



**Intergovernmental Oceanographic Commission**  
*Reports of Meetings of Experts and Equivalent Bodies*

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## **Coastal Ocean Observations Panel**

### **Fourth Session**

Cape Town, South Africa

24–27 September 2002



**GLOBAL  
CHANGE**

**Intergovernmental Oceanographic Commission**  
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## **ABSTRACT**

This report presents a summary of the topics discussed at the fourth session of the Coastal Ocean Observations Panel (COOP). The Panel revised The Integrated, Strategic Design Plan for the Coastal Ocean Observations Module of the Global Ocean Observing System, in response to the external review of the plan prior to the meeting. The Panel also started discussions on the integrated implementation plan for the Coastal Ocean Observations Module of the Global Ocean Observing System and an outline of the plan was developed.

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## 1. OPENING

Tom Malone and Tony Knap, co-chairs of the Coastal Ocean Observations Panel (COOP) opened the meeting at 9 a.m. Geoff Brundrit offered welcoming remarks on behalf of the University of Cape Town and expressed his best wishes for a productive and successful meeting. Worth Nowlin provided opening remarks on behalf of the chair of the GOOS Steering Committee (GSC) and mentioned the great interest the GSC have in seeing the strategy and implementation plans for the coastal module of GOOS finalised. He also drew attention to the first GOOS Regional Forum in Athens, Greece (December 2002) and encouraged the Panel to think about GODAE and Argo like pilot projects for the coastal module. Finally Thorkild Aarup welcomed the participant on behalf of the sponsors of GOOS—the United Nations Environment Programme (UNEP), the International Council for Science (ICSU), the World Meteorological Organisation (WMO), and the additional sponsors of COOP—the United Nations Food and Agricultural Organisation (FAO) and the International Geosphere and Biosphere Programme (IGBP). He also acknowledged the financial support to the meeting from the sponsors as well as the US Office of Naval Research International Field Office (London, United Kingdom).

Following these welcoming remarks Tom Malone informed that Drs. Dewailly, Gajewski, Korenteng and Smirnov had rotated off the COOP in August 2002. Based on consultation with the sponsors of COOP four new members were selected to replace them as follows (with expertise areas in parentheses): (i) Dr. Laura David (Ecological Modelling and Remote Sensing); (ii) Dr. Marcel Babin (*in situ* sensing of non-physical variables); (iii) Dr. Vladimir L. Vladymyrov (data management); and (iv) Dr. Jeffrey Polovina (fisheries, ecosystem modelling, remote sensing). Tom Malone thanked the outgoing panel members for their contributions and welcomed the new panel members.

## 2. OVERVIEW OF THE INTEGRATED DESIGN PLAN AND EXTERNAL REVIEW INPUT

Tom Malone gave an introduction to the draft version of Integrated, Strategic Design Plan for the Coastal Ocean Observations Module of the Global Ocean Observing System. The draft plan had been sent out for review in August 2002 and more than 20 reviewers from more than 10 countries had reviewed the draft plan prior to the COOP-IV meeting.

The reviews had been overwhelmingly positive. However, most of the reviewers had suggested that the main body of the plan be shortened and edited more tightly.

One reviewer had pointed to fisheries issues as a particular area where the current draft COOP Strategy Plan would need to be clarified further in order to avoid creating the impression that the coastal module of GOOS would create parallel observing activities, concerning fishery stock assessment and management, to those already ongoing in many parts of the world. To that end Michael Fogarty provided an overview of fisheries issues and highlighted the areas where the coastal module of GOOS can contribute to existing fisheries observing activities.

Requirements for fisheries management have led to establishment of many sustained observing systems comprising: (i) Commercial and recreational catches; (ii) Demographic information; (iii) Fishing effort and fleet characteristics; and Fishery independent surveys. Fishery management institutions and authorities span from the global level to the local level and include (i) Food and Agriculture Organisation of the United Nations; (ii) Regional Fishery Management Institutions; (iii) National Fishery Management Institutions; and (iv) State/Provincial Fishery Management Institutions. Fisheries management approaches span (with increasing data requirement

and model uncertainty) from a single stock/single species model over to multi-species over to ecosystem management. Most if not all sustained [fishery] monitoring programmes are tailored to ecosystem types, and most resource management is local to regional in scale. As fisheries management is moving towards ecosystem based management coastal GOOS can contribute significantly to this through provision of for instance environmental and socio economic measurements and products. However, this collaboration fits most naturally in the context of GOOS Regional Alliances (GRAs) which will address enhancements of the coastal observation network in order to target regional needs.

In order to finalise the plan part of the COOP-IV meeting was devoted to revising the document in break-out working groups addressing reviewer comments that had been distributed to all panel members prior to COOP-IV. The Panel suggested that IOC arrange to have the final draft version of the plan edited and proofread by a professional editor before it would be submitted to I-GOOS for approval.

### **3. TOWARD A PHASED IMPLEMENTATION PLAN FOR THE COASTAL MODULE OF GOOS**

This session reviewed some observing elements and observing initiatives which have linkage to the coastal module of GOOS.

#### **3.1 PROGRESS TO DATE ON THE GOOS FRONT**

##### **3.1.1 The Implementation Plan for the Ocean-Climate System: Highlight of Key Attributes for Success—the OOPC Experience**

Ed Harrison gave a brief overview and status of the activities of the Ocean Observations Panel for Climate (OOPC)—see <http://ioc.unesco.org/goos/oopc.htm> and <http://ioc.unesco.org/oopc>.

The OOPC traces its origins to the Oceans Observing System Development Panel (OOSDP) which was sponsored jointly by the World Climate Research Programme (WCRP), GOOS and the Global Climate Observing System (GCOS).

Some of the key events for the OOPC has been publication of a number of focus documents such as (i) the final OOSDP document titled *Scientific Design for the Common module of GOOS and the GCOS: An Ocean Observing System for Climate* (1995); (ii) The GOOS/GCOS Action Plan for Global Physical Ocean Observations (1998); (iii) The Action Plan in association with OceanObs99 Conference, St Raphael, France; (iv) the establishment of the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM); and (v) the proceedings from Observing the Ocean in the 21st Century (Biarritz, France 2001), Smith and Koblinsky, Eds. (2001).

Several background/“homework” reports have been prepared such as (i) reviews of historical data distributions; (ii) summaries on what is known about signals; (iii) documentation of present data sources; (iv) identification of regions where present knowledge is not sufficient to estimate uncertainties; and (v) specification of desired requirements.

The strategy OOPC has followed has been to: (i) to define role and responsibilities of existing implementation bodies for initial efforts; (ii) list actions to be taken by each body; (iii) suggest ways to facilitate transition from research mode to operational mode; (iv) provide a context within which

more detailed plans can be elaborated; (v) try to identify possible efficiencies and recommend actions to minimize inefficiencies and ineffective implementation efforts.

