
Global

Ocean

Observing

System



Intergovernmental Oceanographic Commission
Reports of Meeting of Experts and Equivalent Bodies

**The *ad hoc* Advisory Group for
IOCARIBE-GOOS**

Second Session

29 November – 1 December 2000

La Havana, Cuba

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IOCARIBE-GOOS-II/3
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1. OPENING

The co-chairs of the *ad hoc* Advisory Group for IOCARIBE-GOOS, Mr. Guillermo Garcia-Montero and Mr. Douglas Wilson, opened the meeting at 09:15 hours, thanking all participants for attending the meeting, kindly hosted by the Acuario Nacional de Cuba. The list of participants is given as Annex I.

The Co-Chairs reminded participants, several of whom were new to the group, that the overall purpose of IOCARIBE-GOOS was to get countries working together to produce a common benefit.

Mr. Wilson pointed out that there have been several significant changes since the last meeting, which give reason for optimism about the future of IOCARIBE-GOOS. There is now much more advice available on how to implement GOOS in coastal seas, stemming from the publication of the strategic design plans of the three GOOS advisory panels: Coastal GOOS, Living Marine Resources; and Health of the Oceans. These three bodies have now been merged into a single new integrated advisory panel – the Coastal Ocean Observations Panel (COOP), reflecting the new focus of GOOS on (i) the open ocean and climate; and (ii) coastal seas. In addition, the GOOS Steering Committee has published a regional discussion document clarifying the roles of regional bodies such as IOCARIBE-GOOS. These various developments give the *ad hoc* advisory group for IOCARIBE-GOOS much more information to use in developing the first draft of the IOCARIBE-GOOS strategic plan.

Mr. Wilson noted that Janice Trotte, the original Technical Secretary, had left the IOC and returned to Brazil, her place being taken by the Director of the GOOS Project Office, Dr. Colin Summerhayes. In addition he was pleased to be able to report that the IOC had found funds to initiate an IOCARIBE-GOOS Secretariat, which would initially be staffed by Ms. Gletys Guardia-Montoya, who would work under his supervision in Miami.

On behalf of IOC, Colin Summerhayes, Director of the GOOS Project Office, thanked participants for their attendance, and thanked the local organizers, in particular Mr. Guillermo Garcia-Montero, for hosting the meeting. Dr. Summerhayes stressed the importance of regional groups like IOCARIBE-GOOS to the overall implementation of GOOS. He also thanked the government of the Netherlands for financial support.

2. ADMINISTRATIVE ARRANGEMENTS

Mr. Guillermo Garcia-Montero explained the logistical arrangements, and plans for social events, including a visit to the Research Vessel *Ulyses* scheduled for the morning of Friday December 1st.

Apologies were presented from Prof. Worth Nowlin, Chairman of the GOOS Steering Committee, Frank Muller-Karger of the University of South Florida, and Nelson Andrades-Colmenares of the UNEP Office in Jamaica.

2.1 ADOPTION OF THE AGENDA

The provisional agenda (Annex II) was adopted.

2.2 DESIGNATION OF THE RAPPORTEUR

Gletys Guardia-Montoya was appointed to serve as the Rapporteur of this Session.

2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION

Doug Wilson presented the working and information documents, which were distributed and available to participants in advance. The main documents were:

- (i) the Report of the IOCARIBE Users and the Global Ocean Observing System (GOOS) Capacity Building Workshop, held in San Jose, Costa Rica, 22-24 April 1999 (IOC Workshop Report No. 158 GOOS Report 84);

- (ii) the Report of the *ad hoc* Advisory Group for IOCARIBE-GOOS meeting held in Caracas, Venezuela, 3-5 November 1999 (GOOS Report 88); and
- (iii) the Strategic Plan and Principles for the Global Ocean Observing System (GOOS), Version 1.0, January 1998 (GOOS Report 41).

Other key GOOS documents include the strategic design plan for Coastal GOOS, available on the GOOS web site (<http://ioc.unesco.org/goos>). This will soon be joined by the strategic design plans for the Living Marine Resources and Health of the Oceans Modules of GOOS.

Dr. Summerhayes was asked to make available copies of GOOS Reports 84 and 88 in both English and Spanish, and to ensure that all future IOCARIBE-GOOS reports are produced in these two languages plus French.

Action 1: GPO arrange for all IOCARIBE-GOOS reports past and present to be translated into French and Spanish.

3. OVERVIEW AND BACKGROUND INFORMATION ON GOOS DEVELOPMENT AT GLOBAL SCALES

Dr. Summerhayes provided an overview of developments in GOOS since the first IOCARIBE-GOOS meeting. GOOS is an integrated global network that systematically acquires and disseminates data and data products in response to the information needs of government, industry, science and the public to address marine-related issues and problems in a timely fashion. Its work is now focussed through two design panels. The Ocean Observations Panel for Climate (OOPC) focuses on the open-ocean and weather and climate. The Coastal Ocean Observations Panel (COOP) covers all aspects of coastal seas and integrates the activities of three former advisory panels: Health of the Oceans, Living Marine Resources, and Coastal Seas.

3.1. COASTAL GOOS

The new Coastal GOOS (COOP) is intended to be a sustained and integrated observing system that makes more effective use of existing infrastructure and resources to detect and predict the causes and consequences of changes in coastal ecosystems for the benefit of human populations, and provides the data and knowledge required to:

- (i) detect and forecast the effects of climate change;
- (ii) manage and restore healthy coastal ecosystems and living resources;
- (iii) forecast and mitigate the effects of natural hazards;
- (iv) enable safer and more cost-effective marine operations;
- (v) protect public health.

The system requires timely access to both data and information products, integrated to provide useful information in a timely fashion to multiple user groups. Timely exchange of data is essential to provide the regional context in which all local problems are nested.

The COOP design must be guided by the following principles:

- (i) be user driven: produce data-products responsive to the needs of many user groups;
- (ii) provide timely and free access to and exchange of data;
- (iii) provide more cost-effective use of existing data, expertise; and infrastructure than is currently the case;
- (iv) develop into an end-to-end system that is multi-disciplinary;
- (v) be traceable from original data to final product.

