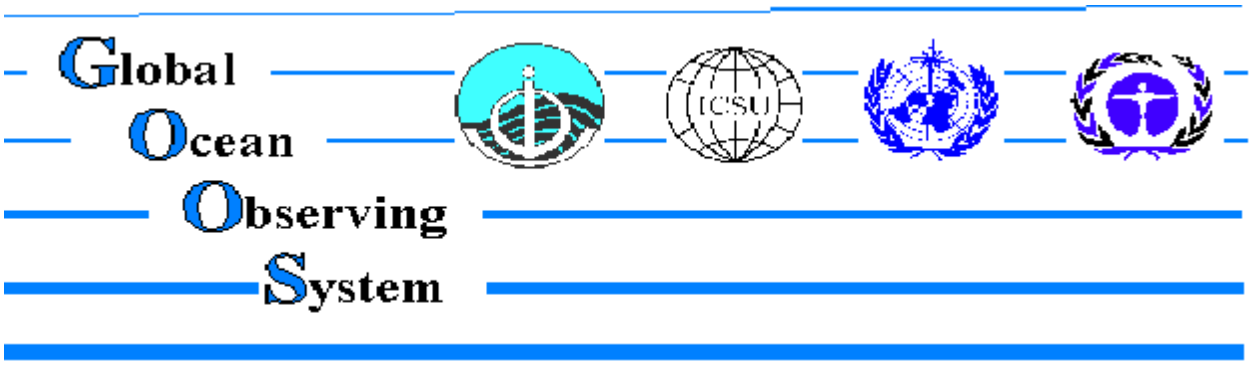


Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS)

Third Session
10-12 May 2000
Paris, France

GOOS Report No. 87

UNESCO

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS)

Third Session
10-12 May 2000
Paris, France

GOOS Report No. 87 **UNESCO**

IOC-WMO-UNEP-ICSU/GSC-III/3
Paris, July 2000
English only

ABSTRACT

The third session of the GOOS Steering Committee took place on March 10-12, 2000, in Paris, France. The Committee was advised of the progress in science planning by the four advisory panels dealing with Climate (OOPC), Coastal seas (C-GOOS), Health of The Ocean (HOTO), and Living Marine Resources (LMR). The Committee considered and approved plans for the integration of the last three of these panels into one new advisory panel dealing with all aspects of coastal seas (Coastal Ocean Observations Panel, or COOP). The Committee considered progress with and plans for space-based observations and data and information management. It agreed that the Joint Data and Information Management Panel (J-DIMP) of the three oberving systems (GOOS, GCOS and GTOS) should be dissolved. Progress with and plans for regional GOOS activities were considered and approved, along with a discussion document on how regional GOOS bodies could and should relate to one another. Plans for the further development of JCOMM were endorsed, as were selected extensions to the GOOS Initial Observing System. The Principles of Capacity Building for GOOS were endorsed, with minor modifications being requested to the document before its publication. Progress with and plans for communication and information about GOOS were approved, as was the GOOS work programme and budget.

TABLE OF CONTENTS

ANNEXES

1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SESSION

The third session of the Global Ocean Observing System (GOOS) Steering Committee (GSC) was called to order by its chairman, Prof. W. Nowlin, on Wednesday May 10th 2000, at 0900, at UNESCO headquarters in Paris, France. The Chairman welcomed new members of the core committee, N.Hasegawa, R.Rayner and G.Narayanaswamy, and the new ICSU representative Professor Peter Burbridge (replacing Allyn Clarke). Apologies were presented from committee members, Drs Brundrit and Yu. The list of participants is presented in Annex II.

1.2 WELCOMING REMARKS

Patricio Bernal, Executive Secretary of the IOC, welcomed the committee to Paris. GOOS is making good progress. On the broader scene the development of the Partnership for the Integrated Global Observing Strategy (IGOS) is helping us to strengthen links with the space agencies. Within the GOOS structure the Coastal GOOS (C-GOOS) and Living Marine Resources (LMR) Panels are enabling the more balanced development of GOOS. The IOC is working hard with the World Meteorological Organization (WMO) to make the Argo Project a reality, and looks forward to increasing implementation of GOOS. For the future, one can see a need to form even stronger links with the potential users of GOOS products, and a need to involve the developing countries more, especially in developing a Coastal GOOS. The IOC, as the major sponsor of GOOS, is committed to its success. It is to be hoped that the ongoing reorganization and renewal of UNESCO will help that development.

1.3 REMARKS BY SPONSORS REPRESENTATIVES

On behalf of the WMO, Peter Dexter indicated the continued support of the WMO for GOOS, and the pleasure of the WMO in the considerable progress in GOOS in recent years, much of which is attributable to the efforts of the GOOS Officers and the GOOS Project Office (GPO). WMO also strongly promotes the development of the Argo project. He noted the considerable efforts made towards the integration of pre-existing observing systems to help cut costs and benefit users, and noted that WMO is working with IOC to develop the new Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), to enable further integration in support of GOOS implementation.

On behalf of the International Council for Science (ICSU), Larry Kohler confirmed ICSU's pleasure with progress in GOOS, and continued support for the development of GOOS, a project that supplies key observational data for major ongoing ICSU global change research programmes like Climate Variability (CLIVAR) and Land-Ocean Interactions in the Coastal Zone (LOICZ). ICSU's national linkages and the ICSU Council offer hitherto unused means of spreading the word about, gathering support for, and providing advocacy for the global observing systems, including GOOS. He saw an increasing future need to include in GOOS more consideration of the human dimension, as represented by the social sciences, and offered ICSU's expertise in this area.

Action 1: GPO to accept offer by ICSU to assist with contacts in nations that might foster GOOS implementation.

On behalf of the United Nations Environment Programme (UNEP), Arthur Dahl confirmed continued support for, and satisfaction with progress in GOOS. Development of observing systems is a key part of the new UNEP strategy. Such systems are needed to create the time series required to understand global change, and to provide the data essential for environmental assessments and inventories. He reported that the UN Commission on Sustainable Development (CSD) will hold a meeting on 9 April 2001 on Information for Decision Making as a contribution to Chapter 40 of Agenda 21, and suggested that this provided an opportunity to demonstrate GOOS and its products for an audience of decision makers in governments. If GOOS wishes to participate, there will be a preliminary workshop on this topic in Canada in September 2000. GOOS should consider what messages it wants to get across.

Action 2: GPO to work intersessionally with GSC members and Arthur Dahl (UNEP) to develop a GOOS products display for CSD-9 meeting (April 2001) on Chapter 40 of Agenda 21 (Information for Decision Making for Sustainable Development), noting the preliminary workshop will be in Canada in September 2000.

1.4 ADOPTION OF THE AGENDA

The provisional agenda (document GSC-III/1) was adopted.

1.5 WORKING ARRANGEMENTS

Dr. Summerhayes, Director of the GPO, set out the meeting timetable (document GSC-III/2) and introduced the documentation (document GSC-III/4; see Annex III), noting that all meeting documents had been made available (and would stay) on the GOOS web site (http://ioc.unesco.org/goos/GSC-III_doclst.html).

2. REPORT FROM THE CHAIRMAN OF I-GOOS

Dr. A. McEwan, Chairman of the Intergovernmental IOC-WMO-UNEP Committee for GOOS (I-GOOS) addressed the Committee, offering an I-GOOS perspective on the future of GOOS (document GSC-III/5).

In recent years GOOS has moved from a concept to a reality. What will shape its development over the next decade? GOOS is recognised within the international and intergovernmental arenas concerned with global earth science and observation. It is seen as the main organizational framework for coordinated and sustained international observation of the ocean, is acknowledged in the most important *fora* concerned with global change and environment, is endorsed by its intergovernmental sponsors, and is part of the Integrated Global Observing Strategy (IGOS).

In spite of this acceptance and endorsement, there is no room for complacency concerning the implementation of GOOS. Ocean observing systems are in a relatively early stage of development, and responsibility for their implementation is spread between sometimes unrelated bodies. Many are supported through research funding. The recognition of their value has emerged mainly in the specialised meteorology and climate communities over the last 15 years as a result of ambitious research programmes and the success of satellite-borne instruments whose power has exceeded expectation. The coordinated development of the observing systems such as SOOP, IGOSS, the Pacific XBT network and TAO has proceeded so far without much dependence on the GOOS framework, albeit with a belief that incorporation within GOOS will ultimately be necessary for 'mainstream' operational implementation, but their utility in weather and extended seasonal climate forecasting would probably ensure their continuation anyway. Likewise, vanguard experiments and pilot projects such as GODAE and Argo, which capture the interest of both scientists and managers by the promise they hold for exploiting today's new technological tools, are supported for their obvious application to weather and climate.

In 'non-physical' observations the prospect is not so clear. While many countries have grappled with the problems of degradation of the marine environment and the depletion of marine living resources there remains less recognition of the need for an internationally coordinated observing system to deal with them. Paradoxically, the resources these countries commit to the amelioration of these problems certainly exceeds by a large factor those applied to climate-related marine observations.

The elements of GOOS that justify its creation as the comprehensive, embracing system for observation of the ocean remain as originally envisaged. These are:

- A unifying set of plans to guide and shape national effort;
- The promise of economies of scale and organization, resulting in the more efficient use of national resources;
- The efficient development of data archiving, management and distribution strategies and the scientific tools for applying observations to national needs in marine management;

- The creation of processes that encourage quality and continuity in observations and the development and application of new methods and technologies;
- A medium for increasing the capacity of countries to participate and gain national benefit from the system; and
- Inter-governmental and international sponsorship to aid in the recognition of the system and its national support and continuation.

The impact of global economics has been strongly felt in the last decade. Although there is a growing awareness of environmental change and degradation, in some countries there is strong pressure towards the privatisation of science and the commercialisation of intellectual property, to the disadvantage of 'public good' activity. The vision of GOOS as seen by those who guided its conception has had to be tempered by the realities of implementing a system through the cooperative effort of individual nations in which:

- Responsibility for ocean affairs is usually divided between several departments and agencies, not necessarily well-represented in the relevant international *fora*;
- Internal interaction between national organizations on ocean matters may not be strong, or may be actually competitive;
- New resources will be required on an ongoing basis; and
- Awareness of and practical commitment to GOOS are mostly confined to a specialist scientific community.

The champions of GOOS so far are mainly the scientists involved in the use of its data and information systems. They rally under the banner of the "operational paradigm" by which individual ownership of data is subordinated to the benefits of sharing a larger collective resource. This approach is essential to the implementation of GOOS as a permanent operational system, but is a considerable departure from the "original research" approach that has characterized most marine science. Outside the sphere of physical observations there will be some obstacles to its adoption and where there are commercial or political implications in specific data types, accommodation may be needed for the GOOS concept to succeed.

Approaching GOOS in five "Phases" (planning; pilot projects; incorporating existing systems; gradual operational implementation; and review and improvement) (see *The GOOS 1998*), was convenient for classifying tasks, and measuring progress. Approaching GOOS through five design modules (Climate, Coastal, Living Resources, Health of the Ocean, and Services) was useful in the Planning and Design Phase, in allowing independent development of separate observing elements according to their readiness. Climate is now well advanced, with published implementation advice. Workable design strategies are now being developed for the Coastal, Health of the Ocean, and Living Marine Resources Modules.

The last year has seen much activity contributing to the second (Pilot), third (Initial Observing System) and fourth (Operational Implementation) Phases. This mode of development will continue with the addition of more and more elements, which will tax the resources and attention of the GPO, raising questions of when and how the elements of GOOS can become autonomous and self-supporting while maintaining the essence of its integrity. To facilitate development it is now planned that implementation will be aggregated into two "Themes": Coastal and Open Ocean. The Open Ocean Theme should benefit greatly from the creation of JCOMM, which will become the main vehicle for the implementation of physical observing systems. It remains to be decided how the Coastal Theme will be implemented, not least because owing to the difficulties in making appropriate chemical and biological measurements some elements of a Coastal GOOS will take some years to achieve. The Coastal Theme is likely to attract nations, departments and agencies (especially those concerned with environmental management) that do not yet appreciate the value of a GOOS.

Apart from within a specialized scientific community, the GOOS concept is not well understood in the wider marine community . This has limited the recruitment of countries with a potential interest in participation. The relevance of GOOS to their practical environmental and economic needs must be proven. With few exceptions it is only in the context of weather and climate that this has this been attempted in any but the most qualitative way. Thus, even with examples of such enormous impact as El Nino and climate change, the logical strategic link to a robust ocean observing system cannot be taken for granted, and the commitment to its implementation has so far been very small in proportion to the value it may add to reliable prediction.

The success of GOOS will depend on attracting national government and private sponsorship, which in turn requires support from governmental sponsoring organizations and national scientific communities. Both require the ammunition of convincing evidence that the observations, the data management systems and the direct and indirect products of the GOOS system will make a difference to the end users. Positive feedback from these users (in most cases the departments of governments themselves) is essential to secure operational continuation of the system.

Among users, it is the scientific community that is most aware of the potential of GOOS, and of the inadequate coverage of present observational systems. It falls mainly on the shoulders of this community to sustain and reinforce the case by example, for example through pilot experiments and modest regional GOOS programmes. This will be a challenge for the Coastal Theme, implementation of which will require the involvement of organizations with less traditional commitment to international programmes.

To ensure success, the "marketing" of GOOS may need to become a central component of implementation. This involves the tailoring of GOOS information, publicity and products to appeal to a targeted "market" of potential users. A primary target sector should be the national environment departments and agencies concerned with coastal management and conservation. Web-based communication is essential, supported by Internet-formatted CD ROM's where web access is unavailable.

To aid this strategy, better information must be gathered on the national (internal) organization of marine affairs. Effort should be redoubled to recruit "agents" for GOOS within countries and to encourage the establishment of national coordinating committees for establishing observing networks, preferably linked and aligned with GOOS. Among these agents are the National Operational Centres listed in the GOOS IOS, but they represent those countries that already have the strongest GOOS commitment.

From its inception GOOS has been proposed as a permanent operational system and emphasis has been given to "commitments" by national participants for its continuation. While the scientific reasons for this requirement cannot be disputed, in practice it inhibits recruitment. Commitment statements at the Initial GOOS Commitments Meeting generally indicated a scope of contributed activity that was limited by the mandate and operational budget of the agencies concerned. The gaining of additional resources through government policy process was seen as much more protracted and uncertain.

GOOS will need to be receptive and flexible to offers of participation of limited duration and scope. Experience indicates that successful trial commitments often lead to continuation of support. Initializing the commitment is the critical step, and the role of the GOOS process is to mould the contribution to agreed plans, principles, networks and quality control and to assist in securing continuation through the IOC (and other) networks and sponsoring mechanisms. This will be particularly important in dealing with contributions from less-developed countries, where the capacity to contribute and weaknesses in infrastructure inhibit participation.

The GOOS requirements for quality, reliability, conformity with defined design and principles and continuity are assets of considerable value to future users, and should be used in promoting GOOS. The "GOOS Label" applied to data and products is one effective means of asserting the worth of GOOS. Administration of the process of "certification" will require resources and there is already some overlap with such activities as GOSIC, JCOMM and IODE, specifically the "end to end data management systems", with which plans should be developed in concert.

To supplement his verbal presentation, Dr. McEwan presented Tables 1, 2 and 3 in Annex IV.

The GSC thanked Dr. McEwan for his thoughtful and comprehensive review of the wider issues, agreeing that although much has been accomplished, there is -not surprisingly with such an ambitious programme- a great deal still to do. The I-GOOS perspective offers a useful set of pointers to areas where action is needed. The future looks bright. Many nations are already investing in operational oceanography following GOOS precepts, thereby helping to increase the momentum of GOOS. **The GSC agreed** that pilot projects are a useful means of demonstrating the utility of GOOS, and provided a means of attracting investment. **The GSC also agreed** that further regional alliances are needed, for example with the UNEP Regional Seas programme and with PICES (see agenda item 5). Already something has been done about marketing with the publication of *The GOOS 1998*. More is being done through the preparation of the GOOS Brochure (see section

7.3.4, below), but undoubtedly yet more is needed. **The GSC agreed** that as a first step the network of national and regional GOOS bodies needs to be strengthened.

Action 3: GPO to create listing of all National GOOS Coordinating Committees (or their equivalents) and key contact points and details for the GOOS Web Site, as the basis for strengthening the GOOS network, by GSC-IV.

3. REPORT BY THE DIRECTOR OF THE GPO

The Director of the GPO reported on GPO activities since GSC-II (document GSC-III/6), and on the meeting of the sponsors of the three global observing systems (June 1999) and their significance for GOOS (document GSC-III/7).

An IOC Regional (GOOS) Programme Office has been established in Perth, Western Australia, with funds from the Government of Western Australia and IOC, and assistance from the Commonwealth of Australia (Bureau of Meteorology) (see agenda item 7.2.1). The office was formally opened in September 1999, at an Indian Ocean GOOS meeting chaired by Patricio Bernal, IOC Executive Secretary.

Staff support increased by 16% (from 7.5 to 8.7 man-years per year) compared with 1998/99. New professional staff included: (i) Maria Hood, working on contract 50:50 for IODE and GOOS Data and Information Management; (ii) Brian Sadler, working part-time on contract through the Australian Bureau of Meteorology to set up the IOC Regional (GOOS) Programme Office in Perth; (iii) William Erb, hired on full time contract to replace Brian Sadler as Head of the IOC Regional (GOOS) Programme Office in Perth. The GPO was about to lose (i) Janice Trotte, whose secondment to the GPO from Brazil's Directorate of Hydrography and Navigation ends in mid May 2000; and (ii) Rimi Nakano, whose secondment from Japan ends in June 2000. MONBUSHO has graciously agreed to replace Ms Nakano in the GPO, and it is hoped that Ms Trotte may be able to work part-time on GOOS affairs when she returns to Brazil. In addition it is intended to recruit a part-time member of staff to work as Argo Technical Coordinator, under the supervision of Etienne Charpentier in Toulouse. The IOC is maintaining secretarial support for the GPO at an adequate level.

A high level of coordination is being maintained with the sponsors, with GCOS, GTOS, CEOS, CLIVAR, GLOBEC, LOICZ, WOCE and JGOFS, with regional GOOS bodies, and with major national organizations especially in Europe, Japan and the USA. Connections have been strengthened with ICES, and PICES. GOOS reports are now made available on the GOOS Web Site in a timely fashion. Promotion of and communication about GOOS remain at a high level, with several papers on GOOS being delivered at conferences and/or published, with twice yearly publication of the GOOS News, and with continued improvement of the GOOS Web page. The Perth Office also publishes a newsletter. GOOS featured in an IGOS brochure in 1999; a GOOS brochure is being developed.

The GPO has organized or been involved in several workshops to facilitate the international coordination and implementation of GOOS. The main GOOS-related conference was OceanObs'99 in St Raphaël (October 1999). GOOS also featured in the IOC-SCOR-SCOPE Oceans 2020 Workshop in Potsdam (October 2000), in an IGOS Forum in Vienna (July 1999), and in a POGO workshop in La Jolla (December 1999). Capacity building workshops were held for IOCARIBE-GOOS (Costa Rica, April 1999), western South America (Concepcion, August 1999), the Indian Ocean (Perth, September 1999), MedGOOS (Rabat, November 1999), and PIRATA (Casablanca, April 2000). Training Courses were held on Data and Information Management (NEAR-GOOS, Tokyo, January 2000) and on Sea Level Measurement (Sao Paulo, September 2000, and Jeddah, April 2000).

The IOC has continued to provide just under half of the funds to support GPO activities. To maintain the work programme, considerable efforts have been made to bring in the external funds needed; funds have been provided from the following sources: WMO, FAO, UNEP, ICSU, Australia (WA and Commonwealth), France (IRD and Meteo-France), Holland (NWO), Japan (Monbusho), PERSGA, USA (NOAA, ONR), and UK (NERC, UKMO).

The GSC commended the GPO on the results of the hard work its team had carried out during the year, and its generally high standards of service and products.

4. GOOS PLANNING

4.1 SCIENCE GUIDANCE

The Chairman introduced this item, inviting the committee to consider what more needs to be done to aid in the development and implementation of GOOS. He pointed out that this item should more properly be entitled design and implementation, since it was not just about planning. There has been a great deal of progress towards implementation in the climate/services area, ranging from identification of the observations needed, through the generation of pilot projects, to the development of the new coordination mechanism offered by JCOMM. The Action Plan for GOOS/GCOS (GOOS Report 66), and the proceedings and summary of the OceanObs'99 Conference held in St Raphaël in October 1999, together consolidate the design of the global side of GOOS, making clear the integration needed between the research and operational communities. There is now good understanding in both communities about the need for timely release of ocean data.

The Coastal and Living Resources Panels have been very active, and are close to finalizing implementation designs. The HOTO Panel will move in the same direction, and already has an active pilot project in RAMP. The merger proposed in *The GOOS 1998* between the C-GOOS, LMR and HOTO Panels, with the object of forming an integrated coastal advisory body for GOOS, was discussed in Washington, in April, at a meeting of GOOS principals (Chairs of GSC, C-GOOS, LMR and HOTO Panels, Director GPO, and Technical Secretaries of LMR and HOTO) (document GSC-III/14).

4.1.1 Science Planning

The status of design for each of the four modules, including future plans, proposed outputs, and timetables for meetings and implementation was reviewed by the module panel chairs.

4.1.1.1 OOPC

Dr. N. Smith reported on OOPC activities, including especially the results of the International Conference on an Ocean Observing System for Climate (documents GSC-III/8; GSC-III/B4). The Fourth meeting of the Ocean Observations Panel for Climate (OOPC) was held in Woods Hole during May, 1999. The Fifth meeting is scheduled for Bergen, June 2000.

The main work over the last year was dedicated to the preparations for, conduct of, and analysis of the First International Conference for the Ocean Observing System for Climate (known as OceanObs'99), held in Saint Raphaël, France 18-22 October 1999. The Conference was attended by 330 people from 20 countries. Dr. Smith thanked the GPO for its considerable assistance in organizing the meeting.

The GSC commended Neville Smith and Chet Koblinsky on the hard work they had put in to make the Conference a success.

The draft papers for OceanObs'99 can be accessed through http://www.bom.gov.au/OceanObs99/Program.html and the Conference Statement at http://www.bom.gov.au/OceanObs99/Papers/Statement.pdf. OceanObs'99 sought consensus on the blend of measurements and on the means for gathering them and addressed the collective needs of both research and operational oceanography. The Conference was bold in its vision and goals, successfully developing a broadly based and sound scientific rationale for the establishment of a sustained system. The rationale for implementing and sustaining the observing system include practical El Niño forecasts, research on climate variability, climate change, and ocean and marine forecasts. The Conference encouraged consideration of, and agreement on, the value of a multi-purpose, integrated system. The Conference considered issues of cost and returns on investment. Highest priority was attached to elements that were reliable, efficient and sustainable, from the perspective of delivering both short and long-term value for the investment. Proven methodologies were preferred to emerging or

potential techniques. Remote sensing has become a mature technology for collecting regular, global observations. Sea surface temperature, surface wind vectors, surface wave height and surface topography can all be measured reliably from space. The Conference agreed that for a global system such capacity is fundamental. Consistent with the IGOS Oceans Theme study, continuity was seen as a major issue. A multi-faceted, robust *in situ* network must also be implemented, in part as a complement to, and to provide calibration for, remotely sensed data, but also for its own intrinsic value in various applications. The primary contributions include:

- The surface drifter and observing ships network;
- The tropical Pacific ENSO Observing System and its mooring array; and
- The global array of profiling floats, Argo, giving around 100,000 annual profiles of temperature and salinity.

Dr. Smith showed overheads illustrating the elements of the primary observing system for climate and their schedule for implementation. OOPC aims to have a high quality climate network fully in place by 2005. However, it takes time to get commitments to the different elements of the system. In the case of DBCP, there are problems in providing the surface drifter network with barometers. In the case of SOOP, there may be difficulties in moving from the previous low-density network to the proposed high-density lines.

An important new paradigm that emerged from the Conference is the widespread acceptance of the need for rapid release of data, and it was realised as important that in the chain from contribution to product, credit is given to the data suppliers.

The OOPC is using several working groups to make progress. These include one on SST climate products, together with operational agencies. Here a project has been initiated in cooperation with the AOPC to compare SST products and to improve knowledge about the quality and reliability of global SST products, which may differ at present by up to an unacceptable 0.5°C in the Pacific. A sea-level working group has been formed as a subgroup of GLOSS to examine scientific issues associated with sea level. In collaboration with the WCRP/CAS working group on Numerical Experimentation a project has been initiated to develop a suite of reference surface flux data sets in order to provide high quality data sets for testing NWP surface flux products. Last year a review was conducted of the upper ocean thermal network, with the support of NOAA and the Australian Bureau of Meteorology, and with sponsorship from the UOP and SOOP-IP. A workshop in Melbourne in August 1999 examined among other things the SOOP network and the efficiency and appropriateness of the associated data and information management practices. A revised SOOP plan was devised and issued.

In response to an OOPC recommendation for a scientific working group on observations and modelling of surface wind waves, **the GSC decided** that because an expert team for waves and surges was being formed under JCOMM (see agenda item 5.2.1) a second group under the OOPC is not warranted at this time.

In response to an OOPC recommendation for a scientific working group on polar observations**, the GSC decided** that because JCOMM was forming a subgroup on Polar Regions, and bearing in mind the CLIC initiative, a second group under the OOPC is not warranted at this time. **The GSC noted** the focus of the up-coming OOPC meeting on the Arctic region and asked the OOPC to report on specific actions that arise from those considerations.

Action 4: OOPC to report to GSC-IV on specific actions that arise from the considerations of the OOPC meeting on the Arctic region.

The OOPC and UOP will convene a workshop in mid November, in Perth, in conjunction with a TAO-IP meeting and a workshop on the Southern Ocean, to consider the ocean observing system for the Indian Ocean. **The GSC welcomed** the initiative on the Indian Ocean, noting in particular the aim to entrain Indian Ocean nations in the development and maintenance of the observing system. **The GSC believes** a system-wide approach is appropriate at this time and that the co-sponsorship of the Workshop with CLIVAR is appropriate. Consistent with the conclusions of the Perth IOC Workshop in September 1999, **the GSC believes** the initiative should be given high priority and support by the Perth Office.

Action 5 : Consistent with the conclusions of the Perth IOC Workshop, the Indian Ocean initiative should be given high priority and support by the Perth Office. The Perth Office should, to the extent possible given the interests of the sponsors, focus its efforts on GOOS development activities in the Indian Ocean.

