX I

### AGENDA

Monday -13 November 2000

#### A. OPENING PLENARY

1. Welcoming remarks
2. Discuss and adopt agenda
3. Overview of GOOS  
Focus on user-driven approach; include relationship of the Coastal Ocean Observations Panel (COOP) to national and regional GOOS programmes
4. Goals of GOOS Fora and expectations from this forum

#### B. GOALS, PRIORITIES, AND STATUS OF CURRENT EFFORTS (plenary)

Towards international co-operation, coordination and development of the global system. What are the user needs? What are the expectations regarding contributions and collaborations?

1. National programmes (Presentations by representatives of national GOOS committees)
2. Discussion of regional GOOS groupings.  
Attention will be called to the Discussion of Regional GOOS Groups<sup>1</sup> prepared by the GOOS Steering Committee (GSC) and offered as a background document.
3. Regional GOOS activities and/or pilot projects (Presentations by representatives from regional GOOS programmes)

#### C. ISSUES AND PRIORITIES TO BE ADDRESSED BY COOP (plenary)

1. Attention will be called to the preliminary designs<sup>2</sup> offered as background documents for the sub-modules: Living Marine Resources (LMR), Health of the Oceans (HOTO), and Coastal GOOS (C-GOOS). Questions will be discussed.
2. Discussion of issues to be addressed by working groups.  
These might include: user needs; capacity building; and priorities for design and implementation of the coastal component of GOOS. Attention will be called to the GOOS Capacity Building Strategy<sup>3</sup> offered as a background document. Identify chairs, rapporteurs, and charges.
3. Organize working groups

Tuesday -14 November 2000

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<sup>1</sup> Available at: ([http://ioc.unesco.org/goos/regional\\_groups\\_final.rtf](http://ioc.unesco.org/goos/regional_groups_final.rtf))

<sup>2</sup> Available: late October 2000 only.

<sup>3</sup> Available at: ([http://ioc.unesco.org/goos/Cap\\_Build\\_principles.pdf](http://ioc.unesco.org/goos/Cap_Build_principles.pdf))  
([http://ioc.unesco.org/goos/Cap\\_Bldg\\_Plans.doc](http://ioc.unesco.org/goos/Cap_Bldg_Plans.doc))

D. WORKING GROUP MEETINGS

E. REVIEW AND DISCUSSION OF WORKING GROUP SUGGESTIONS (plenary)

1. Reports from WG chairs
2. Summary and formulation of recommendations
3. Suggested follow-on activities

F. CLOSURE

## ANNEX II

### LIST OF PARTICIPANTS

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## ANNEX III

### REPORTS FROM NATIONAL AND REGIONAL GOOS COMMITTEES

#### A. ARGENTINA NATIONAL REPORT

The Southwestern Atlantic is characterized by the confluence of the Brazil and Malvinas currents, the fresh water and sediment contribution of a mayor river as the Río de la Plata, extreme tidal amplitudes ranging up to almost 13 meters, a very extended shelf with its own and peculiar circulation and an intense land-ocean-atmosphere interaction which, added to the rest of natural and anthropogenic forcings, make of this a very complex system.

We have experienced the depletion of fish stocks, suffered the effects of storm surges and floods, as well as the consequences of interrupting along-shore currents with breakwaters and jetties which led to sand bank formation and coast line modifications. Nevertheless, it still supports a very rich and diverse environment, an important industrial and fisheries activities, several million people living in the coastal areas and an ever-increasing use of the water bodies for recreational and commercial purposes.

Between our main concerns is to attain an appropriate knowledge of the region, especially regarding sea level, currents, waves and meteorology, in order to achieve an integrated management of the area. On the other hand, the requirements and needs of a great variety of current and potential data and services users (government offices, port authorities, civil defense, universities, public services, fisheries, tourism, NGOs, etc.) must be properly addressed. Some of our challenges are related to the following topics;

- Observations
- Modelling
- Data and information exchange
- Capacity building

In order to reach our goal, we are finding good results in focusing these issues according to different levels, *id est* local, national, bi-national and regional level, organizing them into a nested type system. In this system the national level plays a key role channeling the flow of information and having the capability to fully appraise the needs, limitations and willingness and seek the necessary guidance and opportunities.

At the local level some programmes have been running already for more than a decade. Such is the case of the Rio de la Plata Southern Coastal Area Water Quality Monitoring Programme, an area supporting the effects of a population above 12 million and concentrating almost 50% of the maritime traffic.

At the national level, for example, there are several initiatives leading to the implementation of a Federal Emergency System, which will include an important observational and modelling component. Another initiative is the Coastal Pollution Prevention and Marine Biodiversity Management Project covering an area extending from Necochea (Buenos Aires) to Ushuaia (Tierra del Fuego), expected to complement the outcome of a similar bi-national programme focused on the Rio de la Plata and its maritime front. And going further south, we have the Antarctic research programmes with a strong component devoted to analyze circulation patterns and tides along the peninsula.

At a regional level, and at different development stages, there is the QUIJOTE Pilot Project and the OCEANOS Project, which look forward not only to the observation and



analysis phases but also to the implementation of a regional network through which results and future initiatives can be made available to the community.

Being the information and data exchange a cornerstone to any development, a metadata base was made available to the community through the National Oceanographic Data Center's website (<http://www.hidro.gov.ar/ceado/metadata/metadata.htm>) containing its data holdings as well as that of other institutions. This initiative will hopefully encourage individual researches and organizations release either the data or, at least, the reference information.

Undoubtedly efforts to identify users must continue, as well as those related to capacity building and the creation of awareness of the usefulness of observational systems.

## **B. CANADA NATIONAL REPORT**

### **1. INTRODUCTION**

Canada, bordering three oceans of the Northern Hemisphere, the Atlantic, Pacific, and the Arctic, recognizes the importance of coastal ocean observing programmes in ecosystem management. The Oceans Act in Canada authorises the Minister of Fisheries and Oceans to lead the development and implementation of a national strategy for oceans management based on the principles of sustainable development, integrated management of activities in estuaries, coastal and marine waters, and the precautionary approach. To meet this requirement, Canadian coastal regions are divided into a number of Integrated Coastal Management Areas (inside which there may be Marine Protected Areas), and management plans are being developed for each. The integrated management approach for the oceans will entail planning that will take into account the interests of all users and regional differences while ensuring the structured management of activities.

Canada continues its support of GOOS as the principal international mechanism for obtaining long-term systematic observations of the marine environment, both regionally and globally, to meet a broad range of user requirements. This support involves Canadian participation in the planning of GOOS through its panels, working groups, and I-GOOS, as well as through Canada's support of the infrastructure that is being used to implement GOOS. Canada also contributes more directly to GOOS through the designation of parts of its long-term monitoring effort as contributions to GOOS and does so in a manner that is consistent with the GOOS Principles. In addition, Canada is encouraging the development of capabilities fundamentally important to GOOS through support of a variety of projects in partnership among university and government researchers and in some cases the private industry.

### **2. CANADIAN GOOS ORGANIZATION AND PLANNING**

Within Canada, the responsibility for the planning and implementation of ocean observing systems rests primarily with the Department of Fisheries and Oceans (DFO).

Potential contributions to GCOS, including the ocean, terrestrial and atmospheric elements as well as the required augmentation of the sparse GCOS global network to provide the enhanced climate observing system needed to meet Canadian national interests, are being defined. Canada's additional ocean climate observations, beyond those required for GCOS, will be taken on the continental shelves and in the oceans directly off Canada's coasts.

Collaborations are established with other departments and agencies to include those variables for which the responsibility falls outside DFO. Within this framework, ocean monitoring programmes are being developed for the ocean off both the Atlantic and the Pacific coasts and to a lesser extent for the Arctic. They have been designed to meet various Canadian requirements for marine environmental information and have elements relevant to COOP.

### **3. STATUS**

Integrated coastal zone management is a continuous planning process in which stakeholders and regulators reach general agreement on the best mix of conservation, sustainable resource use and economic development for coastal areas, to achieve the goals of conservation, sustainable use of coastal resources and economic diversification. Even though there are unique socio-cultural, environmental and economic factors affecting each of Canada's coasts, there are a number of key elements that are common in all planning initiatives. These include:

- A co-ordination, consultation and planning process, designed to derive general agreement, but providing for conflict resolution, when required;
- A process to facilitate full stakeholders involvement;
- A comprehensive programme of education, research and communication;
- An improved system of access to information and to regulatory processes; and
- A programme of monitoring, evaluation and feedback.

Presently, a number of integrated management pilot projects are being implemented which will provide, among other things, guidance for establishing an appropriate monitoring programme for each Management Area.

Concurrently, the scientific community in Canada has been developing a set of initial observing systems for the coastal areas and particularly for the living marine resources. The first in this sequence was the establishment of an Atlantic Zonal Monitoring Programme, a collaborative effort among 5 regional institutions. Elements of this programme include repeated sampling of physical, chemical and biological variables at selected fixed sections and stations, standardization of methods and instrumentation, remote sensing, 'real-time' dissemination of data, annual review of the project and publication of the 'state-of-the-environment report', and scientific research.

A second initiative is to develop and implement a LMR monitoring programme in Canada, which will provide:

- A sustained, long-term assessment of the state of the ocean
- Improved understanding of the structure and function of ecosystems
- Indicators and products useful for the broader conservation objectives of integrated oceans management.

Also under development are monitoring programmes in the Arctic and the Pacific which will be implemented in collaboration with the communities in the respective regions, and when appropriate with other countries.

Data management is an important component of the Canadian Ocean Science programmes. Recently, a data policy has been developed by the Fisheries and Oceans, which will facilitate timely and free access to most of the observations. Data models are also being implemented for biological and chemical data and standards and formats are being developed.

In this regard, Canada collaborates with international groups through ICES, PICES, NAFO and IOC.

Canada has also taken some important steps in the development of operational systems of the coastal ocean that transform marine observations into products made available to a wide range of users. Recent examples include forecast systems for sea ice distributions, surface currents and sea level. Applications include marine navigation, search and rescue and flood mitigation. The Department of Fisheries and Oceans, in collaboration with other government agencies and universities is planning to increase the range of variables to be forecast including biological quantities such as ocean productivity.

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## C. COLOMBIA NATIONAL REPORT

(Colombian Commission of the Ocean – CCO)

### 1. INTRODUCTION

During the last year, the Colombian Commission of the Ocean (Comisión Colombiana del Océano – CCO), in its role of GOOS National Committee Coordinator, has been working on the planning and implementation of the GOOS in Colombia, developing for this the National Marine Information Network. The NMIN identifies the organizations, programmes, projects and researchers that are working on GOOS related topics.

Now, Colombia is developing researches in the five modules of the GOOS, with special interest in Climate Change and Climate Variability in the coastal areas of the country. Other topics that have special interest in its study are the living resources and the other related programmes.

The development of the National Marine Information Network will help the actors to have information of each of the different researches and of the different projects. Also, the network will play the facilitator role to identify the wants and needs of the GOOS system users in Colombia and to find the solution to their requirements.

Colombia has played an important roll in the development of the Strategic Regional Plan, with an active participation in the different meetings and panels.

### 2. COLOMBIAN GOOS ORGANIZATION

Within Colombia, the Colombian Oceanographic Commission (Comisión Colombiana del Océano – CCO) leads the GOOS and coordinates all the organizations related to the marine research activities. The CCO leads these themes in collaboration with the Environment Ministry, Transport Ministry, Education Ministry, Agriculture Ministry, General Maritime Direction, and other organizations.

To achieve the national proposes regarding the maritime observation, are in process of developing some plans to implement the capacity of continue monitoring the climate and its variability.

### **3. LINES OF RESEARCH:**

Colombia develops its programmes and researches in the following themes:

- Paleooceanography
- Modelling the evolution of the coastal line
- Marine Ecology, Biodiversity and marine Ecosystems
- Development of the Marine Environmental Information System (Sistema de Información Marine Ambiental – SINA), working with the SIG Geographical Information System and the Documentation, Information and Reference Centre
- Coastal Geomorphology
- Marine Pollution
- Integrated Coastal Zone Management
- Oceanographic Data Service
- Physical Oceanography
- Numerical modelling of coastal and ocean circulation and polluting processes
- Cartography, production of thematic charts
- Physical environmental studies
- Marine Mammals
- Chemical Oceanography
- Hydrology
- Tsunami warning and reporting system
- Marine Meteorology
- Mareography
- Climate Change
- Coral Reefs

### **4. GOOS NATIONAL USER WANTS & NEEDS**

For Colombia it is very important to have general information (physical, chemical and biological) to develop knowledge in its marine and coastal environment, as a base to complete the Vision of the National Environment. For this reason, it is necessary to have the elements for measuring and analyzing the Colombian marine and coastal zones, its physical, chemical, biological and atmospheric variables.

### **5. DEVELOPMENT PLANS**

Colombia has already a base installed, in terms of equipment, organization and professionals with experience in marine environment development. There are oceanographic research platforms (Colombian Navy oceanographic research ships), tide and oceanographic variable measure instruments, two regional research centres (Centro de Investigaciones Oceanográficas – CIOH, and the Centro de Control de Contaminación del Pacífico – CCCP), two national research institutions (Instituto de Hidrología, Meteorología y Estudios Ambientales – IDEAM, and the Instituto de Investigación INVEMAR).

In complement of the above exposed, at the universities are different developing professional programmes and researches in themes related to living resources (marine biology), meteorology and geology.

To cover the most urgent information needs are used the data from different meteorological and oceanographic stations, located in the coastal zones of the country. Other sources of data are the remote sensors in AVHRR of the NOAA satellite, with the temperature of the sea surface, and the SeaWIFS of the Tristar satellite, with the ocean color information.

This information is available for the community usage, generation of monthly reports and daily public information by radio or Internet.

To improve the capacity of the information base installed, Colombia plans to increase the measures *in situ* on the marine zones by the installation of meteorooceanographic buoys on the Colombian Caribbean and Pacific waters, plus getting the information caught by the satellites.

The first step will be the installation of four (4) buoys, two on the Pacific and the other two on the Caribbean. It is the interest of Colombia to participate in the ERFEN project, led by Chile, in the installation of this kind of buoys.

#### D. CHILE NATIONAL REPORT

(Chilean National Oceanographic Committee)

##### 1. INTRODUCTION

During the last three years, the Chilean National Oceanographic Committee (Comité Oceanográfico Nacional de Chile – CONA) has been organizing several activities related to the planning and implementation of the GOOS observing system in Chile.

This document serves to describe the activities that are performed by the Marine Institutions and Universities that form part of CONA.

##### 2 NATIONAL GOOS COORDINATING COMMITTEE (Chilean-NGCC)

A National Coordinating Committee for GOOS has been established to develop, plan, coordinate and implement the necessary infrastructure to support operational oceanography and marine meteorology. This Committee is part of the workgroup Ocean and Atmosphere Dynamics:

Dagoberto Arcos  
Instituto de Investigación Pesquera  
(INPESCA)  
Talcahuano – Chile  
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Rodrigo Nuñez  
Departamento de Oceanografía  
Servicio Hidrográfico y Oceanográfico  
(SHOA)  
Valparaíso – Chile  
Email: [rnunez@shoa.cl](mailto:rnunez@shoa.cl)

José Rutllant  
Departamento de Geofísica (DGF-  
UCHILE)  
Universidad de Chile  
Santiago – Chile  
Email: [jrutllan@dgf.uchile.cl](mailto:jrutllan@dgf.uchile.cl)

Sergio Salinas  
Escuela de Ciencias del Mar  
Universidad Católica de Valparaíso  
(ECMA-UCV)  
Valparaíso –Chile  
Email: [ssalinas@ucv.cl](mailto:ssalinas@ucv.cl)

Osvaldo Ulloa  
Programma de Oceanografia Física y  
Clima (PROFC)

Universidad de Concepción  
Concepción - Chile  
Email: [oulloa@profc.udec.cl](mailto:oulloa@profc.udec.cl)

### 3. SEA LEVEL NETWORK (GLOSS and Pacific Tsunami Warning System)

The Chilean contribution to GLOSS and to the Pacific Tsunami Warning System, covers installation, operation and maintenance of 20 sea level stations located between latitude 18° S and the Antarctic Peninsula (Base Prat).

The network was updated from bubbler type gauges and digital platforms to one of the latest generations of digital collector platforms (DCPs) linked via satellite. The installation of all the platforms north of latitude 42° S was completed during May of 1999, leaving only four stations to be replaced. Near real-time data can be obtained down loading the data directly from the GOES-East satellite, from the University of Hawaii Sea Level Centre (UHSLC) or from <http://www.shoa.cl/oceano/depto/frontpage.html> (graphic displays of sea level, air temperature, water temperature and atmospheric pressure). Data in a delayed mode can be requested from the Centro Nacional de Datos Oceanograficos (CENDOC) at [rrojas@shoa.cl](mailto:rrojas@shoa.cl).

Table 1 and Figure 1 show the geographic location of the sea level stations and transmitting codes for the GOES-East satellite

Table 1: location and code identification of sea level stations			
Station Code	Station Name	Latitude [South]	Longitude [West]
9320E016	Arica	18° 29'	070° 19'
ADC01548	Iquique	20° 13'	070° 10'
ADC020D2	Antofagasta	23° 39'	070° 25'
9321011E	Caldera	27° 04'	070° 50'
ADC033A4	Coquimbo	29° 56'	071° 21'
932127F2	Valparaiso	33° 02'	071° 38'
ADC0063E	San Antonio	33° 35'	071° 38'
ADC04534	Talcahuano	36° 41'	073° 06'
ADC05642	Corral	39° 52'	073° 26'
ADC063D8	Puerto Montt	41° 29'	072° 58'
ADC070AE	Ancud	41° 52'	073° 51'
ADC0935C	Puerto Williams	54° 56'	067° 37'
93214214	San Felix island	26° 16'	080° 07'
140F372	Salas y Gomez Island	26° 25'	105° 28'
93202BDA	Easter Island	27° 09'	109° 27'
93215162	Juan Fernandez island	33° 37'	078° 50'
ADC0802A	San Pedro island	47° 43'	074° 53'
DCP self-contained	Punta Arenas	53° 10'	070° 54'
DCP self-contained	Base Prat (Antarctica)	62° 29'	059° 38'
DCP self-contained	Chacabuco	45° 28'	072° 50'

Figure 1: Geographic location of sea level stations.



#### 4. WOCE HIGH DENSITY XBT PROGRAMME

Chile is involved in the WOCE high density XBT programme, along line PX-50, from Valparaiso-Chile to Auckland-New Zealand and along line PX-25, from Valparaiso-Chile to Japan/Korea. SCRIPPS and SHOA operate both lines jointly.