The coastal observing system will be a global network for measuring and analyzing a common set of core variables that is regionally and locally customized to address issues of greatest concern to participating countries.

It will consist of:

- (i) an observing subsystem;
- (ii) a data communications and management subsystem;
- (iii) a modelling and applications subsystem.

The Observing Subsystem

There will be six main observing elements (many components are already in place, though not necessarily yet committed to GOOS):

The ideal observing network will comprise:

- (i) Remote sensing from satellites and aircraft;
- (ii) Beach and nearshore zone observing elements (including meteorological stations on land, and remote-sensing from land-based platforms – including HF radar);
- (iii) Tide gauges (GLOSS plus);
- (iv) Fixed and floating data-gathering buoys, drifters and other platforms;
- (v) Ships of opportunity (including ferries);
- (vi) Long time series records demonstrating the scales of natural variability.

Seventeen core variables will be measured ideally, including: surface winds; air pressure; air temperature; precipitation; sea-level; bathymetry; water temperature; salinity; currents; waves; turbidity; sediment type; nutrients; phytoplankton pigments; and water clarity. Others will be added as needed.

The system will develop along five tracks:

- (i) building an initial global network by incorporating existing operational elements;
- (ii) pre-operational pilot projects to demonstrate the utility and cost-effectiveness of the GOOS end-to-end, user driven approach and contribute to the development of the global network and regional enhancements;
- (iii) capacity building;
- (iv) enabling research;
- (v) continued interaction with users to determine those products that are most useful.

There will be three main activities:

- (i) operational programmes;
- (ii) pre-operational pilot projects to demonstrate the value of GOOS and to test concepts;
- (iii) enabling research.

National and Regional GOOS Programmes are the primary means for continued development of the design plan, implementation, and regional customization.

The users are likely to be:

- ≠! Intergovernmental conventions (e.g. GOOS can serve the needs of the Cartagena Convention);
- ≠! Government agencies;
- ≠! Environmental managers;
- ≠! Operating agencies (safety; search and rescue; navigation; ports; pilots);
- ≠! Small companies (fish farmers; trawler skippers; hotel owners; recreation companies);
- ≠! Large companies (oil and gas; surveying; shipping; fisheries; dredging; construction);
- ≠! Single users (tourists; yachtsmen; surfers; fishermen);
- ≠! Scientific researchers.

Users will also include on land the planners for supplies of food, water and energy, which are affected by climate.

The Communications Network and Data Management Subsystem

A well-planned and co-ordinated approach to data management is vital. Development of a comprehensive data management plan will be a formidable task. Data streams will include physical, biological, chemical, sedimentological and bathymetric data input from in situ and remote sensors and from laboratory analyses of samples collected from fixed platforms, drifters and ships. Some applications will require real time or near real time inputs. The COOP Data and Information Management Plan contains the following guidelines:

- Full and open sharing and exchange of relevant data and products for all COOP users. Data provided in a timely manner and at the lowest possible cost;
- Preservation of all COOP data in suitable archives with designated data custodians;
- Procedures and criteria for setting methods for data acquisition, retention, and purging, with a clearinghouse prevent the purging and loss of important data;
- All data-sets subject to well documented quality control and quality assurance procedures described in the meta-data;
- Data archives must include meta-data, including quality assessments, supporting information, and guidance and aids for locating and obtaining the data;
- Internationally agreed standard protocols should be developed for the acquisition, processing, archiving, and distribution of both data and associated meta-data;
- Data should be processed to a level which is useful to users without detailed knowledge of the observing instrument;
- Description of COOP data and products in on-line computerized directories conforming to agreed standards;
- Users of COOP data must acknowledge the source(s) of data and information;
- Data streams monitored to ensure that they are routine and reliable. Users will be encouraged to provide feedback on the quality and timeliness of data product, and to suggest improvements and new products;
- Data communication and management networks will be harmonized on national, regional and global scales.

The initial data management system will grow in an incremental way by linking and integrating existing national and international communications networks and data management programmes that collect and manage the data types required. Several end-to-end systems may develop, each contributing one or more data types and providing data to other parts of the global system as required. Each of these systems is likely to involve several organizations with varying expertise and emphasis in operational data assimilation, modelling, data dissemination, meta-data standards, archival, and product development and distribution. The challenge will be to develop an integrated network that can adapt to accommodate development of new requirements and capabilities as the full end-to-end system evolves.

COOP data management and communication mechanisms must recognize the multiplicity of data sources and data types, the multiplicity of users and their varying needs, and the overarching concerns of quality assurance, timeliness, and ease of access to data and data products. The International Oceanographic Data and Information Exchange (IODE) and the WMO's World Weather Watch (WWW) of the WMO, represent existing communication and data management structures that should be adapted.

International (and often national) mechanisms are generally lacking for many types of chemical, biological, ecological and sedimentological, data. Many existing data management programmes need to increase their capabilities in these areas to collate and integrate existing data, and to accommodate increases in the volume of data and the number of data types as user needs become better defined and the diversity of data products increases. This is likely to be a long-term process.

There will be three main levels of data management:

- (i) Level I: local: organizations that collect, process, and quality control data, disseminate it and archive it. They support distributed environmental data bases, and provide data and data products via the web.

Functions:

- ÷! Sustain collection of data on one or more core variables;
- ÷! Quality control of the data;
- ÷! Provide network access to data sets and meta-data;
- ÷! Timely delivery of data and meta-data to higher levels.

- (ii) Level II: National: collate diverse data types from many different sources, and assure quality. Do not generally develop data-products, but are responsive to user needs for better products.

Functions:

- ÷! Seek and acquire quality controlled data from national sources;
- ÷! Develop and implement quality assurance procedures;
- ÷! Timely exchange of quality data with other Centres;
- ÷! Inventory and archive quality assured data;
- ÷! Communicate data and information to other levels.