All requirements for all users cannot be specified. Needs and technologies will evolve. Focus has tended to be on “NEXT STEPS”. OOPC has also tried to address the data and information management challenge through the Ocean Information Technology (OIT) initiative

Partnership with research has been established. The OOPC and the CLIVAR Ocean Observations Panel have met jointly and co-sponsored meetings such as the OceanObs99 Conference. There has also been sign-off of “next steps” from both groups.

A number of workshops have been convened on ocean time series, sea level, sea surface temperature and sea ice, upper ocean thermal field, tropical moored arrays and sea level pressure. Major pilot projects have also been established such as ARGO, GODAE and the High Resolution SST (GHRSSST), Ocean Time Series Reference Sites, and repeat hydrography/carbon inventory. Regional observing workshops have also taken place for the Southern Ocean and the Indian Ocean and the SE Atlantic (1<sup>st</sup> quarter of 2003).

In summary Ed Harrison stated that considerable interest and good will has been mobilized and several activities have been launched. However, many of the observing network elements are incomplete and progress is likely to be on a system-element-by-element and country-by-country basis, but international-community-building effort is needed to obtain long-term commitments for observations

### **3.1.2 Current Status of GOOS Regional Alliances**

Thorkild Aarup provided a status of the GRAs based on reports given to the Intergovernmental Committee for GOOS (I-GOOS)

(see [http://ioc.unesco.org/goos/docs/GOOS\\_110\\_IG5\\_rpt.pdf](http://ioc.unesco.org/goos/docs/GOOS_110_IG5_rpt.pdf); and additionally [http://ioc.unesco.org/goos/docs/GOOS\\_127\\_GRF1.pdf](http://ioc.unesco.org/goos/docs/GOOS_127_GRF1.pdf) and [http://ioc.unesco.org/goos/docs/GOOS\\_130\\_I-GOOS-VI.pdf](http://ioc.unesco.org/goos/docs/GOOS_130_I-GOOS-VI.pdf)).

The group of GRAs has developed rapidly over the recent years, i.e. EuroGOOS with its Northwest Self Operational Oceanographic System (NOOS) and its Baltic Operational Oceanographic System (BOOS), the Black Sea (Black Sea GOOS), the Mediterranean (MedGOOS), Africa (GOOS-Africa), the Caribbean (IOCARIBE-GOOS), the Northeast Asian Region (NEAR-GOOS), Southeast Asia (SEAGOOS, including the Southeast Asia Centre for Marine and Atmospheric Prediction (SEACAMP), the Pacific Islands (PacificGOOS) and the Indian Ocean (IO-GOOS, including the Western Indian Ocean Marine Applications Project (WIOMAP)). The GRAs promote regional implementation, develop networks and pilot/demonstrator projects, survey users to determine needs, increase awareness, and foster support and build capacity.

EuroGOOS is beginning to work towards implementing operational ecosystems models and forecasts to assist fisheries and environmental managers, in collaboration with the International Council for the Exploration of the Sea (ICES), the Helsinki Commission (HELCOM) and the Oslo-Paris Commission (OSPAR). The third EuroGOOS Conference is scheduled for Athens, Greece from 3-5 December 2002. NEAR-GOOS is working on including chemical and biological parameters in their observing activities, as well as developing operational forecasting. MedGOOS and Black Sea GOOS were recently awarded substantial funding by the European Commission to develop observing networks.

A discussion document on Regional Implementation of GOOS has been developed by the GOOS Steering Committee (see [http://ioc.unesco.org/goos/GOOS\\_reg\\_policy.rtf](http://ioc.unesco.org/goos/GOOS_reg_policy.rtf)), and I-GOOS has established an inter-sessional group to refine the regional policy statement. It is expected that this document will be finalised at the GOOS Regional Forum (2 and 6 December 2002 in Athens, Greece), so it can be formally adopted by the I-GOOS VI meeting (March 2003 in Paris, France).

The Panel emphasized the importance of finalizing the regional policy and suggested that it also be discussed at the 1st Regional GOOS Forum which will take place in Athens in December 2002. A final policy may then be passed by the I-GOOS VI meeting in March 2003.

### 3.1.3 US GOOS

Worth Nowlin gave a brief overview of US GOOS. US GOOS is coordinated by the Ocean. US Office, which is charged with developing an integrated and sustained ocean observing system. A US GOOS Steering Committee is composed of representatives from academia, industry, government, and environmental organizations providing advice for the planning, implementing, and coordination of US GOOS.

US GOOS is to be a single integrated system consisting of two components: (i) an open ocean component that includes the US contribution to the climate module of GOOS, and (ii) a coastal component for US coastal waters that links the changes in the global ocean-climate system.

A National Observing Network of measurements, data management, and analysis will function as a national “backbone” that provides data and information required by all regional systems for US coastal waters.

The coastal component of US GOOS will evolve into a National Federation of regional observing systems that both contribute to and benefit from the National Network. A total of 8-10 regions within the US are envisioned, with boundaries overlapping due to oceanographic, biological, and political factors. It is expected that each regional observing system will be developed and operated by regional associations that represent both data providers and users. Regions will establish their own governing and coordinating mechanisms.

A strategic design plan for US GOOS has been developed and a phased implementation plan is under development. More information about US GOOS and Oceans.US is available at [www.ocean.us.int](http://www.ocean.us.int).

## 3.2 ONRIFO FUNDING OPPORTUNITIES

Jerry Miller provided an introduction to the US Office of Naval Research International Field Office (ONRIFO, London, United Kingdom). The office functions as the Department of the Navy resource for enhancing global science and technology connectivity. ONRIFO operates field offices in London, Paris, Tokyo, Singapore and Santiago. Jerry Miller highlighted the principal ONRIFO programmes: (i) the Visitor Support Programme which provides financial assistance for travel of scientific and technical personnel as required to support development of international collaborations; (ii) the Conference Support Programme which provides financial support for international conferences and workshops to develop international collaborations; and (iii) the Naval International Cooperative Opportunities in Science and Technology Programme which provides research grants for international Science and Technology collaborative efforts. More information about these programmes is available at <http://www.onrifo.navy.mil/>. Jerry Miller also drew attention to the global and regional operational modelling products which the US Naval Research Laboratory (NRL) provides (see [http://www7320.nrlssc.navy.mil/global\\_nlom/](http://www7320.nrlssc.navy.mil/global_nlom/)) and stressed that

there is particular interest both on ONRIFO and NRL to establish collaboration concerning validation of regional coastal models.