There has been considerable discussion off-line about ocean carbon transport measurements. It was agreed at the OceanObs Conference that repeat hydrographic lines should form an integral part of the observing system. This begs the question, "What should be the GOOS approach to global hydrography for carbon inventory and fluxes, heat and freshwater fluxes, THC overturning, etc.?" Leadership is required from the JGOFS community. Groups such as the IOCCG, the IOC-JGOFS CO_2 Panel, the JGOFS Scientific Steering Group and IGBP are all involved in these discussions in one way or another. Plans are being made for a Surface Ocean-Lower Atmosphere System (SOLAS) programme, and for meetings to discuss carbon inventory issues. For carbon budgets and inventories, **the GSC noted** the strong response of the JGOGS SSG over the last 12 months and the determination of many within that community to build a sustained effort. **The GSC noted** that a white paper is to be developed for the next OOPC and asks the OOPC to use that paper as a basis for developing a strategy over the next 12 months. In particular, **the GSC recommended** the following actions:

Action 6: The OOPC (i) take the opportunity to strengthen its expertise in this area, by inviting the JGOFS SSG to nominate an individual to coordinate work; (ii) use the IOCCG to develop specific plans with respect to remote sensing and in particular ocean colour measurements, using the Oceans Theme process as appropriate; (iii) use the reconstituted CO_2 panel as its source of advice on *in situ* observations and, in particular, on sustained pCO_2 measurements, noting the need to provide a strong rationale for sustained measurements; and (iv) maintain a dialogue with those developing initiatives within WCRP and the IGBP, particularly SOLAS.

Action 7 : In concert with CLIVAR and the SCOR-IOC CO_2 Panel, the OOPC should work to develop a plan for observations needed for global hydrography (for carbon inventory, carbon, heat and fresh water fluxes, thermohaline overturning, etc.).

The GSC noted the decision of the CLIVAR SSG to substantially modify the terms of reference of the Upper Ocean Panel to form a CLIVAR Ocean Observations Panel (OOP) that would embrace the full-depth global ocean and place more emphasis on data assimilation. It has been recommended that the new CLIVAR-OOP should have air-sea fluxes and the science issues of the TAO-IP added to its remit, with the understanding that a reconstituted TAO-IP would concern itself with basic moored buoy activities. **The GSC agreed** with the recommendation of the CLIVAR SSG that the new TAO-IP, with its membership reduced to about 8, would be required to liaise with the new CLIVAR-OOP and with the OOPC; it would focus on logistics, technology, and data flow, and would cover all ocean tropical areas. It would be an action group of the DBCP, would become part of JCOMM, and would be expected to report to JCOMM, CLIVAR, GOOS and the DBCP. **The GSC noted** the continuing role of OOPC in providing advice with respect to observing systems and ENSO prediction. **The GSC also welcomed** the CLIVAR decision to more closely link its Working Group on Seasonal and Interannual Prediction (WGSIP) to OOPC and GODAE.

The GSC requested the OOPC to continue its close ties with CLIVAR and to ensure that research and operational requirements are fully integrated and consistent with GOOS and research sustained needs. **The GSC noted** that through such cooperation, the full benefit of research and technical advances can be brought to bear on the issues that matter to GOOS and its user communities.

Action 8 : The OOPC should continue its close ties with CLIVAR and ensure that research and operational requirements are fully integrated and consistent with GOOS and sustained research needs.

The Working Group on Air Sea Fluxes (WGASF), chaired by Peter Taylor, has produced a detailed report on air-sea flux products, to be published by WCRP/SCOR. This working group might become part of the GOOS structure. **The GSC noted** the strong collaboration between OOPC and the WGASF and noted the importance of the authoritative report on air-sea flux products. **The GSC requested** the OOPC to maintain these links and to offer its assistance in the preparation and convening of a WGASF workshop (June 2001). **The GSC welcomed** progress with the SURFA project and, considered together with the Workshop and plans for a SOLAS, believed the level of activity in this area for the near future was appropriate.

Action 9 : The OOPC should maintain its links with the WGASF, and offer its assistance in the preparation and convenience of the workshop (June 2001).

Data and information management is looming as possibly the most important issue for OOPC and for GODAE. It will be considered further under agenda item 4.2.2 and 5.2.3 below.

Recent additions to the OOPC include R.Reynolds, J.Johannessen, R.Keeley, and J.Picaut. Peter Haugan and Gwynn Griffiths are rotating off the OOPC; **the GSC welcomed** the recommendation that they be replaced with Tommy Dickey and Peter Taylor, and noted that at least 2 new members are sought.

Action 10 : GSC Members to suggest names for new members for OOPC to Neville Smith by the end of June 2000.

The Terms of Reference (ToRs) of the OOPC were laid out in 1995 and have served well to date. But the Panel's responsibilities now go beyond them to include all ocean physics, sea-ice, and ocean carbon. **The GSC recommended** that with the agreement of the other sponsors (GCOS and the WCRP) the ToRs be modified as shown in **Action 11**, below. The sponsors collectively need to consider a change to the title (Ocean Observations Panel for Climate) to reflect its enhanced role.

Action 11 : The ToRs for OOPC should be changed as follows (with the approval of the WCRP and GCOS Steering Committees): (i) to monitor, describe, and understand the physical and biogeochemical processes that determine ocean circulation and effects on the carbon cycle and climate variability; (ii) to provide the information needed for ocean and climate prediction, including marine forecasting.

4.1.1.1.1 GODAE

Dr. N. Smith reported on progress with GODAE (working document GSC-III/9). For details see: http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/godae/homepage.html.

The International GODAE Steering Team (IGST) has not met since GSC II (it meets 15-18 May in Southampton). A GODAE strategic plan has been drafted, for final approval at the IGST meeting. With this plan in place, it is hoped a major effort can be mounted to encourage greater participation in GODAE's modelling and data assimilation phase. The strategic plan will be accompanied by an implementation plan that is likely to become available by October 2000.

GODAE has initiated a project to develop a high resolution SST product. Initial indications suggest widespread support.

Subject to funding, the GODAE Office will employ a full time Executive Scientist within the next 6 months. This should make the Office more effective in support of GODAE activities.

4.1.1.1.2 Argo

Dr. N.Smith reported on progress with Argo (working document GSC-III/10; http://www.bom.gov.au/bmrc/mrlr/nrs/oopc/godae/Argo_Design.html/). The Argo Science Team (AST), under the leadership of Dean Roemmich, met 7-9 March, at the Southampton Oceanographic Centre. The report from the meeting is available at http://www.argo.ucsd.edu/iast2.pdf). A review of national plans for Argo gives the best estimates of average float deployments per year as follows:

- Australia 30
- Canada 50
- France 50
- European Commission 25
- Germany 50
- Japan 100

• R. Korea	40
• UK	50
• USA	375
• TOTAL	770

While this looks good, in that around 750 floats/year are needed for the target of 3000 floats, each with an assumed life expectancy of 4 years, the actual deployment rate from present funding levels is around 150-200 per year, or about one third of what will be required. Further work is needed to secure the required commitments. Ten to fifteen per cent of the costs will go onto the data stream.

The Argo Science Team (AST) reviewed plans for data management. There are two main thrusts: (i) all Argo data will be available in real time via a rapid platform processing centre stream with automated QC and using the GTS; (ii) the data will be available via a second stream allowing scientific quality control with a delay of 2-3 months. A task team has been established to develop these plans.

Assessment of the available salinity sensors shows that at least one could be stable to +/- 0.01 PSU over 3 years, though its use might increase float costs by $2000 each. There is still debate about the best power source - Lithium versus Alkaline batteries. There is debate and testing of communication systems, with ORBCOMM and ARGOS being favoured.

Implementation continues to be a key issue. Original estimates of costs were too optimistic. The issue of deployment within EEZs is a major concern, where solutions vary from following the DBCP path and entraining nations into the process, to establishing bilateral or multilateral agreements. Plans are developing to encourage regional implementation plans for Argo. An International Implementation Meeting for Argo Floats in the Pacific Ocean and Adjacent Regions was held in Tokyo in April 2000 to review commitments and national plans for that region. A follow-up for the Atlantic will be held July 10-11 in Paris.

A Technical Co-ordinator will be established on a half-time basis in Toulouse, alongside the DBCP/SOOP Co-ordinator. About one third of the costs for the post have been found; the rest is being sought from interested nations.

The discussion focused on such topics as getting ship-time to deploy Argo floats, and on making decisions about regional deployments. Aircraft, VOSs, and naval vessels all offer means of widening deployment opportunities. **The GSC considered** that solutions to problems of regional deployment, apart from those mentioned above, may involve ways of persuading regional nations to join the Argo Science Team and through it to influence the programme. In addition, JCOMM will provide an intergovernmental forum in which to discuss Argo implementation, though it has to be remembered that it will meet only every 4 years, with its first meeting in June 2001.

Considering that it is barely 2 years since the idea for Argo was put to GODAE, we are making good progress towards a greatly enhanced observational capacity through the GODAE operational phase.

The GSC congratulated the OOPC Chair on the impressive progress made to date by the OOPC and allied bodies in developing overall implementation plans and in taking Argo forward.

4.1.1.1.3 Ocean CO_2

Dr. Lilian Merlivat gave a presentation on the status of a pCO_2 observing system based on a paper by Andy Watson, Chair of the IOC/SCOR CO_2 Panel (Annex V). The main objective of the panel is the design of a pCO_2 observing system that can be used to measure not only the flux of CO_2, but also *in situ* fluorescence to provide a complement to ocean colour measurements from space.

The GSC thanked Dr. Merlivat for her presentation. **The Committee agreed** with the need for a pCO_2 observing system, **but considered** that although some systems are now available for measuring surface ocean pCO_2, much remains to be done to ensure that different instruments are measuring the same thing. **The Committee will take advice** from the IOC/SCOR Panel on this matter.

4.1.1.2 C-GOOS

Professor Tom Malone reported on progress with C-GOOS (working document GSC-III/11; background documents GSC-III/B5 and B6). The Panel had met twice since GSC-III, with C-GOOS IV being held at Tianjin, China, 2-5 November 1999, and C-GOOS V at Gdansk, Poland, 3-7 May 2000. As in the past, each panel meeting began with a one-day meeting with stakeholders.

The stakeholders in Tianjin identified several topics that operational oceanography was used for, and which could be enhanced through a coastal GOOS, including: (i) marine environmental forecasting to help ensure the safety of offshore operations and reduce the effects of coastal flooding; (ii) tidal prediction and disaster mitigation based on real-time sea-level observations for storm surge warnings; (iii) information for sea area use and coastal zone management; (iv) forecasts of sea-ice and typhoons for offshore oil & gas exploration and production; (v) information to aid in coastal engineering design; (vi) real-time information and improved ecosystem models to support fisheries; and (vii) information for educating students and training practitioners.

The stakeholders in Gdansk discussed the need for information on such topics as: biodiversity and tourism, and the effects of tourism on the coastal zone; environmental protection and water quality monitoring; coastal erosion and its socio-economic effects; land-ocean interactions in the Arctic; and heavy metals in the Baltic ecosystem.

A full report of the C-GOOS-IV meeting in Tianjin had been issued in draft as GOOS Report 82 (GSC-III/B6). The goal of that meeting had been to develop a first draft outline of the C-GOOS Strategic Design Plan. The goal of the C-GOOS-V meeting in Gdansk had been to complete the Design Plan. Most of the work had been achieved during the meeting, and it was hoped that a final version would be available for external review close to the end of June.

Aside from the work on the Design Plan, at each meeting the panel discussed related programmes and initiatives that need to be considered in developing the plan, including LOICZ, GTOS, GLOSS, U.S. GOOS, the monitoring programme of the IAEA, the Mediterranean Forecasting System (MFS) Project, GCRMN, the Ramsar Convention on Wetlands. Because the Baltic Ocean Observing System (BOOS) is an example of coastal GOOS in practice, there was substantial discussion about its design, implementation, maintenance, data management, users and products. In addition, C-GOOS-V discussed the needs for remote sensing of ocean color, and for shallow water, high resolution bathymetry.

The Strategic Design Plan will begin with an Executive Summary, Prologue, and Introduction, and will have sections on: Challenges; the Design Framework; the Initial Observing Subsystem; Communications Network & Data Management; Modelling & Applications; Pilot Projects; Conclusions and Recommendations.

The Introductory Section will spell out the goal of detecting and predicting the effects of changing inputs of energy & matter from land, air and sea on coastal marine ecosystems & human populations in the coastal zone. The main themes will be: detection; prediction; and natural variability versus anthropogenic effects. The Introductory Section will also cover Biological and Chemical Indicators, Physical Indicators, and Inputs and External Forcings. Among the Biological and Chemical Indicators will be: Eutrophication and HABs; Carbon Storage and Export; Habitat Loss and Biodiversity; Sustaining Living Resources; Chemical Contamination; Mass Mortalities and Disease; and Growth of Exotic Species. Among the Physical Indicators will be: Habitat Loss; Sea Level Rise; Coastal Erosion; Saltwater Intrusions; Temperature and Salinity Distributions; Frequency and Intensity of Natural Hazards; Sea State and Circulation Patterns; and Shallow Water Bathymetry. Among the Inputs and Physical Forcings will be: Large Scale Meteorological Events & Natural Hazards; Nutrient Mobilization and Enrichment of Coastal Waters; Introductions of Non-Indigenous Species; Physical Restructuring of Habitats; Exploitation of Living Resources; Chemical Contamination; and Climate Change.

The Plan will make certain Design Assumptions:

(i) that although the indicators of change in the coastal ocean are many & complex, they are related by ecosystem dynamics; thus there is a common set of key state variables that measured with sufficient

resolution, over long enough periods, and large enough areas, will cost-effectively serve many needs; and

(ii) that physical processes are of fundamental importance to the prediction of chemical & biological variability in coastal marine and estuarine systems, a reality that provides the framework for building the fully integrated ocean observing system.

The Design Framework section will include subsystems dealing with: Observations (covering detection and prediction, core variables, and individual elements; Data Communications & Management (covering laboratory networks, regional data management and synthesis centres); Modelling & Applications (covering data assimilation, the design of Observing System Simulation Experiments (OSSEs), nesting and coupling, visualization, skill assessment, and applications).

The Detecting Change section will include indicators, variables of state and user needs.

The Predicting Change section will cover predictions and their required variables, as well as user needs.

The Core Variables section will be subdivided into the "State Variables" and the "Forcings". The State Variables will include: (i) physical ones such as: temperature and salinity; currents; surface waves; surface roughness; photosynthetically available radiation (PAR) attenuation; and sediment type/grain size, and (ii) bio-chemical ones such as: [N], [P], [Si], [O_2], [Chl a], species composition, phyto-pigments, [TSS] (total suspended solids), and Ocean Color. The Forcings will include: Surface Wind; Air Pressure; and Sea Level; they may also include: Incident Radiation & PAR; River Runoff; and Atmospheric Deposition.

The Conclusions and Recommendations section will include specific requirements for research, along with requirements from allied major research programmes like: CLIVAR; LOICZ; GLOBEC; GEOHAB; SIMBIOS (Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies); and COLORS (Coastal region Long-term measurements for colour Remote Sensing development and validation). Recommendations will include links with a set of Pre-Operational Pilot Projects that offer examples of users or GOOS or providers of data and information to GOOS, which will include some existing projects such as: MFS; ICAM (user); SEAGNET (user & provider); and CARICOMP (user & provider), along with specified C-GOOS Pilot Projects. There will also be recommendations regarding the interaction between C-GOOS and various operation programmes including: GLOSS; DBCP/NDBC; GIPME (user & provider); GCRMN (user & provider); GPA/LBA (user & provider); BOOS/COMBINE; CalCOFI; ITSU; UNEP's Regional Seas programmes (user & provider); and IPHAB (user & provider).

During the discussion, **the GSC noted** that carbon does NOT appear to be a core variable for users. It may be that carbon has to be handled by the OOPC under its new terms of reference. The new ToRs for the OOPC also require it to cover marine weather prediction as well as climate. This observation led to a discussion about overlapping panel remits. **The GSC decided** that the coastal panel should cover natural hazards such as coastal storms, which redistribute sediments. It seems clear that there will be some necessary overlaps of user requirements and needs for data and products. Regular exchange of information between the OOPC and the future coastal panel must take place to reduce duplication of effort and clarify responsibilities.

Action 12: Close coordination between the integrated coastal panel and OOPC will be required to avoid duplication of effort and clarify responsibilties.

The GSC agreed that the strategic design plan of C-GOOS should be flexible so that it can be adapted as appropriate for different regions to reflect the operation and scales of local processes. The Panel had not included flux measurements, such as oxygen demand, among the state variables, because the variables had been chosen to be very easy to measure anywhere, even by those countries lacking on sophisticated observing technologies. During discussion, emphasis was placed on the need to base the implementation on use of models. It was questioned whether the focus will be on monitoring/detection or prediction.

The GSC congratulated the C-GOOS Chair on the impressive progress made.

During discussion, it was noted that an inventory of coastal data developed by the GPO for presentation to C-GOOS-IV and LMR-III, had helped the Panels take forward their respective designs. It would continue to be refined for use by the integrated coastal panel.

4.1.1.3 LMR

Professor Warren Wooster reported on recent progress with LMR-GOOS. The Panel's third meeting was held 8-10 December in Talcahuano, Chile, and a fourth meeting was held 1-4 May 2000 in Honolulu, Hawaii. The Panel has now completed a first draft of a strategic design plan, and expects to finalize it by the end of the summer.

Because of the ubiquitous nature of living marine resources in the marine environment, and the heterogeneity of marine ecosystems, an LMR observing programme must be broad in scope and regional in nature. The panel adopted a nested "three system" design, which treats the open ocean, near-coastal ecosystems, and inshore, estuarine systems differently, while recognizing the interconnections between them. Observing plans have now been developed for the open ocean system, and for several examples of coastal ecosystems, including eastern boundary current upwelling systems, the Scotian Shelf off Canada, the Yellow Sea and East China Sea and the Gulf of Guinea. For each of these, an end-to-end plan has been developed based on specified design criteria which identifies users, specific observing system elements and products, and the capacity building required to achieve LMR-GOOS goals. The strategic plan is underpinned by research and is oriented toward fisheries, which will be the primary user community for LMR data. However, the strategic design recognizes that fisheries are not the only users of LMR data. Due to lack of time and expertise, the panel did not develop observing system plans for inshore, estuarine systems, nor for sport fisheries. These issues will have to be considered by the integrated coastal panel.

Regional development is seen as the key to progress. For that reason, it is proposed that implementation will be based around "regional analysis centres" (RAC's). These will likely be developed within operational organizations with associated scientific infrastructure, and in partnership with existing institutions, organizations or programmes such as ICES, PICES, the CPPS or the Benguela LME Programme. **The GSC endorsed** the concept of regional analysis centres.

At the 8th annual PICES meeting in Vladivostock in October 1999, Ned Cyr, Technical Secretary to LMR-GOOS, participated in a GOOS workshop, the outcome of which was increased interest in developing a PICES GOOS in the North Pacific. Discussions are also underway between PICES and NEAR-GOOS.

Action 13: GPO and Warren Wooster to work with PICES to encourage formation of a PICES-GOOS group to take forward, before GSC-IV, the development of a North Pacific GOOS covering living resources elements, perhaps leading to a North Pacific Regional Analysis Centre.

Data and information management were not addressed in depth by the LMR Panel. However, a data and information management plan has been developed for GOOS as a whole, C-GOOS is developing a data and information management plan, and JDIMP has developed a more general data and information management plan for the G3OS. **The GSC agreed** that where appropriate, these plans should take LMR data and information issues into account, while recognizing that LMR data are more complex than physical and chemical data, and that special consideration should be given to how to handle them.

The LMR Panel invited representatives of the Secretariat of the Convention on Biological Diversity (CBD), and the FAO office in charge of implementing the Straddling Stocks Convention to attend LMR-IV. The CBD Secretariat declined, citing the need to prepare for the upcoming Nairobi Conference of Parties of the CBD. FAO indicated that it is yet too early for the information needs of the Straddling Stocks Convention to be considered by LMR-GOOS.

The LMR Panel has identified several operational elements that it felt should be added to the GOOS Initial Observing System so as to broaden its biological dimension. This matter is discussed further under agenda item 5.2.2.

The third meeting of the Panel also identified several potential LMR Pilot Projects. These include:

(i) A Northeast Pacific Continuous Plankton Recorder (CPR) Network

The MONITOR Task Team of the North Pacific Marine Science Organization (PICES) Climate Change Carrying Capacity (CCCC) programme recommended that large scale measurements of zooplankton species composition and abundance be initiated in the NE Pacific. The CPR is the best tool, since it has a proven record in the Atlantic and its sampling characteristics, although with some problems, are well known. In March 2000 a two-year sampling programme will begin that will consist of two transects, as suggested by the Task Team. The first, from Prince William Sound, Alaska to Long Beach, California will be run five times a year, with approximately monthly spacing from March to August, and the second, a great circle route from Vancouver Island, Canada to the Bering Sea will be run once per year. The first line will sample Prince William Sound, the offshore region feeding the downwelling zone on the shelf, close to the centre of the Alaska Gyre (crossing Line P) and will intersect the CalCOFI grid off California. The second line will cross the first and also run parallel to Line P. In the short term this research will provide data on the structure of plankton variability along these lines and will be used to design a long-term zooplankton sampling programme for the NE Pacific. This future programme would reflect improvements in the technology available to estimate plankton abundance and will enable the monitoring of climate change variability. PICES would like to see the CPR programme as a Pilot Project within GOOS and would hope to work with GOOS to develop a long-term strategy for it.

(ii) The BENEFIT and Benguela Current Large Marine Ecosystem Programmes

These two programmes are complementary initiatives dealing with the Benguela Current regime.

(a) The BENEFIT (Benguela Environment and Fisheries Interactions and Training) Programme:

The programme began in 1998. It is a cooperative initiative between Angola, Namibia and South Africa, supported by fisheries institutes in the three countries and with financial support from the African Development Bank, the FAO, France, Germany, Iceland, Japan, Norway and the World Bank. Its goal is:

- To develop the enhanced science capability required for optimal and sustainable utilization of the Benguela System's living resources by:
  - Improving knowledge and understanding of the dynamics of important commercial stocks, their environment, and linkages between environmental processes and stock dynamics; and
  - Building appropriate human and material capacity for marine science and technology in the countries bordering the Benguela ecosystem.

A science plan and implementation plan have been compiled and the first research and monitoring projects have been initiated. Target species are hake, sardines, anchovy, horse mackerel, sardinella and rock lobster and the principal environmental parameters are temperature, winds, oxygen, zooplankton and top predators such as birds and seals. Transboundary issues, principal fish habitats and frontal zones are the initial focus of research and monitoring activities.

(b) The Benguela Current Large Marine Ecosystem Programme:

The objective of this GEF-funded project is to enhance national and regional efforts to move towards sustainable integrated management of the Benguela Current Large Marine Ecosystem (BCLME). The first steps in this process will be the establishment of a mechanism for regional cooperation, a review of the existing knowledge of the status and threats to the BCLME, and the development of a Strategic Action Programme to address both these threats and the gaps in knowledge essential to the sustainable management of the ecosystem. The project will be based on a monitoring and assessment programme to obtain information on productivity, living marine resources, pollution, socio-economics and governance.

(iii) Biological Action Centres (BACs)

It is recognized that certain coastal regions, particularly those where different water masses are dynamically mixed, are far more productive than the open ocean. Even these highly productive coastal regions

are not uniform. Some areas of smaller spatial scale stand out because of the higher abundance of most species at several trophic levels. This abundance demonstrates the relevant contribution of these small spots to the overall system productivity. Some of these areas sustain high levels of biological activity throughout the full year, while in others this activity is seasonal.

Along the eastern boundary region of the North Pacific, within 160 km or less of the coast, biological activity is high in some relatively small areas. These areas are fixed in space because of coastal geography, and thus can be characterized as Biological Action Centres, or BACs. The high abundance of marine organisms found here at multiple trophic levels appears to be mostly a consequence of the increased concentration of primary producers.

BACs may represent an opportunity to improve the efficiency of LMR-GOOS sampling, by concentrating observations in these small areas of high biological activity. It is proposed that a pilot study be initiated to investigate BACs and their role in marine ecosystems. Specifically, the pilot project would: (i). identify existing BACs; (ii) determine the extent to which observations in BACs can be extrapolated to surrounding areas; and (iii) investigate the extent to which BACs provide an indication of climate change.

The GSC agreed that these three proposals were worthy of further consideration, and should be taken up by the integrated coastal panel (see agenda item 4.1.1.5).

Action 14: New integrated Coastal panel to consider proposals by the LMR and other panels for Pilot Projects.

Dr. Wooster also introduced the Census of Marine Life, referring to *Oceanography*, Vol.12, No. 3, a special issue on the Census of Marine Life. To aid progress toward implementation of the Census, an International Scientific Steering Committee has been formed under the chairmanship of Dr. Fred Grassle. Some seed money has been made available for pilot projects, by the Sloan Foundation, and some awards have been made to support development of an Ocean Biogeographical Information System (OBIS). OBIS will underpin the entire Census by providing an enhanced framework for the management of the complex biological and ecological information that will result from it. OBIS will be developed and designed based in part on a pilot study for the development of a Dynamic Biogeographic Information System for the Gulf of Maine (NOPP grant to Dale Kiefer, Wrigley Institute of Environmental Studies, University of Southern California).

In discussion, **the GSC agreed** that the Census has the potential to expand significantly our knowledge of the biodiversity in the world's oceans. The Census will contribute to GOOS goals related to living marine resources by providing synoptic information on status of the marine ecosystems. In many respects, it is like WOCE or JGOFS, in that it will provide a snapshot of a dynamic ocean ecosystem; it is not a substitute for monitoring.

4.1.1.4 HOTO

Dr. Tony Knap reported on progress with the HOTO module. He described the progress made by the panel to implement the HOTO Strategic Plan. The main goal of this implementation is to develop inexpensive and non-destructive methods that can be used in developing countries to test ecosystem health. Immunoassay techniques have been developed for this purpose through the RAMP (Rapid Assessment of Marine Pollution) project, and tested in the field in Brazil during 1999. A workshop to pass on these techniques to others was held in the Caribbean, September 15-20, in San Jose, Costa Rica. One of the next major challenges is to get funding to the developing countries in order to implement these new programmes and methods.