#### 5. CAPACITY BUILDING

Within Chile, capacity building is mainly carried out by universities and a few marine science institutes. These academic centers provide undergraduate and graduate studies in oceanography, marine biology and atmospheric science: Universidad de Antofagasta; Universidad Arturo Prat; Universidad Austral de Chile; Universidad Catolica del Norte;

Universidad Catolica de Valparaíso; Universidad de Chile; Universidad de Valparaíso; Pontificia Universidad Catolica. Universidad de Concepción, in the south of Chile, has an interdisciplinary Ph.D. programme in oceanography for students from Latin American countries.

## **6. OCEAN SOUTH EAST PACIFIC ARRAY (OSEPA)**

The South East Pacific Ocean is one of the areas of the planet that has no systematic meteorological and oceanographic information. Only the coastal stations and a few islands (Easter Island, Juan Fernandez Island, San Felix Island and Salas y Gomez island) provide information on the sea surface temperature and sea level. The actual knowledge on the oceanographic conditions of the area does not help understand the ocean phenomena occurring along the coast, such as the upwelling processes and continental shelf wave propagation which impact fishing and coastal climate. The initial economical impact of ENSO 1997/1998 in Chile was close to US\$ 655 millions.

Chile is proposing to install an array of buoys that combined with the new upgraded tidal network to monitor the evolution of ENSO to provide inputs for the Regional Models presently being develop to mitigate the impacts on the phenomenon in the coastal area.

This array will consist of 16 buoys (similar to the ATLAS buoys used by the TOGA/TAO array) and 12 current meter arrays installed at 3, 20, 100 and 1000 miles of shore at 20°S, 30°S, 40°S and 45°S. The data collected with this array could be used by Chile, Perú and Argentina, as part of an advanced meteorological warning and monitoring system. *All data collected by this array and by the coastal stations will be freely shared among the scientific community to prevent and mitigate the social and economical impacts caused by El Niño in the Southeast Pacific Ocean.*

The proposed array (OSEPA) has been adopted and extended by the Permanent Commission for the South Pacific (Comisión Permanente del Pacífico Sur – CPPS) to cover the oceanic and coastal waters on front of Colombia, Ecuador, Peru and Chile and now consists of 27 buoys and 17 current meter arrays. A meeting to complete the proposal for this project took place in Concepcion, Chile during August of 1999. The meeting was being sponsored by WMO, IOC and CPPS.

Figure 2 next page shows a schematic diagram of OSEPA.

## **7. EASTERN BOUNDARY CURRENT STUDY OFF CHILE**

Along the coast of Chile two large programmes in oceanography accomplished off Chile. The JGOFS-Eastern Boundary Current study off Chile (1991-1997) and the FONDAP-Mayor Programme 2 “Circulation and physical-biological interactions in the Humboldt Current system and their impact upon regional biogeochemical cycling” (1997-2000)

The general objectives of the FONDAP Humboldt Current System HCS (Perú Current System) are the characterization and evaluation of the influence of remote and local physical forcing and of low oxygen conditions upon: (i) the structure and dynamics of coastal benthic and pelagic systems, and (ii) biologically mediated carbon and nitrogen fluxes in the HCS off Chile.



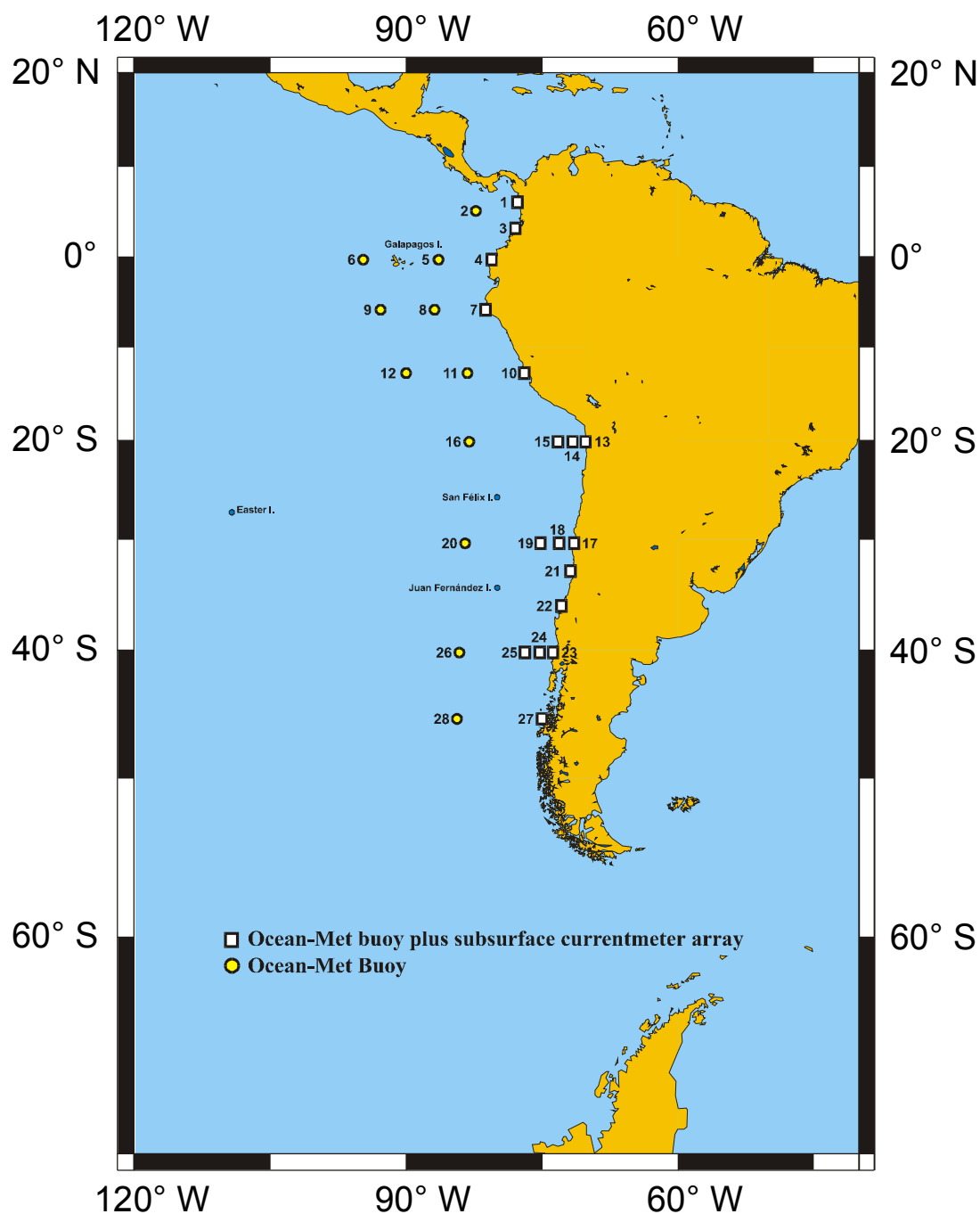
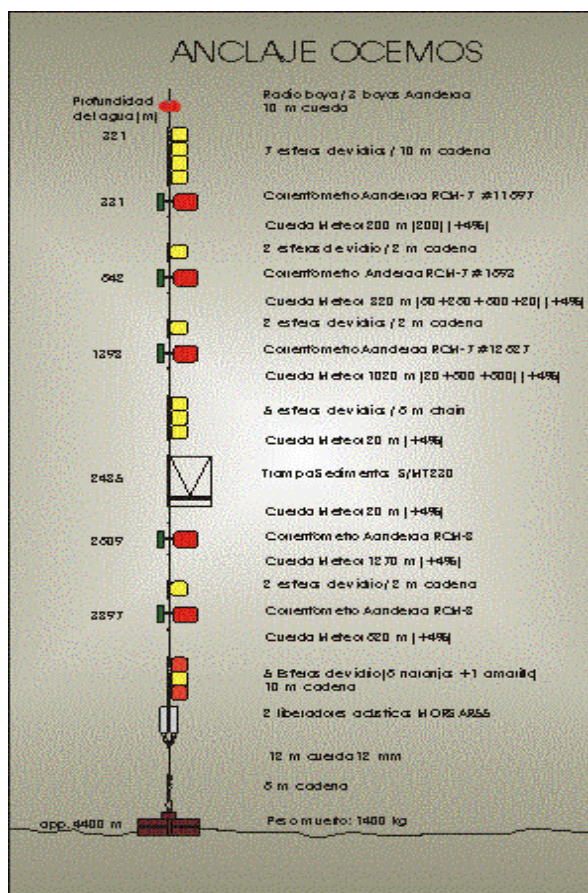


Figure 2: Schematic Diagram of the Ocean South East Pacific Array (OSEPA) as proposed by the Permanent Commission for the South Pacific (CPPS).

Figure 3: the moored array Ocemos off Coquimbo (30°S).



## E. CHINA NATIONAL REPORT

### Needs For Goos Data And Data Products In China<sup>1</sup>

The 21<sup>st</sup> century will be an era of the ocean and the activities of ocean exploitation and utilization will be greatly enhanced. For the sustainable utilization of the ocean, we must know the ocean well and protect the ocean. We are very sure that GOOS, through international cooperation, will help all the coastal countries protect the ocean effectively and exploit the ocean rationally and sustainably. China, like other coastal countries who wish to benefit from GOOS, will do her best to contribute to the development of GOOS.

#### 1. LONG-TERM GOALS EXPECTED BY USERS

From the viewpoint of users' need, we hope that GOOS will become an operational system for data gathering, distribution and exchange through our concerted efforts, which should be similar to the GTS system of WMO for meteorological data service. We believe that such a system will be of great significance for the sustainable development of the ocean and the protection of the ocean. It needs the common efforts of all the countries in the world to build such a system and it also needs a long time. We expect that GOOS will develop in this direction.

<sup>1</sup> Prepared by Zhouwen Yu, National Marine Environment Forecasting Center, Beijing, China

## **2. PRESENT NEEDS FOR GOOS IN CHINA**

Now in China, marine activities are concentrated in the coastal area and in the waters of Northwest Pacific. These activities include marine fishery, marine aquaculture, ocean shipping, offshore oil exploration, etc. For the safety of the marine activities and for the reduction of economic losses caused by marine disasters, we have been making operational routine forecasting of the marine environment. Therefore, we urgently need ocean observational data of the Northwest Pacific Ocean, such as VOS observations, buoy data as well as the near-shore environment data (including physical, chemical and biological data). The international data exchange through the mechanism of GOOS would be one of the best methods to meet such needs.

The coastal area of China is a water area with extensive marine production activities and frequent marine disasters such as red tides, storm surge and sea ice. Pollution caused by human activities, deterioration of the ecological environment and coastal line variation are the problems, which urgently need to be solved. The Chinese government has been paying great attention to the integrated coastal zone management, which needs the formulation of correct policies as well as of the development of science and technology, such as those for coastal monitoring, observational data exchange and processing, and the research on physical, chemical and biological processes. It is certain that the GOOS system, particularly C-GOOS, can provide help to all the coastal countries in their coastal zone exploitation and management as in the framework of GOOS, the countries can exchange data, technology, experience and related scientific results needed in their coastal exploitation and management activities.

## **3. EFFORTS FOR THE DEVELOPMENT OF GOOS**

As a member state of NEAR-GOOS, China has built up the real-time database and the delayed mode database for data exchange in the GOOS framework. The data in the real-time database are updated every day. These 2 databases contribute data to the NEAR-GOOS databases (operated in Tokyo) and they are also open to anyone who is interested in them. Both of the databases have been in good operation.

Besides, China is improving all the monitoring systems, which is of great importance to the development of GOOS in China. Within the next two years, China will update all the equipment of her environment monitoring network, build more than ten new coastal stations, set up VOS observation system and establish a modernized pilot monitoring system in the coastal area off Shanghai, which will include satellite remote sensing, aerial remote sensing, platform-based monitoring, sea-bed-based monitoring and land-based monitoring systems.

We are very confident that GOOS will greatly promote the sustainable exploitation of the ocean in all the coastal countries and promote the protection of the ocean. China will contribute to the development of GOOS and will absolutely benefit from GOOS.

### **F. COSTA RICA NATIONAL REPORT<sup>2</sup>**

The development of marine science in Costa Rica has been an effort between the public universities and governmental agencies promoting science, management, and education. The

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<sup>2</sup> Report presented by Prof. José A. Vargas, Ph.D., Director of CIMAR  
javargas@cariari.ucr.ac.c

study of the marine and freshwater ecosystems of Costa Rica was started at the University of Costa Rica during the mid 1960 decade. Training of graduate students in coastal issues, including marine biology, started in 1975 and continues to date, with many students coming from countries in Central America.

Most of the marine and freshwater research, and graduate training, is presently conducted by the public universities: Universidad Nacional (UNA) and Universidad de Costa Rica (UCR). See IOC Workshop Report No. 158 (GOOS Report No. 84, April 2000)

The Global Ocean Observing System (GOOS) Users Forum and the Coastal Observation Panel Meeting took place 13-17 November at the University of Costa Rica Research Campus and at the Centro de Investigación en Ciencias del Mar y Limnología (Research Centre in Marine Science and Limnology - CIMAR). Both activities are a follow up of the IOCARIBE Users and GOOS Capacity Building Workshop conducted also at CIMAR on April 22-24, 1999.

The following CIMAR Research Programmes are being conducted in the context of GOOS:

**1. COASTAL ECOSYSTEMS** – study of environmental changes in coastal marine ecosystems (coral reefs – mangroves – intertidal flats) and their impacts on people.

Priority areas:	Gulf of Papagayo	(upwelling – tourism)
	Gulf of Nicoya	(estuary - fisheries, ports, aquaculture)
	Dulce Gulf	(fjord-like anoxic basin – biodiversity – tourism)
	Caribbean coast	(reefs, ports, tourism, hurricane impact)

CIMAR is also a member of the CARICOMP NETWORK (Caribbean Coastal Marine Productivity Programme)

**2. COASTAL MARINE POLLUTION** – obtaining baseline information and monitoring of chemical contamination.

Coastal Pollution of Costa Rica (CoCosRi Project) is being conducted at the four coastal systems cited above (10 parameters being evaluated including indicator species, primary productivity, coliform bacteria, chlorophyll-a, suspended sediments, pesticides, metals, hydrocarbons, PCBs, and beach debris).

A Rapid Assessment of Marine Pollutants (RAMP) regional training course was conducted at CIMAR in September 1999, under the Coastal Marine Pollution programme.

**3. Capacity building at the regional level**

A new (2000) Master of Science Programme in Integrated Tropical Coastal Area Management (GIACT) was approved at the University of Costa Rica in 1998.

It was developed as part of the ASFA Networks programme of the European Community and with the participation of universities from Europe and Latin America. The GIACT Programme includes courses in oceanography, sociology and economy as applied to the integrated management of coastal environments. The student is expected to complete the programme in two years, including field research (Thesis).

CIMAR also provides the facilities for the conduction of short regional training courses in coastal issues.

#### **4. SUSTAINABILITY OF LIVING MARINE RESOURCES**

CIMAR has ongoing projects focusing on the evaluation of populations of marine species including statistical analyzes of fishery data, and the application of multivariate techniques to evaluate the relationships between biotic and abiotic factors.

##### **Potential users for GOOS products**

Costa Rica has made a heavy investment in the management of its marine ecosystems. There are several marine parks, including Coco Island (A UNESCO site) located 300 nautical miles SW of Costa Rica in the Pacific Ocean. A high percentage of the population of the country live near or on the coastline. There is an urgent need for data on global parameters such as water temperature and chlorophyll from the Costa Rica Economic Exclusive Zone that is mostly under the direct influence of El Niño and La Niña. The Caribbean coast is frequently under the influence of hurricanes. Thus, governmental agencies, as well as the universities, would benefit most from GOOS generated information.

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#### **CIMAR in numbers**

Founded in 1979. 320 scientific papers to date.  
16 part time scientists (9 Ph.D. - 7 M.Sc.), 22 ongoing research projects.  
For additional data: <http://cimar.ucr.ac.cr>

#### **G. CUBA NATIONAL REPORT**

##### **1. COUNTRY: Cuba**

##### **2. PRINCIPAL NATIONAL CONTACT FOR GOOS**

Name: Roberto R. Pérez de los Reyes  
Function: Chairman of the National GOOS Coordinating Committee.  
Deputy director.  
Address: Institute of Oceanology. Ave. 1ra Nro. 18406, entre 184 y 186.  
Reperto Flores, Playa, Ciudad de La Habana, Cuba. C.P. 12100  
Tel/Fax: (537) 21-6008/33-9112  
E-mail: [rperez@oceano.inf.cu](mailto:rperez@oceano.inf.cu)

##### **3. MECHANISM FOR NATIONAL COORDINATION OF GOOS**

National GOOS Coordinating Committee: CUBA-GOOS  
The CUBA-GOOS Committee is under the National Oceanographic Committee.  
The members of the CUBA-GOOS are representatives from:  
Research Institutes (Institute of Oceanology, Institute of Meteorology, Center for Fisheries Research, Center for Marine Research, Center for Bay's Management)  
Governmental Users (Ministries of Science, Technology and Environment;  
Fisheries; Tourism; Transport; Heavy Industry; Defense)

#### **4. MEMBERSHIP OF AND CONTRIBUTION TO REGIONAL GOOS BODIES IOCARIBE-GOOS**

#### **5. NATIONAL CONTRIBUTIONS TO GOOS IMPLEMENTATION**

Actual **(AC)** and planned **(PC)** contributions.

##### **5.1 CONTRIBUTIONS TO ELEMENTS OF THE GOOS INITIAL OBSERVING SYSTEM**

- Meteorological measurements from the Voluntary Observing Ship (VOS) network of the WMO. **(AC)** Ministry of Science, Technology and Environment (CITMA)
- The Global Sea Level Observing System (GLOSS) network of tide gauges. **(AC)** (Data from 3 Cuban stations to the GLOSS) (CITMA)
- The Global Coral Reef Monitoring Network (GCRMN). **(AC)** (Contribution through AGRRA, CARICOMP, REEFCHECK). (CITMA), NGOs.
- Upper ocean measurements of the Ship of Opportunity Programme (SOOP). **(PC)** (CITMA)

##### **5.2 CONTRIBUTIONS TO GOOS PILOT PROJECTS**

- The Argo float programme of GODAE. **(PC)** (CITMA)

##### **5.3 CONTRIBUTIONS TO GOOS-RELATED RESEARCH**

- Biodiversity Management at Sabana-Camaguey Region **(AC)** (CITMA)
- Environmental Management of Caribbean Bays **(AC)** (Ministry of Transport)
- Impact of the hydro-climatic fluctuations on lobster (*Panulirus argus*) fisheries **(AC)** (Ministry of Fisheries)
- Frontal ecosystems associated to the Yucatan Circulation System

##### **5.4 OTHER CONTRIBUTIONS TO GOOS**

- National Ocean Data Centres:
- National System for Environmental Information (SNIA) **(PC)** (CITMA)
- National Centre for Biodiversity (CENBIO) **(AC)** (CITMA)

This information is free for Research, Fisheries, Tourism, Sustainable Coastal Management and Regulatory activities.