### 3.3 KEY ISSUES TO BE ADDRESSED IN THE IMPLEMENTATION PLAN

#### 3.3.1 Governance: Is JCOMM the Mechanism?

Savi Narayanan provided an overview of JCOMM and reported on progress made in the development of JCOMM and its significance for the ongoing implementation of GOOS. After describing briefly the JCOMM structure, she highlighted (i) progress in coordination of the GOOS observing elements like the Data Buoy Co-operation Panel (DBCP), Ship of Opportunity (SOOP) and Global Sea Level Observing System (GLOSS) in support of integrating data requirements expressed by GOOS and other systems; (ii) the support provided by JCOMM in the development of Argo and OOPC; (iii) the efforts underway within JCOMM to develop performance metrics to measure the extent to which existing requirements were met; (iv) the high priority given to integrated data management including non-physical data; (v) collaboration with IODE through merging of the JCOMM expert team on data management practices and the IODE Group of Experts on technical aspects of data exchange, as well as by the IODE secretariat providing the secretariat function for the JCOMM Data Management programme area; (vi) the establishment, within the JCOMM Services programme area, of a new Task Team on Development of Ocean Services; (vii) the work of the JCOMM Capacity Building Coordination Group and its possible merging with the GOOS Capacity Building Panel. Savi Narayanan also highlighted 'The Colour of Ocean data' conference, Brussels, Belgium, 25–27 November 2002 which puts special emphasis on management of non-physical data. Finally it was mentioned that JCOMM-II and an associated Scientific Conference is scheduled to take place in Halifax, Canada in September 2005.

The question of governance of activities under the coastal module of GOOS was briefly discussed. Both co-chairs of JCOMM suggested that pieces of these activities could be integrated into the focus areas of JCOMM. It was furthermore suggested that as a start, a 'COOP'-type committee could be established under one of the JCOMM programme areas which could begin to take on an implementation role for the GOOS coastal module observing activities.

#### 3.3.2 Data Management – POGO

Tony Knap gave an update on the Partnership for Observation of the Global Oceans (POGO). Some of the recent developments are: (i) A time series working group was established and POGO has begun to set up a Time Series Web Site and also help with designing a Time Series Brochure; (ii) Chilean Oceanographers were able to use the POGO *São Paulo Declaration* to justify why Chile was ideally positioned to make valuable and unique contribution to the field—one of the outcomes has been a Chilean National Centre for Excellence in Oceanography; (iii) A joint POGO-Census of Marine Life workshop on biodiversity in South America is to take place at the end of October 2002; (iv) A POGO ad-hoc committee on data issues has been established. This committee will (a) Catalogue data management practices in member institutions; (b) Identify impediments to enhancing data archive, data exchange and dissemination and also suggest solutions; (c) Report to POGO on other ongoing efforts related to data management and dissemination; (d) Identify what POGO members could do to enhance these efforts; (e) Identify issues related to archival and distribution of non-physical variables and information. Further information on POGO is available at [www.ocean-partners.org](http://www.ocean-partners.org).

### **3.3.3 Data Management—OBIS**

Tony Knap gave an overview of the Ocean Biogeographic Information System (OBIS) which is a component of the Census of Marine Life (CoML) research programme to assess and explain the diversity, distribution, and abundance of marine organisms throughout the world's oceans. OBIS is a web-based provider of global geo-referenced information on accurately identified marine species. OBIS is developing on-line tools for visualizing relationships among species and their environment. OBIS will assess and integrate biological, physical, and chemical oceanographic data from multiple sources, generate testable hypotheses about the origins and maintenance of marine biodiversity, and facilitate research on the roles of species in ecosystem function. More information on OBIS is available at [www.iobis.org](http://www.iobis.org).

### **3.3.4 Global Biogeochemical Sampling via COOP/OOPC Collaborations**

Tommy Dickey highlighted some of the issues concerning implementation of global biogeochemical sampling plans for GOOS: (i) Measurements: verification, calibration, validation, accuracy, resolution, biofouling, real-time data telemetry, cost; (ii) Optimal sampling strategies: How many platforms and where?; and Groundtruthing satellites, Scales from data, Models such as Optimal Sampling Simulation Experiments; and (iii) Linkages of coastal and open ocean sampling programs.

Tommy Dickey also outlined potential areas for COOP-OOPC collaborations such as (i) Sensor selection, development, and testing; (ii) Data and model sharing. (Such collaboration could benefit both GOOS modules leading to enhanced spatial coverage); (iv) Shared boundary/initial conditions for models; and (v) Joint measurement/model testbed programmes. Some of the coastal issues to be addressed in such a joint COOP-OOPC project could be: (i) Forecasting shelf circulation; (ii) Forecasting of upwelling and biological consequences; (iii) Water quality; (iv) Physical reconstructions to interpret fisheries recruitment data? Some of the regional candidate regions could be: (i) North Atlantic initially; (ii) Pacific; or (iii) Contrast east-west boundaries, wide/narrow shelves. Such a modelling project could also provide a platform for inter comparison of models and assimilation techniques using same metrics.

A summary was also provided of existing instrumentation for measuring water properties from fixed platforms, moorings, vertical profilers, remotely operated vehicles, autonomous underwater vehicles, surface autonomous vehicles, gliders and drifting buoys.

John Cullen provided an update on the workshop on Real-time Coastal Observing Systems for Ecosystems Dynamics and Harmful Algal Blooms, to be held from 11-21 June 2003 in Villefranche, France. More information is available at <http://habwatch.org>.

### **3.3.6 Incorporating Socio-Economic Indicators into COOP**

Robert Bowen reported on this issue. For COOP observations and models to have their full effect on the reasoned and effective development of coastal policy, additional efforts to link to socio-economic factors must be made. Recent efforts to utilize a Driver-Pressure-State-Impact-Response model show some promise in this regard (see Figure 5.3 and Annex X in [http://ioc.unesco.org/goos/docs/GOOS\\_125\\_COOP\\_Plan.pdf](http://ioc.unesco.org/goos/docs/GOOS_125_COOP_Plan.pdf)). Within this framework, data describing larger-scale social dynamics (drivers), human forcing on environmental systems (pressures), the social benefits gained and costs imposed (impacts) by changes to environmental conditions (state) are conceptually linked to responsive regulatory approaches (responses). While still at an early evolutionary stage this approach could serve to build more operational models and

serve as an organising framework for the articulation and analysis of a broad suite coastal system and socio-economic indicators.

### 3.3.7 Pilot Projects: COOP-GTOS Collaboration

Robert Christian reported on this item. The coastal zone is a place of dense human settlement and unique ecological challenges. Most of the coastal observation planning efforts thus far have been led by COOP. Yet the combination of land and water inherent to coastal ecosystems requires information beyond the oceanographic realm. For this reason, GTOS has created a coastal initiative that will be responsible for the terrestrial component of coastal observations. A coastal panel under GTOS (C-GTOS) has been established and charged with developing the elements for the coastal activities of GTOS. The first meeting of C-GTOS is planned for 16–18 October 2002 (Greenville, North Carolina, USA).