- (iii) Level III: Supra-National Data Management and Synthesis Centres: building blocks of a global network; needed for global scale observations, to serve key regions, or to address key issues.

Functions:

- ÷! Collate data from Level II Centres and elsewhere;
- ÷! Establish data standards and exchange protocols;
- ÷! Monitor the performance of the data exchange system;
- ÷! Establish global data bases;
- ÷! Enable problem-specific data synthesis;
- ÷! Establish online data and data product services for users;
- ÷! Provide an information directory of products and services;

3.2 OPEN OCEAN OBSERVATIONS

The recommendations of the OOPC for ocean measurements have been published in GOOS Report 66: *Global Physical Ocean Observations for GOOS/GCOS: an Action Plan for Existing Bodies and Mechanisms* (see GOOS web page (<http://ioc.unesco.org/goos>)).

The principal pilot project for the OOPC is the Global Ocean Data Assimilation Experiment (GODAE), which is designed primarily to develop and apply state-of-the-art ocean models and assimilation methods (i) for short-range open-ocean forecasts, (ii) for boundary conditions to extend the predictability of coastal and regional subsystems, and (iii) for initial conditions of climate forecast models. As part of GODAE it is planned to make a global collection of upper ocean thermal and salinity data by using profiling floats in the Argo project. Argo is a GOOS pilot project. There will be some Argo profiles in the IOCARIBE area, and it will be up to IOCARIBE-GOOS to make best use of them, and to become involved in the Argo project.

Regional information beyond the IOCARIBE area is needed because the region is affected by what happens in the larger earth-ocean-atmosphere system. This information can be supplied in the form of boundary conditions from GODAE for local area models. Examples of external events affecting the region are: Amazon outflow; the North Atlantic Oscillation; the Tropical Atlantic Dipole (monitored by the PIRATA array); and the El Nino-Southern Oscillation, monitored by the TAO array in the equatorial Pacific.

3.3 GOOS INITIAL OBSERVING SYSTEM

Dr. Summerhayes reported on the GOOS Initial Observing System, which comprises many international elements at the global scale. Full details are available on the GOOS web site. Some elements are already operative in the IOCARIBE region. These include the Global Coral Reef Monitoring Network (GCRMN), and the Global Sea Level Observing System (GLOSS). There are also Ships of Opportunity (SOOP) collecting subsurface data, and Voluntary Observing Ships (VOS) collecting marine meteorological data. These last two (SOOP and VOS) will come together under the new Joint WMO/IOC Technical Commission for

Oceanography and Marine Meteorology (JCOMM), which holds its first meeting in June 2001. It is important that IOCARIBE countries appoint oceanographic representatives to JCOMM.

3.4. REGIONAL GOOS DEVELOPMENTS AND CAPACITY BUILDING

Dr. Summerhayes noted that IOCARIBE-GOOS is one of a number of regional bodies created to implement GOOS at the local level. Others include PacificGOOS for the Pacific islands; Black Sea GOOS; MedGOOS for the Mediterranean; NEAR-GOOS for N.E. Asia; EuroGOOS for Europe. In each case the task is:

- ≠! To promote implementation of GOOS in the region;
- ≠! To develop pilot/demonstrator projects;
- ≠! To adapt existing observing systems and integrate them into a common system;
- ≠! To survey the users to determine their needs;
- ≠! To encourage development of a production line approach to data management;
- ≠! To increase awareness, build support, and develop capacity.

Dr. Summerhayes gave a comprehensive view of Baltic GOOS to illustrate that GOOS is really working in coastal seas in some places.

For capacity building we need in each region:

- ≠! To seek regional involvement;
- ≠! To build institutional infrastructure;
- ≠! To make an inventory of capabilities and needs;
- ≠! To focus on practical assistance related to needs;
- ≠! To provide appropriate training;
- ≠! To ensure sustainability for the long term;
- ≠! To demonstrate costs and benefits;
- ≠! To solicit donor funding.

Dr. Summerhayes noted that there were no meteorological agencies represented among the members of the *ad hoc* advisory group for IOCARIBE-GOOS. He pointed out that the IOC and the WMO are now working actively to encourage the collaboration of oceanographers and meteorologists in developing operational oceanographic services, through the Joint WMO/IOC technical Commission for Oceanography and Marine Meteorology (JCOMM), and suggested that it may be advisable in the future to co-opt meteorologists into the IOCARIBE-GOOS process.

Action 2: (i) All members work to bring national meteorological agencies into the IOCARIBE-GOOS community; (ii) GPO to ask Peter Dexter (WMO) to work with us to contact Caribbean meteorological agencies as the basis for engaging them in IOCARIBE-GOOS.

Dr. Summerhayes noted that GOOS is a tool that can be used to enable governments to meet the needs of Conventions. In the case of IOCARIBE-GOOS this means exploring the possibility of links to the Cartagena Convention through UNEP's Caribbean Environment Programme Office in Kingston, Jamaica.

Action 3: GPO work with Nelson Andrade (UNEP) (i) to consider how IOCARIBE-GOOS may be designed to provide data and information in support of the Cartagena Convention; and (ii) to find out what data are being collected for the Cartagena Convention, and where; (iii) to check whether Cartagena Convention is planning to include 4th protocol on Biodiversity Convention.

Dr. Summerhayes suggested that IOCARIBE-GOOS might wish to consider developing region-wide capacity particularly in the generic fields of (i) numerical modelling; and (ii) satellite remote sensing. He noted that elsewhere in GOOS capacity is also being built through the mechanism of pilot or demonstrator projects, and suggested that the *ad hoc* Group might wish to consider what pilot projects might be developed to demonstrate to governments the value of implementing GOOS in the region. In the Caribbean, as elsewhere, GOOS will be implemented first by capitalizing on existing systems. In this context it appears that there are

some gaps, for example a dearth of SOOP lines. In discussion it was agreed that IOCARIBE-GOOS could consider instrumenting ferries and cruise ships. Yachts are already being instrumented through the Seakeepers programme. IOCARIBE-GOOS will also need to consider how the region becomes involved in the Argo project to seed the global ocean with 3000 profiling floats.