Observations other than those in the GOOS Initial Observing System (e.g. Tide Gauges other than GLOSS)

- PORTALES Project **(PC)** (CITMA)

Ocean Modelling activities/centres

- Yucatan circulation model **(AC)** (CITMA)
- Model for Oil Spill Drift forecast in coastal waters **(AC)** (CITMA)

Main ocean services and products and their sources

- Monitoring of the coastal erosion rates in Cuban beaches. **(AC)** (CITMA)
- Nautical and meteorological Routing Service **(AC)** (CITMA)
- Sea Level Network **(AC)** (CITMA)
- Environmental Monitoring at the Coastal Zone. **(PC)** (CITMA)

- Methodology for the assessment and control of the beach erosion in the Caribbean. **(PC)** (CITMA)

## **6. CAPACITY BUILDING IN SUPPORT OF GOOS OR GOOS-RELATED RESEARCH**

- Data Center for GOOS related information **(PC)** (CITMA)
- CUBA-GOOS Web site **(PC)** (CITMA)
- Workshop on Data Management and Operational Products and Services **(PC)** (CITMA)

## **7. SUGGESTIONS FOR WAYS TO IMPROVE GOOS**

- Creation of regional capacity of financial support for the elaboration of operative products and training.

## **8. INDICATIONS OF FINANCIAL CONTRIBUTION TO GOOS**

### **8.1 INVESTMENT IN NATIONAL ACTIVITIES**

- Salaries, travels, communications.

### **8.2 INVESTMENT IN NATIONAL COORDINATION**

- Salaries, travels, communications.

### **8.3 INVESTMENT (REAL OR POTENTIAL) IN INTERNATIONAL COORDINATION**

- Salaries, travels, communications.

## **H. GREECE NATIONAL REPORT**

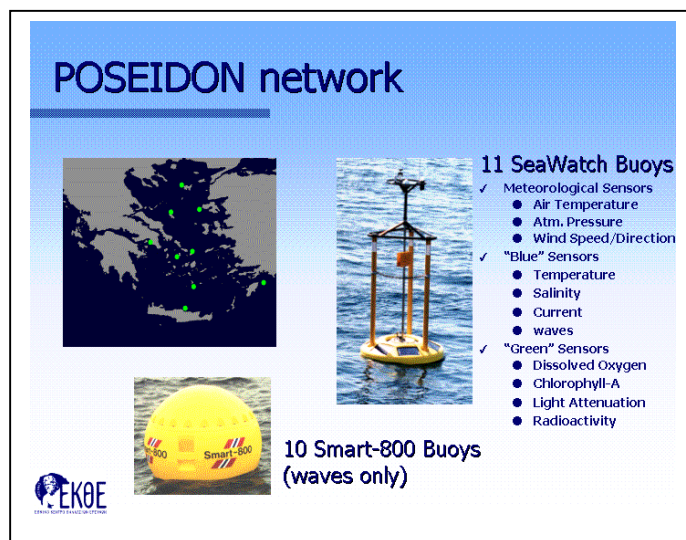
### **The Poseidon System:**

**An example of Operational Monitoring and Forecasting in regional Seas**

**By: Dr C. Tziavos & Dr C. Nittis - National Centre For Marine Research, Greece**

As a maritime country with over 18000 km coastline and 2000 islands, Greece relies significantly on the exploitation of its marine resources. Tourism/recreation, fisheries / aquaculture and marine trade are activities of major economic importance. In the same time, the Greek marine environment is a system with complex geomorphology and phenomenology subject to rapid changes, due to air-sea and land-sea interactions, the effect of the open Mediterranean Sea, human activities, etc. The systematic monitoring of this complex marine system is a significant contribution towards an integrated management plan for sustainable exploitation of its resources.

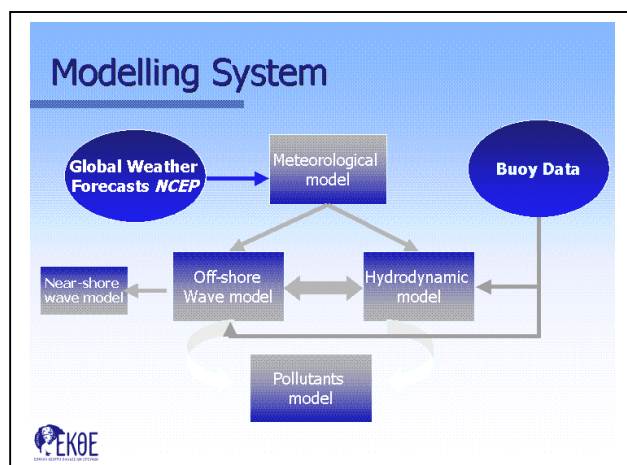
The aim of the POSEIDON project was to develop an operational monitoring forecasting and information system for the marine environmental conditions of the Greek Seas. The project was undertaken by the Institute of Oceanography of NCMR. Oceanor-ASA was the main contractor that had the responsibility of system set up and delivery of instrumentation with subcontracts to groups from Greek universities that had the responsibility to develop the numerical forecasting system. The project was funded by the Financial Mechanism of the European Economic Area and the Hellenic Ministry of Economy. It had a 3-years duration and was concluded during May 2000.



The backbone of the POSEIDON system is a network of 11 oceanographic buoys installed in the Aegean Sea. Various sensors measuring meteorological and oceanographic parameters at subsurface (0-50m) layers equip the Seawatch type buoys. Each buoy has a minimum number of sensors, namely those measuring meteorological and physical oceanic parameters, while certain buoys are equipped with additional sensors that measure biochemical parameters at surface. A 3-hour sampling period has been selected for all measurements.

The communication system that allows two-way data transmission between the buoys and the Operational Center is based on satellite INMARSAT C and GSM-cell phone technology. Using those systems, disseminated data are automatically transmitted every three hours to the Operational Center of the POSEIDON project at NCMR. Following the routine checks of battery level and buoy position, which are performed upon their arrival, data are automatically stored in the POSEIDON database as raw measurements. They automatically pass through a first-level quality control that performs a broad range-check and detects spikes. They are then made available to users through the project web page ([www.poseidon.ncmr.gr](http://www.poseidon.ncmr.gr)) with a delay of less than ½ hour. A second quality control that identifies abnormal trends, usually related to bio fouling, is performed approximately every one month.

The POSEIDON forecasting system includes three operational models (weather, waves and hydrodynamic) that provide every day 72-hour forecasts and two application models (near-shore waves and pollution) that are being used on demand.



The weather forecast is based on the ETA model, which is a limited area weather forecasting system. An extended domain covering the whole Mediterranean Sea (21W to 51E and 16.7S to 52.2N) is resolved by a 0.25 deg grid and 32 levels in the vertical. A higher resolution nested grid of 0.1 deg is used for the Aegean Sea. Initial and boundary conditions are from the NCEP global analysis.

The hydrodynamic model is based on the Princeton Ocean Model and is applied in the Aegean Sea with a high-resolution grid of 0.05 deg in the horizontal and 30 layers in the vertical. The prognostic variables are the three components of velocity, temperature, salinity and the sea level elevation.

The offshore wave model is based on WAM and is applied in the Aegean Sea with a 0.05 deg resolution. The prognostic parameter is the wave spectrum and all the deriving



operational quantities like the significant wave height, the main wave direction and the significant and mean wave period.

A near shore wave model is also developed for the simulation of the wave field in the coastal zone. It has a very fine horizontal resolution of 10-100 m and can cover a range of up to 10km shoreline. Finally, the pollutants transport model is used to forecast the transport (3D advection, diffusion and bio-chemical transformations) and other relevant by-processes (such as sedimentation, beaching) of the buoyant pollutants introduced accidentally into the sea. The model receives information from the waves and ocean hydrodynamic prediction models and produces quantitative information (concentration patterns) of the investigated pollutant. The model is specifically adapted to the tracking of oil slicks and floating objects.

Overall, the products that the POSEIDON system delivers to its users are:

*In Near Real Time:*

On-line data (“meteo”, “blue” and “green”)  
Meteorological Forecasts  
Sea-State Forecasts (waves)  
Forecasts of currents and hydrological characteristics

*In Delayed Mode:*

Processed Data (statistics etc.)  
Dispersion of Pollutants (oil-spills)  
Near-shore wave conditions  
The present and foreseen applications of the system are:  
Safety of life and transports at sea,  
Prompt response in marine accidents,  
Tourism development,  
Fishing and sea farming,  
Coastal zone management,  
Harbor and coastal works design  
Research oriented applications (process studies, validation of satellite data and models)

Potential Users of the POSEIDON system are:

Private sector exploiting sea resources (aquaculture, fisheries, tourism)  
State organizations for the protection and management of the marine environment  
Local authorities  
National Meteorological Service  
Athens 2004 Olympic Committee  
Research centres and universities

The POSEIDON project delivered an operational monitoring and forecasting system for the Aegean Sea. NCMR has undertaken the task to maintain and further develop the various system components with ultimate goal the increasing quality of its products (data, forecasts).

The future scientific plans include:

Extend observing capacity with deep layer sensors and remote sensing data  
Increased quality of waves and currents forecasts using data assimilation methods  
Improved meteorological forecasts using non-hydrostatic high-resolution model  
Downscaling to selected coastal areas of interest.

## I. MAURITIUS NATIONAL REPORT

Mauritius, a small island developing state, is highly dependent on the seas and oceans that surround it. They provide the livelihood for a large number of people through the tourism and fishing industries. They serve as a means of transport for goods and link the republic with the rest of the world. Although there is currently little expertise in the island in the field of ocean sciences due to the lack of funds and training, Mauritius recognizes the need to increase its understanding of land-sea human interactions, air-sea interactions and to participate in global ocean observing initiatives. This in order to ensure the protection, conservation and sustainable development of resources, for safer navigation and for better protection of coastal populations during cyclones and floods. With this objective, Mauritius has been actively working to develop the field of ocean science. This has resulted in two concrete achievements namely, the setting up of :

- (i) The Mauritius Oceanography Institute, and
- (ii) An Integrated Coastal Zone Management unit at the Ministry of Environment.

Coastal development in Mauritius has taken place with little understanding of the impacts of anthropogenic activity on the coastal ecosystem. These fragile ecosystems should be treated with care since they not only contribute to the economy of Mauritius, but are a heritage for mankind and should be preserved for future generations. Thus the ICZM unit has been set up to look into the development of policy for the sustainable management of the coastal zone while the aim of the MOI is to foster, rationalize and coordinate oceanographic research in the country. Both units are still at the infancy stage having been set up in the year 2000. They need to build up their institutional capacity, acquire equipment, develop local expertise in the fields of monitoring, data collection, data analysis and interpretation. Mauritius is willing to collaborate in the worldwide efforts to increase oceanographic know-how and the MOI looks forward to playing an increasingly important role at the regional level. Given the central location of Mauritius in the Indian Ocean, its proximity to Africa, Madagascar and the islands in the Mascarene region, as well as the current impetus in the field oceanography, Mauritius would be an ideal location for the setting up of a regional office for GOOS.

This new impetus in oceanography is further illustrated by the endeavor to set up a National Oceanographic Data Centre. The aim is to centralize all ocean related data and commence standardization of data collection. With the setting up of an NODC, information will be readily available to interested institutions and individuals, hence facilitating research and development in oceanography. Furthermore, it will contribute to the ODINAFRICA project. It will also aid the implementation of GOOS in Mauritius by offering support for data management for data collected within the programme.

Under the GLOSS programme, Mauritius installed two sea-level stations in 1986. These provide hourly sea-level data and contribute valuable information to the global effort to monitor sea level variability and sea level rise. However, these gauges are becoming obsolete, as it is difficult to procure spare parts for them. Hence under the GOOS/GLOSS programme, upgrading the network of sea level stations in the Western Indian Ocean should be considered.

The backdrop of our concerns is the fact that the Indian Ocean is the least known ocean in the world, with the Mascarene Ridge still something of an enigma deserving extensive exploration and greater understanding of its ecosystem, fauna and flora. Mauritius

recognizes that oceans know no boundaries and that issues such as global warming, El Nino, sea-level rise, coral bleaching should be studied at an international level. Mauritius also appreciates that coastal ecosystems are under great threat due to human activity and that deeper scientific investigations are necessary to assess the impact on these ecosystems. Thus Mauritius will continue to support the intergovernmental efforts to increase understanding and know how in the fields of oceanography and ocean sciences.

## **J. NORWAY NATIONAL REPORT**

### **Norwegian GOOS activities<sup>3</sup>**

This report describes the GOOS activities of the Norwegian Meteorological Institute, the Nansen Environment and Remote Sensing Centre and the Institute of Marine Research. The report is extracted from the Norwegian report to the Initial Global Ocean Observing System (GOOS) Commitments Meeting (GOOS Report No. 80).

### **NORWEGIAN METEOROLOGICAL INSTITUTE (DNMI)**

DNMI is an operational institute with highly specialized services to marine activities, industry and authorities; coastal navigation and environmental protection, offshore oil production and exploration, high sea shipping for economic routing advice and safety support, and support to fisheries and coastal aquaculture.

DNMI has experience in operating GOOS type services for the North East Atlantic adjacent sea areas; providing services and products from the domains of physical, chemical, and biological oceanography. It has a clear priority to user interaction, tailoring services to their needs, and accordingly professional Quality Assurance procedures.

DNMI is strongly in support of the development of GOOS.

Its specialized Marine Forecasting Centre (MFC) has the position and skills required to interact with and contribute to the GOOS implementation and future operation. Typical points of action or contribution will be:

- facilitating exchange of real time oceanographic measurement data, mainly on waves. Norway already contributes to GLOSS, VOS and DBCP and others;
- implementation assistance and 'best practice' advice where new national services are established;
- offering a leading role in knowledge transfer regarding availability, quality and user satisfaction of GOOS type services around the world.

DNMI and other cooperating institutes organized and operated a 'Pilot GOOS' named 'HOV' in the period 1990 - 1994. Its main objectives were to organize and operate services in accordance with identified marine users needs. The main users were representing offshore industry, aquaculture, marginal ice zone fisheries, and coastal environmental protection.

This experiment initiated a variety of new marine services still in operation, and left a base of experience in multidisciplinary 'operational skills', such as to run an 'end-to-end'

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<sup>3</sup> Presented by Ola Johannesen

operational service, with its administrative, budgetary, scientific and technical aspects, choreographed to produce end results to the satisfaction of the users.

An independent governmental assessment committee decided that HOV had achieved the goals set up for it, but also had to recognize obstacles and difficulties that mainly were due to the cultures of the participating organizations.

## **PARTICIPATION:**

Con's: Difficulties to team up national organizations, either being in competition or having different perspectives on GOOS. Reluctance to 'shift resources (funding) from science to operation'. Lack of 'culture to exchange'. Complex governmental funding mechanisms and distributions of responsibilities. Ongoing but unpredictable commercialization of services originally funded by governments.

Pro's: Closer cooperation and interaction with the marine user communities and other domains of activity and responsibility. Broader regional and global coordinations and cooperations. Synergy benefits due to exchange of data, tools and resources. Significant feedback to science. Enhanced influence at the political level, demonstrating applications of operational oceanography and follow-up of international conventions (re. GOOS-98).

## **THE INTERGOVERNMENTAL PROCESS**

### **The GOOS infrastructure, as a partial analogy to WWW (World Weather Watch):**

It will bring significant synergy benefits to operational oceanography due to:

- data exchange, including format and QA standardization;
- know how exchange, both in the scientific and technological sense;
- broader reference for developing countries, re. capacity building.

### **Therefore:**

The intergovernmental process must facilitate participation through enhanced lobbying and promotion of GOOS towards the relevant political levels, in particular signatories of the international conventions that constitute the legal framework in the foundation of GOOS.

### **Further:**

In the light of the fact that few (if any) of the existing GOOS relevant national agencies or institutes have the fully adequate capacity to foster GOOS alone, it must be explained to governments that we are looking for new organizational creations, for instance national or international cooperation consortia composed of partners from different mother organizations.

## **NANSEN ENVIRONMENT AND REMOTE SENSING CENTRE**

### **Marine Products and Services**

#### **Ice Information Products**

- Arctic climate monitoring and predictions
- Ship navigation and routing
- Offshore Arctic operations

#### Ocean and Coastal Monitoring

- Oil spill detection
- Algae bloom monitoring
- High-resolution wind retrieval

#### Ocean Modelling and Data Assimilation

- Circulation and tracer modelling
- Ecosystem modelling
- Data Assimilation

#### Climate Module Examples

- Sea-ice concentrations from passive microwave satellites (monthly averages)
- Modelling Arctic ice cover
- Arctic total sea ice area for given periods
- Arctic total sea ice area departures for given periods
- Arctic multi-year sea ice area for given periods
- Modelled sea ice thickness
- Satellite-derived ice concentrations
- Modelled and satellite-derived sea cover
- Eddy kinetic energy

#### Operational Services

##### Sea Ice Users

Icebreakers  
Merchant Vessels  
Offshore Industry  
Fisheries  
Weather Services  
Regional Authorities  
Coast Guard  
Research Expeditions

##### Northern Sea Route

historical sailing routes

##### Ice Type Classification

backscatter values threshold based on ERS SAR imagery

##### Operational Support

ERS imagery used in navigation of MSC icebreakers

##### River Channel - Ob Estuary

Use of SAR images to find best routes for icebreakers

##### Sea Ice Type Classification

RADARSAT (Central Kara Sea)

##### The ARCDEV Exploratory Voyage (schematic view of convoy route)

##### High Resolution Winds

Velocity wind fields derived from ERS SAR images

## Ocean Fronts and Jets

COASTWATCH 1996:

ERS-2 SAR image resolving ocean front features

## Living Resources and Health of the Ocean Modules

*In situ* and SeaWIFS Mapping of a toxic *Chatonella* Bloom in west Danish waters

Monitoring Algae Blooms

*In situ*, Satellite and Modelled Phytoplankton Distribution (toxic *Chatonella* Bloom in west Danish waters)

## Coastal Zone and Health of the Oceans Modules

Oil Slicks

ERS SAR image data from the North Sea

Ship Pollution Slicks

ERS SAR imagery (Baltic Sea)

## ALL MODULES

Ocean Modelling and Data Assimilation

DIADEM - North Atlantic Data Assimilation System  
prototype with 20 km resolution in North Atlantic

Model system is based on

MICOM (Miami isopycnal coordinate ocean model)

Fasham type biogeochemical model

Viscous plastic ice dynamics model

Data assimilation method

ensemble Kalman Filter (EnKF)

Observations

TOPEX & ERS sea level anomalies

AVHRR sea surface temperature

SeaWIFS ocean colour

Nested Ocean Models

Industrial applications

one way nesting

orthogonal curvilinear model grids

7-8 km intermediate model

2 km high-resolution model

High Resolution Ocean Circulation

## INSTITUTE OF MARINE RESEARCH (IMR)

### INTRODUCTION

IMR is a national centre placed under the Ministry of Fisheries for research on the Marine living resources and the marine environment. The institute has about 500 employees of which 150 are scientists. In addition to the main facilities in Bergen, IMR has three

research stations and five research vessels. The overall objectives of the institute are to provide the scientific basis for:

- Future-oriented and sustainable management of the marine environment
- Diverse and economic viable fisheries by ecologically responsible utilization of the marine living resources.
- Diverse and viable aquaculture on a genetic and environmental safe base.