Growing in importance is an element that did not figure prominently in the HOTO Strategic Plan, namely the relation between marine pollution and human health. It is hoped that we can focus on the wider Caribbean and Mexico to provide a test case. We intend to use similar approaches, developed for Arctic populations, for the tropics. For example, concentrations of DDT and pesticides, and methyl mercury can be investigated in people, and through an analysis of diet one can determine the source. The problems then occur in the connection to seafood as concentrations of contaminants in seafood are very difficult to get and assimilate. Dr. Knap also mentioned that surveys of other contamination concerns in specific regions were increased nutrients, marine pathogens and algal toxins.

The next step for HOTO will be to develop a strategic design plan for implementation, along the lines being followed by the C-GOOS and LMR Panels, and building on the HOTO Strategic Plan, which was published in 1996. This will be tackled at the 5th session of the HOTO Panel, planned for Paris in late September, 2000. Added to the present plan will be a more detailed description of RAMP, a closer connection with human health, and more detail on the importance of ecosystem models for the effects of contaminants.

One element of the final plan will be the development of pilot projects. An Arctic Pilot Project is underway by AMAP (Arctic Monitoring and Assessment Programme), and interim reports are published. AMAP is a good model for HOTO-type activities. The past set of possible HOTO Pilot projects will also be assessed.

The issues of indicators of stress, as discussed in GSC-II, have already been incorporated in the HOTO plan and these will be re-visited in the final HOTO meeting. In the end, a final plan will be developed as the basis for the merger of HOTO into the proposed COOP.

4.1.1.5 C-GOOS/LMR/HOTO merger

Worth Nowlin reported, on the meeting of GOOS module panel chairs in Washington DC, April 17-18, 2000, to consider the merger of the C-GOOS, HOTO, and LMR panels into a single panel for an integrated coastal ocean observing system (working document GSC-III/14). The name “Coastal Ocean Observations Panel” (COOP) was proposed as an analog to the Ocean Observations Panel for Climate. He reminded members that the idea of the merger was part of the proposal for the future development of GOOS as set out in *The GOOS 1998*, in subsections 5.6 and 5.7 of Chapter 5 - "A Framework for Implementation - Priorities for Action". The proposal suggested implementation within two themes based on physical domains:

- Theme 1: Coastal and shelf monitoring and modelling: to be achieved by integrating and meeting the requirements of the Climate, Coastal, Living Marine Resources, Services and Health of the Ocean Modules in this physical domain. (Theme 1 lends itself to local and regional implementation.); and

- Theme 2: Global open-ocean monitoring and modelling: to meet the needs of the Climate Module in particular, enabling open ocean services and extending the predictability of regional services, and supporting LMR and HOTO secondarily. (Inevitably many of the systems and methods applicable to theme 2 will be implemented first on a basin scale.)

Subsection 5.7 provides guidance on the implementation of these two themes.

This strategy was accepted at GSC-I (see GSC-I report, section 6.5), and the schedule for it was approved at GSC-II (see GSC-II report, section 4.3.2), where it was agreed that:

(i) The LMR, HOTO and Coastal Panel chairs and technical secretaries should meet to develop a framework for merging the three panels into a single one;
(ii) GSC-III would discuss this framework and offer guidance on the merger;
(iii) The merged panel would meet first in fall 2000 to formulate an integrated design for subsequent review by the GSC; and
(iv) The new Panel should contain representation from each of the three panels.

To achieve these requirements the LMR, HOTO and C-GOOS Panels had been asked to finalize their strategic designs before the first COOP meeting in fall 2000.

The Washington meeting had:

(i) considered draft Terms of Reference for the COOP;
(ii) recommended initial foci of COOP;
(iii) developed procedures for the COOP meeting;
(iv) explored possible venues for the COOP meeting;
(v) developed a provisional list of members for COOP and a possible candidate for the Chair;

(vi) discussed the principles that the three panels should use during their meetings in 2000 to finalize their strategic design plans; and
(vii) developed a request that the LMR, HOTO and C-GOOS Panels develop a set of actions on which COOP should focus initially.

It was agreed that the new panel should be formed with the clear knowledge that its major task in the not so distant future will be implementation; and that the first step toward implementation is to have in hand a design plan.

4.1.1.5.1 Scope of COOP

The COOP will plan and facilitate implementation of an end-to-end observing system to provide systematic data sets and products to users. Its goals will be to monitor, assess, and predict effects of natural variations and human activities on the marine environment and ecosystems of the coastal ocean. Its principal foci will be issues of ecosystem (including human) health, living marine resources, natural hazards, and safe and efficient marine operations. It is not intended that "coastal" be limited by specific geographic boundaries. Although the emphasis will be on coastal ecosystems (e.g., estuaries, bays, sounds, fjords, open waters of the continental shelf), boundaries should be determined by the problems being addressed and the products that are to be produced. Thus, the broad area of concern extends from semi-enclosed systems in the coastal zone to the continental shelf and the deep ocean as required to provide products relevant to the issues listed above.

The focus will be on design and implementation of a sustained, integrated system. It must be designed and implemented as an end-to-end system, from measurements to the timely distribution of products. It must take into account user requirements, scientific and technical feasibility, and utility. This will require oversight and adjustments to the design and operation as needs and feasibility change.

4.1.1.5.2 Strategy

Initial Activities

(i) Integrate existing designs:
- Integrate the existing designs by first agreeing on a common vision, then on a common set of scientific rationale (objectives);
- Merge the existing plans as the basis of these common objectives and identify any areas where merged plans are inadequate;
- Identify dependencies on and connections with the open ocean elements not yet covered by the Ocean Observations Panel for Climate;
- Maintain awareness of and, where practical, integrate with projects and work of the OOPC, and particularly the Global Ocean Data Assimilation Experiment in the area of processing and products.

(ii) Identify initial observing system elements:
- Define the first elements of the coastal GOOS;
- Note the status of these elements, projects underway to sustain/improve, and future needs to maintain.

Continuing Activities

(iii) Refine design:
- Ensure that the design is end-to-end;
- Maintain awareness of science/technology and encourage needed developments;
- Encourage prototype observing system elements, observing system design/sensitivity experiments, and other design/redesign projects;
- Encourage relevant research and technology programmes.

(iv) Implement System Elements:
- Develop implementation plan, to be coordinated with that of the Ocean Observations Panel for Climate;
- Initial focus on data and information management infrastructure;
- Include model development, data assimilation, and regional analysis/products centres.

(v) Evaluate the System:
- Formulate procedures and identify necessary resources required for this tactical function.

(vi) Build Capacity:
- Identify local and regional needs and priorities, and reflect them in the implementation plan;
- Communicate needs to Capacity Building Panel;
- Draw on successful experience, e.g., activities of WMO, FAO, and IOC (GIPME, HAB, GLOSS, and IODE-ODINAFRICA);
- Encourage demonstration projects.

(vii) Communicate:
- Enunciate COOP objectives and expected value and benefits;
- Promote COOP development and implementation.

4.1.1.5.3 Terms of Reference

Tom Malone noted that the above strategy is the basis for the Terms of Reference, which are:

(i) integrate and refine the design;
(ii) more effectively involve user groups inn the design process;
(iii) select the initial observing system elements;
(iv) formulate the Implementation Plan;
(v) define the procedures for ongoing evaluation;
(vi) build capacity; and
(vii) promote development of the system.

4.1.1.5.4 General Considerations regarding the COOP

The Panel will set its own frequency and schedule of meetings; it is expected to meet at intervals between six months and one year. The Panel is encouraged to form time limited committees to provide needed expertise. The Panel is encouraged to select meeting venues that will assist in strengthening regional GOOS programmes and building capacity.

4.1.1.5.5 Initial Key Activities with Times

The Washington meeting proposed that the LMR Panel should produce a first draft of its design plan at the LMR meeting in May 2000, followed by a draft meeting report in early June, the first draft plan for review in August, and a final design plan in October 2000. The C-GOOS Panel should produce a first draft design plan at the C-GOOS meeting in May 2000, for external review in August, with a final plan being made available in October 2000. The HOTO Panel should work on its strategic design plan for implementation inter-sessionally prior to its last meeting in September, and submit the final version to the GPO before the end of October.

The GSC in May 2000 should agree on the formation of COOP, including scope, terms of reference, initial foci, methods of operation, membership, and plans for its first meeting.

After GSC-III, the IOC will invite approved nominees to join the panel and will provide them with relevant documents including the finalized strategic designs as they become available.

The first COOP meeting will be in November 2000 (Nov 15-17). It was proposed to hold it in the Caribbean to highlight the relevance of GOOS to small island developing states.

It will be held in association with the first GOOS Users Forum (described in section 4.1.1.5.7 below) (Nov. 13-14) to enable COOP members to interact with representatives of the user community.

The COOP implementation plan, version 1.0, should be published before the "Agenda 21 + 10" meeting in 2002.

COOP plans also should be available to inform the discussions in the UN open-ended Informal Consultative Process on Oceans and the Law of the Sea (first meeting May 30, 2000).

4.1.1.5.6 Mechanisms for Continuing Interactions with Users

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

Dialog meetings: These are meetings of GOOS representatives with representatives of the user community (a mechanism used by ICES). Meetings selected should be regional and focus on specific regional interests. They might be organized under the auspices of interested professional associations (e.g., regional organizations such as PICES, or trade associations). It was recommended that consideration should be given to forming a PICES-GOOS group to match the ICES-GOOS group.

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

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

4.1.1.5.7 The GOOS Users' Forum

The objectives of the GOOS Users' Forum will be to:

(i) Regularly communicate user needs to COOP, and COOP developments to users;
(ii) Strengthen the GOOS network through interactions and the trading of information between GOOS bodies;
(iii) Strengthen individual National GOOS Coordinating Committees by exposing them to activities of other nations and regions and by recognizing their central role in assembly of user needs;
(iv) Link the COOP to the national and regional operations of GOOS.

The first GOOS Users' Forum will be held in association with the first COOP meeting. The chairs of the LMR, HOTO, and C-GOOS Panels will present their strategic designs, and attendees will be asked to provide their views on these designs, on their integration, and on what they see as important in the implementation of a coastal ocean observing system. This will engage the representatives of the user community in the COOP implementation process.

Aside from National GOOS Coordinating Committees and regional bodies, attendees should include representatives of key UN "user" agencies -WMO, UNEP, FAO, and IMO- as well as ICSU.

To encourage diversified representation on National GOOS Coordinating Committees the letter of invitation to the initial GOOS Users Forum will explain the rationale for the formation of COOP and that we thus expect representation to these meetings to be matched to the foci of COOP, not confined to interests in marine services or climate.

4.1.1.5.8 Marketing

Marketing describes activities directed at ascertaining users' requirements and at demonstrating how those requirements can be met. Much of it should be carried out in practice at the national and regional level by appropriate GOOS bodies rather than by COOP. However, COOP also has a role, especially at the international level. It includes promotion, for instance, through GOOS displays and presentations at key national and international meetings such as:

Marine Technology Society (USA)
Ocean Technology Conference (USA)
Oceanology International Europe (Brighton)
Oceanology International Americas (Miami)
Oceanology International Asia (Singapore)
EuroGOOS Conference
PACON (Pacific)
World Fishing Conference
Challenger Society Annual Meeting (UK)

Effective marketing demands interactions with users to ascertain their needs. It requires determining what activities a company really is in as opposed to what they appear to be in (e.g., ski resorts are really in the climate and weather business). In addition, marketing must be opportunistic, capitalizing on specific fora and events, e.g., El Niños.

Action 15: Panel Chairs, GOOS Officers and GPO to identify marketing opportunities [subsequently Tony Knap offered to develop a GOOS session at the Americas Oceanology International 2001 Meeting in Miami (April 3-5, 2001)].

4.1.1.5.9 COOP Membership

Members should be chosen with the skills and experience to address the topical areas listed below. Several of the members should be from the present LMR, HOTO and C-GOOS panels to ensure continuity. Some of the members should be scientifically competent representatives of National GOOS Coordinating Committees and/or regional GOOS bodies, such as ICES-GOOS or PICES-GOOS.

4.1.1.5.10 COOP Topic Areas

The Washington meeting identified the following provisional list of topical areas that will bear on the design of the coastal module and that should be represented on the COOP:

1. Fisheries
2. Critical Habitat (coral, intertidal wetlands, SAV)
3. Remote Sensing
4. Hydrodynamic Modelling
5. Data Assimilation
6. Ecosystem Modelling
7. Contamination/Bioeffects
8. Data and Information Management
9. Public Health
10. Harmful Algal Blooms/Toxicity
11. Coastal Erosion
12. Natural Hazards/Climate Impacts
13. Coastal and Physical Oceanography
14. Biological Oceanography
15. Chemical Oceanography
16. Marine Meteorology/Storm Effects
17. Coastal Zone Management
18. Biological Indicators/Sensors
19. Technology
20. Biodiversity

4.1.1.5.11 Open Ocean Considerations

Some pollution and living resources issues extend beyond the continental shelf and are not addressed by the current "open ocean" panel, the Ocean Observations Panel for Climate. For the time being these should be dealt with by COOP. HOTO issues include things like (i) deep-sea low temperature ecotoxicology, in which there is potential user interest from oil companies; and (ii) transport of methyl mercury into Arctic Ocean ecosystems. LMR issues include open ocean fisheries and deep-sea ecology.

4.1.1.5.12 Health of the Ocean Considerations

In addition to issues mentioned above, COOP should work with GIPME to ensure that the RAMP pilot project of HOTO continues, and that human health indicators are further developed.

4.1.1.5.13 LMR Considerations

COOP might address aquaculture, coastal fisheries, and critical fish habitats. The panel did not have the time or skills to address these topics.

It was suggested that the proposed LMR regional analysis centres proposed by the LMR panel (see 4.1.1.3 above) could be broadened to include the breadth of COOP activities. FAO has noted (in LMR-III) that care must be taken in developing this concept so as not to duplicate ongoing FAO activities.

4.1.1.5.14 C-GOOS Considerations

The Washington meeting suggested that the inventory of coastal observing systems under development for C-GOOS by the GPO will be a key element for building an operational system.

4.1.1.5.15 Relation of Ongoing Assessments to COOP Design

Several ongoing or planned environmental assessments, including those by GESAMP, GIWA, and the proposed UN-World Bank Millennium Assessment Project, will provide information that may influence the COOP strategic design**.**

4.1.1.5.16 Discussion

The GSC approved the plan for the proposed merger, but wished to see a clearer statement of focus for the integrated panel, to ensure that its activities were not too diffuse. Initial activities should include those of the existing panels.

Action 16: GSC Executive and Chairs of C-GOOS, LMR and HOTO are to develop a clearer statement of focus for the integrated panel prior to its first meeting in November 2000.

The GSC recommended Tom Malone as chair and Anthony Knap as co-chair of the new coastal panel, and asked members to suggest new members.

Action 17: GSC members to suggest to GSC chair potential members for the new integrated coastal panel, before end June 2000.

The GSC decided that the merger offered an opportunity to build closer links with GTOS and the IGBP (the parent body for LOICZ), which should be asked to consider co-sponsorship of the panel (much as GCOS and the WCRP are co-sponsors of the OOPC). In addition to seeking co-sponsorship the integrated panel was encouraged to develop joint projects with GTOS and LOICZ (IGBP).

Action 18: (i) Jeff Tschirley will ask the GTOS SC if it wishes to consider co-sponsorship of the new merged committee for coastal and shelf seas; (ii) GPO and Chair GSC will draft a letter asking IGBP to co-sponsor the new merged committee for coastal and shelf seas, for completion prior to GSC-IV.

The GSC also decided that since the FAO was a co-sponsor of the LMR Panel, which would be absorbed into the integrated panel, it should also be invited to carry its sponsorship across to the integrated panel. An approach to the FAO would provide an opportunity to ask if they were interested in co-sponsorship also of the regional analysis centres proposed by the LMR Panel.

Action 19: (i) Director GPO and Chair GSC to draft a letter for consideration of the GOOS sponsors to ask FAO to co-sponsor GOOS, by end June 2000; (ii) at the appropriate time GPO in consultation with Chair GSC and other appropriate panel members to ask IOC and FAO to jointly sponsor the development of the regional information centres proposed by LMR.

There was considerable discussion about the possible name of the integrated panel, and **the GSC agreed** that the Chairman should consider this matter off line.

Action 20: GSC Chair to consult with members and the GPO on the name for the integrated coastal panel, for completion before the meeting in November.

The GSC called for the implementation design to be finalized in early 2002. At that time, the terms of reference and performance of the panel would be reviewed.

There was a substantial discussion about how to deal with the user community. At one level this comprises individuals and organizations; at another level nations; and at a third level the international community and its agreements in the form of Conventions and Action Plans. **The GSC agreed** that globally there were far too many users at the level of individual or organization for any one panel to deal with, and that collecting the views of these communities should be one of the prime functions of the National GOOS Coordinating Committees (NGCCs). In addition the NGCCs should be encouraged to stimulate national coordination and the marketing of GOOS at the national level. **The GSC asked** the GPO to develop list of contact points for all NGCCs and regional GOOS bodies, as requested in **Action 3**, above, as the basis for invitations to the Users' Forum.

The GSC agreed that the integrated coastal panel should inform itself about the international user requirements of Conventions and Action Plans, such as the Global Plan of Action for the Protection of the Marine Environment against Land Based Activities (GPA-LBA), and take them into account in designing its own plans.

Geoff Holland noted that the deliberations on ocean issues at the UN Commission on Sustainable Development in 1999 have led to the establishment of an annual series of open-ended informal consultative meetings at the UN General Assembly level, the first of which will be held this year. The rationale for the meetings is to improve the integration and coordination of all aspects of ocean affairs. This is a considerable challenge, because under the provisions of the UN Law of the Sea, all countries will require data, information and knowledge to manage their respective marine environments and ecosystems and associated activities in their 200 nautical mile Exclusive Economic Zones. Many countries are without the capacity and capability to do this. However, the Law of the Sea also obliges ratifying countries to assist in capacity building activities.

The common need for the observation, collection and distribution of ocean data and information is something that could be addressed at the level of the UN itself, for instance, through an international instrument such as a Convention, or a codicil to the UN Convention on the Law of the Sea (UNCLOS). Such an initiative could well be complementary to the efforts of GOOS to market and promote the benefits of operational ocean observing systems to governments, agencies and industrial users. This or a similar kind of political recognition could generate the much needed governmental support for GOOS infrastructure, and the funding required for operational monitoring, management and related assistance programmes. Such an agreement could also complement and re-energize the many global and regional marine environmental Conventions and Agreements that presently exist, and raise the visibility and status of the GOOS programme.

Action 21: Director GPO, Chair GSC, and Geoff Holland to explore with Executive Secretary IOC the possibility of developing a UN general agreement on a coastal ocean observing system, prior to GSC-IV.

4.2 CROSS CUTTING BETWEEN OBSERVING SYSTEMS

4.2.1 Global Observing Systems Space Panel (GOSSP)

Dr.Francis Bretherton introduced GOSSP, as the basis for a discussion of what is required for the future (working document GSC-III/15). GOSSP has been meeting with expert panels of the G3OS and communicating at other times by e-mail. The chair met with TOPC in Birmingham July 1999, and again with the Terrestrial Carbon Theme writing group in Ottawa, Feb. 2000.

Dr. Bretherton noted that much of the GOSSP agenda has been driven by the need to relate to evolving IGOS activities. That part of his presentation is reported under agenda item 6.3, below.

There is a recurring need to draw attention of CEOS/SIT members on behalf of the G3OS to major gaps or apparent overlaps in planned satellite coverage. A first round of discussions of potential satellite issues has been completed with each of the disciplinary panels of GCOS, and, in the context of theme teams, with GTOS and GOOS. Satellite measurements for atmospheric chemistry and climate were discussed in depth at the GCOS/AOPC meeting in April 1999.

A meeting in June 1999 with the WMO/OPAG on Integrated Observing Systems -Expert Team on System Redesign- provided insights into the experience of the weather prediction community with the design, operation, evaluation and redesign of a successful operational Integrated Observing System. This experience, formalized as a rolling review, provides a significant model for IGOS activities and highlights the importance of thinking in terms of the entire end-to-end system, not just of the observations themselves. The approach is discussed further in Section 6.3 below.

GOSSP also has reviewed the contents of the CEOS/WMO database, which revealed a number of apparent anomalies in the statements of requirements. Formal checks of planned satellite capabilities against requirements as stated failed to yield satisfactory matches in most instances, for a wide variety of reasons. This prompted requests from GOSSP to GCOS Panels, and to GOOS and GTOS to revisit the statements, especially in the provision of comments that reference a more extensive rationale and flag special requirements (e.g. non-sun synchronous orbits for precision altimetry). Though all groups have been responsive, the end results have been less immediately satisfying than was originally hoped.

Dr. Bretherton explained how the Weather Prediction Community uses a “rolling review” of the complete observational system in building and sustaining a viable operational base. This activity is managed by WMO Commission for Basic Systems and involves a structured, cyclical, process:

- determination of user needs and requirements,
- assessment of present performance and capabilities,
- technical consideration of alternative possibilities for improvements,
- decisions on changes to be made,
- implementation of those changes,
- followed after a deliberate interval by a new iteration.

Besides those directly responsible for the measurements, the concept requires identification and involvement of representative users, of institutions committed to product generation and data archive, of the co-ordination and communications infrastructure, as well as ongoing activities to measure performance, to research alternative system designs, and to develop new instruments and analysis techniques. He suggested that this approach be taken as a model for the evolving ocean observing system.

Dr. Bretherton noted tradeoffs between satellite and *in situ* observations for weather prediction will not necessarily be the best interests of climate or coastal applications (e.g. funding may be discontinued for pressure sensors on Southern Hemisphere drifting buoys). This is something for the GSC to consider.

He noted that the task of providing a unified view to space agencies on behalf of G3OS is a substantial task. The *ad hoc* way in which it is done at present may not be sustainable past the introductory phases of GOOS and GTOS. It would be up to the G3OS Steering Committees and sponsors to decide whether or not to

continue this task. As an alternative possibility, WMO's Commission for Basic Systems (CBS) might be given overall responsibility for observing system design for all G3OS themes.

Finally he dealt with database issues. The CEOS/WMO database is a reliable source of information on requirements and capabilities of satellite systems for the G3OS, World Weather Watch, IGBP, WCRP and several other user organizations The database and some tools for comparative analysis are issued annually on a CD-ROM, and the data are available on the Web. However, progress in improving its usefulness on a daily basis has been mixed. The CD-ROM for fall 1999 is not yet available, and search capabilities on the Web are limited. Non-uniformity of input greatly complicates comparative analysis. A database is needed of the institutions producing core products for each observing system. These institutions are generally critical users of the raw data and their involvement in assessments of the adequacy of the observing system is critical. If appropriately structured they may also serve as monitors of data availability and quality. There is a need to broaden the scope of the existing database to include structured information about core products and representative users at all levels of aggregation. Such information will be necessary for a rolling review of observing system design as current initiatives within IGOS gain operational experience, and meanwhile it will stimulate awareness among participants of the connections and feedbacks that are needed to sustain their operations. It will take several years and a concerted effort to develop and populate the necessary extensions to the present CEOS/WMO database. This process would probably start with pilot studies within the Ocean and Carbon themes, in consultation with WMO and GOSIC. If requested by its sponsors, GOSSP would consider co-ordinating such an activity.

He concluded by asking where GOSSP should put its effort, for example: (i) on helping the IGOS Partners to develop their themes; (ii) on bringing gaps and problems to the attention of CEOS; or on (iii) working to extend the database to make it more useful.

The GSC thanked Dr. Bretherton for his comprehensive report, recognizing that much of what had been achieved was due to his personal efforts, which had been supported by the GCOS Secretariat. **The GSC agreed** that GOSSP is needed to update space-based (but not *in situ*) requirements on behalf of the advisory panels, and that no change to the GOSSP Terms of Reference appears to be needed at this time.

4.2.1.1 IOCCG

Professor Trevor Platt, representing the International Ocean Colour Coordinating Group (IOCCG), sponsored by SCOR, gave a presentation on the potential scientific and operational uses of ocean colour measurements from satellites. IOCCG's function is to act as a liaison and communication channel between users, managers and agencies in the Ocean Colour arena. It held its first meeting in Toulouse, France, in March, 1996, and a Project Office was established at the Bedford Institute of Oceanography in January 1997. The activities of the IOCCG are supported by financial contributions from national space agencies and other groups, and upon infrastructure support from SCOR. Further information about the IOCCG and its objectives can be found at www.ioccg.org.

Dr. Platt identified three broad scientific applications of ocean colour data:

(i) the ocean carbon cycle and the role of the ocean in climate change. A primary goal of ocean-colour remote sensing is to produce synoptic fields of chlorophyll pigment, an index of phytoplankton biomass. It is the single most important property of the marine ecosystem that we would like to measure at synoptic scales. It is used as the basis of a method to compute ocean primary production, and also to provide the chlorophyll fields that can be used to initiate and verify coupled, numerical models of the ocean and its embedded ecosystem;
1.1

(ii) provision of a synoptic, observational link between the development of the ocean ecosystem and the physics of the mixed layer. Because phytoplankton control the optical turbidity in most parts of the ocean, they control the manner in which the mixed layer heats up under the influence of the sun. Physical models of the mixed layer include a balance between the onset of stratification through heating and the erosion of stratification through turbulence. Optical turbidity is a key property in these models, and it can be delivered synoptically from ocean colour remote sensing. Mixed-layer models seek to

predict sea-surface temperature, critical for weather forecasting in maritime areas, especially in the tropics;

(iii) coastal zone management including fisheries management. One of the key questions in fisheries science is the extent to which fluctuations in the biomass of exploited stocks can be accounted for by fluctuations in the ecosystem consequent upon variations in the large-scale circulation. It is a question that can be addressed only with the aid of a time series of synoptic views of the ocean ecosystem as supplied by ocean colour remote sensing. It was noted that no ocean color sensor was in operation when major fish stocks were failing around the world. Beyond fisheries issues, ocean colour data are useful for many other aspects of coastal zone management, for example the monitoring of algal blooms and coastal pollution.

Dr. Platt noted that there currently is no integrated plan for operational, satellite based, ocean colour sensors in the post 2005 era. IOCCG continues to bring this issue to the attention of senior space agency officials and he suggested that the GSC should also take this issue forward.

The Committee recognized that interpretation of ocean colour data in coastal waters still poses challenges. Dr. Platt observed that developments are under way which look promising and soon could lead to break-through. For instance, several different colour bands are proving to be informative. As the science advances, more benefits will appear, making a stronger case for the observations. Finally, **the GSC agreed** that the IOCCG is the group to provide GOOS with scientific advice regarding ocean colour.