Action 4: Doug Wilson: (i) get ship route maps for IOCARIBE region from NOAA, IMO, and other sources (with help from Ruben Aparicio and Hazel McShine for petroleum carriers), from Alfonso Botello (for IMO), and from UNEP; (ii) consider the need for and possible locations of high density SOOP lines in the Caribbean; (iii) consider developing joint proposals between oceanographers and meteorologists to resource combined VOS/SOOP lines;

IOCARIBE-GOOS will need to interact with a broad range of data producers and users. Navies are both producers and users, and some effort will be needed by all members to convince navies in particular of the benefits to be gained from sharing data and information.

Dr. Alfonso Botello gave a brief presentation on the results of the First GOOS Users' Forum (Costa Rica, Nov. 13-14, 2000), and the first meeting of the COOP (Costa Rica, Nov. 15-17, 2000). Several IOCARIBE nations made presentations as part of the Forum, demonstrating a considerable depth of interest in establishing GOOS at the national level in the region. Dr. Botello noted that the strategic design plan for the Health of the Oceans Module gave generic advice on the development of pilot projects addressing environmental health issues. One of the key mechanisms recommended by the HOTO Panel for assessing environmental health is the Rapid Assessment of Marine Pollution (RAMP) approach. Implementation of HOTO recommendations may prove useful to the Cartagena Convention.

4. IMPLEMENTATION OF FOLLOW-UP ACTIONS FROM THE *AD HOC* ADVISORY GROUP FOR IOCARIBE-GOOS (FIRST SESSION, CARACAS, VENEZUELA)

As part of the introduction to this item, Guillermo Garcia-Montero noted that IOCARIBE-GOOS should make faster progress now, with the appointment of Ms Guardia-Montoya. Among other things, Ms Guardia-Montoya will develop 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; and
- (v) commercial interests.

Her work will be carried out by means of a questionnaire, which will be finalized for distribution by Christmas 2000. In discussion it was agreed that the inventory should also include Regional Fisheries Bodies, as well as satellite capabilities.

Action 5: Gletys Guardia-Montoya to (i) compile list of potential contacts to approach for the inventory, including among others Regional Fisheries Bodies; (ii) begin making contacts via e-mails with the aim of having as complete as possible an inventory to present at the Miami meeting; (iii) inform contacts about the Miami meeting; (iv) begin building a mailing list of IOCARIBE-GOOS and contacts, and send monthly updates; (v) include in the inventory an overview of satellite capabilities across the region.

Action 6: GPO and Co-chairs: Develop questionnaire before Christmas for Gletys Guardia-Montoya to use to gather inventory input.

Action 7: GPO to provide Gletys Guardia-Montoya with (i) attendance list from the First GOOS User's Forum, Costa Rica, 2000; (ii) list of GOOS national contacts in the IOCARIBE region; (iii) list of national GOOS Coordinating Committees or their equivalents in the IOCARIBE region; (iv) via Thorkild Aarup, the GPO inventory of coastal GOOS data; (v) Provide Gletys Guardia-Montoya with EuroGOOS example of web-based listing of operational activities.

Action 8: Alan Duncan to provide Gletys Guardia-Montoya with IOCARIBE evaluation report.

Action 9: Alfonso Botello to provide Gletys Guardia-Montoya with copies of his two papers on Caribbean oil pollution.

4.1. REPORT ON TASKS OF MEMBERS OF THE *AD HOC* ADVISORY GROUP

As agreed at the Caracas meeting, the *ad hoc* advisory group will produce a draft strategic plan entitled "The Case for IOCARIBE-GOOS", which will be based on the format of the GOOS Strategic Plan (GOOS Report 41). Of the 11 chapters proposed for the draft plan, 6 were completed in time for the Havana meeting. To complete the draft the following actions will be needed.

Action 10: All members to prepare drafts of each chapter by 1.15.2001 – responsibilities include:

- (i) Definition of IOCARIBE-GOOS: Guillermo Garcia;
- (ii) Assessment of Needs: Ruben Aparicio;
- (iii) Design of IOCARIBE-GOOS: Doug Wilson;
- (iv) Implementation and integration: Artemio Gallegos (GPO to assist);
- (v) GOOS products: Artemio Gallegos (GPO to assist);
- (vi) Data and information management: Doug Wilson (GPO to assist);
- (vii) National and regional development: Hazel McShine;
- (viii) Training and capacity building: Antonio Rowe (GPO and Guillermo to assist);
- (ix) Technology development: Antonio Rowe (GPO to assist);
- (x) Resources: Ruben Aparicio;
- (xi) Ensuring effective coordination: Hazel McShine.

Action 11: All Members to (i) complete and distribute final draft by mid-March, ready for presentation at April 3-5 Miami Oceanology International (OI) meeting; (ii) provide a reference list for each chapter to indicate comprehensive coverage; (iii) complete the final document after April meeting feedback, by end June 2001, for submission to I-GOOS and IOC Assembly.

Progress reports on each chapter follow.

4.1.1 The definition of IOCARIBE-GOOS

Guillermo Garcia-Montero presented a draft definition, which was revised by the participants as follows:

"IOCARIBE-GOOS is a basic source of information, services and products to support sustainable social and economic development, welfare, and safety, through systematic observations and associated research on coasts and seas in the IOCARIBE region. The system is operational in nature and designed to yield products and services that meet the needs of users. It provides information on the past, present and future state of the marine and coastal environment, on marine ecosystems and biodiversity, and on weather and climate variability. It is also a tool for integrated management of the coastal zone. International cooperation and capacity building are essential to the effective operation of the system and to enable potential users to benefit from it."

This definition is designed to make IOCARIBE-GOOS understandable to governments, potential funding agencies and donor organizations. It also respects the opinion of the summit of the heads of states of the Association of Caribbean States, held in Santo Domingo in April 1999, where sustainable tourism was declared as one of the top priority issues of the organization.