## **FIXED OCEANOGRAPHIC STATIONS AND SECTIONS**

During the period 1935-1947 the IMR established a number of fixed oceanographic stations along the Norwegian coast between the Skagerrak and the Barents Sea. The main objective was to monitor the ocean climate variability in relation to fisheries. Temperature and salinity measurements were regularly taken on these fixed stations since the start with yearly observation frequency of 26-40. The work is carried out by local observers who today are equipped with modern instrumentation. Ocean Weather Station Mike in the Norwegian Sea has been operated by the University of Bergen since 1948. Since 1990 the IMR carried out weekly measurements of nutrients, chlorophyll and phytoplankton.

The systems of fixed oceanographic sections has been operated for about 20 years in the Norwegian and the Barents Seas and for about 30 years in the North Sea. Some of the sections have sporadically been observed since the turn of this century. Chemical parameters, such as nutrients and oxygen, as well as plankton have been observed on selected stations and sections during the last 10-20 years.

## **REGIONAL COVERAGES**

In addition to the system of fixed oceanographic stations and sections IMR has regular regional monitoring of the conditions in the North Sea/Skagerrak, the Norwegian Sea, the Barents Sea and in the Norwegian coastal area. This activity is related to variability in ocean climate, plankton production, recruitment to fish stocks and anthropogenic impacts such as input of nutrients and harmful algal blooms, organic contaminants and radioactivity.

## **THERMOGRAPHIC SERVICE**

In 1936 the IMR established a system for recording temperature and salinity in the surface layer along the Norwegian coast by using commercial vessels. The route between Stavanger and the northern most coast of Norway is surveyed twice a week. In the mid-fifties the programme was extended to some shipping routes across the North Sea.

These routes were stopped in the early 1980s and today only the North Sea route between Stavanger and Aberdeen is covered once a week.

## **MONITORING THE FJORDS**

In November - December each year the environmental conditions in the fjords along the western and northern coast of Norway are observed. Temperature, salinity, oxygen and nutrients are measured. These observations give information on long-term variations in the ocean climate and a possible negative development in the content of nutrients and oxygen as a consequence of eutrophication.

## **THE SKAGERRAK COASTAL CONDITIONS**

At Flødevigen Research Station temperature and salinity are observed daily at several depths. These time series date back to 1924. Since 1985 there has been a regular monitoring for harmful algae and the results are reported weekly during the algae season. Since 1990 hydrographic, hydrochemical and biological parameters have been observed monthly at two locations off Arendal. In October each year the fjords of the Norwegian Skagerrak coast are monitored with respect to hydrographic and hydrochemical parameters as well as beach seine sampling for juvenile fish. These investigations started in 1920.

## **WHY DO LONG-TERM ENVIRONMENTAL MONITORING?**

The world oceans play a major role in a large number of processes occurring at the surface of the earth. These processes influence the human environment and are in turn influenced by human pressure. The global climate seems to be in a process of change, which could be caused by anthropogenic influence. Superimposed on this possible global changes are the large natural fluctuations.

In our waters there is a close relationship between the marine environmental variability and the fish stocks. Ocean climate fluctuations influence distribution, recruitment and growth of fish stocks. Long-term observation series combined with studies on the driving forces of the climate variability are necessary to predict the climate and thereby improve the management of the fisheries.

Significant amounts of contaminants have the ocean as their final destination. Monitoring the contaminant level is important both as an early warning of possible ecological damage and to observe the effect of introduced measures to reduce the pollution.

All nations have international obligation to monitor their marine waters and thereby contribute to the Global Ocean Observing System (GOOS). GOOS is conceived as a new, internationally organized system for gathering and distribution of marine data and derived products. It is envisioned to resemble the global meteorological observations and prediction network. The GOOS data and products will be applied for the benefit of mankind and for the safe use and preservation of the marine environment.

## **K. PERU NATIONAL REPORT**

### **NAYLAMP Pilot Project**

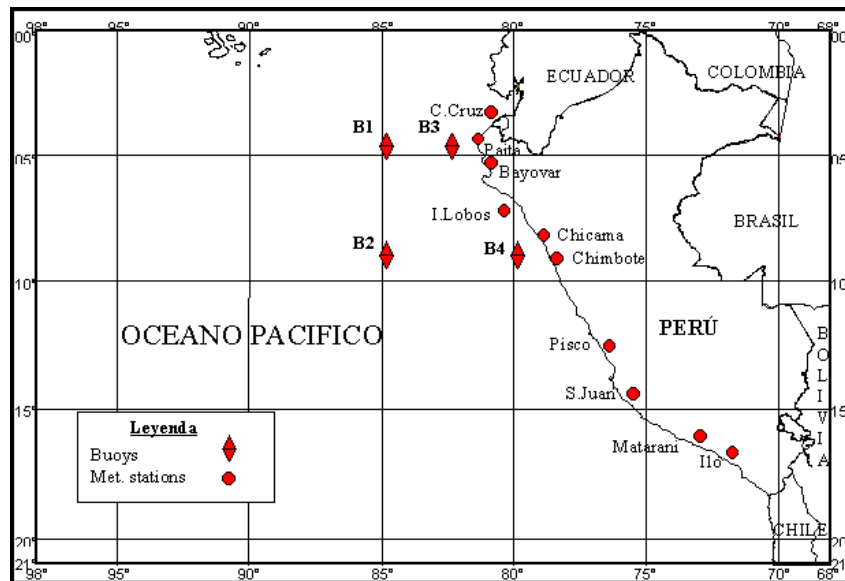
El Niño Anual Y Las Anomalías Medidas en el Pacífico  
(The Annual El Niño and Measurement of Anomalies in the Pacific)

### **What is NAYLAMP?**

NAYLAMP is an ocean observing Pilot Project that will be implemented starting September 2000 in the South East Tropical Pacific primarily in an area adjacent to the northern coast of Perú, one of the areas most affected by "El Niño".



It will consist of a series of 4 oceanographic buoys and 10 tide & meteorological stations spread along the coast of Perú that will complement the already existing observation network.



### Why NAYLAMP?

The acronym of the Project, NAYLAMP, merits an explanation. Naylamp was the mythical name of a courageous and wise warrior of the Moche culture that flourished in northern Perú 15 centuries ago.

Legend has it that Naylamp came from the ocean with his people in a large fleet of rafts. They built large cities and palaces and their culture prospered peacefully for many centuries.

An idol named Yampallec recalling Naylamp was worshipped at his place of burial. Today, the name of this idol remains alive as that of one of the most important departments of northern Perú, *Lambayeque*.

Many years after Naylamp's death his tomb was profaned and, as a consequence, 30 consecutive days of rain (*El Niño?*), destroyed towns and crops as punishment of those who dared to disturb Naylamp's tomb (*'never had this happened before in this barren desert territory...'*).

(Legend collected by Miguel Cabello de Valboa and reproduced in "Miscelanea Antartica, una Historia del Perú Antiguo. Universidad Mayor de San Marcos. Facultad de Letras, 1951.)

### Why study the annual 'El Niño'?

It may be odd for many scientists and the general public, to hear about an *annual* El Niño since this is a non-cyclic, recurrent phenomenon. However, we must remember that the origin of the name El Niño was given by northern Peruvian fishermen to the *annual* warming of ocean water that disrupts, every year, the local fisheries off the port of Paita (5° South).

This annual phenomenon marked the end of the fisheries season, in December, just prior to the Christmas festivities when fishermen also celebrate the arrival of the Child Jesus (El Niño Jesus). The coincidence led fishermen to call this annual phenomenon the "El Niño current".

The name Naylamp is also a reminder that the purpose of this project is not only the monitoring of the recurrent El Niño phenomenon, but of the annual variability of ocean conditions in this sensitive area. This variability has an important effect on socio-economic activities, particularly fisheries and agriculture, in this important geographical area.

Naylamp will constitute a local observation network of buoys and coastal tide & meteorological stations in northern Perú. The information provided by this project will be available for researchers and the general public in a web page presently under construction.

### **The financing of the NAYLAMP Project**

The project is co-financed by the World Bank and the Peruvian Government as part of a large funding package for the reconstruction of infrastructure damaged in northern Perú by the heavy rains of the 1997-98 El Niño.

### **Location of the buoys and stations of the NAYLAMP Project**

#### **Location of the Oceanographic buoys\***

<b>BUOY</b>	<b>LATITUD (South)</b>	<b>LONGITUD (West)</b>	<b>DEPTH (Meters)</b>	<b>DISTANCE FROM COAST (Miles)</b>
<b>1</b>	05°00'00"	85°00'00"	4500	230
<b>2</b>	09°00'00"	85°00'00"	4500	390
<b>3</b>	05°00'00''	82°00'00''	4000	55
<b>4</b>	09°00'00''	80°00'00"	680	85

**The buoys are model *Seawatch Wavescan* made by OCEANOR**

#### **Location of the Tide & Meteorological stations**

<b>Loc.</b>		<b>LAT. SOUTH</b>	<b>LONG. WEST</b>
Caleta La Cruz	1	03° 37.8'	80° 35.0'
Paita	2	05° 02.0'	81° 06.0'
Bayobar	3	05°45.0'	81°03.0'
Isla Lobos de Afuera	4	06° 55.5'	80° 42.5'
Chicama	5	06°55.0'	80°42.0'
Chimbote	6	09° 04.4'	78° 36.0'
Pisco	7	13° 43.0'	76° 13.0'

Loc.		<b>LAT. SOUTH</b>	<b>LONG. WEST</b>
San Juan	8	15° 21.6'	75° 09.7'
Matarani	9	16° 59.5'	72° 06.1'
Ilo		17°03.0'	77°09.0'

- THE TIDE & METEOROLOGICAL STATIONS ARE MADE BY **SUTRON**

### **NAYLAMP Project Information contact**

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### L. POLAND NATIONAL REPORT<sup>4</sup>

Since last year we have established National GOOS Committee. Approximately half of its 30 members are research people of different marine sciences specialities, and have representatives of users and potential users.

Network of coastal stations along the polish coast, measure standard meteorological and oceanographic parameters such as: water level, water temperature & salinity, some chemical analysis of pollutants and some biological sampling.

Besides that, several open sea stations regularly produce data on basic meteo and oceanographic conditions of the Baltic Sea environment in the framework of the Baltic Monitoring Programme.

Presentation was focused on the following topics:

- Monitoring fish stocks for sustainable exploitation
- Preserving a healthy marine ecosystem
- Ensuring public health
- Safe and efficient navigation
- Coastal protection and management
- Data management.

### **MONITORING FISH STOCKS FOR SUSTAINABLE EXPLOITATION**

Marine fisheries industry in Poland provides bases for leaving of tens of thousands families. On the other hand brackish waters of the Baltic Sea make living conditions for marine fishes, and to some of fresh water species as well, close to the verge of their capacity. Pollution, frequent periods of anoxic condition in the deep waters, and over-fishing make recruitment process and survival of fish stocks very sensitive to any variations in the Baltic Sea physical environment. Fishery industry thus is strongly dependent on oceanographic information not only for safe and efficient operations but also for better planning and investment.

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<sup>4</sup> by Jan Piechura

Continuous monitoring of environment and biota at all trophic levels, fish recruitment success and stock assessment is carried out, and catch control as well. Regular forecast of physical environment, fish stocks and fishing conditions is provided by Sea Fisheries Institute, Data for fisheries regulating authorities are provided as well.

## **PRESERVING HEALTHY MARINE ECOSYSTEM**

Densely populated and industrialized drainage area with the intensive agriculture around the Baltic Sea put great anthropogenic pressure on the environment. To fight growing pollution and to restore, as far as possible, natural conditions, the Helsinki Commission was established. Actions taken in the Baltic Monitoring Programme and additional national activities, monitoring of the health of the Baltic Sea, and provide basis for periodic assessments of the state of the sea, agreed recommendations and protective measures.

To speed up the process of data exchange, production and dissemination of assessments proper mechanism are being worked out by the BOOS partnership.

## **ENSURING PUBLIC HEALTH**

Recreation and tourism is a growing industry in the coastal area, and creates new demand for services. Quality of water control along the coastal beaches, weather and oceanographic conditions forecast is provided on daily basis to tourist industry, local authorities and publicized by media. Warning of envisaged hazards to the human health conditions in certain areas are publicised on TV, radios and newspaper.

## **SAFE AND EFFICIENT NAVIGATION**

Forecast of weather conditions and oceanographic parameters such as water level, current velocity and direction, waves parameters, sea ice and buoyancy are required by ship captains and pilots and are provided by national services with improving quality. Growing number of people coming for recreation, e.g. wind surfer, demand good forecast for any specific area of the sea shore.

## **COASTAL PROTECTION AND MANAGEMENT**

Polish seacoast undergoes rather large changes, in some places cliffs are destroyed and coastline is retreating.

The permanent surveillance of the coast creates the base for monitoring the coastal processes, sediment transport and human interference in the natural processes e.g. port constructions disturbing sediment transport and disposal. Expertise and recommendations are distributed to local authorities, marine administration and constructing companies.

## **DATA MANAGEMENT**

Majority of our data can be found in the ICES and HELCOM databases. Research on long-term variability of Atlantic Water volume, heat and transport by Norwegian-Atlantic Current & West Spitsbergen Current carried out in the Nordic Seas is meant to support the Climate Module of the GOOS.

## M. RUSSIA NATIONAL REPORT<sup>5</sup>

The First GOOS User's Forum is a very important event, aimed at uniting the efforts of the commonwealth for obtaining the fullest and most operative information about ocean.

Russia has always been interested in the problem of investigation of the World Ocean. It is due to the fact, that the Russian Federation is one of the biggest sea powers and its coasts are washed by waters of three oceans (Atlantic, Pacific and Arctic) and many seas. A problem of utilization of the World Ocean resources is of great scientific and practical importance. In this connection it is a vital problem for Russia to obtain full information about ocean and sea conditions.

In 1998 the National Oceanographic Committee of the Russian Federation (NOC RF) established a National Working GOOS Group. The results of its activity are presented at the Web-side ([www.extech.msk.su/english/ocean](http://www.extech.msk.su/english/ocean)).

Nowadays in the Russian Federation this problem is investigated by a number of Ministries and National agencies, such as the Russian Academy of Sciences, Federal Services of Russia for Hydrometeorology and Environmental Monitoring (Roshydromet), Ministry of Defense, Ministry of Higher and Secondary Special Education etc., as well as different Institutes, such as the P.P. Shirshov Institute of Oceanology, State Oceanographic Institute, the Arctic& Antarctic Scientific Research Institute (State Scientific Centre of the Russian Federation), Hydrometeocenter of Russia, Far-Eastern Regional Hydrometeorological Institute, N.N. Andreyev Acoustic Institute, All-Russian Research Institute of Hydrometeorological Information – World Data Center and others. Russia is participating in the International Programmes, such as CLIVAR, ACSYS, Arctic Buoys, etc. Common research and expeditions are conducted and different information systems are worked out in the frames of mutual agreements with a number of States (the USA, Germany, Norway, Sweden, Korea, Turkey etc).

A definite operative work in the GOOS frames is conducted in Russia by Institutes of the Roshydromet and by the Hydrometeocenter, specially ([www.hydromet.ru](http://www.hydromet.ru)), which provides the general operational ocean. Some Special sub-projects have been created in the frames of the Objective programme. Nowadays Russia is participating in the work of two regional GOOS projects: Euro-GOOS, and Near-GOOS (Asia Regional - Global Ocean Observing System). Russian contribution in the fulfillment of the Near-GOOS project is aimed at achieving the following objectives:

- Providing information for natural hazard elimination, caused by wind waves, storm surges and sea ice;
- Raising the fishing effectiveness;
- Providing information for sea pollution monitoring, recreation and mariculture development;
- Providing information, necessary for modelling and forecasting.

A Web-side ([www.hydromet.com](http://www.hydromet.com)) has been created by the Far-Eastern Regional Hydrometeorological Institute in the Near-GOOS frames in 1999-2000. For twenty-four hours the data of ship observations in the Japan and Okhotsk seas in the LASO-system are

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<sup>5</sup> By Igor V. Lavrenov, State Research Centre of the Russian Federation – Arctic&Antarctic Research Institute, Bering 38, 199397, St.Petersburg, Russia, e-mail: [lavren@aari.nw.ru](mailto:lavren@aari.nw.ru)

being renewed in semi-automatic mode. There is also another useful information as well there.

The Russian participation in the Euro-GOOS is very perspective in development of forecasting technologies of the oceanic condition, estimation of economic and social results of their implementation and use, formation of priority trends of development in this sphere of activity, co-ordination of the European countries' attitude to the GOOS development as it is, support of collaboration between the Euro-GOOS members. The Roshydromet Institutes participate in the work of three regional projects: the Arctic (Arctic& Antarctic Scientific Research Institute), the Baltic sea (St.Petersburg Branch of the State Oceanographic Institute and the St.Petersburg Hydrometeorological University) and the Black sea (State Oceanographic Institute). Joint expeditions and common ecological investigations are held in the Euro-GOOS frames with an active Russian participation.

The national complex programme of the Black and Azov seas monitoring has been development in Russia. Besides the Russian-Ukrainian complex programme on hydrometeorology and monitoring of pollution of the Black and Azov seas has been prepared. A fulfillment of this programme is supposed to create a base monitoring system on the seas. It will be a contribution of Russia into an analogues International system.