In discussion **the GSC concluded** that the lack of commitment to ocean colour measurements appears to be because no good argument for them has yet been made either by the science community to the space agencies, or by programme managers within space agencies to their decision makers. Dr. Platt noted that in response to this need he was planning to write a paper presenting the appropriate statements of operational need to the space agencies and on behalf of IOCCG and the wider community. Dr. Nic Flemming suggested making the case for satellite ocean colour missions by identifying model products that need chlorophyll as an input parameter. **The GSC concluded** that there still appears to be a need for operational research development and that it would be necessary to find users for the products in order to make the argument for continuation of ocean colour data streams.

Action 22: Noting that ocean colour measurements are not now planned after 2005, **the GSC encourages** its design panels and other activities to document the value of such measurements to GOOS, and work through GOSSP to convince satellite agencies of the operational need for ocean colour. [This encouragement also appears in the Oceans Theme document discussed in agenda item 6.3].

4.2.2 Data and Information Management

4.2.2.1 Joint GOOS-GCOS-GTOS Data and Information Management Panel (J-DIMP)

The Chairman presented the key points of working document GSC-III/16, asking the GSC to consider options for the future of J-DIMP, which had not met since its 4th session, April 28 and May 1, 1998, in Honolulu. He reminded members that J-DIMP started in 1996 when the three observing systems had the concept of strict control of formats, data and metadata, and of certification of data and products (see from Annex III to the Data and Information Management Plan, Version 1.0, April 1995. GCOS-13, WMO/TD-No. 677). However, as implementation has proceeded, it has been increasingly realized that contributed elements of the observing systems are largely autonomous. Strict control may not be feasible because it may result in few system elements being contributed. In reality, it appears that as long as certain general principles are met, the observing systems are going to rely on the elements adhering to best practices regarding the details of quality assessment and control, application of metadata, and production of products. Among these principles, given in one form in the report of J-DIMP-III, and in another form in the final report of the OOSDP, it is accepted that the sustained observations typical of an observing system must be: long term; sustained; systematic; relevant; cost-effective; timely; routine; and subject to continuing examination.

In principle J-DIMP was to guide the development of the data and information management system for the three global observing systems, G3OS, which should be developed, to the degree possible, to accommodate

data and products from the various components of the global observing systems. J-DIMP was envisioned as a highly focused "problem solving" group, concentrating on resolving crucial issues affecting the quality and maintenance of global observing system data sets, and routes of access to them. Its Terms of Reference (Annex IV of the report of GSC-II, and Annex D-V of the Report of the 4th Session of J-DIMP) are:

(i) In concert with the G3OS science requirements and associated user communities, formulate and develop the G3OS Data and Information Management Plan(s);
(ii) Monitor the overall implementation of the data-related elements of the plans;
(iii) Make reports and present recommendations, as required, to the steering committees of GCOS, GTOS and GOOS on information management issues.

Given the above background, and the change in perception of how the observing systems will actually manage data and information, GOOS, GCOS and GTOS had held an extensive, largely e-mail based discussion about whether or not J-DIMP is still needed, and if so what is role should be. The discussion took into account J-DIMP's recent tasks as listed in the report of J-DIMP-IV: (i) to produce a J-DIMP Data and Information Management Plan; (ii) to oversee the G3OS Information Centre (GOSIC); (iii) to develop the J-DIMP Metadata Project; and (iv) to define the roles of G3OS data centres.

J-DIMP has not met since May 1998, not least because the G3OSs had no specific tasks for it once the J-DIMP DIM Plan was completed in April 1999 (published soon by GCOS). Remaining, however, is the need for a group to oversee and guide the activities of GOSIC.

The key points emerging from the e-mail discussions prior to GSC-III were as follows:

(i) J-DIMP has fulfilled its initial role;
(ii) G3OS DIM issues are sufficiently diverse that a single committee cannot provide each of the G3OS units with the specific advice needed;
(iii) GOOS, GCOS and GTOS each need to address their own specific data issues, especially as we work more closely with the space agencies that have their own panel (WGISS);
(iv) Rather than J-DIMP we may need *ad hoc* task forces that can focus on specific initiatives. One such need is providing guidance regarding GOSIC.

In addition it was recognized that some data and information management mechanism would be needed to coordinate multiple data sources; to advise on implementation so as to ensure that data and products are provided as required and archiving activities are adequate; and to work with observing system programme elements to improve the operation of the system. Some of what is required might be done by GOSIC.

In discussion, Francis Bretherton reminded members that there would be a need for a body addressing how to handle the vast increases in rates data flow that should be anticipated in the near future. This matter is addressed in more detail in agenda item 6.3. The Chairman of the IOC's International Ocean Data and Information Exchange programme (IODE), Dr. Ben Searle, suggested that the new extensible markup language (XML) for marine data may help with the speedy handling of large bodies of data from multiple sources (background paper GSC-III/B29).

Putting GOSIC issues aside (see agenda item 4.2.2.2, below) **the GSC decided** that a standing committee on data and information management for the G3OS is not needed at this time for issues of data and information management common to GOOS, GTOS, and GCOS. Instead, to enable common issues in data and information management to be recognized and addressed, **the GSC agreed** that data and information management linkages between the three observing systems should be a permanent topic on the agenda of the meeting of the G3OS sponsors, and that such issues would probably be addressed most effectively by small focused and time limited *ad hoc* groups rather than by a broad ranging body like J-DIMP.

Action 23: J-DIMP should be disbanded, and the chair GSC, on behalf of the G3OS, should thank J-DIMP Panel Members for their services (by year-end 2000).

Action 24: Data and Information issues should be placed on the agendas of the annual G3OS partners meetings, as soon as possible.

4.2.2.2 G3OS Information Centre (GOSIC) and Other Data Centres

4.2.2.2.1 GOSIC

Dr. R. Wilson briefed the committee on progress with and plans for GOSIC, which is intended to provide descriptions of the observing system elements, their data, and their products, and information on how to obtain the data and products. GOSIC is located at the University of Delaware as a Pilot Project funded by U.S. agencies.

The key to the success of GOSIC in its present (pilot) form is that it is small and efficient. It needs help from the centres managing the original data. These centres each have to create a web page linked to GOSIC and displaying G3OS-related products.

GOSIC now contains several elements of the GOOS Initial Observing System. The plan for the immediate future is to: (i) finalize the addition of elements of the GOOS Initial Observing System; (ii) test the IODE's new metadata software (MEDI) (see 4.2.2.2.2 below), which should become a web tool for GOSIC; and (iii) develop a network of networks for GTOS.

GOSIC is half way through a 3-year grant allocation, and plans are being made to develop a proposal to obtain from a collection of funding agencies the funds for an expansion of its activities. The proposal will include a further 3 years of development to finalize the system, followed by a 2-year operational implementation phase, probably at some appropriate operational centre.

The GSC decided that a full review of GOSIC by the three observing systems is needed before year end, so as to provide advice for development of the new funding proposal. This review should be carried out by a small *ad hoc* team comprising 2-3 people from each of GOOS, GCOS and GTOS. GOSIC should be reviewed again near the end of the second development phase so as to provide advice for the development of the operational phase.

Action 25: (i) GPO and GSC Executive Committee to agree with GCOS and GTOS on the procedure and Terms of Reference for a full review of GOSIC in the 6-9 month time frame, by end November 2000; (ii) GSC to name two individuals to represent it on the review group, by end November 2000; (iii) second review to take place prior to operationalization of the system (in about three years); (iv) Tom Malone and Neville Smith to select one candidate each from COOP and OOPC to represent GOOS on the *ad hoc* review panel.

The GSC noted that there was an outstanding action from GSC-II (**Action GSC-II/43**) to consider linking to the new FAO fisheries database.

4.2.2.2.2 Marine Environmental Data Inventory (MEDI)

This item was introduced by Dr. Ben Searle, Chairman of the IODE, who explained that the IODE is willing to work with GOOS and GOSIC to provide a comprehensive and user friendly metadata format for all GOOS data (background paper GCS-III/B28). He gave a laptop demonstration of the MEDI system, which is written in JAVA and is compatible with the NASA Global Change Master Directory. MEDI provides a user friendly means of managing metadata, and is an excellent potential tool for GOSIC. A few bugs remain to be worked out before the system is fully ready for GOSIC, and some improvements are needed, for example to improve the resolution of the coastline, and to make the system web based (at present it is stand alone). MEDI is highly flexible and can be used over the top of existing systems to add value to them. A prototype version will be made available before the summer for people to test. In addition it will be tested by the IODE community. It could prove to be ideal for GCOS and GTOS as well as by GOOS. Dr. Searle anticipated that full release of MEDI would be approved at the 16th session of IODE in Lisbon in October 2000.

Ron Wilson confirmed that GOSIC intends to use MEDI to provide metadata records for the elements of the GOOS Initial Observing System in GOSIC. GOSIC will ask its co-operating data centres to use MEDI as the tool to provide access to their data.

The GSC found the demonstration very informative and was pleased to see the new developments. Neville Smith wondered whether MEDI would be able to deal with real-time data.

Action 26: IODE to finalize Marine Environmental Data Inventory and make it widely available initially via CD then as web-based system for use in GOOS data and information management, before year end 2000.

4.2.2.2.3 WOCE Data Centres

The Chairman introduced the subject of Data Centres for GOOS, referring to background paper GSC-III/B30, by Dr. David Legler, on the World Ocean Circulation Experiment (WOCE) Data Products Committee (DPC), which meets regularly with the elements of the WOCE Data System, i.e. the representatives/managers of WOCE data centres. The WOCE Data System has proven to be remarkably flexible and robust mechanism for delivering data, information, and products to meet community needs.

WOCE data activities fall in three areas: assembly and distribution of data/metadata; production of data products; and participation in analysis/interpretation of the data sets in order to understand ocean processes. For each type of data there is at least one Data Assembly Centre (DAC), which assembles data sets, subjects them to quality control, and ensures distribution. The DACs and a Data Information Unit (DIU) provide metadata about how the data were obtained and quality review results. For two types of data -hydrographic and surface fluxes- there are also Special Analysis Centres (SAC's) which perform additional functions to address science-driven objectives such as developing gridded products for analysis of water-mass properties or evaluating various surface flux products for forcing ocean models.

Among other things, the DPC focuses attention on developing higher-level products and synthesis of multiple data streams, and monitors the timely and appropriate production and delivery of WOCE data and data products. It aims to provide better and more comprehensive access to WOCE data of all kinds through a WOCE "data resource" that will provide researchers with a single interface through which a wide range of WOCE data and data products may be accessed without concern for the complex internal structure and distributed nature of the WOCE data infrastructure. This is much like the GOSIC approach. A major step towards the WOCE data resource has been the production of version 1.0 of the WOCE Global Data on CD-ROMs, Version 2.0 of which will be distributed in Sept. 2000. WOCE Global Data V3.0 (to be distributed in 2002) represents the integration of the complete WOCE data resource.

The Chairman noted that the future of the DPC is uncertain. However, end-to-end management of data streams pioneered in WOCE will inevitably be required by large scale projects like CLIVAR and GODAE. This begged the question – would the WOCE data system be a good basis for a GOOS data and products system, or at least for the physical components of such a system? **The GSC decided** on the following action:

Action 27: GPO and Chair GSC to arrange periodic meetings between representatives of the data assembly centres, possibly involving subsets of centres dealing with related data sets, starting during 2000. In this regard, the WOCE/CLIVAR Data Products Committee might serve as the focus for discussion of physical ocean data.

4.3 COST/BENEFIT ANALYSIS

Dr. Nic Flemming introduced this topic, basing his presentation on the paper that he had presented at the OceanObs99 Conference in St Raphaël in October 1999 (*Dividends from Investing In Ocean Observations: A European* Perspective). Like any big business, an ambitious programme like GOOS does need a good economic evaluation of how it is doing. As a start, several countries are carrying out or have recently carried out assessments of the value of their marine industrial sector. For instance, a study of the costs and benefits accruing from investment in the ENSO observing system is given in background paper GSC-III/B10, provided by Rodney Weiher, of NOAA. A EuroGOOS study suggests that between 3 and 5% of input to the European GNP (EU) is generated directly by marine-based industries and services. The value added directly by these activities is of the order of $140-230bn/yr. The value is variable because the marine industries are subject to uncertainty, loss of efficiency, and direct costs and damage caused by the marine environment, which also affects weather and climate and hence other industries including agriculture. The question is: what approach can

we best use to analyse the costs and benefits of supplying ocean-based information to these various industries so that they can improve their performance in the face of marine environmental effects?

Improvement of the short- to medium-term prediction services for maritime conditions would improve the value of maritime industries and services by a few percent. If we accept 1% as a most conservative estimate, the value added to the GNP of the EU by a prediction system is of the order of $1.4-2.3bn/yr. This is a minimum which should be exceeded by a factor of 2-3, excluding the longer term benefits of climate prediction, and its impact on agriculture, energy generation, water supply management, land use and other social activities, which would be of the same order.

Recognizing the need for information, most European coastal states have developed operational oceanographic data gathering and forecasting at the shelf seas level, often with collaboration between adjacent states. Existing operational services provide monitoring and short term forecasts of conditions such as storm surges of sea level, wave spectra, currents, floating sea ice, icing conditions, plankton or algal blooms, sea surface temperature, dissolved oxygen, coastal and estuarine pollutants, radionuclides and movement of oil slicks. Many of these services are accessible through the Internet. The existing marine forecast systems provide immediate commercial and social benefits, and essential experience in testing instrumentation, communications, data analysis, and data product delivery to customers.

To facilitate thinking about costs, benefits, and investments, EuroGOOS develop a simple model of the components of investment which will always be needed. Figure 1 in Annex VI shows the connections between these components. The way in which each sector of investment will be developed will change continuously, and the acronyms refer to currently active programmes in each sector.

Figure 2 in Annex VI shows the time-scales on which different types of forecasts influence different industries or activities. For example, storm forecasts are important on time-scales of hours to days, while climate variability forecasts are valuable to agriculture or fisheries on time-scales of months to years. The short term beneficiaries in Figure 2 obtain their benefits in immediate cash profit, or visible reduction in damage. A commercial company or a local government authority can easily justify spending money on a wave forecast which protects an offshore oil platform, or a storm surge forecast which helps prevent flooding. Proof of the justification of investment is obtained within a few months or years. As the time-scale extends the uncertainty becomes progressively greater, and the risk is spread over the whole community. The ENSO cycle is a rewarding target for forecast because the multi-year signal is so strong, and the impacts so immediate on a time-scale less than 1 year. But, generally, the need to estimate risk and probability of damage or benefit at long time-scales makes calculations of benefit difficult.

Here we run into the problem that most studies of the costs and benefits of investing in response to climate variability, natural disasters, or climate changes, assume that the financial discount rate should be set at a level of the order of 7% after inflation. This rate of discount rapidly reduces the incentive to invest in protection or knowledge of risk in regard to future profits or possible disasters. At 7% discount a million dollars in ten years time is worth only half that now, and over 100 years discounted it is worth only 1000 dollars. This rate of discount, applied over more than a few years, encourages people to spend or invest the money elsewhere, and hope that the accrued profit will enable them to fix the problem later, if it occurs. In these circumstances, the rate of discount which should be applied should be reduced, possibly as low as 1%. This makes it more justifiable, on purely economic grounds, to invest in precautionary research and mitigating preparation for long term climate-related problems.

The work of Costanza et al. (*Costanza, R., R. D'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton, and M. van den Belt, 1997. The value of the world's ecosystem services and natural capital.* Nature, *387, 253-260*) also begins to show how the value of the natural environment, and hence the value of preserving it, may be estimated in economic terms over decades.

There are, at least in principle, economic methods for estimating the value of investing in ocean and climate forecasting on all time-scales from hours to decades and even centuries. For instance, one way forward is to analyze each industry activity in terms of its susceptibility to improvement or avoidance of loss by the application of improved ocean forecasting.

For each component of an ocean observing system there will be a certain data stream that could be related to certain economic, social, or environmental benefits. In practice this calculation is not simple, since the same data may be incorporated with many other different data types, producing different benefits to different users. Let us assume that the single investment in a particular range of observations requires several years of deployment and investment, during which the benefits start to accrue, and after a certain period the cumulative return on the investment becomes positive. This is illustrated by any one of the curves in Figure 3 of Annex VI. Each cash flow curve goes negative for a while, and then rises above the zero line, to show a cumulative profit.

Figure 3 shows the effect of combining short- and long-term components of an ocean observing system. Observing component 1 has a maximum cumulative deficit of 2 units, and shows a net economic benefit after 2 years. By contrast, Observing component 4 has a negative cash flow for 10 years before it starts to show any return, and it is 16 years before the return is sufficient cumulatively to pay back the investment. Component 6 is so advanced that it cannot even be started within 10 years, and will require improved scientific knowledge and technology before it can be designed and implemented.

A long-term climate forecasting or global forecasting system based only on the requirement to develop long-term observations and products might be analysed by summing the cash flow curves of observing system components 4, 5 and 6, in Figure 3. The sum of these curves shows an increasing deficit for 12 years, with a maximum deficit of 21 units, followed by a decreasing cumulative deficit up to 21 years, and then a net benefit (Curve A). If observing systems 1, 2 and 3 are added to the whole pattern, cash flow dips to –7 units at 2 years, climbs back slowly to cumulative profit around year 7, and then climbs steadily to cumulative benefits by the 10th year, and 30 units in the date range of 15-20 years (Curve B). This example is a hypothetical and simple model, but it should be noted that systems 1-3 may include observations, instruments and communications devices which will also serve systems 4 or 5. There are differences in accuracy, resolution, stability of calibration, etc., between short-term and long-term requirements, but with good science and a little cunning it is often possible to make the same instruments perform both functions.

The preceding analysis has omitted several factors which are essential in any economic estimate of the benefits of investment in a technological system. All benefits should be calculated as “value added”, that is the value generated less the inputs from other sectors, as if a process is part of the Gross National Product. If this computation is not performed, the summation of the gross value of many activities would add up to a many-fold multiple of the true value of the economy. Each calculation of the justification for investment must also be conducted by computing the discounted or net present value of the factors.

Although some, especially developing, countries have called for estimates of the costs of operational oceanography, in practice agencies seem to be adopting a pragmatic step-by step process, committing to successive stages of ocean observation as each phase appears to provide benefits. This is consistent with an intuitive interpretation of the model presented in Figure 3.

Benefits can best be determined by identifying customers, whether government agencies, international bodies, or commercial companies, determining their requirements for different kinds of operational service, and assessing the economic and social value of the service, as generated by the applications of the data. Depending on the country it is possible to construct mailing lists of many hundreds or thousands of potential beneficiaries from a marine observing and forecasting service at the national level. In addition to these are the intangible benefits that accrue from conserving biodiversity, protecting wildlife, preserving the aesthetic appearance of the coastal zone and wetlands, preserving ecological balance even when it is not shown to jeopardise fisheries or other living resources, and minimising the public sense of disturbance or insecurity which may be caused by climate change or rise in sea level.

It may be possible to maximize short and medium term returns so as to justify the whole system. In practice, expenditure and incomes for the various parts of the system do not occur in the same places, or agencies, and so a national or regional view is required, to maximize the net benefits in terms of public good.

In discussion **the GSC congratulated** Dr. Flemming on his comprehensive presentation on the evolution of methods for evaluating the costs and benefits of GOOS. **The Committee suggested** that the impact of Figure 3 would be improved by the addition of specific examples, for instance drawn from TAO, Argo, and

sea-level systems. **The Committee asked** that the new comprehensive basis for evaluating the costs and benefits of GOOS be broadcast so that developing countries could use it to assess the costs and benefits of GOOS in their own cases.

Action 28: Nic Flemming and colleagues to continue with the development proposed at GSC-II of a cost-benefit regional analysis workshop involving eastern Central and South America (possibly including the Caribbean), and to take place ideally before GSC-IV.

Action 29: Nic Flemming and colleagues to provide specific examples of the development costs of a range of observing system elements, and to put hard numbers on the hypothetical projections in the OceanObs99 paper entitled "Dividends from Investing in Ocean Observations: a European Perspective", prior to GSC-IV.

Mr Hasegawa gave a short presentation on how to estimate benefits, taking an example of ENSO forecasts, dealing particularly with the problem of decision making based on information with inherent uncertainty. He pointed out that if a forecast is provided in a probabilistic way, a user can set a threshold probability of the occurrence of a target adverse event to determine whether he should take preventive action. Simple calculation shows that the threshold to maximize the benefit and the expected benefit depends on the ratio of the cost of the action to the loss from the event. He emphasized that is was important that suppliers of forecasts understand what users need them for, and that the users should be educated as to how to use the information.

5. IMPLEMENTATION OVERSIGHT

The Chairman introduced this topic, asking the GSC to consider what is the most appropriate structure for the international coordination and planning of GOOS implementation. The provisional structure discussed at GSC-II and presented as Figure 1 in the report of the GSC-II meeting (GOOS Report 73) had been modified initially by the Chairman of I-GOOS for the I-GOOS-IV meeting in Paris (June 1999) (see Annex V of the report of I-GOOS-IV; GOOS Report 72). That structure had now been revised again by a small inter-sessional working group in accordance with the requirements of Action 33 from GSC-II. The Chairman tabled the revision for discussion.

The GSC agreed that the tabled structural diagram was an acceptable presentation of one aspect of the GOOS structure, with the proviso that several minor modifications should be made to it before its inclusion in this report as Annex VII.

Action 30: GSC members to give to the Chairman by e-mail their suggestions for modifications to the new web-based design showing GOOS structure and activities, by end July.

Dr. Johannes Guddal presented arguments on behalf of himself and Dr. Dieter Kohnke, the two Co-Presidents of JCOMM) for speeding up the implementation of a fully operational GOOS (working document GSC-III/19). The essence of his presentation was that we still need to convince many users that we have the products that meet their needs, and that one way to do this would be to increase efforts to engage users in product development. One way to show users we have products that meet their needs might be to construct a series of user scenarios, and to give examples of the products that could be available to meet the requirements of these scenarios. A series of scenarios has already been published in GOOS Report 66 (*Global Physical Ocean Observations for GOOS/GCOS: an Action Plan for Existing Bodies and Mechanisms*); these include what managers need to know to improve local flood defenses; to plan national or regional supplies of energy or water; to plan ocean routes; to work offshore in hostile conditions; to plan for and mitigate the effects of El Niño or the Indian Ocean monsoons; and to manage ports and harbours. The prototype GOOS Products and Services Bulletin may be a useful window through which to illustrate examples of services for users (see also agenda item 7.3.6).

The GSC agreed that more should be done to engage users by means of the Products and Services Bulletin, and recommended the following action:

Action 31:(i) Products and Services Committee Advisory Committee to recommend mechanisms for acquiring feedback on products and services (e.g., via trade associations and/or product centres), and to get such agents to help to prepare user scenarios, before year end 2000; (ii) GSC Members to suggest user scenarios, particularly for biological/chemical elements of GOOS, but also for other appropriate elements, with associated examples, and send them to Johannes Guddal by end July for consideration for the Products and Services Bulletin.

5.1 REGIONAL

As the basis for discussion on progress with and requirements for building GOOS on a regional basis, several regional presentations were made, followed by a discussion on regional policy.

5.1.1 National Activities

Much GOOS activity within the regions is happening at the national level. The Director of the GPO reported that through the IOC Assembly, individual contacts, meetings, reports, publications, and the GOOS web site, the GPO has been encouraging individual countries to form national GOOS groups, as required by GSC-II Action 35 (*Encouragement to be given by whatever means to individual countries to develop national groups to promote the development of GOOS (e.g. specifically, to form national steering or coordination committees along the lines recommended above) including placing suggested responsibilities of such groups on the GOOS web site).*

The Director, GPO, reported that the GPO has not yet had time to develop the database of national contacts that was called for by GSC-II **Action 5**, but indicated that this process had begun in late April this year in readiness for the GOOS Forum proposed in association with the first COOP meeting (see section 2, **Action 3**, above).

5.1.2 EuroGOOS

The Director of EuroGOOS, Dr. N. Flemming, reviewed progress in EuroGOOS (background document GSC-III/B11; http://www.soc.soton.ac.uk/OTHERS/EUROGOOS/). It is hoped that lessons about GOOS design, especially for coastal seas, can be learned from the implementation of Baltic GOOS (BOOS), the most advanced regional component of EuroGOOS. The BOOS Chairman, Dr. Erik Buch, described how BOOS works to meet the needs of the Baltic community, referring to background document GSC-III/B24, the Baltic GOOS (BOOS) Plan. Detailed information about EuroGOOS is available on the EuroGOOS web site at http:www.soc.soton.ac.uk/OTHERS/EUROGOOS, including the BOOS Plan.

EuroGOOS is now an association of member agencies that is funded by subscription. and has 28 members from 16 countries. Its intentions were published in January 2000 in a special report: “EuroGOOS Forward Look 1998-2000”. The highlight of 1999 was the Second EuroGOOS Conference held in Rome, and attended by over 300 people, which showed enormous progress in developing and implementing operational oceanography throughout Europe in recent years. The conference proceedings will be published shortly. In the past 5 years EuroGOOS has stimulated the investment in operational oceanography by the EC of 30 million Ecus matched by agency contributions.

At present EuroGOOS focuses on project-driven regional implementation, where national agencies work together and pool their resources to give regional data products. Some 70-80% of planned activities have been achieved. Key major research projects and operational developments progressed during the year include especially the Mediterranean Forecasting System Pilot Project (MFSPP), and the Baltic Operational Oceanographic System Plan. Contacts and meetings have been developed on an Atlantic scale to co-ordinate agency and governmental inputs to the Argo Atlantic project. The MFSPP interfaces a general Ocean Circulation Model for the whole Mediterranean at 1/8 degree resolution with regional models and local high resolution nested ecosystem models. The Target Operational Period of MFSPP demonstrated very effective products of the real time system in pseudo-operational mode. Over 1500 potential customers were alerted to the system, and data products were widely distributed on the Internet.

The BOOS Plan demonstrates the advanced state of collaborative planning for operational oceanography in the Baltic region, and the existing range of ocean data service. Seventeen agencies from 8 countries have combined their skills and resources. Data will be shared in operational mode. The long history of research collaboration and pollution control in the Baltic has resulted in a very large number of routine observations and marine measurements, at time and space scales which are appropriate for operational modelling. The BOOS Plan sets out the integration, standardisation, data assimilation, and modelling needed to provide new services and predictions of water level variation, wave directional spectra, sea ice, three-dimensional salinity and temperature fields, currents, harmful algal blooms, drift of oil spills, and the distribution and transport of hazardous substances. Some of these services already exist in prototype form, and products can be accessed by the Internet.