It was agreed that attempts should be made to encourage IOC Member States to develop a nationally coordinated approach to the establishment of GOOS, using the mechanism of national GOOS coordinating committees (NGCCs), which are designed to ring together all stakeholders, including industries. NGCCs could be formed as subgroups of National Oceanographic Committees (NOCs), from which they differ primarily in the inclusion of all stakeholders. The inventory will need to include listings of all national GOOS contacts and NGCCs.

Action 12: (i) Co-chairs and GPO, jointly with IOCARIBE Secretariat, provide advice to IOCARIBE Member States on the formation of national GOOS coordinating committees, with an appropriate cover letter; (ii) Ruben Aparicio to provide GPO with information on the Venezuelan national GOOS group.

In addition it was agreed that every effort should be made to encourage national and regional meteorological bodies to contribute to or participate in IOCARIBE-GOOS, and that the WMO should be asked to help in this matter (see Action Item 2 (ii) above).

4.1.2 Assessment of Needs, and Resources (two chapters)

Ruben Aparicio-Castro made a presentation on the work he had done on these two topics. He suggested that the nations of the region needed to combine forces through IOCARIBE-GOOS to address two common concerns: (i) vulnerability to severe storms; and (ii) the health of coastal zone resources including fisheries and environmental quality for tourism. These two concerns could provide two common themes for IOCARIBE-GOOS, namely: (i) weather and climate; and (ii) coasts and ecosystems. He pointed out that there already exists a map showing coastal ecosystems where priorities are high for conservation, noting that this provides a guide to where effort might be focussed. He also pointed out that following the UN Convention on the Law of the Sea, most of the Caribbean falls into Exclusive Economic Zones that are supposed to be managed by Member States. Almost none of the Caribbean is open-ocean outside an EEZ.

He went on to illustrate what Venezuela is doing to implement GOOS in Venezuelan coastal waters.

As far as resources are concerned, it was suggested that a bibliography be prepared. In this context three publications deserve particular mention: (i) *The Caribbean Outlook* (published by UNEP); (ii) a publication by IOC/UNEP on small island oceanography; and (iii) a Caribbean issue of the Woods Hole Oceanographic Institution Publication *Oceanus*.

Action 13: Gletys Guardia-Montoya (i) to use information from (a) *The Caribbean Outlook* (published by UNEP); (b) the Caribbean issue of *Oceanus*; (c) UNEP/IOC report on small island oceanography; to provide information on resources; (ii) to develop bibliography on resources.

Action 14: All Members to provide Ruben Aparicio with statistics on resources.

4.1.3 National and Regional Development and Ensuring Effective Coordination (two chapters)

Dr. Hazel McShine made a presentation on the work she had done on these two topics.

In discussion, concern was raised about how IOCARIBE-GOOS would effect coordination between the many different UN and other bodies doing marine research and making observations in the region. It was agreed that such coordination would be best effected through the person of an IOCARIBE-GOOS Administrative Officer, who might in due course be based in the IOCARIBE Regional Office in Cartagena, or elsewhere as appropriate. The task of coordinating between oceanography and meteorology globally and regionally would be made easier in future with the creation of JCOMM.

Action 15: GPO to provide Hazel McShine with GOOS Regional Policy and GOOS Regional Discussion Document.

4.1.4 Design of IOCARIBE-GOOS; and Data and Information Management (two chapters)

These items had not been tackled and the tasks were assigned to Doug Wilson. In discussion, participants asked if the Caribbean tsunami warning system would be included within IOCARIBE-GOOS. A suggestion was made that one element of the design should be specialized regional centres for particular activities. The data and information management plan should capitalize on the GOOS Data and Information Management Plan, on the data and information management recommendations of the strategic design plan for Coastal GOOS, and on the IODE's regional activities including the Global Ocean Data Archaeology and Rescue (GODAR) project.

Action 16: GPO to meet with Paul Geerdes (and Guillermo Garcia) during MarCUBA 2000, to discuss developing GODAR in the IOCARIBE-GOOS context.

As part of the discussion on GOOS requirements for the design of IOCARIBE-GOOS, two meteorologists from the Cuban Institute of Meteorology were invited to attend the session. They described the Cuban Voluntary Observing Ship (VOS) programme. Cuba instruments 5 ships. Currently it is not involved in the Ship of Opportunity Programme (SOOP). Data on upper ocean thermal structure is now known to be critical for gauging hurricane intensity along hurricane tracks. For this and other reasons, there is a general interest among meteorologists in using XBTs for upper ocean temperature profiles, but shortage of resources prevents such a programme from developing. This observation led to a general discussion about building a SOOP network in the IOCARIBE region. Clearly there are good prospects for developing joint oceanographic/meteorological proposals for improving such data gathering in the region.

Action 17: Guillermo Garcia: (i) to arrange a meeting with Patricio Bernal, IOC Executive Secretary, and the Director of Meteorology, during MarCUBA 2000, to discuss instrumenting ships with XBTs to improve hurricane and climate forecasting; (ii) to find out where the regional meteorological office is located

For the design plan Dr. Summerhayes recommended that the group consider developing a set of 2-4 pilot projects to demonstrate how different aspects of GOOS would work to benefit governments in the region. In discussion the group selected six possible themes for pilot projects, from which 2-4 may eventually be chosen:

- (i) Pollution: the HOTO strategic design plan contains generic advice on topics that might be included in a Caribbean pilot project focused on pollution (Annex III). This might address among other things: harmful algal blooms; pesticides; oil spills; eutrophication. The group agreed that it would be wise to focus on one particular topic, not all of these. Such a project might in addition provide a capacity building vehicle for expanding the use of the RAMP approach to indicate changes in environmental health. Such a project might also be designed to provide indicators of human health (e.g. in areas of pesticide runoff). It was further agreed that a HOTO pilot project might be sub-regional rather than region-wide.
- (ii) Circulation Model: remotely sensed data (e.g. altimetric measurement of sea surface height), surface drifter data and other data from the region might be integrated into numerical models to provide regional circulation products that would set the boundary conditions for local area models of various kinds. Regional circulation controls the flow into coastal zones and through marine protected areas, and controls the spread of fish larvae.
- (iii) Capacity Building in Remote Sensing: all IOCARIBE states are over-flown by a number of satellites measuring a broad range of ocean attributes. Much of this data is not currently easily obtainable by these states, and even if it were, they might not all have people trained to make effective use of it. Space agencies are interested in seeing wider use of their products, and individual nations are interested in obtaining access to potentially useful data from their waters. Both of these needs might be satisfied through a comprehensive programme of training in the interpretation and application of remotely sensed data. In addition it would be useful to assess the means of distribution of satellite data in the region to see if it could be improved through the establishment of more ground stations.