The National Oceanographic Committee of Russia has decided to recommend the Arctic&Antarctic Scientific Research Institute to head a work on creation of the Arctic-GOOS in order to co-ordinate activities of Russian Institutes. Nowadays a conception of the Arctic-GOOS is being developed. The objective of the Arctic-GOOS is a creation and functioning of the international system of operational oceanography in the Arctic ocean and Arctic seas, aimed at solution of the following main tasks:

- Monitoring of present conditions of oceanographic, ice and meteorological parameters;
- Development of numerical models and fulfillment on their bases forecasting and diagnostic calculations, as well as operative warning of commonweal about forecasting results and a possibility of dangerous natural hazards;
- Investigation of climate changes in the region;
- Creation of database on hydrometeorological, oceanographic and ice elements, aimed at developing a system of International information exchange

Now the Web-side ([www.aari.nw.ru](http://www.aari.nw.ru)) is in operation with information about conditions of oceanological, ice and meteorological elements in the Arctic region and wind waves in the World Ocean.

Russia is interested very much in the further GOOS development, operative exchange of oceanographic information, fulfillment of joint investigations in the ocean, getting an access to the available oceanographic database.

## N. SPAIN NATIONAL REPORT

Great part of Spain wealth and well-being depends on the sea. The Spanish coast, including the archipelagos, measures 7.980 km long and more of the 60% of the Spanish cities with population higher than 100.000 habitants are located in the coastal zone. Most of the 60 millions of tourists Spain receives annually visit the coastal resorts.

Spain is one of the main world consumers of living marine resources. The value of the fresh fish landing in the Spanish ports is about 14 thousand millions € and the work population directly related to fishing is about 70.000 people. The aquaculture production, that signifies 30% of the total fish landing, has grown 50% in the last 10 years. Canned fish value adds up to almost 700 million €.

A great part of the trade is carried by sea. Annual revenues from harbor rates is about 490 millions €.

Shipbuilding and repair business volume is around 1.5 thousands of millions € and involve 27 thousands jobs.

This is just a small sample of the activities that could make important and feasible in Spain the establishment of an ocean observing system.

Several Spanish agencies include among their activities systematic and routine observation programmes that can be considered under the heading of operational oceanography.

Instituto Español de Oceanografía (IEO) is systematically monitoring the temporal variability and trends in oceanographic conditions and biological communities in the pelagic ecosystem in the neritic and oceanic waters surrounding the Spanish coast. Its scientific objectives are integrated in the framework of GLOBEC and JGOFS. The research effort involves time series in several transects along the Spanish coast and synoptic observations by satellite imagery.

A wave forecasting system developed to predict waves at the coast is run on a twice a day cycle by Clima Marítimo (CM), a group dependent on Puertos del Estado (PE). This system is based on two wave generation models: the WAM model and the WAVEWATCH model. The system is designed to provide a wave forecast with 72 hours of horizon to the Spanish harbors in the Atlantic and in the Mediterranean coast. The performance of the wave prediction system is verified in real time against measurements from the Spanish network of directional and scalar buoys maintained by PE and CEDEX.

CM is running also a storm surge forecasting system developed to predict sea levels at the coast. The system is designed to provide a sea level forecast with 48 hours of horizon to the Spanish harbors.

In 1996 PE launched a marine monitoring project RAYO (Red de Alerta y Observacion) intended to set-up a permanent observing system of surface waters around the Spanish coast. The core of the system is constituted by several ocean-meteorological buoys, moored in the vicinity of the shelf-break in depths ranging from to 250 m up to 900 m at the Atlantic waters of the Iberian Peninsula and the Canary Islands. They record meteorological and sea surface variables and transmit the recorded data on hourly basis via satellite to the Control Centre at Madrid. The project has increased the existing coastal sampling coverage by installing three land based wave radar stations and three wave directional buoys. An objective of the project has been to emphasize quasi-real time transmission and final user's data delivery by installing a dedicated communication link between the Control Centre and the main users (Port Authorities) and developing a web page where other institutional bodies and third parties can get these data.

Presently, the above-mentioned institutions are working in organizing a pool of resources and attracting the interest and financing of other governmental agencies (as in many

countries, in Spain there are many agencies dealing with marine affairs) to create a suprainstitutional oceanic service.

A couple of years ago IEO conducted a data requirements survey in Spain following the questionnaire distributed by the EuroGOOS office. It can be said from that survey and posterior findings that practically all those related with the marine and industry sectors (aquaculture, fishing, navigation, harbor and coast managers, etc) were interested in being identified as potential users of an ocean observing system. One exception was tourism. Although promoters and owners, as well as local authorities are aware of the positive impact of a higher quality of water, coast and beaches in their resorts, they are, at least for the moment, less familiarized than the other users with the potential of an observing system. The most requested data was on waves and currents and the geographic coverage cited most was estuaries, coastal region and continental seas. Surprisingly most of those polled asked for high-resolution scales (0.5-10 km and 1h-10 days) with prediction periods from 10 days to one year. This effort, the survey, was important but still modest. We think that there is still a lot of work to do about matters related with users. One important problem yet is, after the users are thoroughly identified, to make many of them realize that they really are or could be users of an ocean observing system. This is not, by no means, being patronizing; it is that the concept is very new for many potential users to have grasped it yet.

## O. TRINIDAD AND TOBAGO NATIONAL REPORT<sup>6</sup>

### **INTRODUCTION**

In Trinidad and Tobago there is no National GOOS Committee. GOOS activities, where they exist, are carried out by the Institute of Marine Affairs (IMA), Trinidad and Tobago Meteorological Services Division and the University of the West Indies. To provide the reader with an understanding of the potential users of GOOS products, a brief physical description of the islands of Trinidad and Tobago is provided, as well as an overview of the economy.

### **DESCRIPTION OF THE ISLANDS**

Trinidad and Tobago are the southern most islands of the Caribbean islands arc. Both islands are located between 10° - 12° north latitude and 60° - 62° west longitude. They lie on the continental shelf of Venezuela, with Trinidad being closest to the Orinoco Delta (approximately 12 km) and Tobago lying 34 km northeast of Trinidad. Together Trinidad and Tobago comprise an area of approximately 5,128 sq km, of which Trinidad comprises an area of 4,828 sq km.

Near estuarine conditions exist in the Gulf of Paria between Trinidad and Venezuela due to the fact that the Orinoco River empties into this Gulf. Coral development has therefore been restricted. Small patches of coral and drowned coral assemblages are found on Trinidad's west coast, which indicates that coral reefs were more extensive in the past when more suitable conditions existed. The only fringing reef in Trinidad exists in the northeast at Toco, where conditions of salinity and turbidity are more favorable for the growth of corals, although true oceanic conditions still do not occur. Tobago's marine environment is less

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influenced by the Orinoco River. Therefore richer and more diverse coral communities exist, as five major fringing reefs around Tobago.

The climate of Trinidad and Tobago can be described as wet tropical. Annual temperatures are high with daytime averages of 27°C to 30°C. Average annual rainfall is 2,000 mm. Relative humidity is approximately 100%. There are two seasons: a long wet season from May to December and a dry season from January to April. Trinidad and Tobago lie on the southern edge of the hurricane zone. Only one hurricane has struck the country in the last century. This was Hurricane Flora, which hit Tobago in 1963.

## **OVERVIEW OF THE ECONOMY**

Trinidad and Tobago has been transformed from a plantation type agricultural economy, to an oil based economy. In the 1970s the Government attempted to further diversify the economy by diverting revenues earned from oil into the establishment of heavy industries which would use the recently discovered extensive reserves of natural gas for fuel and feedstock. The heavy gas based industries were meant to be an alternative earner of foreign exchange when oil prices fell.

Tobago remained essentially an agricultural island, until oil prices fell drastically in 1986, when the government decided to make Tobago the centre of its new development thrust and alternative foreign exchanger earner, that is, tourism development.

From the 1990s onward, the Trinidad and Tobago Government has pursued strategies aimed at increasing the contribution of the energy sector to the economy. These include increased commercial development of the country's natural gas and oil reserves obtained from offshore of the east coast. Initiatives have been pursued to expand the role and use of natural gas through increased petrochemical production and high fuel consumption industries, such as iron ore and aluminum smelters and liquefied natural gas (LNG). Trinidad and Tobago ranks in the top five countries in the world for the production of methanol and ammonia.

## **PRESENT STATUS OF THE COASTAL AREA**

The coastal areas of the islands of Trinidad and Tobago are currently experiencing strong development thrusts. Projections made in development planning do not contemplate any major shift in emphasis away from the coastal areas. In Trinidad, development has been concentrated in the west coastal area. This area is experiencing tremendous development pressure. Over 88% of the population of the nation lives in this coastal area and the economic activity it generates employs 93% of the labor force (Central Statistical Office, 1980 Population Census). In Tobago, the major infrastructural development and projects proposed for tourism are concentrated on the coastal areas of southwest Tobago.

## **POTENTIAL USERS OF GOOS PRODUCTS**

The potential users of GOOS products in Trinidad and Tobago are the oil and gas companies (most of which are multi-national), the shipping companies, recreational boating, design engineers for ports and coastal structures, port management and research organizations (the university and the Institute of Marine Affairs).

GOOS products in terms of sea state and climatology are required by shipping and recreational boating for navigational purposes. The oil and gas companies require for their offshore installations, wave forecasting, tidal and current data, all of which are applicable for

the design and construction of their rigs and for the use of their remotely operated vehicles (ROVs). The energy-based industries require long-term information on sea temperature and salinity. Design engineers for ports and coastal structures are particularly in need of wave and tide forecasting data.

## **POTENTIAL GENERATORS OF GOOS DATA**

The potential generators of GOOS data in Trinidad and Tobago are the IMA and the Meteorological Office. The IMA is a multi-disciplinary, marine and environmental related research institution, which was established by Act of Parliament in 1976. It is entirely funded by the Government of Trinidad and Tobago. The mission of the IMA is to conduct fundamental and applied research to promote the sustainable use of the natural resources of Trinidad and Tobago and to make the results of such research available to the Government for the formulation of coherent and consistent policies on the conservation and management of these resources; and to respond to general needs for information and collaboration with all sectors of Trinidad and Tobago and the Wider Caribbean.

Research at the IMA is conducted under the following programmes: fisheries and aquaculture; environmental research; legal research; and marine chemistry. The multi-disciplinary, inter-programme research projects cover the following fields:

- Marine fisheries
- Aquaculture
- Sedimentology
- Socio-economic assessment
- Pollution monitoring
- Marine ecology
- Wetlands ecology
- Physical oceanography
- Taxonomy
- Satellite remote sensing
- Geographic information systems
- Marine environmental policy and law
- Environmental management and planning
- Public education and awareness

IMA is required by the Government of Trinidad and Tobago to earn part of its keep and it does this by undertaking consultancies both for the public and private sectors. The consultancies undertaken are mainly environmental impact assessments, current surveys, pollution monitoring and control studies.

The IMA is the agency responsible for Component 1 of the OAS regional project, Caribbean Planning for Adaptation to Global Climate Change (CPACC). In Component 1, the IMA has been designated the regional archiving centre for sea level and sea surface temperature data. The data is collected from 18 multi-sensor monitoring stations located in 12 different countries of the English speaking Caribbean. These stations are generating digitized data on water level, air and sea temperature, wind velocity, precipitation and other site-specific ancillary variables. Data from these stations are presently being downloaded from the Global Observation Earth System satellite at a satellite earth receiving station now installed at the vendor's site in Virginia. This facility is expected to be located in Trinidad by the end of the year. The system will serve as the Caribbean portion of the environmental satellite system

known as GOES East, operated by the US Department of Commerce. It will monitor all CPACC sites, which transmit their data to the satellite every three hours.

To date, IMA has used the tidal data from the CPACC Project to generate a value-added product in the form of a tidal calendar. The predicted tidal values presented can be utilized for engineering, port operations, commercial vessels, fishing and recreational purposes.

At present, the University and IMA utilize NOAA sea surface temperature data for research purposes, but are yet to think in terms of making products from it. IMA also collects long term data on the coastal processes for Trinidad and Tobago, which is used both for research purposes and to advise physical planners and engineers. IMA has not yet addressed the potential for generating products with these data.

### PLANS TO MEET THE NEED FOR GOOS DATA AND PRODUCTS

IMA plans to address long term monitoring of physical oceanographic parameters, but at present has a human resource problem, in that it has lost its Physical Oceanographers who have become consultants. Therefore, IMA needs to rebuild its capability in physical oceanography and is actively seeking funding for training for this purpose.

IMA also plans to collect sea water and sediment chemistry data on a long term basis, which can be generated into products to suit planning for industry.

IMA would like to address the needs of Trinidad and Tobago for GOOS data and products, but it needs funding for institutional strengthening and capacity building, of which training is one of the most important elements.

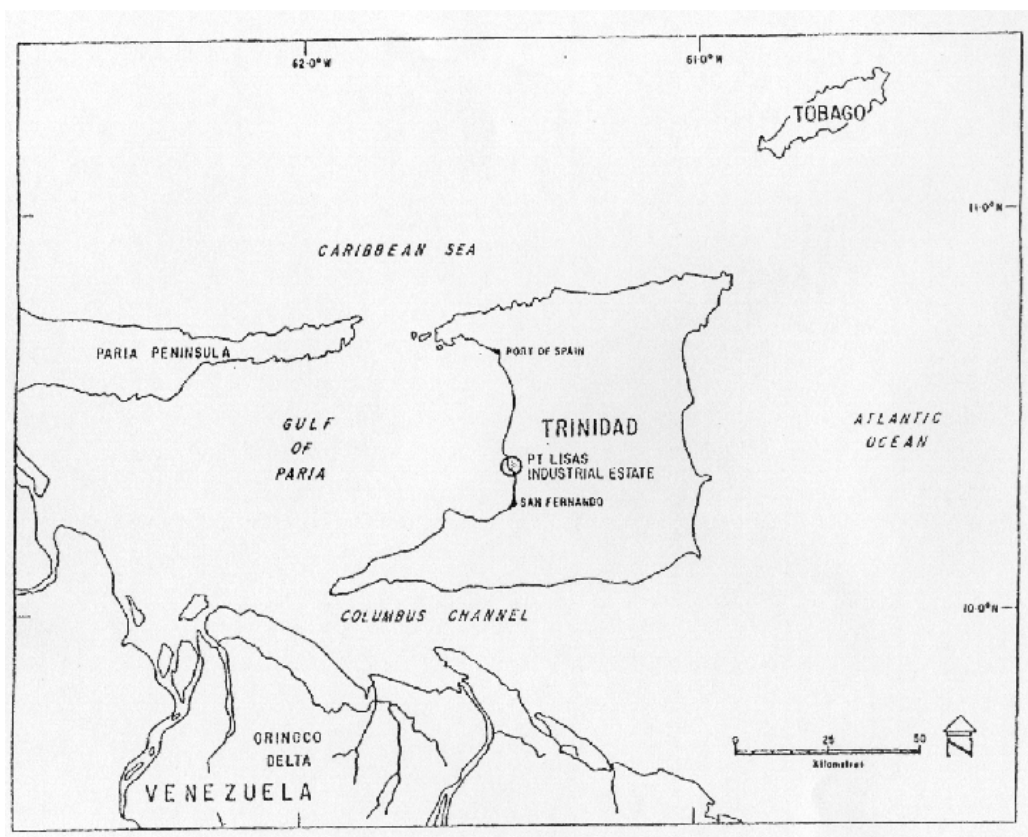


Figure 1: Location of Trinidad and Tobago

## **P. UNITED STATES NATIONAL REPORT**

### **U.S. GOOS STEERING COMMITTEE**

There is a U.S. GOOS Steering Committee (U.S. GSC) appointed and supported by major federal agencies. Chaired by Worth Nowlin and Co-Chaired by Thomas Malone, the U.S. GSC includes representatives of state and federal government, private industry, non-governmental organizations, and academia. The principal goals of the committee are to facilitate the design and implementation of U.S. contributions to global and coastal GOOS and to assist in the coordination between U.S. and international GOOS activities. A specific goal of the U.S. GSC is to "help in the development of information concerning options on how to match the needs of user groups with the observations and products required to meet those needs, addressing what is working well, what is not working well, the impediments we face at present, and the opportunities we face for the future".

The first two meetings of the U.S. GSC focused on the review of initial plans for an integrated, sustained U.S. ocean observing system prepared under the auspices of the National Oceanographic Partnership Programme. The third meeting in June 2000 focused on (1) review of observational programmes and user needs in Southern California Bight, with prioritization of requirements; (2) coordination among developing US regional coastal ocean observing systems in Gulf of Maine, Gulf of Alaska, and Gulf of Mexico; and (3) development a strategy by which U.S. GSC can assist in the development and integration of US regional coastal ocean observing systems. A future focus of the U.S. GSC is to assist in the coordinated development of a federation of regional coastal ocean observing systems that will constitute the U.S. contribution to coastal GOOS. The next meeting, scheduled for January 2001, will review observational programmes and user needs in the U.S. southeast Atlantic Bight and will continue coordination among nascent U.S. regional coastal ocean observing systems.

### **THE U.S. GOOS SUPPORT OFFICE**

Established in 1998, the U.S. GOOS Office consists of two branches — a U.S. GOOS Office based at Texas A&M University with oversight of U.S. GOOS, including support for the U.S. GOOS Steering Committee, as well as a focus on global-scale observations and a U.S. Coastal GOOS Office based at Horn Point Laboratory with a focus on coastal-scale observations. The broad goals of the U.S. GOOS Office is to promote more systematic and comprehensive ocean observations in support of needed products, that include descriptions of conditions and changes, assessments, predictions and other information of socio-economic impact. The broad goals of the U.S. Coastal GOOS Office are to promote more systematic and comprehensive observations of change in the coastal zone and the application of knowledge gained from local and regional observations to global solutions (i.e., toward a predictive understanding of changes in the environment and living resources of coastal ecosystems).

Activities of the U.S. GOOS Office are principally: (1) provide staff and logistical support for the U.S. GSC; (2) maintain U.S. GOOS web site and assist with the international GOOS web site; (3) provide financial and logistic support for Worth Nowlin as chair of the international GOOS Steering Committee; and (4) assist as requested and feasible with planning and implementation of U.S. components of the global component of GOOS.

Activities of the U.S. GOOS Coastal Office are principally: (1) to provide support for Tom Malone as chair of the international Coastal-GOOS panel (and now of the Coastal Ocean

Observations Panel) and co-chair of the USGOOS Steering Committee and (2) to support workshops and publications that promote the development of the coastal component of GOOS in the U.S.

### **NATIONAL OCEANOGRAPHIC PARTNERSHIP PROGRAMME (NOPP)**

The NOPP is a partnership of federal agencies with ocean interests. Over the past few years, NOPP has undertaken a series of activities leading to the development of the U.S. component of GOOS, especially the global module.