Some of the key coastal issues requiring terrestrial observation are:

- Sand and sediment movement.
- Chemical contamination.
- Carbon budget and primary productivity.
- Water quantity and quality.
- Wetland conservation.
- Biodiversity and biocomplexity
- Sea-level rise from global climate change

#### Observation Strategy

Many of the observation variables and the protocols for their sampling have already been designated under the Global Hierarchical Observing Strategy (See GCOS/GTOS Plan for Terrestrial Climate-related Observations, version 2.0, GCOS Report No.32 and also Report of the GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC), fifth session, GCOS Report No. 59. Both reports are available at <http://193.135.216.2/web/gcos/gcoshome.html>). In addition, variables unique to coastal environments and the human populations within them will be identified during the implementation phase of the initiative. C-GTOS and the coastal module of GOOS overlap in the intertidal zone and this overlap is also reflected in the kinds of phenomena the two systems should be responsible for detecting and predicting. The two systems also overlap in terms of human dimension in at least three areas: (i) human activities are major drivers of environmental changes in both terrestrial and marine systems and these changes have socio-economic consequences that affect human behaviour; (ii) there is much overlap in potential user groups; and (iii) integration of observing elements will involve government agencies that contribute to and benefit from both GOOS and GTOS.

The coastal module of GTOS is in the early stages of design. It is clear that linkages with the coastal module of GOOS are not only warranted, but also necessary for a successful observing system for the coastal zone. The opportunities for linkage are at all levels of system design from user groups and the phenomena of interest to observations and data management. There are many opportunities to make more effective use of resources and to achieve economies of scale. But for these to be realized, considerable coordination and collaboration will be necessary. As a first step, GTOS has been represented in the development of the design plan for the coastal module of GOOS. The next step is to establish a joint committee charged with ensuring the two systems are integrated and develop to the benefit of both.

More information on the coastal GTOS panel is available at:

<http://www.fao.org/gtos/gt-netCOA.html> and <http://www.fao.org/gtos/C-GTOS.html>

### 3.3.8 Pilot Projects: IOGOOS-COOP Collaboration

Mohideen Wafar informed about the plans for the 1st Indian Ocean GOOS Conference in Mauritius (4–9 November 2002). A coastal session will take place in connection with the conference with plans to (i) initiate a network of coastal scientists that will link the countries that border the Indian Ocean; (ii) identify 2-3 high priority coastal phenomena that would benefit from the development of the coastal module of GOOS; and (iii) form teams to develop proposals for GOOS pilot projects that link basin scale GOOS to the coastal module of GOOS. More information about IOGOOS and the IOGOOS Conference is available at:

<http://ioc.unesco.org/goos/key3.htm#reg>.

## 3.4 IGOS OCEAN AND CARBON THEMES AND COOP IMPLEMENTATION

Worth Nowlin reported on this item. The Integrated Global Observing Strategy partnership (IGOS; [www.igospartners.org](http://www.igospartners.org)) recognizes that no one country or agency can do all that is required to observe the Earth as a whole, and to do so efficiently and effectively, coherence and synergy between observation systems are needed. The partnership aims to enable more cost effective and timely observations by linking all observing systems together, integrating *in situ* and space-based measurements, taking a thematic approach adapting existing strategies to this end and developing appropriate new plans.

The IGOS Partners published the Ocean Theme document in January 2001 (<http://ioc.unesco.org/igospartners/IGOS-Oceans-Final-0101.pdf>) indicating the capabilities of, and developments needed, in space-based measurements to make GOOS work. The Ocean Theme sets out the challenges, particularly for space agencies. The Ocean Theme document will be updated and revised in the second half of 2003. A Carbon Theme document is under development and will be presented to the IGOS X (June 2003, Paris, France). Plans are also underway to develop a Coastal Theme and it is expected that the Coastal Theme process will be launched at IGOS X and COOP is expected to participate in development of the Coastal Theme. Jerry Miller mentioned that several documents containing coastal requirements for space observations had been developed under the National Polar-orbiting Operational Environmental Satellite System (<http://www.ipo.noaa.gov/>), and that those documents might be of use in the development of the Coastal Theme.

## 3.5 THE COOP-LOICZ LINK

Julie Hall reported on this item. The first phase of LOICZ ended in 2002. A second phase of LOICZ is envisioned and plans are under development for this phase with a tentative start in 2004. More information on the LOICZ Future is available at:

<http://www.nioz.nl/loicz/firstpages/LOICZFuturesV10.PDF>.

At present LOICZ provides some of the science foundation for the coastal module of GOOS, and could assist in the location of sentinel and reference stations for coastal monitoring. Another highlight within LOICZ is the synthesis work of the major findings from the first phase which will be published as a book in early 2004.

IGBP and SCOR are developing a new project on Ocean Biogeochemistry and Ecosystems Analysis (OCEANS). Its goal is to understand the sensitivity of the ocean to global change, focusing on biogeochemical cycles, marine food webs and their interactions in the context of the Earth System. It will seek a comprehensive understanding of the impacts of climate and

anthropogenic forcing on food web dynamics (i.e., structure, function, diversity and stability) and elemental cycling (i.e., biogeochemical pathways, transfers and cycling), including the impacts of underlying physical dynamics of the ocean. It will also strive for a mechanistic and predictive understanding of how these linked systems respond to global change resulting from climate modes (e.g., El Niño Southern Oscillation, North Atlantic Oscillation, etc.) and anthropogenic perturbations.

The new OCEANS project is being established as part of the second phase of IGBP, and will work closely and collaborate with existing projects such as Global Ocean Ecosystem Dynamics (GLOBEC), the second phase of Land-Ocean Interactions in the Coastal Zone (LOICZ), and the Surface Ocean—Lower Atmosphere Study (SOLAS). To develop the OCEANS Science Plan/Implementation Strategy, an open science conference will be held in Paris 7–10 January 2003. More information about this conference and the OCEANS project is available at

<http://www.igbp.kva.se/obe/>, and

[http://www.nioz.nl/loicz/newslett/LOICZNEWSLETTER\\_No.26.pdf](http://www.nioz.nl/loicz/newslett/LOICZNEWSLETTER_No.26.pdf).

#### 4. GOOS-AFRICA

Geoff Brundrit gave an overview of GOOS-Africa. GOOS-Africa is an initiative to serve the interests and needs of the forty coastal and island nations of Africa. The broad objective of GOOS Africa is to improve and strengthen marine data acquisition, analysis and interpretation in Africa. The GOOS-Africa ‘big five’ user areas are in: (i) offshore oil and gas; (ii) shipping and trade; (iii) coastal and offshore mining; (iv) coastal and offshore fisheries; and (v) seaside tourism.

The first meeting of the GOOS-Africa Committee took place at the Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM) Maputo, Mozambique in July 1998. Priorities agreed to at the ministerial level were: (i) enhancing sea-level measurements; (ii) enhancing access to and training in the interpretation and use of remotely sensed data from satellites and modelling and forecasting; (iii) expanding the network of National Ocean Data Centres; and (iv) enhancing electronic communication and exchange of data.