- (iv) Coastal Erosion: a pilot project on this topic could prove useful to planners. Information is required on the real and potential incidence of erosional events. A forecasting ability is desirable and might be achievable through the application of local area models (perhaps bought off the shelf). Monitoring and forecasting of winds, waves and sea-level is desirable.
- (v) Fisheries: there is the possibility of contributing to proposed Large Marine Ecosystem studies in the region.
- (vi) Capitalize on existing or planned pilot projects in the region, for example by jointly sponsoring them. One example might be the RONMAC project.

Action 18: All members to (i) consider developing 2-3 pilot projects for inclusion in GOOS design; (iv) consider co-sponsoring (i.e. adopting) appropriate existing pilot projects as jointly sponsored demonstrators of GOOS benefits.

4.1.5 Implementation and Integration and GOOS Products (two chapters)

These items had not been tackled and the tasks were assigned to Artemio Gallegos.

4.1.6 Training and Capacity Building; and Technology Development (two chapters)

These items had not been tackled and the tasks were assigned to Antonio Rowe.

Action 19: Antonio Rowe to design a questionnaire on capabilities (including technology), needs, and gaps, in consultation with all members.

Action 20: GPO to provide Antonio Rowe with (i) the WIOMAP/PacificGOOS questionnaire on capabilities and technology, and to help design the questionnaire which Gletys Guardia-Montoya will distribute by Christmas if possible; (ii) with the GOOS Capacity Building Principles and Plan, and JCOMM Capacity Building Strategy; and (iii) with the EuroGOOS Technology Report.

5. REVIEW OF THE TERMS OF REFERENCE (TORs) FOR THE *AD HOC* IOCARIBE-GOOS ADVISORY GROUP

The Group modified its Terms of Reference (TORs) slightly from the way in which they were presented in GOOS Report 84, section 5, page 19-20. This means that the IOCARIBE-GOOS Steering Committee will no longer have to draft the Strategic Plan as was proposed in GOOS Report 84, section 4.2.4 (d), page 15. The revised TORs of the Advisory Group are shown below:

- (i) prepare an inventory of:
 - ≠! existing operational systems and programmes both at the international and national levels with relevance to IOCARIBE-GOOS;
 - ≠! existing organizations with potential interest in IOCARIBE-GOOS;
 - ≠! existing and proposed scientific programmes with expression to IOCARIBE-GOOS;
 - ≠! existing services and products with potential interest to IOCARIBE-GOOS; and
 - ≠! commercial interests;
 - ≠! training and capacity building.
- (ii) draft and distribute guidelines for national participation in IOCARIBE-GOOS which would include the setting up of a national GOOS Committee as a step;
- (iii) develop links with existing relevant organizations, programmes and projects in the region; and
- (iv) provide draft IOCARIBE-GOOS Strategic Plan for review by the future IOCARIBE-GOOS Steering Committee, taking into account the GOOS Strategic Plan and Principles (described in GOOS Report No. 41), with specific adaptations to the needs of the region.

Action 21: GPO to inform the IOCARIBE Officers of the amendments to the Terms of Reference made by the Group.

6. COMPOSITION OF THE *AD HOC* ADVISORY GROUP

It was agreed that the present membership, as listed in Annex I, was appropriate but that in addition Alejandro Gutierrez of Costa Rica should be invited to continue as a member, and a new member should be sought from Colombia to replace Mauricio Gonzalez.

Action 22: Guillermo Garcia to recruit possible Colombian member.

7. REPORT ON THE IOCARIBE-GOOS WORKSHOP/OCEANOLOGY INTERNATIONAL – AMERICA, MIAMI, 03-05 APRIL 2001

The Group outlined the following provisional programme for the IOCARIBE-GOOS day, which will be on April 4th. The target will be no more than 12 talks.

- IOCARIBE-GOOS Strategic Plan Introduction: Wilson/Garcia;
- Coastal GOOS: Malone;
- National Cases: Cuba (R. Perez); Gulf of Mexico (W. Nowlin); Mexico (A. Gallegos); Venezuela (R. Aparicio);
- Technology Development and Data and Information Management:
 - ±! Remote Sensing (Muller-Karger);
 - ±! Drifters (NOAA);
 - ±! Models;
 - ±! Databases;
- Regional Environmental Priorities:
 - ±! Reefs (Wilkinson);
 - ±! Hurricanes;
 - ±! Sea-level (Maul);
 - ±! Pollution;
 - ±! Fisheries;
 - ±! Coastal erosion (Leatherman or Nurse);
 - ±! Tourism/Socio-Economics (Bowen);
- Panel Discussion.

The programme will be finalized and speakers invited before year-end. Financing will be required for guest speakers.

We will explore with The Oceanography Society (TOS), who are holding a science meeting in parallel with the Oceanology International meeting, the prospect of the TOS jointly sponsoring the IOCARIBE-GOOS meeting, which would then become a part of the TOS programme.

Action 23: Co-chairs and GPO to (i) contact Ken Brink regarding possibility of joint TOS sponsorship of IOCARIBE-GOOS session at OI meeting in Miami (April 2001); (ii) finalize programme and speakers for IOCARIBE-GOOS session, Miami 2000, and invite speakers by year end; and (iii) arrange for draft strategic plan to be copied and distributed at Miami IOCARIBE-GOOS session.