Two major reports have been prepared. The first report "Toward a U.S. Plan for an Integrated, Sustained Ocean Observing System" was prepared by an interagency committee, review by Ocean Research Advisory Panel of NOPP, and formally submitted to Congress through OMB by NOPP in April 1999. (<http://core.ssc.erc.msstate.edu/NOPPobsplan.html>) The follow-on report, "An integrated ocean observing system; a strategy for implementing the first steps of a U.S. plan", was prepared by an ORAP sub-panel and submitted to NOPP in December 1999. (<http://core.cast.msstate.edu/oceanobs.html>)

NOPP support has been provided for several research programmes intended to contribute to building U.S. capabilities that will be required for GOOS.

#### *Project to prepare for Argo*

"An Integrated System for Real-Time CTD Profiling Float Data on Basin Scales", Dean Roemmich PI, Scripps Institution of Oceanography.

The partnership will, using profiling float technology, provide the oceanographic and climate science communities with the capability to obtain systematic real-time information of the physical state of the ocean. The necessary steps for putting this capability in place are:

- Implementation of recent instrumentation developments to improve the performance and cost effectiveness of the instrument.
- Building a data system that fully integrates data collection, data assembly, quality control and user-based functions.
- Deploying prototype large-scale arrays in the Atlantic and Pacific Oceans, within the scientific context of CLIVAR, to demonstrate the ability to provide real-time and delayed mode data streams of high scientific value.

These initial steps target measurements of physical variables, but the global network toward which the long-term effort is aimed can provide the necessary platforms for variety of complementary and compatible chemical and biological sensors.

This three-year programme includes partnerships with Woods Hole Oceanographic Institution, University of Washington, Seascan, Inc., Webb Research Corporation, NOAA/AOML, and NOAA/PMEL.

#### *Projects to develop modelling & data assimilation capabilities*

"A Consortium for Ocean Circulation and Climate Estimation", Detlef Stammer PI, Scripps Institution of Oceanography

The partnership will develop a five-year NOPP A2 (Phase B) "node" to bring ocean state estimation from its current experimental status to a practical and quasi-operational tool for studying large-scale ocean dynamics, for examining the ocean's role in climate variability, and for quantitatively designing long-term observational strategies. The central technical goal is a complete global-scale ocean state estimation over at least the 15-year period 1985-2000 at 1/4 resolution with a complete error description and regional refinements to support CLIVAR and GODAE needs. The partnership will combine all available and anticipated large-scale data sets - including TOPEX/POSEIDON, TOGA-TAO, high-resolution VOS XBT/XCTD, profiling floats, and drifters - with the dynamics embodied in a general circulation model to estimate the time-evolving, three-dimensional physical state of the full oceanic circulation. Results will be evaluated by the consortium in collaboration with the community and made available to all, fostered through an educational and visitor programme. Partners include Massachusetts Institute of Technology and Jet Propulsion Laboratory.

"HYCOM Consortium for Data-Assimilative Ocean Modelling", Eric Chassignet PI, University of Miami/RSMAS.

The goal of this 5-year project is to validate a Hybrid Coordinate Ocean Model with data assimilation capabilities. The partnership effort accelerates and leverages both existing and planned efforts to develop a consortium for hybrid-coordinate data assimilative ocean modelling, which will be ready in 2003 to address the US-GODAE principal objective to depict the three-dimensional ocean state at fine resolution in near-real time and the climate modelling objective of producing an unbiased estimate of the state of the ocean at coarse resolution for long-term climate variability research. Partners include University of Minnesota, Planning Systems, Inc., Orbital Imaging Corporation, Naval Research Laboratory, NOAA/AOML, Los Alamos National Laboratory, U.S. Coast Guard/International Ice Patrol, and Fleet Numerical Meteorology and Oceanography Center.

"Development and Verification of a Comprehensive Community Model for Physical Processes in the Nearshore Ocean", James Kirby PI, University of Delaware.

The partnership will develop and test a comprehensive community model that predicts waves, currents, sediment transport and bathymetric change in the nearshore ocean, between the shoreline and about 10 m water depth. The model will consist of a "backbone", handling data input and output as well as internal storage, together with a suite of "modules", each of which handles a focused subset of the physical processes being studied. The project will support extensions to the science base associated with each module, and will support the use of existing field and laboratory data sets to define significant tests of the modules. Data assimilation techniques will be developed and employed to address the problems of insufficient boundary data information in model applications to field experiments as well as parameter determination. Partners include Oregon State University, University of Florida, Scripps Institution of Oceanography, Woods Hole Oceanographic Institution, North Carolina State University, University of Michigan, Naval Postgraduate School, and Naval Research Laboratory.

"Models of the Coastal Ocean off the West Coast of North America: A Comparative Study and Synthesis of Observations", Thomas Powell PI, University of California, Berkeley.

The partnership will conduct a year-long planning activity to develop a concrete, detailed work-plan that will concentrate and strengthen modelling and data assimilation off the Pacific coast of North America. The overall goal of the partnership is to develop a coherent and comprehensive picture of the ocean processes in this coastal region of the

eastern Pacific. Moreover, the techniques of data assimilation are becoming sufficiently well developed that a synthesis of data and models is within reach of investigators. Partners include University of California - Los Angeles, Oregon State University, Naval Postgraduate School, Rutgers, Scripps Institution of Oceanography, Jet Propulsion Laboratory, Naval Research Laboratory, NOAA/PMEL, NOAA/Pacific Fisheries Environmental Group, Institute of Ocean Sciences, and National Center for Atmospheric Research.

"Modelling the Central California Coastal Upwelling System: Physics, Ecosystems and Resource Management", Francisco Chavez PI, Monterey Bay Aquarium Research Institute.

This partnership will model the coastal upwelling ecosystem within the Monterey Bay National Marine Sanctuary (MBNMS) with high spatial (kms) and temporal (days) resolution. The high-resolution coastal model is nested within regional and basin-scale models. The model includes the interconnected physical, chemical, and biological processes, and is capable of assimilating data from satellites and in-situ sensors. The model will focus on simulating the observed seasonal and interannual variations in physical oceanographic forcing and the chemical and biological consequences. The rich historical database and excellent matrix of real-time ocean observing systems available in the MBNMS provide a unique environment for the development of the next generation of coupled coastal physical-biological models. Long-term (decadal and longer) simulation and prediction will contribute to policy, short term simulation will guide management. The model will enable the managers of the MBNMS to fulfill their mandate of promoting "resource protection, research, education, and public use." It will also direct future observational efforts within the MBNMS. Partners include University of California at Los Angeles and Santa Cruz, University of Maine, Duke University, NOAA, NASA/Jet Propulsion Laboratory, Naval Research Laboratory, Naval Postgraduate School, and HOBI Labs.

*Project to develop observing system capability*

"Gulf of Mexico Ocean Monitoring System", James Herring PI, Dynalysis of Princeton.

The Partnership will develop a working capability to generate continual synoptic numerical representations of ocean velocity for the Gulf of Mexico. Operational high-accuracy satellite altimetry data and in situ ocean data retrieved from measurement systems in near real-time, together with a proven ocean model, will be used to produce three dimensional determinations of ocean velocity. The purpose of these operational velocity data will be to support ocean monitoring, innovative commercial ocean products, and investigations into ocean transport processes in the Gulf of Mexico. The project represents the initial stage of a longer term effort to accurately specify circulation in the Gulf of Mexico. Partners include Naval Oceanographic Office, University of Texas at Austin, University of Colorado, Naval Research Laboratory, Florida State University, Webb Research, Technocean, Inc., Texas A&M University, Texas General Land Office, Space Systems Analysis, and Waterways Experiment Station.

"Application of an Integrated Monitoring and Modelling System to Narragansett Bay and Adjacent Waters Incorporated Internet-Based Technology", Michael Piasecki (Drexel University) and Malcolm Spaulding (University of Rhode Island) PIs.

This partnership will develop a globally re-locatable, integrated system for real time observation, modelling, and data distribution for shelf, coastal sea, and estuarine waters. The models will be forced by input from GODAE products or similar global or shelf scale

modelling systems. The system will be applied to Narragansett Bay and Rhode Island coastal waters as a demonstration of the practical use of the system to support environmental monitoring, marine pollutant transport and fate, marine transportation, and search and rescue operations and to provide a foundation to advance our understanding of and predictive capabilities for the bay. The study will make use of COASTMAP, an integrated modelling and data analysis and distribution system, developed at the University of Rhode Island, that combines data collecting, data analysis, numerical modelling, and post processing features that are ideally suited for the task. A generalized data base system for data collection, archiving, visualization, and distribution will also be developed. This system will be based on platform independent internet/WEB technology (Java) and will make data collected via telemetry, remote sensing, GODAE, and output from numerical models for oceanographic and atmospheric processes available to the user community at large. Partners include Brown University, Rhode Island Department of Environmental Management, Rhode Island Transportation Center, NOAA, National Ocean Service, Applied Science Associates, and Narragansett Bay Commission.

"Limited Area Coastal Ocean Models: Assimilation of Observations from Fixed Platforms on the Continental Shelf and Far-Field Forcing from Open Ocean Models", Daniel Lynch PI, Dartmouth College.

The objective of this 3-year project is to build an operational system for site-specific, limited-area forecasting of the coastal ocean. The system will be applied and tested in the South Atlantic Bight; it will be modular and portable to other waters. It will feature coupled physical/biological phenomena in and around the South Atlantic Bight Synoptic Offshore Observational Network (SABSOON). In-situ and remotely sensed observations will be assimilated, plus results from atmospheric and global ocean models. The atmospheric products will be handled within the partnership; the remotely sensed data will be obtained from standard sources; and the oceanic products via cooperation with the GODAE. Partners include University of North Carolina, Woods Hole Oceanographic Institution, Skidaway Institute of Oceanography, NOAA/NWS, and North Carolina Supercomputing Center.

*Project to develop an integrated regional-national data exchange capability*

"Planning and implementation of a 'Virtual Ocean Data Hub' (VODHub) activity", Peter Cornillon PI, University of Rhode Island.

This consortium will plan and implement a network based system that will provide for the discovery of and seamless access to oceanographic data. The system will build on the rapidly growing Distributed Oceanographic Data System (DODS) framework. As part of the effort, the system will be seeded with a broad suite of oceanographic data and tools will be developed to facilitate unsolicited contributions to the system in the future. In that many of the components required to build such a system already exist, the planning process will focus on determining the modifications that might be required for these components as well as on defining components that are missing. The implementation will focus on assembling these components into an integrated system. This effort will:

- Result in the design and implementation of an infrastructure for the Virtual Ocean Data Hub (VODHub) system, an integrated - interoperable- oceanographic data environment;
- Link in excess of two terabytes of oceanographic data held in over 250 data sets at approximately 40 sites via this system;
- Establish a diverse group from the ocean data user community committed to the success of the system; and



- Build the basic infrastructure required to couple data providers and users in the science community with data providers and users in the geographic information system (GIS) community.

Partners include Oregon State University, University of Wisconsin, University Corporation for Atmospheric Research, Massachusetts Institute of Technology, Texas A&M University, University of Maryland, U.S. Geological Survey Coastal and Marine Programmes, NASA JPL, NASA Goddard Space Flight Center, Naval Research Laboratory, NOAA Coastal Services Center, NOAA National Geophysical Data Center, NOAA/PMEL, State of Maine Department of Marine Resources, Météo-France, Bureau of Meteorology Research Center, Minerals Management Service, Science Application International Corporation, and Environmental Systems Research Institute, Inc.

Very recently NOPP has established an OCEANS.US Office "to integrate existing and planned elements to establish a sustained ocean observing system to meet the common research and operational agency needs in the areas of: detecting and forecasting oceanic components of climate variability; facilitating safe and efficient marine operations; ensuring national security; managing resources for sustainable use; preserving and restoring healthy marine ecosystems; mitigating natural hazards; and ensuring public health". Elements of the system may be regarded as NOPP-funded, NOPP-coordinated, or NOPP-related.

## **ENHANCEMENTS TO GLOBAL GOOS**

The Global Ocean Data Assimilation Experiment (GODAE) is a GOOS pilot project of the global module. There is a U.S. GODAE committee actively planning U.S. participation. A GODAE data server (for real-time exchange of in situ and satellite data) will be operated by the U.S. Navy at Monterey, California. (<http://www.fnoc.navy.mil/PUBLIC/>)

Argo is a pilot project of GODAE. It evolved from the WOCE programme of autonomous floats. The Argo Science Team membership includes Dean Roemmich (chairman), Bob Molinari, Steve Riser, Breck Owens, and Olaf Boebel; other countries represented include France, Canada, Korea, UK, India, Germany, New Zealand, Japan, Australia, and China. There has been vigorous promotion of Argo by U.S. agencies, lead by NOAA and NASA. The leadership for this promotion has been from NOAA's Office of Chief Scientist with active international promotion by the Administrator of NOAA. U.S. commitments to the implementation of ARGO begin in 2000.

Improvements continue to the ENSO Observing System and the GOOS Center at NOAA/AOML.

## **DEVELOPMENT OF REGIONAL U.S. OBSERVING SYSTEM ELEMENTS**

Gulf of Maine Ocean Observing System (GoMOOS). Federal funding for two years has been provided to initiate the GoMOOS. GoMOOS is not a research project, but should be considered an entity that will build, deploy, operate, transmit/process/archive data, and maintain the infrastructure required to do this. Any research that GoMOOS will be involved in will be sharply focused on observational techniques and technology and in creating products most relevant to, and in the form needed, by the system's clientele. The goal of GoMOOS is to provide the data the public and private sectors need to resolve problems, predict events and to further understand the natural system relating to the Gulf of Maine. Initial funding for GoMOOS has been provided by ONR/NOPP. It is planned that future funding will come directly from the customers—resource managers, military planners,

environmental regulators, fishermen, aquaculturists, mariners, biotechnology interests, and specialists in real time, spatial, oceanographic data.

Northern Gulf Littoral Initiative (NGLI). The U.S. Naval Oceanographic Office is developing a prototype regional observing system for physical products and information in Gulf of Mexico. NGLI is confined to the area of the Mississippi Sound and adjoining rivers, bays, and shelf waters. ([http://www.navy.mil/NGLI/main\\_frame.html](http://www.navy.mil/NGLI/main_frame.html))

Gulf of Alaska Ecosystem Monitoring and Research Programme (GEM). With funds from a separate trust set aside by the Exxon Valdez Oil Spill (EVOS) Trust, planning is proceeding for the development of the GEM (<http://www.oilspill.state.ak.us/future/gem.htm>) to begin in 2002. The mission of the programme is "to sustain a healthy and biologically diverse marine ecosystem in the northern Gulf of Alaska and the human use of the marine resources in that ecosystem through greater understanding of how its productivity is influenced by natural changes and human activities". Managed by the EVOS Trustees, GEM will provide leadership in identifying monitoring and research gaps and priorities; encouraging efficiency and integration through leveraging of funds, coordination, and partnerships; and involving stakeholders in local stewardship by having them help guide and carry out parts of the programme. The scientific background and conceptual design is under review by the National Research Council. The first workshop to review draft plan for the Gulf of Alaska Ecosystem Monitoring and Research Programme was held in Anchorage, Alaska October 12-13, 2000. Representatives of the U.S. GOOS Support Offices attended as did representatives of the NGLI and GoMOOS.

Plans are under development for strengthening the observational base and data exchange within the Southern California Bight.

## **Q. VENEZUELA NATIONAL REPORT**

### **1. GOOS NEEDS OF DATA AND PRODUCTS**

- 1) A National Plan to produce Oceanographic Data and Information
- 2) A National Oceanographic Data and Information Center
- 3) A National Oceanographic Data, Information and Services Network connected to a Regional Network.

### **2. MEANS TO SATISFY THE GOOS NEEDS**

- 1) The National Oceanographic Data, Information and Services Committee for GOOS, under the co-ordination of the National Oceanographic Commission (established in 1985 under the umbrella of CONICIT, the National Research and Technology Council
- 2) A National Voluntary Observing Ship (VOS) Programme, including both governmental (Navy and PDVSA, the Venezuela Oil Company) and private ships (Particularly CONFERRY)
- 3) A National Programme for Users of the Local Oceanographic Satellite Station (AVHRR, NOAA, SeaWIFS), under the responsibility of CPDI-MCT and INTECMAR-USB
- 4) The National Oceanographic "Fleet" integrated by 4 research ships: "Bergantín" (ICLAM-MARN), "Guaiquerí II" (UDO), "Hermano Ginés" (Fundación La Salle, ONG) and "Punta Brava" (Navy)

- 5) A National Oceanographic Research Centers Network, integrated by 21 public centers and by at least 7 private ones
- 6) The National Tide-gauge Stations Network (MARN): six conventional tide gauges along the 4.006 coastal lines.
- 7) The current National Oceanographic Research Programme, particularly: CARIACO Project, Morrocoy macroproject and VENEHMET Project
- 8) A permanently renewed National Oceanographic Research Programme

### **3. GOOS USERS OF DATA AND PRODUCTS**

#### **3.1 PUBLIC SECTOR**

- 1) Coastal and island states and counties authorities (Alcaldías & gobernaciones costeras)
- 2) Coastal national, state and local rescue authorities (Defensa Civil)
- 3) Intergovernmental organizations: ACS, CARICOM, CDB, CEP-UNEP, ECLAC, FAO, GEF, IAI, ICSU, IGBP, IOC, IOCARIBE, IMO, OAS, WMO, UN, UNDP, UNEP, UNIDO, SELA, WB, WMO, etc.
- 4) Ministry of the Environment and Natural Resources (MARNR)
- 5) Ministry of Science and Technology (MCT)
- 6) Ministry of the Defense (Armada, OCHINA)
- 7) Ministry of the Infrastructure (Minfra)
- 8) Ministerio of the Interior and Justice (MIJ)
- 9) Ministry of Trade and Production (MPC)/Autonomic Service of Fisheries and Aquatic Resources (SARPA) and National Tourism Office
- 10) Ministry of Health and Social Development (MSDS)
- 11) National Oceanologic Commission (CNO)
- 12) Venezuela oil company (Petróleos de Venezuela, PDVSA)
- 13) National meteorological service (Navy, Air Force and MARN)
- 14) Public universities and public oceanographic research institutes

#### **3.2 PRIVATE SECTOR**

- 1) Coastal engineering building enterprises (docks and dockyard, harbors, landing places, marinas, piers, etc.)
- 2) Environmental NGOs (marine, island and coastal affairs)
- 3) Fishing and fisheries enterprises
- 4) Maritime enterprises for transportation of people, merchandises and other varied products
- 5) Private oceanographic research universities and specialized centers
- 6) Private oil companies
- 7) Shipbuilders and shipwrights
- 8) Shipmaster schools
- 9) Shipowner organizations
- 10) Shipping agencies
- 11) Tourism Enterprises