The second GOOS Africa meeting was held in Nairobi, Kenya from 19–23 November 2001 ([http://ioc.unesco.org/goos/Africa/Nairobi\\_2001.htm](http://ioc.unesco.org/goos/Africa/Nairobi_2001.htm)). The objective of that workshop was to draft a proposal that could be addressed to funding agencies under the umbrella of the post-PACSICOM African Process (held in connection with the World Summit on Sustainable Development (WSSD)). That meeting developed a proposal for a Regional Ocean Observing and Forecasting System for Africa (ROOFS-Africa; <http://ioc.unesco.org/goos/Africa/ROOFS-AFRICA.htm>). The indications from the African Process meeting suggests that some of the components in GOOS Africa should be recast within the framework of African LMEs.

Some of the GOOS Africa associated projects include: (i) the Ocean Data and Information Network in Africa (ODINAFRICA; <http://www.odinafrica.net/>); (ii) the Pilot Research Array in the Tropical Atlantic (PIRATA; <http://www.ifremer.fr/orstom/pirata/pirataus.html>); and (iii) the Large Marine Ecosystem programmes in the Gulf of Guinea and the Benguela Current region (GOG-LME, BCLME; (<http://www.edc.uri.edu/lme/default.htm>)). Additional projects are in planning: (i) the Western Indian Ocean Marine Applications Project (WIOMAP; <http://ioc.unesco.org/goos/WIOMAP.htm>); (ii) the Canary Current and Western Indian Ocean Large Marine Ecosystem Programmes; (iii) a Seawatch buoy system for the west coast of Southern Africa.

More information on GOOS Africa is available at:

<http://ioc.unesco.org/goos/Africa/AFRIGOOS.htm>

## 5. STRATEGY FOR DRAFTING THE IMPLEMENTATION PLAN

Tom Malone provided a suggested outline of contents for an implementation plan for the coastal module of GOOS. The suggested issues to be addressed are: (i) The objectives of the plan and target audience?; (ii) Benefits of participation; (iii) Linking and coordinating the development of GOOS Regional Alliances; (iv) Mechanism for identifying and linking existing operational elements; (v) Capacity Building; (vi) Socio-Economic elements; (vii) Establishing a user-base; (viii) Phased Implementation/Milestones; (ix) Coordination and oversight; and (x) First Steps.

The objective of the implementation plan is to formulate a blueprint for how to implement the design of the coastal module. This will have to describe a set of processes for how to do it, which cannot be too prescriptive. The target audience is seen as (i) national GOOS programmes; (ii) GOOS Regional Alliances; and (iii) the GOOS Regional Forum of GRAs.

The linkage and coordination of developing GRAs must offer support and provide opportunities for participation of GRAs. This should include development of common standards and protocols (i.e. measurements, data exchange and data management, products) to facilitate the emergence of the global coastal network.

The mechanisms for identifying and linking existing operational elements should address (i) the global elements of the observing system; (ii) scaling up national/regional elements (that are operational); (iii) selection criteria; and (iv) mechanism(s).

The socio-economic elements are to include (i) cost-benefit analysis of global coastal network; and (ii) specification and incorporation of socio-economic indicators.

The establishment of a user-base should provide advice on: (i) Involvement of stakeholders from research, operational and user communities; and product development and marketing.

The phased implementation chapter should lay out: (i) Required time-space scales of resolution for the global common variables in the global coastal network based on an impact-feasibility analysis; (ii) Priorities for implementing the initial global coastal observation network; (iii) Priorities for pre-operational projects, pilot projects, and research and development; (iv) Time lines for incorporation of observations into an operational system with provision of milestones; (v) Identification of clients, products and services; (vi) Identification of existing elements (for all three subsystems—i.e. the observation system, the data and information management system and the modelling system); (vii) Plans for data and information management; (viii) the initially needed enhancements; (ix) Integration of existing elements; (x) Initiate system performance metrics (internal and external); (xi) Selective enhancements to system. (In that context the GODAE implementation plan could be a model (<http://www.bom.gov.au/bmrc/ocean/GODAE/Planning/IP/Plan.htm>)); and (xii) Time lines for elements in each subsystem.

For coordination and oversight of the implementation of the coastal module the implementation plan should provide advice on: (i) GRA input; (ii) Coordination and linkage of GRAs as they develop; (iii) Facilitate development of global coastal network of observations (i.e. observation, data and information management and modelling); (iv) Capacity building; (v) Products and services; (vi) Common standards and protocols and the adoption of these; (vii) Promotion of community-based modelling activities; (viii) Establishment of intergovernmental agreements (sustained support of GRA, global C-net).

First Steps should lay out initial measures for implementation such as: (i) I-GOOS endorsement of a regional policy for GOOS; (ii) Remote sensing requirements for coastal marine

and estuarine systems (including both satellite and airborne sensors)—these requirements can be advanced through the IGOS Coastal Theme which will be developed in 2003/2004; (iii) Identify selected topics and issues (this may include commissioning special reports or convening conferences and workshop); (iv) Review and improve data communications and management programmes (including steps for more rapid access to diverse data and info from many sources); (v) Pilot projects; (vi) Governance with internationally accepted mechanisms to identify and link existing systems and establishment of common standards and protocols.

Following discussion of Tom Malone's presentation the Panel agreed on the following outline for the implementation plan:

#### The Need For A Global Coastal Observing Module—Benefits

1. Phenomena of interest are, for the most part, local expressions of larger scale changes.
2. The broad goals of GOOS have common data requirements.
3. Capacity varies enormously among nations.
4. Conclusion:

⇒ A global network of observations, data communications, data management, and data analysis will provide economies of scale that will make national and regional observing systems more cost-effective.

#### Guiding Realities

1. The global coastal network will come into being through a combination of national, regional and global processes. As this occurs, the involvement of user groups in design, implementation and improvement of GOOS must increase relative to data providers from the scientific community (in both private and public sectors).
2. Priorities vary among nations and regions. Consequently, National GOOS Programmes and GRAs provide the primary means for involving user groups in the design and implementation of coastal GOOS and in product development.
3. The development of the coastal module will depend on harmonizing the need for a global network with user needs based on national and regional priorities.
4. Conclusions:

⇒ Although some elements of the system will be global in scale from the beginning (GLOSS, observations from space), national and regional coastal observing systems will be the building blocks of the global coastal network. Thus, a mechanism is needed to enable coordinated development of national programmes and GRAs on a global scale, including common standards and protocols for measurements, data exchange and modelling. This will involve an ongoing iterative process between data providers and users.

⇒ Performance metrics for both must be specified and mechanisms established for using them to ensure that the goals of the observing system are achieved and the system evolves and improves in response to user needs.

⇒ As the observing system develops the set of common variables will evolve based on experience, more complete understanding of the requirements of national programmes and GRAs, and new knowledge and technologies.