Action 24: Doug Wilson to (i) write announcement of IOCARIBE-GOOS session for Gletys Guardia-Montoya to send to contacts; and (ii) arrange Miami venue for IOCARIBE-GOOS meeting April 1-2, and morning of April 5th, and appropriate hotel.

Action 25: (i) Co-chairs and GPO to find resources for speakers to attend Miami meeting; (ii) Guillermo Garcia to ask Patricio Bernal and Ricardo Sanchez, Director of Regional UNEP, for help in resourcing

speakers for the Miami meeting. (iii) Doug Wilson to see if the OI organization will fund the attendance of Malone and Nurse and/or other speakers in Miami.

It is intended to publish the papers from the meeting in some appropriate journal, or by NOAA.

Action 26: Co-chairs and GPO to arrange for the full set of papers from the IOCARIBE-GOOS session to be published in an appropriate journal (e.g. *Caribbean Jl. Mar. Sci.*) or by NOAA.

8. OTHER BUSINESS

There was no significant other business.

Action 27: GPO to (i) find out if EuroGOOS has commercial members, and if they are or can be data providers; (ii) Provide IGOS Ocean Theme report to all members; (iii) send draft of the meeting report to members for comments, and subsequently print and distribute.

9. ADOPTION OF THE REPORT

The action list was approved by the group during the meeting, and the Report was approved later by the group through e-mail contact.

10. DATE AND PLACE FOR THE NEXT MEETING

The third session of the *ad hoc* advisory group for IOCARIBE-GOOS will take place in Miami at a venue to be announced, on April 1st and 2nd, with a continuation on the morning of April 5th.

11. CLOSURE

The Co-Chairs thanked participants for their hard work during the session, and declared the meeting adjourned at 1200 hours.

12. LIST OF ACTIONS (BY INDIVIDUALS)

I. All Members

1. Work to bring national meteorological agencies into the IOCARIBE-GOOS community;
2. Prepare drafts of each chapter by 1.15.2001 – responsibilities include:
 - (i) Definition of IOCARIBE-GOOS: Guillermo Garcia;
 - (ii) Assessment of Needs: Ruben Aparicio;
 - (iii) Design of IOCARIBE-GOOS: Doug Wilson;
 - (iv) Implementation and integration: Artemio Gallegos (GPO to assist);
 - (v) GOOS products: Artemio Gallegos (GPO to assist);
 - (vi) Data and information management: Doug Wilson (GPO to assist)
 - (vii) National and regional development: Hazel McShine;
 - (viii) Training and capacity building: Antonio Rowe (GPO and Guillermo to assist);
 - (ix) Technology development: Antonio Rowe (GPO to assist);
 - (x) Resources: Ruben Aparicio;
 - (xi) Ensuring effective coordination: Hazel McShine.
3. Complete and distribute final draft by mid-March, ready for presentation at April 3-5 Miami OI meeting;
4. Provide reference list for each chapter to indicate comprehensive coverage;

5. Complete final document after April meeting feedback, by end June 2001, for I-GOOS and IOC Assembly;
6. Develop 2-3 pilot projects for inclusion in GOOS design;
7. Consider co-sponsoring (i.e. adopting) appropriate existing pilot projects as jointly sponsored demonstrators of GOOS benefits;
8. Provide Ruben Aparicio with statistics on resources.

II Chairs and GPO

9. Develop questionnaire before Christmas for Gletys Guardia-Montoya to use to gather inventory input;
10. Jointly with IOCARIBE Secretariat, provide advice to IOCARIBE Member States on the formation of national GOOS coordinating committees, with an appropriate cover letter;
11. Contact Ken Brink regarding possibility of joint TOS sponsorship of IOCARIBE-GOOS session at OI meeting in Miami (April 2001);
12. Finalize programme and speakers for IOCARIBE-GOOS session, Miami 2000, and invite speakers by year end;
13. Find resources for speakers to attend Miami meeting;
14. Arrange for draft strategic plan to be copied and distributed at Miami IOCARIBE-GOOS session;
15. Arrange for the full set of papers from the IOCARIBE-GOOS session to be published in an appropriate journal (e.g. *Caribbean Jl. Mar. Sci.*) or by NOAA.

III GPO

16. Arrange for all IOCARIBE-GOOS reports past and present to be translated into French and Spanish;
17. Work with Nelson Andrade (UNEP):
 - (i) to consider how IOCARIBE-GOOS may be designed to provide data and information in support of the Cartagena Convention; and
 - (ii) to find out what data are being collected for the Cartagena Convention, and where;
 - (iii) check whether Cartagena Convention is planning to include 4th protocol on Biodiversity Convention;
18. Supply Gletys Guardia-Montoya with:
 - (i) inventory of coastal GOOS data;
 - (ii) list of GOOS national contacts in the IOCARIBE region;
 - (iii) names and addresses of attendees at First GOOS Users' Forum in Costa Rica, November 2000;
 - (iv) list of national GOOS Coordinating Committees or their equivalents in the IOCARIBE region;
19. Ask Peter Dexter to work with us to contact Caribbean meteorological agencies as the basis for engaging them in IOCARIBE-GOOS;
20. Provide Gletys Guardia-Montoya with EuroGOOS example of web-based listing of operational activities;
21. Provide Antonio with WIOMAP/PacificGOOS questionnaire on capabilities and technology; help design questionnaire which Gletys Guardia-Montoya will distribute by Christmas if possible;
22. Provide Antonio with GOOS Capacity Building Principles and Plan, and JCOMM Capacity Building Strategy;
23. Provide Hazel with GOOS Regional Policy and GOOS Regional Discussion Document;
24. Provide Antonio with EuroGOOS Technology Report;
25. Find out if EuroGOOS has commercial members, and if they are or can be data providers;
26. Meet with Paul Geerdes (and Guillermo Garcia) during MarCUBA 2000, to discuss developing GODAR in the IOCARIBE-GOOS context;
27. Provide IGOS Ocean Theme report to all members;
28. Send draft of the meeting report to members for comments, and subsequently print and distribute.
29. Inform the IOCARIBE Officers of the amendments to the Terms of Reference made by the Group.