An important achievement of EuroGOOS's operational oceanography is the usefulness of its products. Many EuroGOOS Member agencies have sophisticated web sites displaying real time data which can be accessed and interrogated free of charge, often with additional information about data archives, data bases, or services which may be available on a commercial basis. Users can access these through the EuroGOOS Home Page. Individual Members' web-sites report hits on their real time and operational data displays at rates of tens of thousands of hits per month indicating that operational oceanography and real time data delivery have reached the everyday individual user, which should be very good for future developments and funding. To facilitate greater exchange of data a EuroGOOS Data Policy has been agreed.

A pioneering workshop was held in March on "Bio-ecological observations in operational oceanography", to identify user communities for operational data products in bio-ecology, methods of observation and technology, and numerical modelling and forecasting techniques. The meeting was successful, and the abstracts and proceedings will be published soon.

A Space Panel has been established to analyze operational mission requirements on the time scale 2005-2010.

The GSC was impressed with the progress being made by EuroGOOS, and especially with the development of BOOS and its presentation by Dr. Buch. **The Committee agreed** that BOOS was a model with useful aspects to follow in establishing GOOS in coastal seas, but it was noted that it does not include open data sharing.

5.1.3 NEAR-GOOS

Dr. N. Hasegawa, the former Chairman of NEAR-GOOS, reported on the results of the 4th session of NEAR-GOOS, in September 1999 (background document GSC-III/B12).
http://ioc.unesco.org/goos/neargoos.htm)

NEAR-GOOS has acted as a catalyst for data exchange. Its most significant achievement to date is that a free and open system for exchanging data has been agreed upon, and that the exchange of data has begun. The creation of NEAR-GOOS led to China setting up its own Real Time and Delayed Mode databases. Korea and Russia are already providing access to data. Training courses are being held to raise skills in data management and exchange across the region.

At its 4th session, NEAR-GOOS began a dialogue with other groups including HOTO, PICES, the HAB programme, ONR and the UNEP Regional Seas programme NOWPAP (Northwest Pacific Action Plan). NEAR-GOOS could evolve to provide the infrastructure for exchange of data by these other groups. The next step is to obtain their requirements (in this context, see **Action 10**, regarding PICES). In addition there is a need to engage with the LMR module of GOOS, and, eventually, to extend NEAR-GOOS geographically beyond the confines of Asian marginal seas.

In discussion, **the GSC encouraged** the plans for NEAR-GOOS and PICES to work towards developing a common interest and/or project in the north western Pacific. **The Committee noted** that NEAR-GOOS had not yet added to its membership agencies with significant interests in environmental and living marine resources issues, and encouraged NEAR-GOOS to take this step at the appropriate time.

5.1.4 MedGOOS

Dr. Silvana Vallerga, Chairperson of MedGOOS, reported on progress in establishing MedGOOS, and on the results of the recent meeting of MedGOOS in Rabat (November 1-3, 1999). MedGOOS was initiated at a GOOS Capacity Building Workshop in Malta in November 1997. It was established by a Memorandum of Understanding signed by research groups in 15 countries. Its initial aim is to develop a pre-operational system, one of the central features of which is the Mediterranean Forecasting System Pilot Project (MFSPP) being developed under the banner of EuroGOOS (see 5.1.3, above). In this context MedGOOS expands the potentialities of EuroGOOS's Mediterranean developments, by bringing in the non-European Mediterranean countries to provide a whole-Mediterranean dimension. MedGOOS and EuroGOOS are thus complementary.

One of the primary objectives of the MedGOOS meeting in Rabat was to develop the MedGOOS strategy, with the following thrusts: (i) raise awareness of the potential of operational oceanography and the GOOS concept; (ii) identify user needs for products, especially in the south and east, as the basis for designing the system; (iii) identify the need for capacity building; (iv) broaden the association to include all Mediterranean countries; (v) initiate selected pre-operational demonstrator projects; and (vi) form north-south linkages to strengthen development. Gaps in data coverage have to be identified. An initial observing system has to be designed. And all agencies have to be brought together. The initial focus for implementing the strategy is a pilot project for *a "Mediterranean network to Assess and Upgrade Monitoring and Forecasting Activity in the basin"* (MAMA), which will be submitted for funding through the Vth Framework Programme of the EU, before the closing date of 28th September. It involves 26 agencies from 19 countries. In addition several bilateral agreements for cooperative projects are ongoing.

In discussion, **the Committee was impressed** with the excellent progress so far, especially in entraining all of the Mediterranean countries in the dialogue about future needs and developments.

5.1.5 Other Regional Activities

The Director GPO reported on other regional GOOS developments.

The GOOS Office in Perth is working with SOPAC on plans for a PacificGOOS workshop on coastal GOOS that will take place in Apia, Samoa, on August 16-17. This will immediately precede a GCOS workshop. Between the two workshops there will be a presentation and discussion on the benefits of the Argo project in the Pacific islands region. Earlier in the year the GOOS Office in Perth had participated in the Pacific Islands Climate Change Conference (17-21 April, 2000, in Rarotonga) at which the focus was on improving the understanding of and responding to climate change and sea-level rise.

In the Caribbean, a regional GOOS body (IOCARIBE-GOOS) formed in April 1999 (see GOOS Report 84, which is background document GSC-III/B14) had spawned an *ad hoc* Advisory Group that met in Venezuela on November 3-5, 1999 to develop a plan for implementing the actions stemming from the April workshop (see GOOS Report 88). The Advisory Group will prepare an inventory of existing systems; draft and distribute guidelines for national participation in IOCARIBE-GOOS; develop links with existing organizations and projects in the region; and provide advice on the development of a Strategic Plan. A second meeting will be held in December 2000 with the aim of preparing a Strategic Plan in time for distribution at the Oceanology International meeting in Miami (April 3-5, 2001).

GOOS-AFRICA had not held any meetings. However, its Chairman, Professor G. Brundritt, a Member of the GSC, had participated on behalf of GOOS-AFRICA in the MedGOOS meeting in Rabat (November 1999), and in the IOCEA (IOC Eastern Atlantic) regional meeting in Dakar (May 5-11, 2000). A paper on GOOS development in the Eastern Atlantic was given at the IOCEA meeting to stimulate the involvement of west African countries in GOOS. Plans were afoot to develop a GOOS-AFRICA capacity building meeting in East Africa some time in 2001.

GOOS-AFRICA has a significant interest in the proposal for WIOMAP (Western Indian Ocean Marine Applications Project). Peter Dexter reported that the WIOMAP proposal is in the process of revision prior to presentation to funding agencies. The revision will create modules that are likely to be more attractive to potential funding agencies than the initial integrated proposal.

In the Indian Ocean the Perth Office is involved in aiding development of an Indian Ocean GOOS. A workshop on this topic was held in Perth when the office was opened (September 1999). Follow-up meetings with the same objective are planned for November 2000. The Head of the GOOS Office in Perth attended the IOC Regional Committee for the Central Indian Ocean (IOCINDIO) session in Teheran in March 2000, where a paper on GOOS development in the Indian Ocean was given to stimulate the involvement of Indian Ocean countries in GOOS.

There had been no direct progress in developing a South East Asia GOOS (SEA-GOOS). Nevertheless, Dr. Peter Dexter reported that in the SEA-GOOS region the proposal for a South East Asia Centre for Atmospheric and Marine Prediction (SEACAMP) had been converted to modular form for presentation to the ASEAN secretariat for funding. SEACAMP, if successful, could initiate SEA-GOOS.

In response to an approach from ICES, the 4th session of I-GOOS in June 1999 approved a resolution calling for ICES and the IOC to co-sponsor the ICES Steering Group for GOOS. The resolution was approved by the IOC Assembly and the ICES Council. Dr. Mike Sinclair of the LMR Panel will be the IOC-GOOS co-chair of the Steering Group, partnered by Dr. Raould Saetre for ICES. The group will meet next in Southampton in October.

A Black Sea GOOS group has been formed and is establishing its strategy under the IOC Regional Committee for the Black Sea.

Regarding links with PICES, see the text in section 4.1.1.3.

5.1.6 Regional Policy

Prof. Nowlin introduced this topic, referring to working document GSC-III/20. The development of GOOS through regional alliances is accelerating. This development is natural and desirable. But, in order to avoid overlap with other existing regional organizations, duplication of effort, inefficient use of resources, and conflicts, it was accepted at GSC-II that there must be a policy to cover regional GOOS development. A small group was asked to prepare a draft policy statement for consideration at GSC-III.

This draft first considers the operational units of GOOS, beginning with the fundamental unit -the national contribution-. It then discusses the rationale for and possible numbers of GOOS regional groups, and makes some suggestions for the definition of regional boundaries. Requirements that must be met by GOOS regional groups are suggested as a procedure for recognizing GOOS regions. Quite a number of GOOS regional groups already exist, are emerging or are being considered. The draft assesses the present situation, then presents some possible next steps.

The potential for confusion and conflict is great in the development of regional GOOS groupings of nations. Recognition of groups claiming or intending to develop a regional GOOS must be carefully considered, both as regards boundaries and the technical capabilities of the proposing, parent organization. Failure to do so will lead to boundary disputes and inefficient or ineffective use of resources. Therefore, the international GOOS organization, consisting of the GSC, I-GOOS and the GPO, must agree on and promulgate a policy as soon as feasible. The document produced by the GSC will provide advice to I-GOOS, which is the body that will set the policy.

5.1.6.1 National level

The contribution of the Member State to GOOS is the fundamental operational unit. This may be a composite of contributions from diverse entities. Nations with a good internal coordination will be better able than others to make substantial contributions to GOOS and to benefit from it.

There are over 120 Member States in the IOC. Most can be assumed to have some role in implementing and benefiting from GOOS.

The first GOOS Commitments Meeting in 1999 was attended essentially by the OECD countries plus Brazil, Chile, China, and Russia. On that basis, it seems likely that the 30 most wealthy nations (including,

e.g., OECD countries plus Brazil, Chile, China, India and Russia), backed by the various national and multinational space agencies and consortia, are going to contribute most of the input to GOOS. Another 20 or 30 countries with modest and growing economies (e.g., Egypt, Malaysia, Mexico, Nigeria, Poland) will be active participants in GOOS. There are a large number of countries in the developing category that would benefit from participation in GOOS. Access to their sea area and offshore islands would be very useful for developing GOOS. Clearly, building capacity in these nations to participate in and benefit from GOOS is a priority.

Some nations are so large, and have such an extensive oceanic coastline, that alone they effectively form a region which is a logical component on the global scale. Many nations already report belonging to regional GOOS organizations.

5.1.6.2 The nature and size of regions

There are about 180 states in the United Nations, and over 120 in the IOC. Sea-related UN agency activities use regional scales between national and global:

FAO	:	35 regions (global coverage);
UNEP	:	12 regions (not global coverage);
IOC	:	8 regions (not global coverage);
WMO	:	6 regions (global coverage); and
IHO	:	sea area names over 100 regions (global coverage).

Potential reasons for regional structures:

(i) **To reduce the administrative complexity** of trying to administer/coordinate national from a single office. Logically grouping countries into clumps of from 3-4 to 10-20 reduces the total units required to cover the globe to between 30 and 50;

(ii) **To group those countries that are geographical neighbours, and have common political or social interests.** The European countries may wish to work together or the African countries or the South American countries. FAO has both continental and oceanic regions, the former designed to administer inland and freshwater fisheries. A nation may be a member of both its continental block and the adjacent oceanic region. GOOS has requirements for similar groupings.

(iii) **To provide scientific, technical, and logistic collaboration in a sea area, where separate endeavours by individual states would be less effective and efficient, or even impossible.** The smaller regions where this reason is relevant are such areas as the Baltic, Adriatic, or Japan seas. At the oceanic level, it is relevant on the scale of the North Atlantic or the South Pacific.

As part of GOOS implementation, other grouping of nations focused on Projects and Programmes will be formed for the purpose of testing and operating elements of the global observing system. These may be focused on regions and types of observations (e.g., ICES-GOOS), on a narrow range of observations (e.g., the proposed Sea-keepers), or on a product (e.g., the ENSO observing system). It is not our purpose in this policy document to circumscribe groupings of the latter type.

5.1.6.3 Definition of the boundaries of regions

The definitive rationale for the designation of GOOS regions and their boundaries is the need to monitor, model, and predict sea water bodies which can be treated as physical or biological units. It does not make sense to model one half of the North Sea or of the Gulf of Mexico. Some UN agency systems of nomenclature and regions tend to divide the oceans in half, so that you have a Northeast Atlantic, a Northwest Atlantic, etc. GOOS is more logically defined in terms of nested regions of different scales. **There is no contradiction in having a North Atlantic region, which contains within its model boundaries a northwest European shelf region or a USA Atlantic seaboard region. Similarly, there could be a Mediterranean region, or an Adriatic or Aegean sub-region.**

A requirement of nomenclature is that **the boundaries of named sea areas should be consistent with the nomenclature approved by IHO.**

FAO already recognizes both continental regions and oceanic regions, and a coastal state can therefore belong to a region of each type if appropriately situated geographically. **It is natural that GOOS should have regions that overlap in purview the same body (ies) of sea water, such as a European region (EuroGOOS), a Mediterranean GOOS, and an Africa GOOS. Moreover, a coastal state may belong to more than one region.** It is necessary that distinct lines of responsibility and clear lines of coordination be established.

5.1.6.4 Procedure for recognizing GOOS Regions

(i) **GOOS policy must strike a cautious balance between encouraging the development of regional bodies within a general overall strategy, and the excessive promotion or early recognition of groups which do not have the authority or expertise to develop or implement GOOS.** Other reasons for delaying the recognition of a regional group might be the inappropriate size of the region (too small or too large), or the existence of a distinct group also claiming to be in a position to implement GOOS.

(ii) **Any regional organization being set up to implement GOOS must comply with the GOOS principles and strategy.**

(iii) GOOS is not just another programme to assist in obtaining support for marine science. There are numerous ways in which scientific projects can be developed in a region, as well as existing channels for technical aid and assistance, e.g., the UNEP Regional Seas programme, FAO, or UNDP, that provide resources for development of economic and social benefit. **A GOOS regional organization should be recognized only if it will add something genuinely new and valuable to this existing pattern. The new feature must contribute to the integrated, sustained, end-to-end system from observations to products.** If these attributes are not prominent in the plan to establish a GOOS region, the proposal should not be endorsed.

(iv) GOOS must embrace initiatives concerned with information needed by participating nations and organizations from local to global in scales. At the regional and sub-regional levels, the observations and data processing conducted in operational oceanography are likely to focus mainly on site-specific variables, and to be processed in such a way as to produce high-resolution products of strictly local interest. From the point of view of coastal states, these high resolution, customized products are likely to be of the greatest value. Politicians and funding agencies must perceive GOOS as concerned with the variables and scales that will provide the information of highest economic concern to the country and region involved in the system.

(v) **As with all GOOS activities, it is expected that data from regional activities shall be available for use by outside parties**, even if the data are not distributed globally in real time. In recognizing regional GOOS activities it may be advisable to acknowledge that data and products from such activities differ from the truly global data sets, and to recognize them as regional or sub-regional in nature.

5.1.6.5 Assessment of present regional situation

(i) **NEAR-GOOS and EuroGOOS exist and have several years of experience, with many lesions learned. MedGOOS, Black Sea GOOS, and IOCARIBE GOOS have been formally recognized by IOC and have held their first meetings.** There is sufficient local infrastructure and experience to be fairly sure that operational observations and modelling will develop to good professional standards in each region.

(ii) **Africa GOOS has held its first meeting**. There appear to be logical reasons for keeping the countries together as a continental unit, while at the same time recognizing the importance of four or more different oceanic areas of operation: Mediterranean Sea, Red Sea, Indian Ocean, and Atlantic.

(iii) **There is very dispersed activity scattered over many of the island states of the South Pacific, which falls under the umbrella of the newly formed PacificGOOS.** Given the lack of resources and the tenuous skill base, it is difficult to see how much progress can be developed by the region itself.

(iv) **Southeast Pacific GOOS. The countries on the west coast of South America are developing collaborative programmes related to plans for the coastal elements of GOOS.** Their design includes a set of nested scales, entirely consistent with GOOS strategy. No official regional proposal yet exists, but this activity likely will continue to develop.

(v) **Several delegates to I-GOOS-IV mentioned their aspirations to create a South American continental GOOS association.** There are no official proposals yet.

(vi) **Southeast Asia GOOS (SEA-GOOS).** There is a very strong logical requirement for a government-based observing system throughout Southeast Asia that would provide the public domain infrastructure and large scale of observations needed to support the many commercial networks and local agency observations in the region. Recognising local political sensitivities, it is not yet clear how this structure might develop.

(vii) **A proposal for an Arctic GOOS was discussed informally at the first GOOS Commitments Meeting** and was well received by the delegates present. Such a regional operational system could build on many pre-existing science and monitoring programmes.

5.1.6.6 Final remarks

(i) **There is a strong logical argument for implementing GOOS through a combination of national, regional and global scale institutional structures. The driving reason for multinational structures should be to provide scientific, technical, and logistic collaboration in a sea area**, where separate endeavours by individual states would be less effective and efficient, or even impossible. Often this will involve a water mass the physical and biological dynamics of which need to be studied and managed as an integral unit. **GOOS regions should be based wherever possible on either geographical groupings of countries with a common interest and a wish to work together.**

(ii) **Eleven regional groupings already either have been formed or are being discussed as possible GOOS regions**. This number excludes the subregions within EuroGOOS and the possible ocean extensions of Africa GOOS in different directions.

(iii) **Most of the developed or incipient GOOS regions identified thus far seem to have an appropriate scale and membership, with a reasonable chance of implementing operational ocean observations and services.** Some regions are getting off to a very slow start, but the effect is not actually negative.

(iv) **The *ad hoc* formation of GOOS regions so far has been carried out without any standard formulae** for the creation of a region; with no formal procedure for recognition of a region; with no specification for the minimum criteria for a region; and no format for the relations between regions, between regions and the GOOS Project Office, or between regions and the GOOS module panels. These defaults need to be corrected, but without creating so much bureaucracy that it becomes impossible to form any new regions.

(v) If agreement can be reached on the main points constituting a policy for regional GOOS development, **a draft document could be presented to I-GOOS-V.**

5.1.6.7 Discussion

In discussion, **the GSC reconfirmed** the importance of the development of GOOS by regional groupings of countries and agencies, and the need for a policy to cover this. **The GSC accepted** that GOOS is not just an observational programme and encouraged regional partnerships to include users at the value-adding level.

The Committee decided that the working document was a good beginning, and it should be revised as a discussion document, not as a policy statement.

Action 32: (i) GSC members to send initial suggestions for modifications to the Regional Policy document to Chairman by mid June; (ii) revised document to be circulated to members for final comment by end June; (iii) final version to be published as a GSC document and submitted to I-GOOS-V for information.

5.2 GLOBAL

5.2.1 WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM)

5.2.1.1 JCOMM Plans

Peter Dexter reported on progress with JCOMM, formation of which by merger of the WMO's Commission for Marine Meteorology (CMM) and the WMO/IOC Integrated Global Ocean Services System (IGOSS) was approved by the WMO Congress and the IOC Assembly in 1999 (background document GSC-III/B15). The first full meeting of the new Commission will take place in June 2001, in Iceland. In preparation for it a first JCOMM transition planning meeting took place in St Petersburg, Russia, July 23-25 1999. It will be followed by a second transition meeting in Paris on June 14-16 2000. An *ad hoc* management team has been set up to manage the transition. It is led by the two interim co-presidents of JCOMM, Johannes Guddal (past president of CMM) and Dieter Kohnke (past Chair of IGOSS).

At the first transition planning meeting, two *ad hoc* Working Groups were created, one to devise a work plan and structure for JCOMM, and another to devise a strategy for capacity building. The strategy for capacity building is not yet complete. Peter Dexter outlined the development of the structure so far. It comprises a number of areas of specialist expertise which group into Programme Areas (PAs) activities that were formerly handled separately by CMM and IGOSS. In due course the clustering is meant to lead to integration of these formerly separate activities. The four Programme Areas proposed are: data management; marine services; observations; and capacity building, otherwise known as ETIS (Education, Training and Implementation Support). These will report to and be coordinated by a Management Group. Within each Programme Area there will be a number of small teams of experts focussing on specific activities; marine services will include teams on maritime safety; wind-waves; and sea-ice; observations will include teams on ship observations, data-buoy observations, and sea-level observations; and so on. The Terms of Reference (ToRs) for the Management Group and each Programme Area have been drafted. For the specialist teams within each Programme Area, the merger will involve some merging of present Terms of Reference, e.g., in the case of the ship observations team a merging of the ToRs for ASAP (Automated Shipboard Aerological Programme), SOOPIP (Ship of Opportunity Programme Implementation Panel) and VOS (Voluntary Observing Ship Programme). The former IGOSS Electronic Products Bulletin will also be part of the new structure, as the JCOMM Electronic Products Bulletin.

Peter Dexter sought the committee's advice on how JCOMM can best meet GOOS interests. **The Committee considered** that more should be done to ensure that existing data streams and services should be continued without interruption until agreement had been reached on how they fit into the new structure. **The Committee also considered** that the draft structure as presented at the meeting appeared cumbersome, and made several suggestions for streamlining.

Action 33: It is suggested that JCOMM (i) ensure that existing data streams and services are continued without interruption and (ii) work toward a streamlined structure.

There was an extended debate about how JCOMM could take on responsibility for data unrelated to weather or climate. **The GSC agreed** that JCOMM should start by building on the systems and services that exist at present, but **the Committee considered it essential** that JCOMM should prepare itself to manage other data (e.g., biological and chemical) as they become available.

Action 34: The GSC recommends that JCOMM be prepared to manage the archival and distribution of non-physical global datasets/products as they become available. Examples might be dissolved oxygen, macronutrients (N, P, Si), surface ocean and atmosphere pCO_2, and derived products from ocean colour satellites such as chlorophylla pigments. QC should be managed at a specialist level prior to submission to JCOMM.

In the context of adding new data streams, **the Committee noted** that JCOMM does not include any service relating to tsunamis. Although such a service is already provided through the International Tsunami warning service based in Hawaii, in principle, the tsunami warning service could be folded into JCOMM in future through the waves and surges group. **The Committee agreed** that in seeking new member for the JCOMM wave group, expertise in wind-waves should be given priority. In view of the expert team for waves and surges under JCOMM, the GSC does not believe a second group under the OOPC is warranted at this time.

Action 35: In seeking new members, expertise in wind-waves should be given priority by JCOMM.

Under capacity building, **the Committee noted** that ETIS is equivalent to the IOC's TEMA (Training, Education and Mutual Awareness) programme, and asked that the ETIS team be asked to adopt the GOOS Capacity Building Strategy and Principles. In addition Geoff Holland, as Chair of the GOOS Capacity Building Panel, was asked to comment on the JCOMM Capacity Building papers before JCOMM-TRANS-II (Paris, June 2000).

Action 36: GPO to provide G. Holland with JCOMM Capacity Building papers for comment prior to JCOMM-TRANS-II (June 2000).

Geoff Holland presented a report on polar seas and other ice-covered regions (working document GSC-III/21) and asked the Committee for its opinion on the need for the proposed development of a JCOMM technical advisory body dealing with these topics. He noted that the report was a draft and asked for feedback to help to reduce duplication and improve accuracy. He asked if in view of the requirement for specialist activities in Arctic and Antarctic or Southern Ocean observation the Committee saw any need at this time for an Arctic or an Antarctic GOOS body, or for some polar GOOS body to deal with these matters. He noted the strong interest in Europe on the Arctic, for example, in EuroGOOS where there is an Arctic task team. He also noted that countries with Antarctic interests produce a data directory that would meet some GOOS requirements.

In view of the JCOMM sub-group on Polar Regions and the WMO's CLIC (Climate and Cryosphere project) initiative, **the GSC decided** not to recommend the formation of any GOOS body for polar regions at this time.

Action 37: Members to provide feedback to Geoff Holland by the end of June on the JCOMM Polar Strategy report.

5.2.1.2 Tropical Atmosphere Ocean array (TAO) Implementation Panel

The Committee was asked to consider the question of funding for international panels required for coordinating the implementation of observing system elements. Clearly the project offices of GOOS and GCOS are not in a position to support all of the many panels needed for oversight of implementation of the observing systems. At present these panels are funded in different ways. The DBCP for example is funded by subscription from interested countries. With operational funding having been made available for the TAO array, the question has arisen as to how the TAO-IP should (or could) be funded in future. Since the TAO-IP addresses questions broader than just the implementation of the TAO array, its funding should probably not come totally from TAO operational funds. This raises a generic issue that might be addressed effectively through JCOMM, which will be the forum in which nations work out how they are going to cooperate in ocean observations.

The Committee agreed that the GSC and the GPO should help in pre-operational developments, but that, once activities become operational, their costs should be borne by the operating groups. Peter Dexter noted that this matter will be considered further at JCOMM-TRANS-II (Paris, June 2000).

5.2.2 The GOOS Initial Observing System (GOOS-IOS)

This item was introduced by Colin Summerhayes, referring to working document GSC-III/22. The GOOS Initial Observing System (GOOS-IOS) is the nucleus on which GOOS will grow. It unites the main global observing sub-systems supported by the IOC, WMO and (in the case of coral reefs) the IUCN, and includes measurements from ships, buoys, coastal stations and satellites (see below). In addition to these international elements, as of July 1999 many nations are now contributing substantial parts of their national observing systems to GOOS, as indicated in background document GSC-III/B2, which lists commitments made at the Initial GOOS Commitments Meeting in Paris, July 5-6, 1999. The Commitments Meeting is dealt with under agenda item 5.2.2.4, below.

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

5.2.2.1 Level 1 contributions

Level 1 contributions to the GOOS-IOS are those for which statements from operators exist to the effect that, whatever else they may contribute to, they are expressly contributions to GOOS.