⇒ The implementation plan is, in essence, a plan for building capacity and should be drafted as such.

⇒ A mechanism or mechanisms must be identified or specified for enhancing research and development and for selectively migrating elements from research to operational modes based on requirements for estimating core variables fields and user needs.

⇒ Target Audience: National GOOS Programmes & GOOS Regional Associations.

#### The Blue Print (Procedures for...)

1. Establish, Link & Coordinate GOOS Regional Associations and National GOOS Programmes
2. Entrain user groups in the process of specifying requirements for data and information; establish and build the user-base
3. Specify and incorporate socio-economic elements
4. Formulate a Phased Implementation Plan (no particular order)

⇒ Specify required time-space dimensions (x, y, z, time) and scales of resolution for common variable fields

⇒ Mechanism(s) for entraining user groups in the design, implementation, and improvement of the system; specify products and related requirements for data, data management & models

⇒ Impact-Feasibility Analysis of potential techniques (for estimating common variable fields required for product production)

⇒ Define and implement high priority pilot projects

⇒ Enable developing countries to contribute to and benefit from GOOS

⇒ Identify and link existing pilot and pre-operational projects and operational elements

⇒ Increase observing system capabilities; research priorities; migrating elements to pilot projects and pre-operational projects

⇒ Coordination and oversight (including performance metrics)

#### Phased Implementation

1. Phase I Priorities (Mechanisms and Milestones)

⇒ Development of National GOOS Programmes & Regional Associations<sup>1</sup>

⇒ Identify and prioritize pilot projects (e.g., a coastal GODAE)

⇒ Data Management & Communications<sup>2</sup>

⇒ Capacity Building<sup>3</sup>

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<sup>1</sup> Foster the development of National GOOS Programmes and Regional Association that enable alliances to form among regional bodies including LMEs, RSCs, and RFBs and establish procedures for selecting and funding research, pilot and pre-operational projects and for migrating successful elements into the operational system – Mechanisms & Milestones.

<sup>2</sup> Develop common standards and protocols for data exchange and establish mechanisms to share existing data and products from observing system elements as a means of developing an integrated system – Mechanisms & Milestones.

⇒ Performance Metrics (Data providers: decrease time lag between change and detection of change – increase rate of data supply, more rapid access to data from different sources, increase quality and diversity of data available, improve skill of operational models, development of operational models for phenomena of interest in public health, ecosystem health and living marine resources areas; Data users – data meets user criteria in terms of availability and QA/QC, existing data products are improved, new products are generated that meet user needs/priorities)

## 2. Phase II Priorities (Mechanisms & Milestones)

⇒ Continue phase I

⇒ Incorporate socio-economic indicators<sup>4</sup>

⇒ Develop Operational Models for Public Health, Ecosystem Health & LMRs

⇒ Apply performance metrics

## 3. Phase III Priorities (Mechanisms & Milestones)

⇒ Continue phases I and II

⇒ Develop multidisciplinary, multi-platform capabilities

## 6. VENUE FOR COOP-V

Alfonso Botello offered to arrange COOP V in Mexico sometime in March–April 2003 and it was left for the co-chairmen and the Technical Secretary to explore this offer.

## 7. CLOSING

In closing Tom Malone again thanked Emly Balarain for all his help and the very fine assistance during the meeting.

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<sup>3</sup> Increase capacity in developing countries to access, analyse and use data and information by building the data communication and management infrastructure and providing access to satellite data (development of these elements of the OS provide a cost-effective way to involve developing nations) – Mechanisms & Milestones.

<sup>4</sup> Identify socio-economic indications for integration into the observing system and develop procedures for assessing the costs and benefits of observing systems – Mechanisms & Milestones.

ANNEX I

**AGENDA**

**Tuesday, 24 September**

0900 – 1200: PLENARY

1. Organization of the Meeting

- 1.1 Opening
- 1.2 Welcoming Remarks
- 1.3 Remarks by the IOC Representative
- 1.4 Remarks on Behalf of the GSC
- 1.5 Adoption of the Agenda
- 1.6 Working Arrangements

2. Overview of the Integrated Design Plan and External Review Input

3. Fisheries Issues

4. Break-Out Session: Purpose and Charge

1300 – 1800: BREAK-OUT SESSION

5. Complete Integrated Design Plan (with due consideration of input from external reviews)

**Wednesday, 25 September**

0830 – 1200: PLENARY

6. Status of Design Plan: Reports of Working Group Chairs

7. Toward a Phased Implementation Plan for the Coastal Module

7.1 Progress to Date on the GOOS Front

- 7.1.1 The Implementation Plan for the Ocean-Climate System: Highlight Key Attributes for Success
- 7.1.2 The US IOOS Phased Implementation Plan
- 7.1.3 Current Status of GRAs

1300 - 1830

7.2 Key Issues to Be Addressed in the Implementation Plan

- 7.2.1 Governance: Is JCOMM the Mechanism?
- 7.2.2 Data management – JCOMM, IODE, POGO, OBIS, and The Colour of Ocean Data: Toward a strategy for implementing the COOP Data Communications and Management Design
- 7.2.3 GOOS Regional Alliances
  - (i) A Framework for Enabling Collaborations Among Regional Seas Programs, Regional Fishery Bodies and Large Marine Ecosystem Programs?
  - (ii) IGOOS Policy on GRAs: What can COOP do?

- 7.2.4 Capacity building: Guidelines for establishing requirements and mechanisms for implementing the coastal module – including collaboration with POGO
- 7.2.5 Biogeochemical measurements for the open ocean module: short-term and long-term priorities for implementing the coastal module – including the role of POGO and upcoming workshop on “Real-Time Systems for Observing Coastal Ecosystem Dynamics and HABS”
- 7.2.6 Incorporating socio-economic indicators into the COOP implementation plan
- 7.2.7 Pilot Projects: COOP-GTOS Collaboration
- 7.2.8 Pilot Projects: OOPC-COOP Collaboration (OOPC-COOP-GODAE)
- 7.2.9 Pilot Projects: IOGOOS-COOP Collaboration
- 7.2.10 IGOS Ocean and Carbon Themes and COOP Implementation
- 7.2.11 Formalizing the COOP-LOICZ Link

### **Thursday, 26 September**

0830 – 1200: PLENARY

#### 8. GOOS Africa (Brundrit)

#### 9. Strategy for Drafting the Implementation Plan

##### 9.1 Implementation Plan Outline

##### 9.2 Prioritising techniques for incorporation into the system (the 4 stages, Impact-Feasibility Analysis)

1300 – 1800: BREAK-OUT SESSION

##### 9.3 Milestones for Completing the Implementation Plan

(Working groups will be formed to discuss different part of the outline for the implementation plan. Each group will be asked to specify issues to be addressed, to agree on a process to address these issues, and to establish a timetable for completing their section of the implementation plan. This should include discussion of potential products for each of the phenomena of interest; a listing of variables that must be measured to produce them (including time and space scales of resolution); potential techniques (platforms, sensors, methods of measurement) that are available or are expected to be available in the foreseeable future.); and the development of a prioritised, phased implementation plan.