IV Ruben Aparicio

30. Provide GPO with information on Venezuelan national GOOS group.

V Gletys Guardia-Montoya

31. Compile list of potential contacts to approach for the inventory, including among others Regional Fisheries Bodies;
32. Begin making contacts via e-mails with the aim of having as complete as possible an inventory to present at the Miami meeting;
33. Inform contacts about the Miami meeting;
34. Begin building a mailing list of IOCARIBE-GOOS and contacts, and send monthly updates;
35. Include in the inventory an overview of satellite capabilities across the region;
36. Use information from (i) *The Caribbean Outlook* (published by UNEP); (ii) the Caribbean issue of *Oceanus*; (iii) UNEP/IOC report on small island oceanography;
37. Develop bibliography on resources;

VI Antonio Rowe

38. Design questionnaire on capabilities (including technology), needs, and gaps, in consultation with all members.

VII Guillermo Garcia

39. Arrange a meeting with Patricio Bernal and the Director of Meteorology, during MarCUBA 2000, to discuss instrumenting ships with XBTs to improve hurricane and climate forecasting;
40. Find out where the regional meteorological office is located;
41. Ask Patricio Bernal and Ricardo Sanchez, Director of Regional UNEP, for help in resourcing speakers for the Miami meeting;
42. Recruit possible Colombian member.

VIII Doug Wilson

43. Get ship route maps for IOCARIBE region from NOAA, IMO, and other sources (with help from Ruben and Hazel for petroleum carriers), from Alfonso (for IMO), and from UNEP;
44. See if the OI organization will fund the attendance of Malone and Nurse in Miami;
45. Arrange Miami venue for IOCARIBE-GOOS meeting April 1-2, and morning of April 5th, and appropriate hotel;
46. Consider the need for and possible locations of high density SOOP lines in the Caribbean;
47. Consider developing joint proposals between oceanographers and meteorologists to resource combined VOS/SOOP lines;
48. Write announcement of IOCARIBE-GOOS session for Gletys Guardia-Montoya to send to contacts.

IX Alfonso Botello

49. Provide a copy of his two papers on oil pollution.

X Alan Duncan

50. Provide IOCARIBE evaluation report

ANNEX I

LIST OF PARTICIPANTS

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ANNEX II

AGENDA

- 1. OPENING**
- 2. ADMINISTRATIVE ARRANGEMENTS**
 - 2.1 ADOPTION OF THE AGENDA
 - 2.2 DESIGNATION OF THE RAPPORTEUR
 - 2.3 CONDUCT OF THE SESSION, TIMETABLE AND DOCUMENTATION
- 3. OVERVIEW AND BACKGROUND INFORMATION ON GOOS DEVELOPMENT AT GLOBAL SCALE**
- 4. IMPLEMENTATION OF FOLLOW-UP ACTIONS FROM THE *AD HOC* ADVISORY GROUP FOR IOCARIBE-GOOS (First Session, Caracas, Venezuela, 3-5 November 1999) GOOS Report No. 88**
 - 4.1 REPORT ON TASKS OF MEMBERS OF THE *AD HOC* ADVISORY GROUP
(personal reports of each member of the Advisory Group on the development of their respective responsibilities. Presentation, discussion and approval of the content of their contributions).
 - 4.2 ACTION PLAN FOR THE 2000/2001 BIENNIUM AND DEFINITION OF TASKS FOR MEMBERS OF THE *AD HOC* ADVISORY GROUP
- 5. REVIEW AND UPDATING OF THE TERMS OF REFERENCE (TORs) FOR THE *AD HOC* IOCARIBE-GOOS ADVISORY GROUP**
- 6. FUTURE ACTIONS REQUIRED**
- 7. COMPOSITION OF THE *AD HOC* ADVISORY GROUP**
- 8. REPORT ON THE IOCARIBE-GOOS WORKSHOP/OCEANOLOGY INTERNATIONAL - AMERICAS, MIAMI, 03-05 APRIL 2001**
- 9. OTHER BUSINESS**
- 10. ADOPTION OF THE REPORT**
- 11. DATE AND PLACE FOR THE NEXT MEETING**
- 12. CLOSURE**

ANNEX III

LIST OF ACRONYMS

COOP	Coastal Ocean Observations Panel
EEZ	Exclusive Economic Zone
EuroGOOS	European GOOS
GCRMN	Global Coral Reef Monitoring Network
GLOSS	Global Sea-level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GODAR	Global Ocean Data Archaeology and Rescue
GOOS	Global Ocean Observing System
GPO	GOOS Project Office
HOTO	Health of the Oceans
I-GOOS	Intergovernmental Committee for GOOS
IGOS	Integrated Global Observing Strategy
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOCARIBE-GOOS	IOC Sub-Commission for the Caribbean and Adjacent Regions GOOS
IODE	International Oceanographic Data and Information Exchange
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
MarCUBA	5 th Congress on Marine Sciences, Cuba (December 2000, Havana)
MedGOOS	Mediterranean GOOS
NEAR-GOOS	N.E. Asian Region GOOS
NGCC	National GOOS coordinating committee
NOAA	National Oceanic and Atmospheric Administration (USA)
NOC	National Oceanographic Committees
OI	Oceanology International
OOPC	Ocean Observations Panel for Climate
PIRATA	Pilot Research Array in the Tropical Atlantic
RAMP	Rapid Assessment of Marine Pollution
RONMAC	Red de Observacion del Nivel del Mar para America Central [Water Level Observation Network for Latin America (NOAA and partners)]
SOOP	Ship of Opportunity Programme
TAO	Tropical Atmosphere Ocean Array
TOS	The Oceanography Society
UN	United Nations
UNEP	United Nations Environment Programme
VOS	Voluntary Observing Ship
WIOMAP	Western Indian Ocean Marine Applications Project
WMO	World Meteorological Organization
XBT	Expendable Bathythermograph

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. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
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 Intercalibration
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 CO₂ 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 CO₂ 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**)