- The operational ENSO Observing System in the tropical Pacific, including the Tropical Atmosphere Ocean (TAO) array of buoys [http://www.ogp.noaa.gov/enso/] [http://www.pmel.noaa.gov/toga-tao/] and TRITON buoys;
- Meteorological measurements from the Voluntary Observing Ship (VOS) network of the WMO;
- Upper ocean measurements of the Ship-of-Opportunity Programme (SOOP); [http://www.ifremer.fr/ird/soopip/]
- Fixed and drifting buoys co-ordinated by the Data Buoy Co-operation Panel (DBCP); [http://dbcp.nos.noaa.gov/dbcp/]
- The Global Sea Level Observing System (GLOSS) network of tide gauges; [http://www.pol.ac.uk/psmsl/gloss. info.html]
- The Global Temperature and Salinity Profile Programme (GTSPP); [http://www.nodc.noaa.gov/GTSPP/gtspp-home.html]
- The Global Coral Reef Monitoring Network (GCRMN); [http://coral.aoml.noaa.gov/gcrmn/index.html]
- The Global Telecommunications System (GTS) of the WMO;
- The Global Data Centre of the Atlantic Oceanographic and Meteorological Laboratory (AOML) of the US National Oceanic and Atmospheric Administration (NOAA) [http://www.aoml.noaa.gov/];
- Ocean observations from the operational satellites of NOAA and other entities; [http://www.oso.noaa.gov/]
- The Continuous Plankton Recorder (CPR) programme of the Sir Alister Hardy Foundation for Ocean Science (SAHFOS) [http://www.npm.ac.uk/sahfos/introduction.html];
- The ICES International Bottom Trawl Survey (IBTS) of the North Sea;
- Time Series Station 'S' off Bermuda;
- Time Series Station Bravo in the Labrador Sea;
- The IGOSS (now JCOMM) Electronic Products Bulletin; [http://iri.ldeo.columbia.edu/climate/monitoring/ipb/introduction.html]

The last five elements were added in 1999 (see report of GSC-II for details).

Dr. Summerhayes reminded Members that the LMR Panel had recommended adding the following International Biological Monitoring Programmes to the GOOS-IOS:

(i) Southern Ocean Ecosystem Monitoring in connection with the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR);
(ii) CalCOFI (California Co-operative Oceanic Fisheries Investigations);
(iii) Time series Station P-Line P in the North Pacific;
(iv) Algaline (a Finnish contribution to the Baltic monitoring programme).

The LMR Panel had also recommended adding some national biological monitoring programmes to the GOOS-IOS, including Chile's EcoFish programme, and the Korean and Japanese programmes.

In discussion, **the Committee approved** the addition of the following components to the GOOS-IOS:

- GOSIC (as recommended by GSC-II **Action 25**);
- Selected National Operational Centres (as recommended by GSC-II **Action 25**; see **Action 32**, below);
- CalCOFI.

Action 38: GSC Executive Committee and OOPC to develop and evaluate a list of potential major operational centres for the GOOS Initial Observing System; GPO to contact approved centres to determine their willingness to be part of the GOOS-IOS, before GSC-IV.

The Committee decided that more information was required on CCAMLR and Station-P/Line-P, to evaluate their acceptability, and that the other LMR suggestions should be considered at the first meeting of COOP.

Action 39: (i) Angus McEwan to contact CCAMLR (a potential element of the GOOS-IOS) to find out if they can meet the GOOS Principles, especially regarding data release, by end July; (ii) Warren Wooster/ Ron Wilson to provide more information about Station-P/Line-P.

5.2.2.2 Level 2 contributions

Level 2 contributions are those for which specific commitments remain to be negotiated. The list has been modified from that given in the report of GSC-II to put all US national programmes under the heading "Appropriate components of national observing systems":

- Selected ocean observing satellite missions;
- Appropriate parts of JCOMM (Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology);
- Appropriate parts of IODE (International Ocean Data and Information Exchange programme of IOC);
- Appropriate components of national observing systems (like the US Sea Ice Centre; the US PORTS programme);
- Appropriate commercial observing systems (like long-lived oil platforms);
- The international Mussel Watch programme (recognizing that it measures contaminants but does not provide direct information on the health of the organism or the environment);
- Appropriate parts of the IOC's Harmful Algal Blooms (HAB) programme.

The Committee noted that GSC-II **Action 26** (*GPO to work with OOPC to determine which satellite programmes could/should be added to the GOOS-IOS*) was still outstanding.

5.2.2.3 Major Pilot Projects

Major Pilot Projects are also specifically acknowledged as parts of the GOOS-IOS. They include:

- Baltic GOOS, a EuroGOOS regional project (section 5.1.2, above);
- The Mediterranean Forecasting System Pilot Project (MFSPP) contributing to both EuroGOOS and MedGOOS (section 5.1.2, above);
- The Western Indian Ocean Marine Applications Project (WIOMAP), which is at present unfunded (section 5.1.5, above);
- The Pilot Research Array in the Tropical Atlantic (PIRATA);

[http://www.ifremer.fr/orstom/pirata/pirataus.html]
Dr. Ilana Wainer reported that the PIRATA project has made considerable progress over the past 2 years. It has moved beyond its initial pilot phase into a consolidation phase that will take it to 2006, when it is intended that it will become operational. A resource board has been formed to oversee the necessary logistics and to find the resources to meet pre-operational requirements. In order to extend the PIRATA array beyond its present "backbone", and to entrain more African countries in the PIRATA programme, meetings were held recently in Cape Town and Casablanca. A further expansion meeting is planned for Brazil in September 2000 focussing on the south-west Atlantic;

- The Global Ocean Data Assimilation Experiment (GODAE), described in section 4.1.1.1.1, above;
- The Argo float programme of GODAE, described in section 4.1.1.1.2, above;
- The RAMP (Rapid Assessment of Marine Pollution) pilot project of the HOTO Panel, mentioned in section 4.1.1.4, above.

As mentioned in section 4.1.1.3, above, at is third meeting, the LMR Panel had proposed three additional pilot projects:

- A Northeast Pacific CPR Network;
- The BENEFIT Programme/Benguela Current Large Marine Ecosystem Programme;
- Biological Action Centres (BACs).

The Committee agreed that inclusion of these as GOOS Pilot Projects should be considered at the first meeting of COOP.

5.2.2.4 Initial GOOS Commitments Meeting

Dr. Angus McEwan introduced this item, recalling that 22 nations and 5 organizations had attended or submitted written papers to the Initial GOOS Commitments Meeting in Paris on July 5-6, 1999, and had committed certain parts of their current or planned national observing systems to GOOS. The report of the meeting will be published shortly as GOOS Report 80 (see background document GSC-III/B2). Dr. McEwan reported that for the most part (with the notable exception of Germany) not enough detail had been provided on the various commitments for the GSC or any other body to determine the extent to which they met the GOOS Principles, and were therefore acceptable to GOOS.

The GSC Chair, Prof. Nowlin, noted the lack of any mechanism to evaluate contributions to GOOS. He had been working intersessionally with the GPO, Dr. McEwan, Peter Dexter and Maria Hood to develop a mechanism that could be used not only to evaluate the contributions that had been offered at the Commitments Meeting, but also to evaluate any other possible contributions against the GOOS Principles. Dr. McEwan had drafted a letter that could be sent to agencies offering potential commitments.

The Committee considered that it was premature to add to the GOOS-IOS the various national commitments made at the Initial GOOS Commitments Meeting, because only general information was available about them. **The Committee decided** that a letter was required, consistent with **Action 34**, below. **The Committee agreed** that whatever commitments were made should be compatible with the proposed MEDI software system (see section 4.2.2.2.2), and in a format enabling them to be taken directly into GOSIC.

Action 40: GCS Chair, together with Chairman I-GOOS and Director GPO, to prepare a letter for Secretary IOC to send to IOC representatives and other selected foci in member states, by September 2000, for the purposes of (i) noting that GOOS has advanced to the state of assembling elements into an integrated global-scale system focused first on climate and marine services but extending to biogeochemical observations needed for products, (ii) alerting that GOOS will be approaching nations through their GOOS (/GCOS) national committees for contributions to this system, and (iii) requesting additional information regarding intended contributions (only for contributors to the 1st GOOS Commitments Meeting).

The Committee further agreed that GOOS planners need a list of ongoing observational activities with details of relevant information (e.g., duration, data types, availability, products produced, etc.). This is broader than the list of coastal monitoring information previously sought by C-GOOS and LMR and provided

by the GPO through the GOOS Inventory. Given such information the design panels would be better informed as to which of these elements should be sought as contributions to the observing system.

5.2.3 GOOS Data and Information Management

Dr. R. Wilson presented a second version of the draft Data and Information Management Plan for GOOS (working document GSC-III/24), revised in accordance with advice given at GSC-II. He explained that the plan is to be used:

(i) to form the basis for a review of the GOOS Initial Observing System, to bring the existing applications up to the standards established for GOOS end-to-end systems;
(ii) to guide the development and implementation of new end-to-end systems, as pilot projects are implemented and evolve into operational systems; and
(iii) to be a source of information on all aspects of GOOS data and information management both for developers of new systems and for users requiring access to GOOS data and information management.

He recommended that GOOS data and information management should proceed along two lines:

(i) review and further develop the GOOS Initial Observing System in terms of its data flows, archival procedures, and products; and
(ii) develop new end-to-end subsystems as part of the development and implementation of pilot projects.

The Committee agreed that the document as now constructed is basically what is required, though it still needs some improvement before being published. One of its uses is to allow Panel chairs to see what other parts of GOOS will look like in operational mode. It should be a useful aid in identifying strengths and weaknesses as the basis for improving the system. Data archaeology and rescue should be added to the analysis phase of each element. It would be useful to include regional elements like MedGOOS. The final document will need an executive summary.

What is required in addition is an indication of the next steps, describing how the data management system can be achieved, and identifying gaps in the existing system and ways of filling them. This is a task for the advisory panels and pilot project teams.

The Chairman thanked Ron Wilson for the hard work he had put in to the first and second drafts of the plan.

Ben Searle, Chairman of IODE, noted that IODE would be willing to assist pilot projects in developing their data and information management plans.

Finally, the Committee noted that a GOOS data policy will be formulated when the IOC approves a new Data Policy, which is not likely to be before the next meeting of the IOC Assembly (July 2000).

Action 41: (i) Members to send comments on the GOOS Data and Information Strategy to Ron Wilson by end of June, including comments on how to improve the biological/chemical elements; (ii) Ron Wilson to work with GPO and others as appropriate (including Tom Malone and Mike Fogarty) to finalize the document, including an Executive Summary, by year end 2000, and to publish it on the GOOS and GOSIC web sites as Version 1.0.

Action 42: Panel chairs to involve IODE in aiding the pilot projects build their data and information management plans.

6. LIAISON/INTEGRATION

6.1 GCOS

Kirk Dawson described briefly the latest developments in GCOS, reviewing the decisions of the 4th and 5th Fifth Conference of the Parties (COP-IV ad COP-V) to the UN Framework Convention on Climate Change (FCCC), and referring to background documents GSC-III/B16 and B17. On behalf of all the observing systems, including GOOS, GCOS reports annually to the COP on the adequacy of the observing system for climate, and on the gaps in that system which need to be filled. GCOS is now providing guidance on the development of national plans and reports that will provide the COP and GCOS with a regular overview of national plans for climate observations.

Kirk Dawson told the GSC that COP-V called for the development of capacity building through regional workshops, and noted that the first of these would be held in Apia, Samoa, in August 2000. The UN FCCC had persuaded the World Bank's GEF to make limited funds available to support some of the capacity building requirements that emerged from the workshops, though not hardware.

A meeting of interested nations, held recently in Toronto, had examined the possible role of an intergovernmental mechanism in providing GCOS with a higher profile and better funding. It was decided that rather than creating the equivalent of an I-GOOS for GCOS, GCOS should make better use of the existing intergovernmental machinery, by presenting its case to the governing bodies of all of its sponsors. In this context, GCOS had plans to approach the governing councils of ICSU, UNEP and the IOC, and was proposing to ask FAO to become a sponsor.

To make GCOS more responsive to the needs of the user community, it was proposed to change its membership from almost wholly scientific and technical to more operational, for example by adding more people from government agencies concerned with climate issues. GCOS should also concern itself more with implementation, to the extent of developing an implementation strategy.

The immediate goal is to attract more resources into GCOS so as to increase the size of the Secretariat, in order to achieve more of what the sponsors wish to see emerge from GCOS. It is hoped that this will come about through building ownership at the national level, for example through the new reporting mechanisms specified by the UN FCCC.

In discussion, the GSC agreed that GOOS should also be drawn to the attention of the governing councils of ICSU and UNEP.

Action 43: GPO to work with ICSU and UNEP representatives to select particular GOOS issues to be taken to the meetings of ICSU and UNEP management bodies, before GSC-IV.

6.2 GTOS

Mr. Jeff Tschirley, Director of the GTOS Secretariat described briefly the latest developments in GTOS. A number of activities are being undertaken, but severe financial difficulties prevent action at the scale of either GOOS or GCOS. A representative of GTOS has participated in C-GOOS meetings to ensure as far as possible that the two systems evolve in a mutually compatible way.

Mr Tschirley described the TEMS (Terrestrial Ecosystem Monitoring Sites) database, which has been redesigned on the advice of the Terrestrial Observing Panel for Climate. The focus is on fewer sites with longer term records. Tom Malone suggested that it might be useful to match the TEMS database with the GOOS Inventory. Ben Searle suggested that it would be useful to see how the TEMS and MEDI systems could be brought together.

Action 44: IODE to work with GTOS to see to what extend TEMS and MEDI can be made complementary.

6.3 CEOS AND IGOS

Francis Bretherton introduced this item. GOOS shares common interests with CEOS, the Committee on Earth Observation Satellites, which brings all of the space agencies together to explore common interests. Both GOOS and CEOS belong to the Integrated Global Observing Strategy (IGOS) Partnership, where GOOS is represented by the GPO and the GOOS sponsors. The IGOS Partners (IGOS-P) have decided to move forward through major themes. The idea of the themes is that they should be comprehensive and credible approaches to meeting the needs of a major application area for sustained observational information; a focus that could justify the investment of resources in its own right at the same time as assisting the development of related applications as the opportunity arises.

Recognizing the considerable advances made by GOOS in recent years, the first of these themes is the IGOS Oceans Theme, set out in background document GSC-III/B18. Several people in the GOOS community have made inputs to the Oceans Theme report, including Colin Summerhayes who is one of the co-authors of the document. The second theme, currently under development, is an Integrated Carbon Theme, which will include the ocean carbon cycle. GOSSP has been much involved in providing the IGOS Partners with input to and comment on the development of the two themes.

Dr. Bretherton noted that the Oceans Theme document fairly states the major immediate satellite issues, particularly those of continuity within the planned international satellite programme. He regretted that the document lacked emphasis on the need for a stable infrastructure devoted to data exchange, product generation and quality assurance at all levels, because without such an infrastructure and an indication of the users' needs for the products, it becomes very difficult in an environment of scarce resources to justify some of the ongoing measurements. He also noted that a summary document is still needed that conveys to an interested but non-specialist audience the full scope and phased development of projected GOOS implementation under this theme, together with the specific high level decisions that are needed at each stage from both national and international organizations in order for it to become a reality.

Dr Bretherton endorsed the view that although the value of sustained satellite measurements of ocean colour is not yet well documented, in view of the importance of the subject, preparations should be made for follow on missions without gaps in anticipation of a positive outcome of the evaluation (see **Action 16**, section 4.2.1.1).

Dr. Bretherton told the GSC that in the context of an Integrated Global Observing Strategy he saw the underlying issue as how to manage the complexity that arises from multiple applications of shared information streams that themselves derive from multiple, in homogenous methods of measurement. To illustrate his point he used the tree diagram shown in Annex VIII, explaining that IGOS can be likened to a grove of trees, each one of which has spreading roots that represent individual observing networks and sub-systems, and branches that represent the distribution and reprocessing associated with tailoring information to specific applications (the leaves). In between is a trunk where raw observations are assembled, cross-checked, analyzed and synthesized into core products that provide the common basis for application areas. Systems analysis has to start with the trunk and the match it provides between user needs and available observational information. A group of individuals with specific knowledge of that trunk and its connections, sharing a vision of user needs, can usefully analyze potential tradeoffs among the pieces which serve to improve performance of the whole. That is the existing structure of a rolling review.

He went on to explain that as it is presently operating the IGOS is more akin to a Banyan Tree than a grove of isolated trees; it has branches and roots inter-connecting the trunks (themes), each of which supports independent and sometimes competing crowns. In this situation no individual or group of individuals can have in-depth first hand knowledge of the entire complex. A carefully constructed shared information base is critical to the effective functioning of the whole. Sub-division into themes can help eventual development of the total architecture, but somewhere there has to be an organization cognizant of the gaps and overlaps that such division creates, and capable of recognizing and resolving conflicts in priority between different application areas.

In discussion, Neville Smith noted that GODAE supports the conclusions of the IGOS Oceans Theme document particularly with respect to surface topography (altimetry) and surface wind vectors. GODAE also

supports experimental missions for surface salinity and to better determine the geoid. However, GODAE could only justify one scatterometer mission, where the Oceans Theme document recommends two.

With regard to the tree cartoon shown in Annex VIII, Ralph Rayner observed that the trunk of the tree is not commercially viable, so we will probably not see commercial firms operating throughout the tree from roots to leaves, except in certain circumstances.

The GSC welcomed the progress made by the IGOS Partners in the development of an Oceans Theme paper. In particular, it noted the consolidation and rationalization of remote sensing requirements relevant to GOOS. Further, **the Committee noted** that through the OceanObs'99 Conference, a consolidation and integration of the requirements specified in the Oceans Theme paper with other observations, particularly *in situ* observations, has been achieved, at least for the physical and climate aspects. **The GSC would like** the CEOS Strategic Implementation Team, through the IGOS Partners, to continue to work with the satellite agencies to ensure the GOOS requirements for remote sensing are met and that, in turn, the satellite agencies are made aware of the many GOOS applications that depend on satellite data. Further, for the integration of satellite and *in situ* components, **the GSC requests** the OOPC to continue to work closely with GOSSP and the Oceans Theme to ensure both operate effectively together. **The GSC accepted** that the space agencies are using the themes as long-range planning tools, and **agreed** that GOOS needs to work through this same mechanism to ensure adequate coordination between the space and *in situ* sectors. **The Committee decided** that it needs to know more about where the IGOS Partners are going with the proposed themes, and to become more engaged in the process of developing and implementing the themes.

Action 45: (i) GOSSP and the GPO should request the IGOS Partners (June 2000 meeting) to ensure the GOOS requirements are met, remind them that many GOOS applications depend on satellite data, and point out to them the requirement for the continuance of ocean colour observations beyond 2005; (ii) for the integration of satellite and *in situ* components, the GSC requests the OOPC to continue to work closely with GOSSP and the IGOS Partners' Oceans Theme to ensure both operate effectively together.

6.4 WCRP (CLIVAR)

Dr. N. Smith reported briefly on progress with CLIVAR and its relation to GOOS**.**

6.5 IGBP (LOICZ; GLOBEC)

Dr. T. Malone and Dr. W. Wooster reported briefly on progress with LOICZ and GLOBEC and their relations to GOOS. The LOICZ Project Office has participated in the recent meetings of C-GOOS, so as to ensure that the development of the C-GOOS plan is consistent with developments in LOICZ. In much the same way, experts on GLOBEC have been involved in the development of the plan for LMR.

6.6 OTHER

Interactions with UN Convention Secretariats are reported under the appropriate agenda items above (see C-GOOS, OOPC, LMR, HOTO, and GCOS).

Prof Nowlin reported briefly on interactions with the Partnership for Observations of the Global Oceans (POGO) (background paper GSC-III/B19). Together with Neville Smith (OOPC) and Colin Summerhayes (GPO), he had attended the first formal meeting of POGO (San Diego, December 1999), where he had given a presentation on GOOS. The actions being taken by POGO to support GOOS, and spelled out in the background document, were along the right lines.

7. OUTREACH/ INFRASTRUCTURE

7.1 CAPACITY BUILDING

The Chairman of the GOOS Capacity Building Panel, Dr. Geoff Holland, described the latest version of the Principles of GOOS Capacity Building (working document GSC-III/25), and set out future plans (working document GSC-III/26).

7.1.1 Review of Capacity Building Principles

Dr. Holland explained that the *"Principles Of GOOS Capacity Building"* document, which has been refined with advice from Members of the Committee, starts by setting out the GOOS context, which is that: (i) the ocean is a global commons; (ii) its health is critical to the planetary life support system; (iii) action requires both national and international activity; (iv) GOOS supplies required knowledge and information; and (v) a sustainable solution needs the participation of all countries. The document notes that GOOS has developed in response to international pressures like the UN Law of the Sea Convention (and the resulting creation of EEZs), and other global conventions and agreements, and that a demand for improved ocean governance has arisen recently from several sources, including the UN Commission on Sustainable Development. An essential element of any governance model must be an adequate ocean observing system, built with the support of all nations. Developing and strengthening marine research and observational capacity to meet this governance requirement involves human resources, institutions, and a management framework. Integrating these components is difficult, because of the complexity of jurisdictions and the variations in ability and capacity.

The document is intended to explain and clarify the development of the GOOS assistance programme. The programme must recognize a set of national and organizational requirements. For example, donors will expect an improvement in the performance of GOOS in return for the supply of financial assistance, expertise or technology. Equally, donors must be sensitive to national and regional needs of the recipient countries. GOOS development plans will need to address multiyear commitments. In return, recipient countries must be prepared to support the programme framework and establish its priorities.

The GOOS sponsoring organizations have an important role to play. They are not funding agencies; they have limited resources. But they can provide coordination, facilitation and advice, and they have existing capacity building programmes that can be used. They can assist in entraining support from other UN organizations and donor agencies.

The GOOS Capacity Building Programme must recognize the related interests of other entities, organizations and states interested in the marine environment, and the interests of other global and regional monitoring programmes. It must also recognize that donors may have goals broader than GOOS.

The GOOS Capacity Building programme needs to be creative, to use National GOOS Coordinating Committees to focus and enhance the programme, and to use regional bodies to increase visibility, emphasize local priorities, improve the efficiency and effectiveness of local networks and assist in the transfer of new technology. Donor agencies will be more receptive to well planned programmes that promise national and regional commitments.

7.1.2 The Panel

To facilitate implementation of the strategy, a GOOS Capacity Building Panel has been constituted as a resources and steering committee reporting to the GOOS Steering Committee and through that committee to I-GOOS. The members consist of experts, representatives from the sponsors, and the private sector donor and recipient communities. The Panel Chair will be independent of the GOOS organizational structure. The Panel will develop policies and plans for funding, create awareness and evaluate performance. It will initiate, plan, and oversee the implementation of GOOS capacity building by facilitating and assisting in related programme development and through key demonstration projects. The initial membership is as follows:

A. Botello (HOTO) (Mexico)
A. Dahl (UNEP rep) (Suisse)
E. Desa (developing country rep) (India)
G. Holland (Independent) (Canada) (Chair)
K. Koranteng (LMR) (Ghana)
E. Marone (C-GOOS) (Brazil)
M. C. Piccolo (ICSU rep) (Argentina)
R. Rayner (industry rep) (UK)
C. Summerhayes (Tech Sec) (IOC) (France)
J. Stel (Donor rep)(Netherlands)
I. Wainer (GSC) (Brazil)
R. Weller (OOPC) (USA)

7.1.3 Review of activities (e.g., Training)

The Director of the GPO tabled working document GSC-III 26 (b) listing the capacity building activities being undertaken in the current year. It includes two training workshops:

- GLOSS Training Workshop, Jedda, April 15-20;
- NEAR-GOOS Data and Information Management Course, Tokyo, January 24-February 4;
- HOTO RAMP Training Courses, for example for Black Sea countries in October.

In addition it includes several regional meetings:

- PIRATA Regional Meeting, Casablanca, March 21-23;
- MedGLOSS Workshop, Haifa, May 15-17;
- PacificGOOS Coastal Workshop, Apia, August 14-15;
- PIRATA Western Extension Meeting, Fortaleza, September 11-15;
- IOCARIBE-GOOS Advisory Board Meeting, Havana, November 29-December 1.

For 2001, the Capacity Building Panel will work with the GPO to develop a comprehensive capacity building programme.

7.1.4 Plans

Geoff Holland described the draft GOOS Capacity Building Programme Implementation Strategy (working document GSC-III 26 (a)), which is the logical next step from acceptance of the Principles.

Capacity Building must be designed to allow all governments to contribute to global environmental monitoring. A successful Capacity Building programme will have the support of both donor and recipient and must satisfy the priorities of both.

The sustainability, and the ultimate success of the programme, will require stable goals that will outlast urgent and local priorities. Short term objectives must be consistent with and contribute towards the longer term goals, and must recognize differences in priorities amongst donors and amongst recipients. The objectives must be clearly spelt out and aimed squarely at regional and global levels.

Most donor programmes operate on a bilateral basis, however when considered as part of the GOOS Capacity Building Programme, these bilateral programmes must contribute in some way to the ability of the recipient country concerned to participate in, and benefit from, the regional or global network, otherwise they should not be considered to be part of the GOOS Capacity Building Programme.

The programme must not repeat previous mistakes. The major successes of the IOC's Capacity Building programme, TEMA (Training Education and Mutual Assistance), occurred where there were clearly stated requirements, and the GOOS Capacity Building programme must emulate this by working to clear requirements. There should be well designed accounting or follow-up of activities, enabling adaptations to be made and to ensure retention of focus.

The IOC has relatively limited resources for Capacity Building and no personnel trained or designated to seek out extra-budgetary funds, so a mechanism is needed to obtain the funds needed to implement and where necessary expand the programme.

Marketing is a key initial activity to ensure that potential users clearly see the benefits to local economies and living standards.

Where infrastructure does not exist, strategies should be implemented to meet, among other things:

- The need to develop and maintain minimum scientific capability to support and participate in GOOS related activities;
- The need to raise understanding of the value of in situ and space-based observations of the ocean to solving socio-economic problems;
- The need to raise the ability of countries to contribute to and benefit from global observing systems.

Certain issues have to be addressed to ensure that each Capacity Building Programme is viable or sustainable. First, we need the good will and determination of both donor and recipient communities. Without the contribution of the recipient country a programme will wither as soon as aid is withdrawn. The most valuable aid programme is one which assists a country to fulfil a programme that it has already decided worthy of support. Both donor and recipient organizations should act together to ensure that local personnel are involved. Intergovernmental organizations should try to influence the direction of aid programmes in general by identifying long term objectives.

The performance of the programme must be measured. Measurement should be much more that the identification of the numbers of training workshops held and the numbers of participants from countries and regions. Participants should not feel that such reporting is an examination, the reporting of the lack of value of a training course or the reasons for lack of progress in GOOS activities will be equally important to future planning as are the successes.