### **Friday, 27 September**

0830 - 1200: PLENARY

##### 9.4 Reports from Working Group Chairs

#### 10. Next Steps

##### 10.1 Intersession Action Plan

##### 10.2 Timing and Venue for COOP V

ANNEX II

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ANNEX III

**LIST OF ACRONYMS**

BOOS	Baltic Operational Oceanographic System
CLIVAR	Climate Variability and Predictability
CoML	Census of Marine Life
COOP	Coastal Ocean Observations Panel
DBCP	Data Buoy Co-operation Panel
FAO	Food and Agricultural Organisation
GCOS	Global Climate Observing System
GHRSSST	GODAE High Resolution Sea Surface Temperature Project
GLOBEC	Global Ocean Ecosystem Dynamics
GLOSS	Global Sea Level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
GRA	GOOS Regional Alliances
GSC	GOOS Steering Committee
GTOS	Global Terrestrial Observing System
HAB	Harmful Algal Bloom
HELCOM	Helsinki Commission
ICES	International Council for the Exploration of the Sea
ICSU	International Council for Science
IGBP	International Geosphere-Biosphere Programme
I-GOOS	Intergovernmental Committee for GOOS
IGOS	Integrated Global Observing Strategy
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IODE	International Ocean Data and Information Exchange programme
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
LME	Large Marine Ecosystem
LOICZ	Land-Ocean Interactions in the Coastal Zone
NOOS	Northwest Self Operational Oceanographic System
NRL	Naval Research Laboratory (USA)
OBIS	Ocean Biogeographic Information System
OCEANS	Ocean Biogeochemistry and Ecosystems Analysis
ODINAFRICA	Ocean Data and Information Network in Africa
OIT	Ocean Information Technology
ONRIFO	Office of Naval Research International Field Office (USA)
OOPC	Ocean Observation Panel for Climate
OOSDP	Oceans Observing System Development Panel
OSPAR	Oslo-Paris Commission
PACSICOM	Pan-African Conference on Sustainable Integrated Coastal Management
PIRATA	Pilot Research Array in the Tropical Atlantic
POGO	Partnership for Observation of the Global Ocean
ROOFS-Africa	Regional Ocean Observing and Forecasting System for Africa
SOLAS	Surface Ocean—Lower Atmosphere Study
SOOP	Ship of Opportunity
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Cultural and Scientific Organization
WCRP	World Climate Research Programme
WIOMAP	Western Indian Ocean Marine Applications Project
WMO	World Meteorological Organisation
WSS	World Summit on Sustainable Development

In this Series, entitled

**Reports of Meetings of Experts and Equivalent Bodies**, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans S. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' (**Also printed in Spanish**)
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping (**Also printed in French and Spanish**)
12. Joint 100-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica (**Spanish only**)
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources (**Also printed in French and Spanish**)
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (**Also printed in French**)
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities (**Also printed in Spanish**)
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meeting on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
41. Third Session of the IOC Consultative Group on Ocean Mapping
42. Sixth Session of the Joint IOC-WMO-CCPS Working Group on the Investigations of 'El Niño' (**Also printed in Spanish**)
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN(OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. Cancelled
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
52. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean
53. First Session of the IOC Editorial Board for the International Chart of the Central Eastern Atlantic (**Also printed in French**)
54. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (**Also printed in Spanish**)
55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping

59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications
60. Second Session of the IOC Group of Experts on the Global Sea-Level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
64. Joint Meeting of the Group of Experts on Pollutants and the Group of Experts on Methods, Standards and Inter-calibration
65. First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area
66. Fifth Session of the Editorial Board for the International Bathymetric and its Geological/Geophysical Series
67. Thirteenth Session of the IOC-IHO Joint Guiding Committee for the General Bathymetric Chart of the Oceans **(Also printed in French)**
68. International Meeting of Scientific and Technical Experts on Climate Change and Oceans
69. UNEP-IOC-WMO-IUCN Meeting of Experts on a Long-Term Global Monitoring System
70. Fourth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
71. ROPME-IOC Meeting of the Steering Committee on Oceanographic Co-operation in the ROPME Sea Area
72. Seventh Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' **(Spanish only)**
73. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico **(Also printed in Spanish)**
74. UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
75. Third Session of the IODE Group of Experts on Marine Information Management
76. Fifth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
77. ROPME-IOC Meeting of the Steering Committee for the Integrated Project Plan for the Coastal and Marine Environment of the ROPME Sea Area
78. Third Session of the IOC Group of Experts on the Global Sea-level Observing System
79. Third Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
80. Fourteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
81. Fifth Joint IOG-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
82. Second Meeting of the UNEP-IOC-ASPEI Global Task Team on the Implications of climate Change on Coral Reefs
83. Seventh Session of the JSC Ocean Observing System Development Panel
84. Fourth Session of the IODE Group of Experts on Marine Information Management
85. Sixth Session of the IOC Editorial Board for the International Bathymetric chart of the Mediterranean and its Geological/Geophysical Series
86. Fourth Session of the Joint IOC-JGOFS Panel on Carbon Dioxide
87. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific
88. Eighth Session of the JSC Ocean Observing System Development Panel
89. Ninth Session of the JSC Ocean Observing System Development Panel
90. Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
91. First Session of the IOC-FAO Group of Experts on OSLR for the IOCINCWIO Region
92. Fifth Session of the Joint IOC-JGOFS CO<sub>2</sub> Advisory Panel Meeting
93. Tenth Session of the JSC Ocean Observing System Development Panel
94. First Session of the Joint CMM-IGOSS-IODE Sub-group on Ocean Satellites and Remote Sensing
95. Third Session of the IOC Editorial Board for the International Chart of the Western Indian Ocean
96. Fourth Session of the IOC Group of Experts on the Global Sea Level Observing System
97. Joint Meeting of GEMSI and GEEP Core Groups
98. First Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
99. Second International Meeting of Scientific and Technical Experts on Climate Change and the Oceans
100. First Meeting of the Officers of the Editorial Board for the International Bathymetric Chart of the Western Pacific
101. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
102. Second Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
103. Fifteenth Session of the Joint IOC-IHO Committee for the General Bathymetric Chart of the Oceans
104. Fifth Session of the IOC Consultative Group on Ocean Mapping
105. Fifth Session of the IODE Group of Experts on Marine Information Management
106. IOC-NOAA *Ad hoc* Consultation on Marine Biodiversity
107. Sixth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
108. Third Session of the Health of the Oceans (HOTO) Panel of the Joint Scientific and Technical Committee for GLOSS
109. Second Session of the Strategy Subcommittee (SSC) of the IOC-WMO-UNEP Intergovernmental Committee for the Global Ocean Observing System
110. Third Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
111. First Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate
112. Sixth Session of the Joint IOC-JGOFS CO<sub>2</sub> Advisory Panel Meeting
113. First Meeting of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS)
114. Eighth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño" **(Spanish only)**
115. Second Session of the IOC Editorial Board of the International Bathymetric Chart of the Central Eastern Atlantic **(Also printed in French)**
116. Tenth Session of the Officers Committee for the Joint IOC-IHO General Bathymetric Chart of the Oceans (GEBCO), USA, 1996
117. IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Fifth Session, USA, 1997
118. Joint Scientific Technical Committee for Global Ocean Observing System (J-GOOS), Fourth Session, USA, 1997
119. First Session of the Joint 100-WMO IGOSS Ship-of-Opportunity Programme Implementation Panel, South Africa, 1997
120. Report of Ocean Climate Time-Series Workshop, Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate, USA, 1997

121. IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS), Second Session, Thailand, 1997
122. First Session of the IOC-IUCN-NOAA *Ad hoc* Consultative Meeting on Large Marine Ecosystems (LME), France, 1997
123. Second Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), South Africa, 1997
124. Sixth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico, Colombia, 1996 **(also printed in Spanish)**
125. Seventh Session of the IODE Group of Experts on Technical Aspects of Data Exchange, Ireland, 1997
126. IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), First Session, France, 1997
127. Second Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME), France, 1998
128. Sixth Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1997
129. Sixth Session of the Tropical Atmosphere - Ocean Array (TAO) Implementation Panel, United Kingdom, 1997
130. First Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), France, 1998
131. Fourth Session of the Health of the Oceans (HOTO) Panel of the Global Ocean Observing System (GOOS), Singapore, 1997
132. Sixteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), United Kingdom, 1997
133. First Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1998
134. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IOC/EB-IBCWIOW3), South Africa, 1997
135. Third Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), France, 1998
136. Seventh Session of the Joint IOC-JGOFS CO2 Advisory Panel Meeting, Germany, 1997
137. Implementation of Global Ocean Observations for GOOS/GCOS, First Session, Australia, 1998
138. Implementation of Global Ocean Observations for GOOS/GCOS, Second Session, France, 1998
139. Second Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Brazil, 1998
140. Third Session of IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), China, 1998
141. Ninth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño', Ecuador, 1998 **(Spanish only)**
142. Seventh Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series, Croatia, 1998
143. Seventh Session of the Tropical Atmosphere-Ocean Array (TAO) Implementation Panel, Abidjan, Côte d'Ivoire, 1998
144. Sixth Session of the IODE Group of Experts on Marine Information Management (GEMIM), USA, 1999
145. Second Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), China, 1999
146. Third Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Ghana, 1999
147. Fourth Session of the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC); Fourth Session of the WCRP CLIVAR Upper Ocean Panel (UOP); Special Joint Session of OOPC and UOP, USA, 1999
148. Second Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1999
149. Eighth Session of the Joint IOC-JGOFS CO2 Advisory Panel Meeting, Japan, 1999
150. Fourth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional – Global Ocean Observing System (NEAR-GOOS), Japan, 1999
151. Seventh Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1999
152. Sixth Session of the IOC Group of Experts on the Global Sea level Observing System (GLOSS), France, 1999
153. Seventeenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), Canada, 1999
154. Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y el Golfo de Mexico (IBCCA), Septima Reunión, Mexico, 1998  
IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA), Seventh Session, Mexico, 1998
155. Initial Global Ocean Observing System (GOOS) Commitments Meeting, IOC-WMO-UNEP-ICSU/Impl-III/3, France, 1999
156. First Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, Venezuela, 1999 **(also printed in Spanish and French)**
157. Fourth Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), China, 1999
158. Eighth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series, Russian Federation, 1999
159. Third Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), Chile, 1999
160. Fourth Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS). Hawaii, 2000
161. Eighth Session of the IODE Group of Experts on Technical Aspects of Data Exchange, USA, 2000
162. Third Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME), France, 2000
163. Fifth Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Poland, 2000
164. Third Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), France, 2000
165. Second Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, Cuba, 2000 **(also printed in Spanish and French)**
166. First Session of the Coastal Ocean Observations Panel, Costa Rica, 2000
167. First GOOS Users' Forum, 2000
168. Seventh Session of the Group of Experts on the Global Sea Level Observing System, Honolulu, 2001
169. First Session of the Advisory Body of Experts on the Law of the Sea (ABE-LOS), France, 2001 **(also printed in French)**
170. Fourth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, Chile, 2001
171. First Session of the IOC-SCOR Ocean CO<sub>2</sub> Advisory Panel, France, 2000
172. *Cancelled*
173. Third Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, USA, 2001 **(also printed in Spanish and French)**
174. Second Session of the Coastal Ocean Observations Panel and GOOS Users' Forum, Italy, 2001
175. Second Session of the Black Sea GOOS Workshop, Georgia, 2001
176. Fifth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional – Global Ocean Observing System (NEAR-GOOS), Republic of Korea, 2000

177. Second Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Morocco, 2002 **(also printed in French)**
178. Cancelled
179. Cancelled
180. Second Session of the IOC-SCOR Ocean CO<sub>2</sub> Advisory Panel, Honolulu, Hawaii, U.S.A, 2002 **(electronic copy only)**
181. IOC Workshop on the Establishment of SEAGOOS in the Wider Southeast Asian Region, Seoul, Republic of Korea, 2001 (SEAGOOS preparatory workshop) **(electronic copy only)**
182. Cancelled
183. Fourth Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), France, 2002
184. Seventh Session of the IODE Group of Experts on Marine Information Management (GEMIM), France, 2002 **(electronic copy only)**
185. Sixth Session of IOC/WESTPAC Coordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), Republic of Korea, 2001
186. First Session of the Global Ocean Observing System (GOOS) Capacity Building Panel, Switzerland, 2002 **(electronic copy only)**
187. Fourth Session of the ad hoc Advisory Group for IOCARIBE-GOOS, 2002, Mexico **(also printed in French and Spanish)**
188. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IBCWIO), Mauritius, 2000
189. Third session of the Editorial Board for the International Bathymetric Chart of the Western Pacific, China, 2000
190. Third Session of the Coastal Ocean Observations Panel and GOOS Users' Forum, Vietnam, 2002
191. Eighth Session of the IOC Consultative Group on Ocean Mapping, Russian Federation, 2001
192. Third Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Lisbon, 2003 **(also printed in French)**
193. Extraordinary Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño', Chile, 1999 **(Spanish only; electronic copy only)**
194. Fifth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, France, 2002
195. Sixth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, South Africa, 2003
196. Fourth Session of the Coastal Ocean Observations Panel, South Africa, 2002 **(electronic copy only)**