**Caracas, November 2000**

Ref. Hernan Perez Nieto [perezca@telcel.net.ve](mailto:perezca@telcel.net.ve)

## R. EUROGOOS REPORT

1. The year 2000 is the first year that EuroGOOS has conducted its business as a self-funded organization, supported only by the subscriptions of its Member Agencies. The subscription levels were agreed at the Madrid Annual Meeting in December 1999 and the Members paid the subscriptions promptly, which made the conduct of business efficient and without problems.
2. During 1999 EuroGOOS manifestly changed into an operational organization supported by an infrastructure of crosscutting components and services, rather than an exploratory and planning body, which might one day, become operational. The locomotive for the development of EuroGOOS now consists of the collective efforts of the Regional Seas Task Teams, and the European integration between them. At the Madrid Annual Meeting we re-structured the Officers Steering Group so that the Regional Seas Task Teams become the central focus of activity in EuroGOOS, supported by the Science and Technology Working Groups, and a range of specialist Panels such as the Space Panel and the Data Policy Panel. This format has worked well during 2000, as groups of Member Agencies at the Regional Seas level have moved steadily and even rapidly into the business of providing operational data services to an expanding range of user groups.
3. The Regional Task Teams are producing a steadily increasing range of information products, while the signing of the EuroGOOS Data Policy and the success of the EuroGOOS Space Conference have added substantially to the credibility of operational oceanography. Many data products are accessible on agency home pages in real time. This is an excellent achievement.
4. The year has been notable for a number of major projects, which have proceeded successfully. The Officers visited DG XII in January, and had a very constructive discussion with Christian Patermann and his staff. At the Brighton OI-2000 meeting about 70 experts took part in meetings of the component bodies of EuroGOOS. The Bio-ecology Workshop at RIKZ was attended by 40 people, resulting in a report and recommendations, which will be considered by both EuroGOOS and ICES (EuroGOOS Publication 15). The EuroGOOS meetings at the Hamburg EuroOCEAN 2000 conference were notable for the rapid progress made with the Data Policy, under the Chairmanship of Hans Dahlin, and the development of the NWS Plan, co-ordinated by Leen Droppert and Kees Borst. The Darmstadt Space Conference resulted in a Conference Statement, which requires a strong follow-up, while the conference papers are being published by EuroGOOS (EuroGOOS Publication 16). Members of EuroGOOS have also been active in preparing for the Argo float deployment in the Atlantic. EuroGOOS is continuing to develop working relations and joint projects and workshops with other European multi-national organizations and agencies.
5. The future funding of science and technology projects and pre-operational trials in Europe will be considered in a new way in the immediate future. This applies to the final stages of F5, as well as in F6, and other initiatives. We have been given several strong indicators. These are:
  - Request for a submission to the Busquin initiative “A European Research Area”.
  - Inclusion of the environmental sciences and oceanography in the European Science Infrastructures Conference at Strasbourg.
  - Announcement of the theme “Global Monitoring for Environment and Security”.

- Revision of Key Actions in Environment and Energy for the last stages of F5.
  - Encouragement to submit a Concerted Action proposal on oceanographic strategy.
  - Indications that F6 will include the scope for very large projects.
  - The recognition that EUMETSAT is the natural focus for operational ocean satellite missions.
  - Possibility of applying for support through the Access to Infrastructure Programme.
  - Possibility of a COST action.
5. EuroGOOS needs to develop a continuous effort of lobbying and negotiations at the highest level possible to ensure that the funding of operational oceanography is discussed and approved at the European scale. We need to identify tasks at this level, with appropriate responsibilities taken by the Officers and Member Agencies, working through capitals, and briefing Ministers where possible.
6. EuroGOOS was active in early 1999, and again at the Brighton Conference in March 2000 to promote collaboration between EuroGOOS Member Agencies and NOAA in the implementation of the Argo project in the Atlantic. Many EuroGOOS Members were represented at the Argo Conference in Paris in July 2000. Agencies in UK and France have taken a lead in providing profiling floats for ARGO in the Atlantic, and the GYROSCOPE project has been funded by the Commission in Framework 5. Many other EuroGOOS Member Agencies represented at the July meeting offered to provide facilities, fund floats, or help to launch them.
7. At the Officers Meeting in March the EuroGOOS Office was requested to prepare the routine progress reports as a EuroGOOS Newsletter. This has been done, and the Newsletter is distributed electronically to about 300 addresses. The Annex of photocopied pages, contents lists, conference announcements, etc., is only attached to 100 of the Newsletters, and can only be distributed by post.
8. The EuroGOOS 7<sup>th</sup> Annual Meeting will be held in Brest, France, on 1 December 2000. A work-plan for the year 2001 will be discussed by the Members. Several key projects are on the point of obtaining funding, or being implemented by the Member Agencies from internal funds. These projects will be of benefit to GOOS as a whole. EuroGOOS is also developing strong ties with MedGOOS, and has been in correspondence with the Members of Black Sea GOOS.

## EUROGOOS REPORT - ANNEX 1

### Meetings organized by EuroGOOS during 2000

The following components of EuroGOOS held meetings during the calendar year 2000. Some meetings of Regional Task Teams and projects are not included.

EDIOS Planning group: 14 January

Gridded Bathymetry: 17, January, 7 February,

NWSTT: Brighton, RIKZ, Hamburg 31 August; Toulon, 6-7 November.

BOOS: 1 November.

MFSP: Second Annual Meeting, Bologna, 16-18 September.

ESODAE: March (?): Aberdeen, 20-22 September.

Officers: Brighton: 8 March; Hamburg, 30 August.

SAWG: Brighton: 8 March, Brest 30 November.

SAWG Workshop series: Bio-Ecology, Den Haag, 6-8 April.  
TPWG: Brighton, March, Buoy workshop; Brest 30 November.  
Space Panel: Darmstadt, 2 March; Brighton 7 March; Darmstadt 5-6 October.  
Data Panel: Brighton, 9 March; Hamburg 31 August.  
EuroGOOS display booth, EurOCEAN 2000, Hamburg. 29 August – 1 September.  
Secretariat: GOOS-ICES Steering Group, SOC, 23-25 October.  
Projects Committee, Brest, 30 November.

## EUROGOOS REPORT - ANNEX 2

### Meetings Attended By Eurogoos Secretariat Staff:

All meetings listed were attended by the Director. Meetings marked with an asterisk (\*) were attended by the Deputy Director. Meetings marked with two asterisks (\*\*) were attended by Sally Marine.

Jan 14	EDIOS Planning meeting, IFREMER, France. (*)
Jan 17	Gridded Bathymetry, Heathrow, UK
Jan 18	Officers meeting with DG XII, Dr Christian Patermann. Brussels.
Feb 07	Gridded Bathymetry, Heathrow, UK
Feb 10-12	NOAA Ocean Economics Meeting, Washington USA.
Mar 02	EuroGOOS Space Meeting, planning session, Darmstadt, Germany.
Mar 07-10	Oceanology International, Brighton, UK. (*), (**).
Mar 22-24	EU-CEC DG XII, Oceans Cluster Meeting, Hamburg, Germany.
Apr 06-08	EuroGOOS Bio-ecology Workshop, RIKZ, Den Haag, Netherlands. (*)
May 10-12	GOOS Steering Committee, IOC, Paris, France.
May 19	UK-Norway Atlantic heat transport conference, London, UK.
Jul 06	Oceanography Division, NATO, Mons, Belgium.
Jul 09-11	Argo Meeting, IFREMER-NOAA, Paris, France.
Jul 18	EDIOS planning meeting, BSH, Hamburg (*)
Jul 19	Visit of Chairman and Director to BSH, Hamburg, Germany.
Aug 04	Lecture and meeting at IMBC, Crete, Greece.
Aug 28-Sept 01	EurOCEAN 2000, Hamburg, Germany. (**)
Sep 18-20	EU-CEC European Infrastructures Conference, Strasbourg, France
Sep 21-22	ESODAE Users Workshop, Aberdeen, Scotland.
Oct 04-06	EuroGOOS Space Conference, Darmstadt, Germany.
Oct 16-18	MFSP, Bologna, Italy.
Oct 23-25	GOOS-ICES Meeting, SOC, UK.
Nov 15	MetSoc Conference on Operational Oceanography, UK.
Nov 30-Dec 01	EuroGOOS Annual Meeting, Brest, France. (**)

## S. MedGOOS REPORT

### THE GLOBAL OCEAN OBSERVING SYSTEM FOR THE MEDITERRANEAN (MEDGOOS)<sup>7</sup>

The MedGOOS is an informal association founded in Malta in 1997<sup>(1)</sup> under the auspices of the UNESCO/Intergovernmental Oceanographic Commission (IOC) to provide a concerted approach to the planning and implementation of the Global Ocean Observing System

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<sup>7</sup> Update – November 2000, Prepared by Aldo Drago, MedGOOS Executive Secretary

(GOOS)<sup>(9)</sup> in the Mediterranean. The MedGOOS aims to facilitate the development of an operational forecasting system at a regional to coastal scale to the benefit of a wide group of users in the region. In these initial stages, the MedGOOS is in the process of identifying the regional priorities for operational ocean forecasting and marine meteorology, assessing the related economic and social implications, and guiding and assisting the riparian states to the harmonious implementation of the Mediterranean ocean observing and forecasting system built on existing elements and based on principles of co-development, co-ownership and sharing of benefits. The MedGOOS will ensure the upgrading of national systems to the same level of expertise and infra-structure and will stimulate the necessary pre-operational R&D to ensure that GOOS is fully effective when it is eventually established, hopefully in ten to twenty years time.

The MedGOOS Association currently consists of sixteen marine agencies and institutions from thirteen countries from the EU, Associated States, Mediterranean Partner Countries, and other Countries of the basin. The MedGOOS Association was formally established on the 12th of March 1999 in Rome at a special session during the 2nd EuroGOOS Conference. Since then further institutions have joined and now cover most of the riparian countries including Morocco, Spain, France, Italy, Malta, Slovenia, Bosnia Herzegovina, Croatia, Greece, Turkey, Cyprus, Israel and Egypt. The regional dimension of the Association is an enabling asset to the future projection of MedGOOS into long-term commitments at governmental level.

This commitment was endorsed, in November 1999, in a preparatory Workshop in Rabat, Morocco, by over 30 national Institutions, interagency and intergovernmental organizations from almost all the European and Mediterranean countries. This was a first-time highlight of MedGOOS with a major event in a North African country. The Workshop provided a forum to establish the MedGOOS strategy and obtain consensus at a regional level. The Workshop also helped to broaden the participation in MedGOOS to all Mediterranean countries as well as to bring together scientists and representatives of the institutions involved in operational oceanography in the Mediterranean to define priorities, and plan the way forward with integration of efforts and appropriate measures in favor of technology transfer, cooperation and capacity building elements to bring capacities in different countries at comparable levels. The Workshop also focused on raising the level of awareness in the region on the benefits of implementing MedGOOS, and on the linkages to the UNCLOS and the UNCED '92 follow-ups in the Mediterranean.

Two important ongoing EU-funded RTD projects for the Mediterranean region are already preparing the implementation of MedGOOS. These are the Mediterranean Data Archaeology and Rescue of Temperature, Salinity and Bio-chemical Parameters (MEDAR/MEDATLAS)<sup>(2)</sup> and the Mediterranean Forecasting System Pilot Project (MFSPP)<sup>(3)</sup>. Both projects involve the participation of some of the Maghreb and Southeastern Mediterranean countries and thus offer a first important approach to enhanced research cooperation in marine science between North and South. MFSPP aims to demonstrate the feasibility of a Mediterranean operational system for predictions of physical and biochemical parameters in the whole basin and coastal/shelf areas, and for the time scales of weeks to months. Forecasts will be made by a nowcasting/forecasting modelling system and based on data from a network of automated monitoring stations (including satellites) that will be eventually established. MFSPP will also develop interfaces to user communities for dissemination of forecast results. MFSPP is thus providing the science base for MedGOOS.

The scientific and technological base achieved in Europe <sup>(4,5,6,7,8)</sup>, the enlargement process in the European Union, and the Mediterranean policy of the Union, are all favorable

conditions for a concerted basin-wide integrated effort to establish a strong, common research infrastructure for the implementation of the Ocean Observing System in the Mediterranean basin. On this basis MedGOOS has recently drawn up a concerted action in support for research infrastructures and marine research facilities. The proposal was submitted for funding through the Vth Framework programme of the EU. It aims to enhance and upgrade the research infrastructure needed to provide the knowledge for long-term, viable management strategies for the protection of the Mediterranean ecosystem, within the framework of the GOOS and with a focus on the needs for the sustainable use of coastal areas. More specifically the proposal aims to:

- (i) identify the gaps in the existing capability to measure, monitor, model and forecast the state of the marine environment in the Mediterranean;
- (ii) take stock of existing monitoring systems in the Mediterranean and current RTD experiences to design scientifically sound and cost effective coastal observing and forecasting systems that are fully integrated and mutually supportive to the basin-wide system;
- (iii) network the community of researchers and end-users to optimize the use of available infrastructures and systems;
- (iv) upgrade the monitoring and forecasting capabilities in all Mediterranean countries complementing existing initiatives with compatible systems;
- (v) establish electronic links for the necessary regional information and dissemination network for marine data and services;
- (vi) raise awareness involving stakeholders and disseminate results through a demonstration tool and a pilot test case;
- (vii) provide national agencies with prototype tools for the assessment of environmental impacts.

The principal novelty of the proposal consists in:

- (i) the concerted panEuro-Mediterranean effort to establish a strong, long-term, thematic network of Institutions in Europe, in Associated States and in the Mediterranean Partner Countries, and set the logistics for the ocean and coastal monitoring, modelling and forecasting operational system of the Mediterranean;
- (ii) the involvement in the process of end-users from marine authorities and providers of marine services;
- (iii) the integration of the existing knowledge base derived from national programmes, related RTD EU projects and other international programmes to design the real time observing and forecasting system in the Mediterranean with full coverage of the basin, and with a focus on the coastal area problems;
- (iv) provide the transnational pooling of scientific and technological resources and the necessary interaction with end-users to design the initial observing system and define the research needed to underpin the coastal area problems.

The expected long-term results are to:

- (i) enhance the coastal monitoring and forecasting capabilities in all Mediterranean countries;



- (ii) establish contacts and collaborative efforts among all the Mediterranean countries in favor of the development of a Mediterranean operational forecasting system operating at a global and local (regional to coastal) scale;
- (iii) define the platform for the future Mediterranean data and information network for operational interagency data exchange with the sharing of operational common products including the automated production of added value oceanographic information, and with the delivery of user-oriented products in an operational and interactive mode;
- (iv) improve awareness of policy makers and the marine authorities on the opportunities and need of operational ocean forecasting;
- (v) set-up the transnational Mediterranean network of researchers and end-users for the implementation of operational ocean forecasting.

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## T. IOCARIBE-GOOS REPORT

IOCARIBE-GOOS is the acronym of the regional component of the global GOOS programme for the Caribbean and adjacent regions. The IOCARIBE Subcommission's Member States approved the establishment of a regional ocean observing system during its Sixth Meeting held in San Jose, Costa Rica, April 1999. As the regional component of the global GOOS, the Subcommission agreed likewise that this system would be called IOCARIBE-GOOS.

The Regional Observing System would also have the purpose to promote GOOS technical implementation in the Great Caribbean region, at all appropriated time and space scales as it is required. IOCARIBE-GOOS would have to satisfy the regional economic,

social and environmental needs of coastal and island states. The Subcommission also approved the appointment of an ad-hoc Advisory Group (ah-AG) to be charged with the responsibilities to:

- Continue and complete the inventory of what is already being done in the region.
- Assess the regional and national requirements for setting up the IOCARIBE-GOOS regional project.
- Develop links with existing relevant organizations, programmes and projects.
- Prepare a 10-year strategic plan for the development of IOCARIBE-GOOS.
- Consider mechanisms for gradual and appropriate implementation of pilot-projects to take part in IOCARIBE-GOOS and identify funding sources

The objectives of the regional system will be the same ones than those of the global system although it is considered to include a set of specific objectives that will satisfy the fundamental needs and priorities for the sustainable development of the states of the region. The Sixth Meeting of the Sub-commission also agreed that top priority areas for the conception and implementation of IOCARIBE-GOOS would be the following ones:

Tourism	Fisheries	Agriculture
Coastal populations	Maritime safety	Marine pollution
Storms and hurricanes	Weather forecast	Tsunamis
Storms surges	Marine biological diversity	

It is however clear that, due to the geographical characteristics of the states of the region, COASTS AND SUSTAINABLE TOURISM must be the first long-term priority field in any programme or alternative for GOOS at national or even regional level. The ah-AG considers that the Marine Scientific Community and many governments in the region do not yet fully understand the concept of Operational Oceanography and therefore there is a need to make it broader in perspective as well as to address the benefits for participating in GOOS. The ah-AG also considers that:

- (i) the objectives of GOOS should be prefaced by the definition of IOCARIBE- GOOS. It can be envisaged as a major tool for sustainable development in the region;
- (ii) long-term benefits should also be identified for the region. It was thought that a framework is needed to indicate how IOCARIBE-GOOS will deliver its products;
- (iii) there is a clear need for capacity building in the region as well as to identify the potential donor organizations that could contribute to that, both at the national and international level;
- (iv) examples of end-to-end products that could mitigate impacts from natural hazards and anthropogenic processes should be sought. Those could be implemented as part of IOCARIBE-GOOS, with emphasis to the provision of information to the decision making process of Nationals;
- (v) IOCARIBE-GOOS could be defined as a system to provide and support economic development through systematic observations in the open ocean and coastal areas;
- (vi) IOCARIBE-GOOS should also be providing specific products and services on the past, present and future state of the marine environment that could potentially influence on climate in different time scales;

- (vii) for the particular case of the Caribbean and the Gulf of Mexico, tourism, as an important economic activity, possesses qualities already demonstrated and even more promising due to its capacity to produce direct revenues and so contributing to the gross internal product of countries in the region.
- (viii) high quality weather forecasts is another issue of strategic importance to the region, not only because of the many economic impacts but also due to the recent natural disasters led by climatic events and that caused serious damage to society and economies of the region.
- (ix) GOOS is envisaged as essential to help predict and reduce the risks of human and economic losses due to climate events or associated marine disasters.