The Capacity Building programme must be flexible, because Capacity Building will take place under many and widely different scenarios. The GOOS Capacity Building Implementation Strategy is intended to bring cohesion and direction to the framework under which diverse Capacity Building events occur, not to impede or diminish their value.

The Capacity Building programme must also be creative. The Capacity Building Panel must suggest ways of levering expertise, equipment, facilities, capital and funding sources to increase the scope and impact of the Capacity Building Programme.

To facilitate development of the Capacity Building programme, countries should be asked to nominate a contact who could be used for communications on capacity building programmes. It would be important for such a contact to be familiar with the aid programmes in his/her respective country, and to be linked to whatever form the national GOOS organization takes in his/her country.

7.1.5 Discussion and actions

In discussion, **the Committee congratulated** Dr. Holland on finalizing the Principles and on developing the Implementation Strategy. **The Committee endorsed** the Principles document, **agreed with** the Implementation Strategy, **and recognized** that changes needed to be made to both documents before they were published in hard copy and on-line by the GPO. In particular the Implementation Strategy should contain a clearer statement of the long term goals of the Capacity Building programme, and the Principles Document needs a section on performance measures. Work already had been done on performance measures in response to GSC-II Action 49 (*An Intersessional working group comprising Su Jilan, Ilana Wainer, Geoff Brundritt, Ralph Rayner and Worth Nowlin should be formed to investigate possible methodologies for assessing performance in capacity building)*.

Action 46: (i) Dr. Holland, Chairman of the Capacity Building Panel, was asked to add to the GOOS Capacity Building Principles a new section 5.5 on performance measures, as prepared by an inter-sessional working group; (ii) Members were asked to pass any suggested changes on the text of the Implementation Strategy to Dr. Holland, who will prepare a revised version for consideration at GSC-IV; (iii) GPO to make the draft text available to attendees at the IOC Executive Council in June 2000, and to publish the final text in hard copy and on the GOOS Web Site.

The discussion brought out several new elements that need to be considered for inclusion in either the Principles Document or the Implementation Strategy, or which require action by the Capacity Building Panel. For instance, **the Committee agreed** that one of the general problems with any Capacity Building programme is retention of skills AFTER training programmes. One possible way of retaining skills is through the implementation of long term projects. However, one of the problems is that people get promoted, and their skills are withdrawn. This calls for long term planning and the regular training of new staff. **The Committee suggested** that the Implementation Strategy might include the concept of developing regional centres through which training can be repeated to create sustainability.

The Committee also agreed that the Internet offers considerable potential for disseminating information that can be used for training, and **recommended** that the Implementation Strategy gives more attention to the potential of the web as a Capacity Building tool. In this context more about GOOS Capacity Building is needed on the GOOS web page.

Action 47: GPO to work with Ilana Wainer and GOOS-CB Panel to develop a GOOS Capacity Building web page, before GSC-IV.

The Committee suggested that one mechanism for building capacity might be to get representatives of developing countries to serve in the GPO in the IOC Secretariat, which is an avenue adopted by the LOICZ Project Office.

Action 48: GPO to discuss with the LOICZ Project Office their experience in getting seconded staff from developing countries, to look for similar opportunities for GOOS, before year end 2000.

Ben Searle noted that the IODE Resource Kit, which includes data management tools, manuals and guides, and CD's for training purposes, is a potentially valuable tool for GOOS Capacity Building.

Action 49: Members of the GOOS Capacity Building Panel to evaluate the IODE Resource Kit (accessible via the IOC Web Site at http://ioc.unesco.org) as a teaching tool to meet GOOS needs, and to make recommendations to Chairman IODE regarding improvements, before end September.

The Committee agreed that one of the main activities for the GOOS-CB Panel was to advise on raising money for Capacity Building activities. The proposed GOOS brochure may help in this process, but should be modified to indicate the benefits of Capacity Building.

Action 50: GOOS Capacity Building Panel to suggest strategies for obtaining support for specific activities and recommend needed actions to the GPO, GSC-IV, and I-GOOS-V.

Being aware that POGO offered the potential for developing new approaches to training in operational oceanography, **the Committee agreed** that this matter should be taken up at the next POGO meeting.

Action 51: Chairman GOOS Capacity Building Panel to work with Executive Secretary IOC to develop a set of GOOS Capacity Building initiatives that can be presented to the POGO meeting in Sao Paulo (Nov. 28-30, 2000) for possible action by POGO institutions.

The Committee agreed that the Capacity Building Panel should assist the GPO in developing proposals to follow up the recommendations of the GOOS-AFRICA report regarding Capacity Building projects in Africa. Some of this work has already been done by IODE, which has attracted substantial funding from the Government of Flanders for data centres and related electronic infrastructure. The GOOS-CB Panel can build on this start in association with IODE.

Action 52: Capacity Building Panel to help GPO to develop proposals for funding observing system elements in Africa as part of the follow-up to PACSICOM, before GSC-IV.

Finally **the Committee called for** the Capacity Building Panel to develop a GOOS-CB programme for the year 2001.

Action 53: In consultation with GOOS Panels and with the GPO, Capacity Building Panel to develop a Capacity Building programme for 2001, by end September.

7.2 POSTS

7.2.1 Perth Office

The Director, GPO, reported that Bill Erb has been hired to be Head of the IOC Regional Programme Office in Perth, Western Australia, where he took up his position on February 14th, 2000, replacing the temporary incumbent, Brian Sadler. Angus McEwan reported that the Australian co-sponsors of the Office were satisfied with the progress and plans of the Perth Office in support of GOOS. The tasks of the Office are those approved in the Memorandum of Understanding between the three co-sponsors (IOC, the Commonwealth of Australia and the Government of Western Australia), and set out in some detail in the Office's Strategic Plan. The main focus of attention of the Office is on developing GOOS in the Indian Ocean, with some aid being given to the development of PacificGOOS. A Perth Office Newsletter is available for anyone interested.

7.3 PUBLICATIONS

In order to improve the recognition of GOOS at national levels, GSC-II Action 1 asked the GPO *to identify potential targets for communication and to investigate ways of improving communication regarding GOOS and its resource requirements*. The Director GPO reported on progress as follows:

7.3.1 Newsletter

The Director GPO tabled Newsletter 8 (December 1999) and 9 (April 2000) (background documents GSC-III/B20 and B21).

7.3.2 Reports

The Director GPO tabled the list of GOOS reports published and in press since GSC-III (working document GSC-III/6). Consistent with GSC-II Actions 11 and 12 the GPO had produced a new kind of Status Report to describe what GOOS is about, and to note its progress (background document GSC-III/B22). This will be available on line and in hard copy.

7.3.3 Papers

The Director GPO tabled the list of GOOS papers published and in press since GSC-III (working document GSC-III/6).

7.3.4 Brochures, CDs, Displays, etc.

A brochure for GOOS (working document GSC-III/27), had been produced by the GPO in response to GSC-II Action 3 (*GPO to start work on a GOOS brochure for production in the year 2000, with assistance from Tom Malone and Mike Fogarty, and to explore with NIO, Goa, the possibility of printing and distribution at no cost offered by Ehrlich Desa).* NIO has provided the GPO with copies of its products indicating that NIO print quality is acceptable. An artist has been identified to do the graphics work. Committee members and others have been asked for graphics. The UK Met Office has supplied funds to cover costs apart from printing and initial distribution (free from NIO).

In discussion, **the Committee made several suggestions** for improvements, including: taking out the GOOS structure diagrams; illustrating La Niźa and El Niźo; noting the locations of land-falling hurricanes;

providing stories to go with the pictures; getting products and graphics from the regions; including an example of an operational agency with wide-ranging applications. **The Committee decided** that the brochure could serve more purposes (i.e., meet the interests of different audiences) if it had a pocket for additional information, for example on activities, sub-systems, meetings, or issues. Having a pocket would enable the brochure to be used for example by National GOOS Coordinating Committees, or regional GOOS bodies, which could insert their own local material. Thought needs to be given to the types of audiences and their interests, e.g., the science audience, the education audience, the industry audience, and so on. The purpose of the brochure should be to convince people that we have a system, that it works through cooperation, that the whole is greater than the sum of its parts; and that it addresses the key issues of the day. It should be completed with both a designer and a science writer, if funds are available. It would also be useful to have a standard sized GOOS poster that could be widely reproduced and easily transported for use at scientific and other meetings, where poster displays are now the norm.

Action 54: GSC Members to provide comments by e-mail to the GPO on the format and text of the proposed GOOS brochure, by end June. Tony Knap to send GPO examples of Bermuda station's PR documentation, for possible use as models for the GOOS brochure.

Action 55: GPO to work with Julie Hall on the development and production of a GOOS poster for use at science meetings, before GSC-IV.

7.3.5 Web Site

The GOOS Web Site has recently been upgraded, and a contractor is being hired to make the home-page more user-friendly. The GPO is still working to complete GSC-II Actions 11 and 31, which require the GPO: (i) *to initiate a pilot project for a directory of Web sites for the components of the GOOS Initial Observing System, and other sites having GOOS-like products, to complement the status report; and (ii) to advertise on the GOOS Web site what kinds of products are available and to provide hyper-links to GOSIC and the IGOSS Electronic Products Bulletin and other appropriate centres*. To some extent, the second of these items will be effected through the GOOS Products and Services Bulletin.

7.3.6 Products and Services Bulletin

Dr. J. Guddal introduced the topic of the GOOS Services and Products Bulletin (working document GSC-III/28), and Dr. Maria Hood of the GPO provided a detailed explanation of progress. The prototype bulletin contains examples of what GOOS sub-systems can do. It is not a metadata system, so does not substitute in any way for what GOSIC is doing, nor does it duplicate the JCOMM Electronic Products Bulletin, which provides continuous data and products from upper ocean measurements. The initial version of the Bulletin contains information about the background to this initiative, along with a selection of user scenarios explaining how GOOS may be useful to certain sections of the user community. The examples that will be portrayed through this web-based system will be selected by the Bulletin's Advisory Board, which is chaired by Dr. Guddal. Dr. Hood will be the GPO person responsible for creating each issue of the Bulletin from the inputs proposed.

The Bulletin will include among other things user feedback on how GOOS products have been used, and what improvements are needed.

A number of outstanding questions still need resolution by the editorial board (J.Guddal, Y.Tourre, and C. Summerhayes), among them the following: Should we include space for instrument suppliers? Should we produce printed editions? How should we address quality assessment? Should fish stock assessment be included?

The prototype Bulletin still needs streamlining before it is released. Advice is needed from GSC Members on ways in which the Bulletin might be improved, and on biological and chemical topics that might be incorporated.

The GSC was pleased with the appearance of the prototype Bulletin, and with the progress made. **The Committee noted** that extra-budgetary support for continuation of the Bulletin will be needed in due course, but is more likely to be forthcoming when the first few issues have had time to attract the attention of the community**.**

The Committee decided that there was at present no call for a monthly issue, **and agreed** that the question of including commercial products still needs to be addressed.

Action 56: GSC members are encouraged to visit the Products and Services Bulletin on line and to suggest additional operational activities/products that could be highlighted/included. Maria Hood is encouraged to obtain, for inclusion on the site, short narrative statements describing aspects of GOOS (e.g., a description from Francis Bretherton of his characterization of an operational observation/product delivery system). These actions will be ongoing.

8. WORK PROGRAMME AND BUDGET

The Director GPO tabled the work programme and budget for the next biennium (working document GSC-III/29).

The Committee was pleased with progress on the Action List from GSC-II, where only 5 of the 55 Action Items had not been completed; of those 5, most were ongoing.

9. OTHER BUSINESS

9.1 GSC MEMBERSHIP AND ROTATION OF MEMBERS

The Chairman reminded Members that a rotation procedure has been agreed upon. The core membership of the GSC should reflect a balance between user groups, operational experts, and scientific researchers. Members were asked to suggest and consider suitable new candidates from operational agencies (as experts, not agency representatives), and representatives of groups that might be using GOOS products.

Action 57: GSC members were requested to recommend, by end July, replacements for members rotating off after three-years service. Recommendations should include information regarding area of speciality and GOOS-related activities. In concert with the GOOS sponsors, and in coordination with the GPO, Prof. Nowlin will screen the nominations, assemble brief resumes, and circulate to GSC members for comments, after which final selections and contacts will be made.

Mr N.Hasegawa accepted the nomination to replace Dr. Ken Denman on the GOOS Executive Committee.

9.2 GOOS REVIEW PLAN

The Director GPO reminded members that GSC-I had proposed that, at some appropriate time, there should be a review of progress in GOOS by an external review group.

The Committee decided that a review of GOOS by external agencies should be organized for 2002, and that people should be appointed by the sponsors (IOC, WMO, UNEP and ICSU).

Action 58: GPO and the GOOS Sponsors, with advice from GSC Executive Committee, and before GSC-IV, to develop a plan for a full review of GOOS in 2002.

9.3 DATE AND PLACE OF NEXT MEETING

The GSC intends to alternate its meetings between the regions and Paris. Dagoberto Arcos offered to host the next meeting in Chile in 2001.

10. CLOSURE

The meeting closed at 1730 on Friday May 12.

11. LIST OF ACTIONS

Action 1	GPO to accept offer by ICSU to assist with contacts in nations that might foster GOOS implementation.
Action 2	GPO to work intersessionally with GSC members and Arthur Dahl (UNEP) to develop a GOOS products display for CSD-9 meeting (April 2001) on Chapter 40 of Agenda 21 (Information for Decision Making for Sustainable Development), noting the preliminary workshop will be in Canada in September 2000.
Action 3	GPO to create listing of all National GOOS Coordinating Committees (or their equivalents) and key contact points and details for the GOOS web site, as the basis for strengthening the GOOS network, by GSC-IV.
Action 4	OOPC to report to GSC-IV on specific actions that arise from the considerations of the OOPC meeting on the Arctic region.
Action 5	Consistent with the conclusions of the Perth IOC Workshop, the Indian Ocean initiative should be given high priority and support by the Perth Office. The Perth Office should, to the extent possible given the interests of the sponsors, focus its efforts on GOOS development activities in the Indian Ocean.
Action 6	The OOPC (i) take the opportunity to strengthen its expertise in this area, by inviting the JGOFS SSG to nominate an individual to coordinate work; (ii) use the IOCCG to develop specific plans with respect to remote sensing and in particular ocean colour measurements, using the Oceans Theme process as appropriate; (iii) use the reconstituted CO2 panel as its source of advice on in situ observations and, in particular, on sustained pCO2 measurements, noting the need to provide a strong rationale for sustained measurements; and (iv) maintain a dialogue with those developing initiatives within WCRP and the IGBP, particularly SOLAS.
Action 7	In concert with CLIVAR and the SCOR-IOC CO_2 Panel, the OOPC should work to develop a plan for observations needed for global hydrography (for carbon inventory, carbon, heat and fresh water fluxes, thermohaline overturning, etc.).
Action 8	The OOPC should continue its close ties with CLIVAR and ensure that research and operational requirements are fully integrated and consistent with GOOS and sustained research needs.
Action 9	The OOPC should maintain its links with the WGASF, and to offer its assistance in the preparation and convenience of the workshop (June 2001).
Action 10	GSC Members to suggest names for new members for OOPC to Neville Smith by the end of June 2000.
Action 11	The ToRs for OOPC should be changed as follows (with the approval of the WCRP and GCOS Steering Committees): (i) to monitor, describe, and understand the physical and biogeochemical processes that determine ocean circulation and effects on the carbon cycle and climate variability; (ii) to provide the information needed for ocean and climate prediction, including marine forecasting.
Action 12	Close coordination between the integrated coastal panel and OOPC will be required to avoid duplication of effort and clarify responsibilities.
Action 13	GPO and Warren Wooster to work with PICES to encourage formation of a PICES-GOOS group to take forward, before GSC-IV, the development of a North Pacific GOOS covering living resources elements, perhaps leading to a North Pacific Regional Analysis Centre.
Action 14	New integrated Coastal panel to consider proposals by the LMR and other panels for Pilot Projects.
Action 15	Panel Chairs and GOOS Officers and GPO to identify marketing opportunities [subequently Tony Knap offered to develop a GOOS session at the Americas Oceanology International 2001 Meeting in Miami (April 3-5, 2001)].
Action 16	GSC Executive and Chairs of C-GOOS, LMR and HOTO are to develop a clearer statement of focus for the integrated panel prior to its first meeting in November 2000.
Action 17	GSC members to suggest to GSC chair potential members for the new integrated coastal panel, before end June 2000.
Action 18	(i) Jeff Tschirley will ask the GTOS SC if it wishes to consider co-sponsorship of the new merged committee for coastal and shelf seas; (ii) GPO and Chair GSC will draft a letter asking IGBP to co-sponsor the new merged committee for coastal and shelf seas, for completion prior to GSC-IV.

Action 19	(i) Director GPO and Chair GSC to draft a letter for consideration of the GOOS sponsors to ask FAO to co-sponsor GOOS, by end June 2000; (ii) at the appropriate time GPO in consultation with Chair GSC and other appropriate panel members to ask IOC and FAO to jointly sponsor the development of the regional information centres proposed by LMR.
Action 20	GSC Chair to consult with members and the GPO on the name for the integrated coastal panel, for completion before the meeting in November.
Action 21	Director GPO, Chair GSC, and Geoff Holland to explore with Executive Secretary IOC the possibility of developing a UN general agreement on a coastal ocean observing system, prior to GSC-IV.
Action 22	Noting that ocean color measurements are not now planned after 2005, the GSC encourages its design panels and other activities to document the value of such measurements to GOOS, and work through GOSSP to convince satellite agencies of the operational need for ocean color. [This encouragement also appears in the Oceans Theme document discussed in agenda item 6.3].
Action 23	J-DIMP should be disbanded, and the chair GSC, on behalf of the G3OS, should thank J-DIMP Panel Members for their services (by year end 2000).
Action 24	Data and Information issues should be placed on the agendas of the annual G3OS partners meetings, as soon as possible.
Action 25	(i) GPO and GSC Executive Committee to agree with GCOS and GTOS on the procedure and Terms of Reference for a full review of GOSIC in the 6-9 month time frame, by end November 2000; (ii) GSC to name two individuals to represent it on the review group, by end November 2000; (iii) second review to take place prior to operationalization of the system (in about three years); (iv) Tom Malone and Neville Smith to select one candidate each from COOP and OOPC to represent GOOS on the ad hoc review panel.
Action 26	IODE to finalize Marine Environmental Data Inventory and make it widely available initially via CD then as web-based system for use in GOOS data and information management, before year end 2000.
Action 27	GPO and Chair GSC to arrange periodic meetings between representatives of the data assembly centres, possibly involving subsets of centres dealing with related data sets, starting during 2000. In this regard, the WOCE/CLIVAR Data Products Committee might serve as the focus for discussion of physical ocean data.
Action 28	Nic Flemming and colleagues to continue with the development proposed at GSC-II of a cost-benefit regional analysis workshop involving eastern Central and South America (possibly including the Caribbean), and to take place ideally before GSC-IV.
Action 29	Nic Flemming and colleagues to provide specific examples of the development costs of a range of observing system elements, and to put hard numbers on the hypothetical projections in the OceanObs99 paper entitled “Dividends from Investing in Ocean Observations: a European Perspective”, prior to GSC-IV.
Action 30	GSC members to give to the Chairman by e-mail their suggestions for modifications to the new web-based design showing GOOS structure and activities, by end July.
Action 31	(i) Products and Services Committee Advisory Committee to recommend mechanisms for acquiring feedback on products and services (e.g., via trade associations and/or product centres), and to get such agents to help to prepare user scenarios, before year end 2000; (ii) GSC Members to suggest user scenarios, particularly for biological/chemical elements of GOOS, but also for other appropriate elements, with associated examples, and send them to Johannes Guddal by end July for consideration for the Products and Services Bulletin.
Action 32	(i) GSC members to send initial suggestions for modifications to the Regional Policy document to Chairman by mid June; (ii) revised document to be circulated to members for final comment by end June; (iii) final version to be published as a GSC document and submitted to I-GOOS-V for information
Action 33	It is suggested that JCOMM (i) ensure that existing data streams and services are continued without interruption and (ii) work toward a streamlined structure.

Action 34	The GSC recommends that JCOMM be prepared to manage the archival and distribution of non-physical global datasets/products as they become available. Examples might be dissolved oxygen, macronutrients (N, P, Si), surface ocean and atmosphere pCO_2, and derived products from ocean color satellites such as chlorophyll a pigments. QC should be managed at a specialist level prior to submission to JCOMM.
Action 35	In seeking new members, expertise in wind-waves should be given priority by JCOMM.
Action 36	GPO to provide G. Holland with JCOMM Capacity Building papers for comment prior to JCOMM-TRANS-II (June 2000).
Action 37	Members to provide feedback to Geoff Holland by the end of June on the JCOMM Polar Strategy report.
Action 38	GSC Executive Committee and OOPC to develop and evaluate a list of potential major operational centres for the GOOS Initial Observing System; GPO to contact approved centres to determine their willingness to be part of the GOOS-IOS, before GSC-IV.
Action 39	(i) Angus McEwan to contact CCAMLR (a potential element of the GOOS-IOS) to find out if they can meet the GOOS Principles, especially regarding data release, by end July; (ii) Warren Wooster/ Ron Wilson to provide more information about Station-P/Line-P.
Action 40	GCS Chair, together with Chairman I-GOOS and Director GPO, to prepare a letter for Secretary IOC to send to IOC representatives and other selected foci in member states, by September 2000, for the purposes of (i) noting that GOOS has advanced to the state of assembling elements into an integrated global-scale system focused first on climate and marine services but extending to biogeochemical observations needed for products, (ii) alerting that GOOS will be approaching nations through their GOOS (/GCOS) national committees for contributions to this system, and (iii) requesting additional information regarding intended contributions (only for contributors to the 1st GOOS Commitments Meeting).
Action 41	(i) Members to send comments on the GOOS Data and Information Strategy to Ron Wilson by end of June, including comments on how to improve the biological/chemical elements; (ii) Ron Wilson to work with GPO and others as appropriate (including Tom Malone and Mike Fogarty) to finalize the document, including an Executive Summary, by year end 2000, and to publish it on the GOOS and GOSIC web sites as Version 1.0.
Action 42	Panel chairs to involve IODE in aiding the pilot projects build their data and information management plans.
Action 43	GPO to work with ICSU and UNEP representatives to select particular GOOS issues to be taken to the meetings of ICSU and UNEP management bodies, before GSC-IV.
Action 44	IODE to work with GTOS to see to what extend TEMS and MEDI can be made complementary.
Action 45	(i) GOSSP and the GPO should request the IGOS Partners (June 2000 meeting) to ensure the GOOS requirements are met, remind them that many GOOS applications depend on satellite data, and point out to them the requirement for the continuance of ocean colour observations beyond 2005; (ii) for the integration of satellite and *in situ* components, the GSC requests the OOPC to continue to work closely with GOSSP and the IGOS Partners' Oceans Theme to ensure both operate effectively together.
Action 46	(i) Dr. Holland, Chairman of the Capacity Building Panel, was asked to add to the GOOS Capacity Building Principles a new section 5.5 on performance measures, as prepared by an inter-sessional working group; (ii) Members were asked to pass any suggested changes on the text of the Implementation Strategy to Dr Holland, who will prepare a revised version for consideration at GSC-IV; (iii) GPO to make the draft text available to attendees at the IOC Executive Council in June 2000, and to publish the final text in hard copy and on the GOOS Web Site.
Action 47	GPO to work with Ilana Wainer and GOOS-CB Panel to develop a GOOS Capacity Building web page, before GSC-IV.
Action 48	GPO to discuss with the LOICZ Project Office their experience in getting seconded staff from developing countries, to look for similar opportunities for GOOS, before year end 2000.
Action 49	Members of the GOOS Capacity Building Panel to evaluate the IODE Resource Kit (accessible via the IOC web site at http://ioc.unesco.org) as a teaching tool to meet GOOS needs, and to make recommendations to Chairman IODE regarding improvements, before end September.

Action 50	GOOS Capacity Building Panel to suggest strategies for obtaining support for specific activities and recommend needed actions to the GPO, GSC-IV, and I-GOOS-V.
Action 51	Chairman GOOS Capacity Building Panel to work with Executive Secretary IOC to develop a set of GOOS Capacity Building initiatives that can be presented to the POGO meeting in Sao Paulo (Nov 28-30,2000) for possible action by POGO institutions.
Action 52	Capacity Building Panel to help GPO to develop proposals for funding observing system elements in Africa as part of the follow-up to PACSICOM, before GSC-IV.
Action 53	In consultation with GOOS Panels and with the GPO, Capacity Building Panel to develop a CB programme for 2001, by end September.
Action 54	GSC Members to provide comments by e-mail to the GPO on the format and text of the proposed GOOS brochure, by end June. Tony Knap to send GPO examples of Bermuda station's PR documentation, for possible use as models for the GOOS brochure.
Action 55	GPO to work with Julie Hall on the development and production of a GOOS poster for use at science meetings, before GSC-IV.
Action 56	GSC members are encouraged to visit the Products and Services Bulletin on line and to suggest additional operational activities/products that could be highlighted/included. Maria Hood is encouraged to obtain, for inclusion on the site, short narrative statements describing aspects of GOOS (e.g., a description from Francis Bretherton of his characterization of an operational observation/product delivery system). These actions will be ongoing.
Action 57	GSC members were requested to recommend, by end July, replacements for members rotating off after three-years service. Recommendations should include information regarding area of specialty and GOOS-related activities. In concert with the GOOS sponsors, and in coordination with the GPO, Prof. Nowlin will screen the nominations, assemble brief resumes, and circulate to GSC members for comments, after which final selections and contacts will be made.
Action 58	GPO and the GOOS Sponsors, with advice from GSC Executive Committee, and before GSC-IV, to develop a plan for a full review of GOOS in 2002.