### **IOC Subcommittee for the Caribbean and Adjacent Regions IOCARIBE**

Terms of Reference (TOR) of the Regional ad hoc Advisory Group

- A. Prepare an inventory of:
  - (i) Existing operational systems and programmes both at the international and national levels with relevance to IOCARIBE-GOOS;
  - (ii) Existing organizations with potential interest in IOCARIBE-GOOS;
  - (iii) Existing and proposed scientific programmes with expression to IOCARIBE-GOOS;
  - (iv) Existing services and products with potential interest to IOCARIBE-GOOS
  - (v) Commercial group with potential interests and involvement in IOCARIBE-GOOS.
- B. draft and distribute guidelines for national participation in IOCARIBE-GOOS which would include the setting up of a national GOOS Committee as a start.
- C. develop links with existing relevant organizations, programmes and projects in the region; and
- D. provide advice to the future Steering Committee on the preparation of a Strategic Plan, taking into account the existing elements of the GOOS Strategic Plan and Principles, as described in the GOOS Report No. 41 (IOC/INF-1091), with the specific adaptations to the region.

It was also agreed that the modules for IOCARIBE-GOOS should be

- (i) coastal,
- (ii) oceanic, and
- (iii) training.

The Coastal module is likely to be the most important one to the region, and capacity building activities are to be stressed.

### **U. NEAR-GOOS REPORT**

#### **STATUS OF NEAR-GOOS AND ITS FUTURE DEVELOPMENT<sup>8</sup>**

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<sup>8</sup> Zhouwen Yu, National Marine Environment Forecasting Center, Beijing , China

NEAR-GOOS is one of the regional components of GOOS with China, Korea, Japan, and Russian as its members. It focuses its efforts on common marine data exchange in the Northeast Asian region under the NEAR-GOOS framework. The nature of the cooperation in NEAR-GOOS is that the system functions as a virtual platform of both real-time and delayed mode databases. An important achievement of NEAR-GOOS is the agreement on an open data exchange policy. Oceanographic data in NEAR-GOOS are made available, free of charge, to all users who are interested in contributing and/or making access to the databases.

NEAR-GOOS has been in operation satisfactorily since its establishment. The regional real time database (RRTDB), and the regional delayed mode database (RDMDDB), which are both operated in Japan, and national databases have been set up and all are in operation now. Users can choose to access the national databases or the regional databases. Real-time data are kept up to a period of 30 days from the time of collection. After that time, the data are transferred to the delayed mode database and added to the long-term records. The delayed mode databases in the member countries also collect historic datasets and data that are not collected in real time. A large amount of oceanographic data has been contributed to the system by data gatherers, distributors and processors from a wide range of government agencies of the four member states.

Access to the NEAR-GOOS data collection is free and the databases are open to anyone who is willing to register. During the last few years, the databases have provided marine data to users within and outside the NEAR-GOOS region, and users have accessed the NEAR-GOOS databases and obtained data to improve their ocean research, marine management activities and operational services. By 1 September 1999, 33 organizations had registered as users of RRTDB. In 1999, the frequency of ftp access to retrieve data from RRTDB was up to 14000 files per month. The most frequently accessed were BATHY data, followed by the temperature data in RRTDB common format. The number of RDMDDB users has been steadily increasing. By the end of 1999, 24 organizations had registered as users of the RDMDDB. Since May 1999, the RDMDDB access number has exceeded 200 times a month, and the number of data files downloaded in a month reached 487 files in June 1999.

In the initial phase of NEAR-GOOS, the parameters in the database are temperature, salinity, currents, winds and waves. The result of this initial phase is the establishment of an efficient data exchange scheme for the existing observing systems in the region. In the long-term, it is expected that the NEAR-GOOS system will expand in scope to better serve the overall goal of global ocean and climate monitoring and forecasting.

NEAR-GOOS constitutes in essence a virtual network where each of the countries have an equal opportunity to contribute to and benefit from the data maintained in both the real-time and delayed mode components of the system. This has proven to be a workable structure for cooperation among the NEAR-GOOS members.

Although the achievements in NEAR-GOOS made so far are encouraging, improvement in many aspects is needed in order to achieve the goals of NEAR-GOOS. The improvements will include expansion of the databases by adding more parameters and more data; the enhancement of data quality control; the promotion of data format uniformity; and the strengthening of cooperation with other related projects.

In the future, NEAR-GOOS will co-exist and interact cooperatively with the other systems for mutual benefits. The cooperation will not be limited to the NEAR-GOOS region. NEAR-GOOS can also benefit from the development of systems in other regions and sectors.

Cooperation with PICES, NOWPAP, CREAMS and other complementary regional frameworks will be encouraged.

In addition, effective collaboration is needed between data providers and the user community. The user community should be the driving force behind the development of NEAR-GOOS. Cooperation between data providers at the national level is also important. NEAR-GOOS should function as a mechanism at the national level to foster operational data exchange and technological and scientific innovation.

## V. PACIFIC-GOOS REPORT

Apia, Samoa, 15–18 August

The focus of the Pacific GOOS meeting was Coastal GOOS and the development of GOOS in the Pacific Island States. 45 people attended the meeting from 18 countries. A series of presentations were made to highlight the coastal issues in the Pacific Islands and an overview of the Strategic Plan for Coastal GOOS was presented.

The aim of the workshop was to develop a number of potential pilot projects for Pacific GOOS. The participants at the workshop represented a wide range of end users. They had been requested to bring to the meeting ideas and issues they would like to see Coastal GOOS address in the Pacific. The meeting was split into a number of working groups to develop potential pilot projects. After detailed discussions three pilot projects were proposed.

- (i) Monitoring the quality of coastal waters at selected regional sites.

This project had wide support from a range of end users such as government resource management agencies, tourism industry, and the aquaculture industry. Water quality was a concern to all nations represented at the meeting, with a significant number of end users being identified including tourism, fishers, and resource managers.

- (ii) Monitoring systems for mariculture initiatives in the Marshall Islands and Kiribati.

Mariculture, particularly pearl culture and seaweed farming, are growing industries in the Pacific. A monitoring system for pearl culture has already been developed in the Cook Islands. This programme was identified for further development and adaptation for other countries developing a pearl farming industry such as the Marshall Islands. Seaweed farming in Kiribati is a significant export industry. The prediction of wind direction and strength and the impact of rabbit fish on seaweed growth were identified as key issues for the development of monitoring projects to improve harvests.

- (iii) Reef health monitoring at Pacific Island dive sites.

The tourism industry is very important in the Pacific and there is concern about the high numbers of divers in some areas may be impacting coral reefs. This pilot project would use methodologies already developed by the Global Coral Reefs Monitoring Network (GCRMN). Dive operators would be encouraged to survey sites they use regularly. It was felt that divers would be keen to participate in a monitoring programme and dive operators could use their involvement in the programme as a selling point.

Individuals and organizations are being sought to champion these three proposed pilot projects and develop full pilot project proposals.

## W. BOOS REPORT

### BOOS - BALTIC OPERATIONAL OCEANOGRAPHY SYSTEM<sup>9</sup>

The Baltic Operational Oceanographic System (BOOS) constitutes a regional Task Team under the European component of the Global Ocean Observing System - EuroGOOS.

The goals and objectives of BOOS are to:

- improve and further establish services to meet the requirements of environmental and maritime user groups
- co-ordinate, improve and harmonize observation and information systems
- increase the quality of and harmonize user-oriented operational products
- decrease the production costs of public products and services by sharing the workload
- co-operate with HELCOM and other relevant bodies with the aim to avoid duplication of work and to maximize mutual assistance
- identify new customers for operational oceanographic products
- further develop the market for operational oceanographic products
- develop BOOS pursuant to the GOOS Principles
- provide high quality data and long time series required to advance the scientific understanding of the Baltic Sea.
- provide data and forecasts to protect the marine environment, conserve biodiversity, and monitor climate change and variability.

The BOOS members are:

Bundesamt für Seeschifffahrt und Hydrographie (BSH), Germany  
Centre of Marine Research (CMR), Lithuania  
Danish Meteorological Institute (DMI), Denmark  
Estonian Marine Institute (EMI), Estonia  
Finnish Institute of Marine Research (FIMR), Finland  
Finnish Environmental Agency (FEA), Finland  
Institute of Meteorology and Water Management (IMWM), Poland  
Institute of Oceanology (IO), Poland  
Institute für Ostseeforschung Warnemünde (IOW), Germany  
Maritime Institute Gdansk (MIG), Poland  
North-West Regional Administration for Hydrometeorology and Environmental Monitoring, Russia  
Royal Danish Administration of Navigation and Hydrography (RDANH), Denmark  
Swedish Meteorological and Hydrological Institute (SMHI), Sweden  
University of Latvia (UL), Latvia

## 1. **PRESENT AND PLANNED LEGAL STATUS**

Current BOOS is an informal organization of operational and scientific institutions acting in the field of operational oceanography. The present status will be changed by the expected signing of a Memorandum of Understanding (to be done in Tallin, May 2001 at the annual BOOS meeting) establishing BOOS as formal regional GOOS organization under EuroGOOS.

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<sup>9</sup> By Juliusz Gajewski

The Memorandum of Understanding besides changing the legal status of the organisation will also facilitate a platform for already operational joint services in the Baltic. The cooperative work will be organized as projects.

## **2. PRESENT AND PLANNED BOOS PROJECTS**

There are several already running BOOS projects including the high resolution operational model of the Baltic Sea (HIROMB), a water level web page, web based oil spill drift models, a wave buoy page, harmful algae bloom page, etc.

At the a recent meeting in Copenhagen (November 2000) the following projects were given priority in regards to development of joint products: water level page, wave monitoring and modelling, daily maps of SST, harmful algae bloom monitoring and analysis, current forecast.

## **3. THE USER PERSPECTIVE – WHO ARE THE BOOS USER AND HOW TO SERVE BOOS USERS WITH INFORMATION**

The BOOS recognize different core users within the societies of the Baltic countries, including:

- HELCOM and its work done in the assessment of the Baltic Sea environment,
- BOOS members – operational agencies responsible for preparation of oceanographic products, including forecasts and warnings,
- marine transport industry – pilot work (especially in the Danish Straits) and ferry operations,
- pleasure boating, surfing – tourism in general,
- fisheries and aquaculture.

These groups of users are being served through following information distribution means:

- Internet – web pages, ftp, web-based applications,
- phone and fax services,
- media broadcasting.

The most popular one is the Internet – for example – the BOOS home page ([www.boos.org](http://www.boos.org)) was visited more than 3000 time during December 2000, the Danish water level page was visited more than 17000 times and the wave forecast was visited 8300 times in the same period.

There are plans to develop Wireless Application Protocol (WAP) products to deliver the information to mobile phone users and also to build more specialized web-based applications.

More information about BOOS can be found in the BOOS implementation plan (BOOS Plan – Baltic Operational Oceanographic System 1999-2003; see also <http://www.eurogoos.org/Activities/ActivitiesFrameSet.html>).

## ANNEX IV

### **GOOS AND UN CONVENTIONS**

Colin Summerhayes

Among the various users of GOOS output the collective intergovernmental requirements represented by UN Conventions should be included. The Jakarta Mandate of the Convention on Biodiversity (CBD), for example, is a call, by governments collectively, to improve our understanding of marine and coastal biodiversity, as the basis for managing it better in future. In addition, the various Conventions and Action Plans of UNEP's Regional Seas Programme (RSP) together constitute a 'distributed convention' on environmental conditions in coastal seas.

GOOS can be thought of as a distributed facility or tool to meet the needs of the Jakarta Mandate and the RSP distributed convention. GOOS will provide a greatly enhanced capacity to understand and forecast ocean properties, behavior and resources on time-scales that permit relevant and effective decision-making in the context of these conventions.

It is significant that the CBD already sees the RSP as a mechanism for providing it with the information it needs, and is developing Memoranda of Understanding with the various RSPs to develop appropriate work programmes. One can envisage a further improvement in efficiency and effectiveness coming from a triangular alliance between the CBD, the RSP and GOOS. This is something the GOOS community should work towards. However, it is not just a one way street. Just as GOOS can provide the RSPs with new information about driving forces, so the RSPs can provide GOOS with information about the environmental parameters monitored in that programme.

Many regional GOOS bodies map nicely onto the various RSPs as well as onto similar programmes that are not part of the RSP, in particular the area covered by the Helsinki Commission (HELCOM) for the Baltic, and the Oslo and Paris Commission (OSPARCOM) for the North Sea and northeast Atlantic. BOOS is already being considered as a tool for HELCOM, and other regional GOOS bodies should work towards becoming tools for their respective RSPs.

In the future there is also the potential for linking with the FAO's Regional Fisheries Bodies, which are themselves exploring links to UNEP's RSPs. The desirable end point is cost-effective integration of the approaches of the different UN bodies (IOC with its GOOS; UNEP with its RSPs; the Food and Agricultural Organization (FAO) with its RFBs and the CBD), to improve sustainable management of coastal seas.



## ANNEX V

### LIST OF ACRONYMS

ARGO	GODAE global profiling float project
ASFA	Aquatic Sciences and Fisheries Abstracts
AOML	Atlantic Oceanography and Meteorological Laboratory (USA)
AVHRR	Advanced Very High Resolution Radiometer
BOOS	Baltic Operational Oceanographic System
CARICOMP	Caribbean Coastal Marine Productivity Programme
CARIPOL	Caribbean Pollution Programme
CBD	Convention on Biodiversity
CCCP	Centro de Control de Contaminación del Pacífico (Columbia)
CCO	Comisión Colombiana del Océano (Columbia)
CENDOC	Centro Nacional de Datos Oceanográficos (Chile)
C-GOOS	Coastal Panel of GOOS
CIMAR	Centro de Investigación en Ciencias del Mar y Limnología (University of Costa Rica)
CIOH	Centro de Investigaciones Oceanográficas (Columbia)
CITMA	Ministry of Science, Technology and Environment (Cuba)
CLIVAR	Climate Variability and Predictability
CM	Clima Marítimo (Spain)
CONA	Comité Oceanográfico Nacional (Chile)
COOP	Coastal Ocean Observations Panel
CPACC	Caribbean Planning for Adaptation to Global Climate Change
CPPS	Comisión Permanente del Pacífico Sur
CPR	Continuous Plankton Recorder
DBCP	Data Buoy Cooperation Panel
DCP	Digital collector platform
DFO	Department of Fisheries and Oceans (Canada)
DODS	Distributed Oceanographic Data System
ECMWF	European Center for Medium Range Weather Forecasting
ERS 1 – 2	European Remote Sensing Satellite 1 - 2
EuroGOOS	European GOOS
EVOS	Exxon Valdez Oil Spill
FAO	Food and Agricultural Organization
GCOS	Global Climate Observing System
GCRMN	Global Coral Reef Monitoring Network
GEF	Global Environmental Facility
GEM	Gulf of Alaska Ecosystem Monitoring and Research Programme
GIACT	Integrated Tropical Coastal Area Management
GIS	Geographic Information System
GLOBEC	Global Ecosystem Experiment
GLOSS	Global Sea Level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GOES	Geostationary Operational Environmental Satellite
GoMOOS	Gulf of Maine Ocean Observing System
GOOS	Global Ocean Observing System
GOOS-IOS	GOOS-Initial Observing System
GPO	GOOS Project Office
GSC	GOOS Steering Committee
MedGOOS	Mediterranean regional GOOS

HELCOM	Helsinki Commission -Baltic Marine Environment Protection Commission
HOTO	Health of the Oceans
ICES	International Council for the Exploration of the Sea
ICSU	International Council for Science
IDEAM	Instituto de Hidrologia, Meteorologia y Estudios Ambientales (Columbia)
IEO	Instituto Español de Oceanografía (Spain)
I-GOOS	IOC-WMO-UNEP Committee for the Global Ocean Observing System
IMA	Institute of Marine Affairs (Trinidad and Tobago)
INVEMAR	Instituto de Investigación (Columbia)
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOCARIBE-GOOS	IOC Sub-commission for the Caribbean and Adjacent Regions
JGOFS	Joint Global Ocean Flux Study
LMR	Living Marine Resources
LNG	Liquefied Natural Gas
MBNMS	Monterey Bay National Marine Sanctuary
MEDAR	Mediterranean Data Archaeology and Rescue of Temperature, Salinity and Bio-chemical Parameters
MFC	Marine Forecasting Centre (Norway)
MFSP	Mediterranean Forecasting System Pilot Project
NAFO	North-West Atlantic Fisheries Organization
NASA	National Aeronautics and Space Administration (USA)
NCMR	National Centre for Marine Research (Greece)
NEAR-GOOS	North East Asian GOOS
NGLI	Northern Gulf Littoral Initiative
NGO	Non-governmental Organization
NOAA	National Oceanic and Atmospheric Administration (USA)
NOC	National Oceanographic Committees
NOPP	National Oceanographic Partnership Programme
OAS	Organization of America States
ODINAFRICA	Ocean Data and Information Network for Africa
OMB	Office of Management and Budget (USA)
OOSDP	Ocean Observing System Development Panel
ORAP	Ocean Research Advisory Panel (USA)
OSEPA	Ocean South East Pacific Array
OSPARCOM	Convention for the Protection of the Marine Environment of the Northeast Atlantic
PCB	Polychlorinated Biphenyl
PE	Puertos del Estado (Spain)
PICES	North Pacific Marine Science Organization
PMEL	Pacific Marine Environmental Laboratory (NOAA)
QA	Quality Assessment
RAC	Regional Analysis Center
RAMP	Rapid Assessment of Marine Pollution
RAN	Regional Analysis Network
RAYO	Red de Alerta y Observacion (Spain)
RDMDDB	Regional delayed mode database
RFB	Regional Fisheries Body (of FAO)
ROSHYDROMET	Federal Services of Russia for Hydrometeorology and Environmental Monitoring
ROV	Remotely operated vehicle

RRTDB	Regional real time database
RSP	Regional Seas Programme of UNEP
SABSOON	South Atlantic Bight Synoptic Offshore Observational Network
SAR	Synthetic Aperture Radar
SeaWiFS	Sea-viewing Wide Field-of-view Sensor
SINA	Sistema de Información Marine Ambiental (Columbia)
SOOP	Ship-of-Opportunity Programme
TOPEX	Ocean Topographic Experiment
TOR	Terms Of Reference
UCR	Universidad de Costa Rica (Costa Rica)
UHSLC	University of Hawaii Sea Level Center
UNA	Universidad Nacional (Costa Rica)
UNCED	The United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Cultural and Scientific Organization
VODHub	Virtual Ocean Data Hub
VOS	Voluntary Observing Ship
WAM	Wave Analysis Model
WAP	Wireless Application Protocol
WMO	World Meteorological Organization
XCTD	Expendable Conductivity Temperature Depth
XBT	Expendable Bathy Thermograph