ANNEX I

AGENDA

1. ORGANIZATION OF THE SESSION

1.1. OPENING OF THE SESSION
1.2. WELCOMING REMARKS
1.3. REMARKS BY SPONSORS REPRESENTATIVES
1.4. ADOPTION OF THE AGENDA
1.5. WORKING ARRANGEMENTS

2. REPORT FROM THE CHAIRMAN OF I-GOOS

3. REPORT BY THE DIRECTOR OF THE GPO

4. GOOS PLANNING

4.1. SCIENCE GUIDANCE
- **4.1.1. Science Planning**
  - 4.1.1.1.1. OOPC
  - 4.1.1.1.2. GODAE
  - 4.1.1.1.3. Argo
  - 4.1.1.1.4. C-GOOS
  - 4.1.1.1.5. LMR
  - 4.1.1.1.6. HOTO
  - 4.1.1.1.7. C-GOOS/LMR/HOTO MERGER

4.2. CROSS CUTTING BETWEEN OBSERVING SYSTEMS
- **4.2.1. GOSSP**
  - 4.2.1.1.1. IOCCG
- **4.2.2. Data and Information Management**
  - 4.2.2.1.1. J-DIMP
  - 4.2.2.1.2. GOSIC

4.3. COST/BENEFIT ANALYSIS

5. IMPLEMENTATION OVERSIGHT

5.1 REGIONAL
- **5.1.2 EuroGOOS**
- **5.1.3 NEAR-GOOS**
- **5.1.4 MedGOOS**
- **5.1.5 PacificGOOS**
- **5.1.6 IOCARIBE-GOOS**
- **5.1.7 GOOS-AFRICA**
- **5.1.8 Other (e.g. SEACAMP, SEAGOOS, WIOMAP, Indian ocean)**
- **5.1.9 Regional Policy**

5.2 GLOBAL
- **5.2.1 JCOMM (incl DBCP, SOOP, TAO, GLOSS)**
- **5.2.2 The GOOS Initial Observing System (GOOS-IOS)**
- **5.2.3 GOOS Data and Information Management**

6. LIAISON/INTEGRATION

6.1 GCOS
6.2 GTOS
6.3 CEOS AND IGOS
6.4 WCRP (CLIVAR)
6.5 IGBP (LOICZ; GLOBEC)
6.6 OTHER

7. OUTREACH/ INFRASTRUCTURE

7.1 CAPACITY BUILDING
- **7.1.1 Review of CB Principles**
- **7.1.2 The Panel**
- **7.1.3 Review of activities (e.g Training)**
- **7.1.4 Plans**

7.2 POSTS
- **7.2.1 PERTH Office**
- **7.2.2 Other**

7.3 PUBLICATIONS
- **7.3.1 Newsletter**
- **7.3.2 Reports**
- **7.3.3 Papers**
- **7.3.4 Brochures, CDs, Displays, etc.**
- **7.3.5 Web-Site**
- **7.3.6 Products and Services Bulletin**

8. WORK PROGRAMME AND BUDGET

9. OTHER BUSINESS

9.1 GSC MEMBERSHIP AND ROTATION OF MEMBERS
9.2 GOOS REVIEW PLAN
9.3 DATE AND PLACE OF NEXT MEETING

10. CLOSURE

ANNEX II

LIST OF PARTICIPANTS

I. CORE COMMITTEE

Ken DENMAN
Institute of Ocean Sciences
9860 West Saanich Road
P.O. Box 6000
Sidney, British Columbia V8L 4B2
Canada
Tel: (1 250) 363 6346
Fax: (1 250) 363 6690
Email: denmank@pac.dfo-mpo.gc.ca

Michael FOGARTY
Senior Scientist
NOAA, NMFS
164 Water St
Woods Hole, MA 02543
USA
Tel: (1 508) 495-2384
Fax: (1 508) 495 2354
Email: mfogarty@whsun1.wh.whoi.edu

Julie HALL (GSC Vice Chair)
National Institute of Water & Atmospheric Research Ltd (NIWA)
Gate 10, Silverdale Road
Hamilton
New Zealand
Tel: (64 7) 856 1709
Fax: (64 7) 856 0151
Email: j.hall@niwa.cri.nz

Naoyuki HASEGAWA
El Nino Monitoring and Prediction Centre
Japan Meteorological Agency
1-3-4, Otemachi, Chiyoda-ku
Tokyo 100-8122
Japan
Tel: (81) 3 3212 8341 (ex 5153)
Fax: (81) 3 3211 8406
Email: naohase@naps.kishou.go.jp

Liliane MERLIVAT
Université Pierre et Marie Curie
LODYC
Tour 14, 2ème étage, 4 place Jussieu
75252 Paris Cedex 05
France
Tel: (33 1) 44 27 70 72/44 27 32 48
Fax: (33 1) 44 27 38 05
Email: merlivat@lodyc.jussieu.fr

G. Narayana SWAMY
Scientist
National Institute of Oceanography (NIO)
Dona Paula
403004 Goa
India
Tel: (91 832) 22 10 69/4271
Fax: (91 832) 22 33 40
email: narayana@csnio.ren.nic.in
narayana@darya.nio.org

Worth NOWLIN **(C**hair)
Texas A&M University
Department of Oceanography
College Station, Texas 77843-3146
USA
Tel: (1 979) 845 3900
Fax: (1 979) 847 8879
Email: wnowlin@tamu.edu

Ralph RAYNER
Managing Director
Fugro GEOS
Gemini House
Hargreaves Road, Swindon
Wiltshire SN25 5AL
United Kingdom
Tel: (44 1793) 725766
Fax: (44 1793) 706604
Email: r.rayner@geos.com

Friedrich SCHOTT
Institut fuer Meereskunde
Duesternbrooker Weg 20
D-24105 Kiel
Germany
Tel: (49 431) 597 3820
Fax: (49 431) 597 3821
Email: fschott@ifm.uni-kiel.de

Ilana WAINER
Department of Physical Oceanography
Praça do Oceanográfico 191
Cidade Universitária
São Paulo, SP. CEP 05508-900
Brazil
Tel: (55 11) 818 6578
Fax: (55 11) 210 3092
Email: wainer@usp.br

II. SPONSORS REPRESENTATIVES

International Council for Science (ICSU)

Peter R BURBRIDGE
Director of the Centre for Tropical Coastal Management
Dept of Marine Sciences and Coastal Management
Ridley Building, University of Newcastle upon Tyne Newcastle upon Tyne
England NE1 7RU
England
Tel: (44 191) 222 5676
Fax: (44 191) 222 5091
44 191 222 5095 (direct)
Email: p.r.burbridge@ncl.ac.uk

Intergovernmental Oceanographic Commission (IOC of UNESCO)

Nic FLEMMING
Director, EuroGOOS
EuroGOOS Office, Room 346/18
Southampton Oceanography Centre
Empress Dock, Southampton, Hants SO14 3ZH
United Kingdom
Tel: (44 2380) 596 262
Fax: (44 2380) 596 399
Email: n.flemming@soc.soton.ac.uk

1.2 World Meteorological Organization (WMO)

1.3

Johannes GUDDAL
Co-President JCOMM
Norwegian Meteorological Institute
Region West, Allegaten. 70
5007 Bergen
Norway
Tel: (47 55) 23 66 26
Fax: (47 55) 23 67 03
Email: j.guddal@dnmi.no

United Nations Environment Programme (UNEP)

Arthur DAHL
Deputy Assistant Executive Director
Division of Environmental Information, Assessment and Earth Warning
Coordinator UN System-wide Earthwatch
United Nations Environment Programme
13 chemin des Anémones
CH-1219 Chatelaine, Geneva, Switzerland
Tel: (41 22) 917 8207
Fax: (41 22) 797 3471
Email: dahla@unep.ch

III. GOOS PANELS

Ocean Observation Panel for Climate (OOPC)

Neville SMITH (Chair)
Bureau of Meteorology Research Centre
150 Lonsdale Street
Box 1289K
Melbourne, Victoria 3001
Australia
Tel: (61 3) 9669 44 34
Fax: (61 3) 9669 46 60
Email: nrs@bom.gov.au

GOOS Coastal Panel (C-GOOS)

Tom MALONE (Chair)
Director & Professor
Univ. of Maryland Centre for Environmental Science (UMCES)
Horn Point Laboratory
P.O. Box 775
2020 Horn Point Road
Cambridge, Maryland 21613
USA
Tel: (1 410) 221 8406
Fax: (1 410) 221 8473
Email: malone@hpl.umces.edu

Living Marine Resources Panel (LMR)

Warren WOOSTER (Co-Chair)
Professor Emeritus
School of Marine AFF
Univ. of Washington
Seattle, Washington 98105-6715
USA
Tel: (1 206) 685 2497
Fax: (1 206) 543 1417
Email: wooster@u.washington.edu

Dagoberto ARCOS (Co-Chair)
Oceanographer
Fisheries Research Institute
Cristobal Colón 2780
P.O.Box 350
Talcahuano
Chile
Tel: (56 41) 588886
Fax: (56 41) 583939
Email: inpesca@inpesca.cl

Health of the Ocean Panel (HOTO)

Anthony KNAP (Chair)
Bermuda Biological Station for Research
Ferry Reach
Bermuda GE 01
Tel: (1 441) 297 1880 ext 244
Fax: (1 441) 297 0860
Email: knap@bbsr.edu

Intergovernmental Committee for GOOS (I-GOOS)

Angus McEWAN (Chair)
Senior Science Advisor, Oceanography
Bureau of Meteorology
Box 727G
Hobart, Tasmania 7005
Australia
Tel: (61 3) 6221 2090
Fax: (61 3) 6221 2089
Email: a.mcewan@bom.gov.au

GOOS Capacity Building Panel

Geoffrey HOLLAND (Chair)
24-195 Lower Ganges road
Saltspring Island
British Columbia V8K 1T3
Canada
Tel: (1 250) 537 4472
Fax: (1 260) 537 4850
Email: hollandg@saltspring.com

IV. G3OS PANEL REPRESENTATIVES

1.4 Joint Data and Information Management Panel (J-DIMP/GOSIC)

John Ronald WILSON
Manotick Gift & Stationery Ltd
5771 Rideau Valley Dr.
Manotick, Ontario
Canada K4M 1133
Tel: (1 613) 692 3009
Fax: (1 613) 992 2605
Email: rwilson@fox.nstn.ca

Global Observing System Space Panel (GOSSP)

Francis BRETHERTON (Chair)
Space Science and Engineering Centre
University of Wisconsin - Madison
1225 West Dayton Street
Madison, WI 53706
U.S.A
Tel: (1 608) 262 7497
Fax: (1 608) 262 5974
Email: francisb@ssec.wisc.edu

Global Climate Observing System (GCOS)

Kirk DAWSON (Chair)
RR No 1, S84A C1
Okanagan Falls,
British Columbia VOH 1RO
Canada
Tel: (1 250) 497 8621
Fax: (1 250) 497 8621
Email: kirkDawson@home.com

Alan THOMAS
Director, GCOS Secretariat
GCOS – Geneva
World Meteorological Organization (WMO)
7 bis Ave de la Paix
CH-1211, Geneva -2
Switzerland/Suisse
Tel.: (41 22) 730 8275/8067
Fax: (41 22) 730 8052
Email: Thomas_A@gateway.wmo.ch

Global Terrestrial Observing System (GTOS)

Jeffrey TSCHIRLEY
Programme Director
GTOS Secretariat
FAO, SDRN
Viale Terme di Caracalla
Rome 00100
Italy
Tel: (39 06) 5705 3450
Fax: (39 06) 5705 3369
Email: jeff.tschirley@fao.org

V. SECRETARIATS

World Meteorological Organization (WMO)

Peter DEXTER
World Weather Watch
WMO
7 bis Ave de la Paix
CH-1211, Geneva 2
Switzerland
Tel: (41 22) 730 8237
Fax: (41 22) 730 8021
Email: dexter@www.wmo.ch

International Council for Science (ICSU)

Larry KOHLER
Executive Director
International Council for Science
51, Bld de Montmorency
75016 Paris
France
Tel: (33 1) 45 25 03 29
Fax: (33 1) 42 88 94 31
Email: larry@icsu.org

Anne LARIGAUDERIE
Environmental Sciences Officer
International Council for Science
51, Bld de Montmorency
75016 Paris
France
Tel: (33 1) 45 25 03 29
Fax: (33 1) 42 88 94 31
Email: anne@icsu.org

Intergovernmental Oceanographic Commission (IOC) of UNESCO

UNESCO
1, rue Miollis
75732 Paris Cedex 15
France

Executive Secretary

Patricio BERNAL
Tel: (33 1) 45 68 39 83
Fax: (33 1) 45 68 58 10
Email: p.bernal@unesco.org

Senior Assistant Secretary

Ned CYR
Tel: (33 1) 45 68 41 89
Fax: (33 1) 45 68 58 12
Email: n.cyr@unesco.org

Peter PISSIERSSENS
Tel: (33 1) 45 68 40 46
Fax: (33 1) 45 68 58 12
Email: p.pissierssens@unesco.org

Umit UNLUATA
Tel: (33 1) 45 68 40 08
Fax: (33 1) 45 68 58 12
Email: u.unluata@unesco.org

GOOS Project Office

Colin SUMMERHAYES
Director
Tel: (33 1) 45 68 40 42
Fax: (33 1) 45 68 58 13
Email: c.summerhayes@unesco.org

Thorkild AARUP
Tel: (33 1) 45 68 40 19
Fax: (33 1) 45 68 58 12
Email: t.aarup@unesco.org

Justin AHANHANZO
Tel: (33 1) 45 68 39 78
Fax: (33 1) 45 68 58 13
Email: j.ahanhanzo@unesco.org

Arthur ALEXIOU
Tel: (33 1) 45 68 40 40
Fax: (33 1) 45 68 58 13
Email: a.alexiou@unesco.org

Maria HOOD
Tel: (33 1) 45 68 40 28
Fax: (33 1) 45 68 58 12
Email: m.hood@unesco.org

Rimi NAKANO
Tel: (33 1) 45 68 39 74
Fax: (33 1) 45 68 58 13
Email: r.nakano@unesco.org

Yves TREGLOS
Tel: (33 1) 45 68 39 78
Fax: (33 1) 45 68 58 13
Email: y.treglos@unesco.org

VI. INVITEES

Erik BUCH
Head of Section for Operational Oceanography
Danish Meteorological Institute
Lyngbyvej 100
2100 Copenhagen O
Denmark
Tel: (45 39) 15 75 00 (Switch.)
(45 39) 15 72 10 (direct)
Fax: (45 39) 27 06 84
Email: ebu@dmi.dk
http://www.dmi.dk

Alan EDWARDS
SDME 7/65
Sustainable Marine Ecosystems Unit
Research DG
European Commission
Rue de la Loi, 200
B-1049 Brussels
Belgium
Tel: (32 2) 295 8301
Fax: (32 2) 296 3024
Email: Alan.Edwards@cec.eu.int

Trevor PLATT
Ocean Sciences Division
Bedford Institute of Oceanography
Dartmouth, Nova Scotia B2Y 4A2
Canada
Tel: (1 902) 426 3793
Fax: (1 902) 426 9388
Email: tplatt@is.dal.ca

Ben SEARLE
Chairman IODE
Australian Oceanographic Data Centre
Maritime Headquarters
Wylde St. Potts Point NSW
Australia
Tel: (61 2) 9359 3139
Fax: (61 2) 9359 3120
Email: ben@aodc.gov.au

Silvana VALLERGA
ICB - CNR at IMC
IMC Scientific Director
Località Sa Mardini
09072 Torregrande – Oristano
Italia
Tel: (39 0783) 22027, 22136, 22032
Fax: (39 0783) 22002
Email: vallerga@nameserver.ge.cnr.it

VII COMMITTEE MEMBERS NOT ATTENDING

Geoff BRUNDRIT
Head, Department of Oceanography
University of Cape Town
Rondebosch 7701
South Africa
Tel: (27 21) 650 3277
Fax: (27 21) 650 3979
Email: brundrit@physci.uct.ac.za

Prof. Zhouwen YU
Director
National Marine Environmental Forecasting Centre
State Oceanic Administration (SOA)
No. 8 Dahuisi, Haidian District
Beijing 100081
China
Tel: (86 010) 621 735 98
Fax: (86 010) 621 736 20
Email: yuzw@sun.ihep.ac.cn
yanjh@axp800.nmefc.gov.cn

.

ANNEX III

LIST OF DOCUMENTS [1]

Document Code	Title	Agenda Items	Lang
WORKING DOCUMENTS			
GSC-III/1 prov.	Provisional Agenda	1.4	E only
GSC-III/1b prov.	Annotated Provisional Agenda	1.4	E only
GSC-III/2	Provisional Timetable	1.5	E only
GSC-III/3	Report of the Session (to be prepared during the meeting)	--	E only
GSC-III/4	Provisional list of Documents (this document)	1.5	E only
GSC-III/4b	Provisional List of Participants	--	E only
GSC-III/5	An I-GOOS Perspective on the Future of GOOS	2.1	E only
GSC-III/6	GPO Director's Report director's_report_2000.doc	3	E only
GSC-III/7	Report of G3OS Sponsors Meeting, June, 1999	3	E only
GSC-III/8	2-page preliminary draft report of OOPC activities and plans http://ioc.unesco.org/goos/oopc.pdf	4.1.1.1	E only
GSC-III/9	2-page preliminary draft report of GODAE activities and plans	4.1.1.1.1	E only
GSC-III/10	2-page preliminary draft report of *Argo* activities & plans http://ioc.unesco.org/goos/GODAE_ARGO.pdf **General information can be obtained at:** http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/godae/homepage.html http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/godae/Argo_Design.html	4.1.1.1.2	E only
GSC-III/11	2-page preliminary draft report of C-GOOS activities and plans	4.1.1.2	E only
GSC-III/12	2-page preliminary draft report of LMR activities and plans	4.1.1.3	E only
GSC-III/13	2-page preliminary draft report of HOTO activities and plans	4.1.1.4	E only
GSC-III/14	Report of GOOS Principals Meeting on the C-GOOS/HOTO/LMR Merger	4.1.1.5	E only
GSC-III/15	2-page preliminary draft report of GOSSP activities and plans	4.2.1	E only
GSC-III/16	Proposal for the future of J-DIMP J-DIMP_prop.doc	4.2.2.1	E only
GSC-III/17	Proposal for methodology for addressing costs and benefits	4.3	E only
GSC-III/18	Proposal for GOOS structure	5	E only
GSC-III/19	GOOS Meeting Users Requirements: A Pragmatic Approach	5	E only
GSC-III/20	A Regional Policy for GOOS (not available)	5.1.9	E only
GSC-III/21	A strategy for polar seas and ice-covered regions Polar_doc.pdf	5.2.1	E only
GSC-III/22	An update on the GOOS Initial Observing System GSC-III_GOOS-IOS_2.doc	5.2.2	E only
GSC-III/23	Possible mechanisms for assessing new contributions to GOOS	5.2.2	E only
GSC-III/24	Draft GOOS Data and Information Management Plan, Version 2 http://ioc.unesco.org/goos/GOOSdm_v2_rewrite.doc	5.2.3	E only
GSC-III/25	Principles for GOOS Capacity Building	7.1	E only
GSC-III/26	Initial plans for GOOS Capacity Building Cap_Bldg_Plans.doc	7.1	E only
GSC-III/27	Draft GOOS brochure	7.3.4	E only

[1] This list is for reference only. No stocks of these documents are maintained, except for the Summary Report.

Document Code	Title	Agenda Items	Lang
GSC-III/28	GOOS Services and Products Bulletin	7.3.6	E only
GSC-III/29	GOOS Project Office Work Programme & Budget for 2000 & 2001	8	E only
BACKGROUND DOCUMENTS			
GSC-III/B1	Report of the 4th I-GOOS Meeting http://ioc.unesco.org/goos/IG4REP.pdf	2	E only
GSC-III/B2	Report of the Initial GOOS Commitments Meeting http://ioc.unesco.org/goos	2 & 5.2.2	E only
GSC-III/B3	GOOS-related Resolutions of the IOC Assembly http://ioc.unesco.org/goos/GOOS_Res_IOC_XX.pdf	2	E only
GSC-III/B4	Report of 4th Meeting of OOPC (Woods Hole, 17-20 May, 1999) http://ioc.unesco.org/goos/oopc4.pdf	4.1.1.1	E only
GSC-III/B5	Report of 3rd Meeting of Coastal GOOS Panel (Accra, 13-15 April, 1999) http://ioc.unesco.org/goos/C-GOOS-III_rpt.pdf	4.1.1.2	E only
GSC-III/B6	Report of 4th Meeting of Coastal GOOS Panel (Tianjin, 2-5 Nov, 1999) http://ioc.unesco.org/goos/CGOOS4-REPv2.pdf	4.1.1.2	E only
GSC-III/B7	Report of 2nd Meeting of LMR Panel (Montpellier, 22-26 March, 1999) http://ioc.unesco.org/goos/LMR-II_Rpt.pdf	4.1.1.3	E only
GSC-III/B8	Report of 3rd Meeting of LMR Panel (Chile, 8-11 Dec, 1999) http://ioc.unesco.org/goos	4.1.1.3	E only
GSC-III/B9	Information document on the IOCCG's (International Ocean Colour Coordinating Group's) activities and plans http://www.ioccg.org/	4.2.1	E only
GSC-III/B10	Improving El Niño Forecasting: the Potential Economic Benefits; (Editor R.Weiher), NOAA, August 1999 http://ioc.unesco.org/goos/el_nino.pdf	4.3	E only
GSC-III/B11	EuroGOOS Status Report Report. General information can be obtained at: http://www.soc.soton.ac.uk/OTHERS/EUROGOOS/	5.1.2	E only
GSC-III/B12	Report of 4th meeting of NEAR-GOOS (28 Sept – Oct 1, Tokyo) http://ioc.unesco.org/goos/ng4rep.pdf	5.1.3	E only
GSC-III/B13	Report of the MedGOOS Workshop on Benefits and Costs of Implementing GOOS in the Mediterranean (Rabat, 1-3 Nov)	5.1.4	E only
GSC-III/B14	Report of the IOCARIBE Meeting (Costa Rica, 22-24 April, 1999) http://ioc.unesco.org/goos	5.1.6	E only
GSC-III/B15	Report of the 1st JCOMM Transition Meeting (St Petersburg, 19-23 July) http://ioc.unesco.org/goos/JCOMMTRAN-I_rpt.pdf	5.2.1	E only
GSC-III/B16	Issues related to the Global Climate Observing System. FCCC/SBSTA/1999/10 Report to COP-V (UN-FCCC) http://cop5.unfccc.de/resource/docs/1999/sbsta/10.htm	6.1	E only
GSC-III/B17	Proposal for Regional Workshops for GCOS REG_Wshops.doc	6.1	E only
GSC-III/B18	The IGOS Oceans Theme Document	6.3	E only
GSC-III/B19	Partnership for Observations of the Global Ocean (POGO); report of 1st meeting (La Jolla, Dec 1-3) http://www.sioworld.ucsd.edu/pogo.html	6.6	E only
GSC-III/B20	GOOS News No. 8 http://ioc.unesco.org/goos/GOOSnews.htm	7.3.1	E only
GSC-III/B21	GOOS News No. 9 http://ioc.unesco.org/goos/GOOSnews.htm	7.3.1	E only
GSC-III/B22	GOOS Status Report – 1999 http://ioc.unesco.org/goos/Status_99.PDF	5.2.2	E only

Document Code	Title	Agenda Items	Lang
ADDITIONAL BACKGROUND DOCUMENTS NOT MENTIONED IN ANNOTATED PROVISIONAL AGENDA			
GSC-III/B23	OceanObs'99 Statement http://WWW.BoM.GOV.AU/OceanObs99/Papers/Statement.pdf	4.1.1.1	E only
GSC-III/B24	Baltic GOOS (BOOS) Plan http://www.soc.soton.ac.uk/OTHERS/EUROGOOS/BOOS2000.pdf	5.1.2	E only
GSC-III/B25	Dividends from Investing in Ocean Observations: A European Perspective **(by Nic Flemming)** http://WWW.BoM.GOV.AU/OceanObs99/Papers/Flemming.pdf Alternative URL: http://ioc.unesco.org/goos/Fleming_paper.pdf	4.3	E only
GSC-III/B26	GOOS and High Risk Extreme Events **(from Geoff Brundritt and Colin Summerhayes)** http://ioc.unesco.org/goos/Brundritt_disaster.doc	4.3	E only
GSC-III/B27	Report on the Perth Office **(by Bill Erb)** http://ioc.unesco.org/goos/perth.doc	7.2.1	E only
GSC-III/B28	New Metadata System **(by Ben Searle)** medicorr.doc	7.3.6	E only
GSC-III/B29	A Marine Extensible Markup Language - XML **(by Ben Searle)** A_Marine_XMLcorr.doc	7.3.6	E only
GSC-III/B30	WOCE Data Products Committee **(by David Legler)** woce_dpc.pdf	5.2.3	E only

ANNEX IV

TABLES TO SUPPLEMENT THE PRESENTATION OF THE CHAIRMAN OF I-GOOS

Table 1: Short-term issues

IMMEDIATE ISSUE	APPROACH
Planners of GOOS may be restricted by a discipline-based vision.	• Add planning elements for the non-technical components, especially: ➢ communication with national bodies. ➢ marketing/product development.
Planning process, initial implementation need resources.	• Fund-raising techniques? • Professional help? • Limit the life of WG's by task.
Visibility/priorities within national agencies.	• Gather information on national structure and key personnel. • Recruit involvement (experts, pilot programmes) of target agencies. • Collaborate with POGO, WCRP, IOCCG using specific tasks as a focus. • Assert GOOS in IGOS. • Appoint national 'agents' for GOOS. • Certification of "GOOS Approved" projects. Start with elements of the IOS. • Use the GOOS label.
Seen as "science". Governments unwilling/unable to diverge from research funding. Science budgets are the only workable pathway for new programmes.	• Don't fight it. Proceed, assuming that pilots and "experiments" will evolve to operational systems on their own merits. • Consider how governments can claim ownership of successes as they occur. • Get senior management involved. • Use the GOOS label.
Plan is advancing to define priority systems (mainly weather and climate), actions that tend to define GOOS itself. We may have to settle for a "less than GOOS" system or compete with other emerging systems.	• Keep GSC as the key integrating process, but allow the technical aspects of the modules to split off as appropriate. • Allow climate to keep its momentum. • Implement C-GOOS and HOTO pilots.
Number of committed countries is too small for a truly global vision.	• Acquire a detailed understanding of impediments to commitment. • Maximise the use of regional partnerships and programmes. • Ally programmes with other IOC, WMO, UNEP, FAO, ICSU initiatives. • Label GOOS training. • Identify targets in GOOS for GEF funding.
Less-developed countries (LDC's) remain bystanders.	• Try to avoid tokenism in capacity-raising exercises. • Seek national "sponsorship" of initiatives embracing LDC's. • Relax GOOS requirements initially.
Runs on the board needed to convince, e.g., Space agencies to incorporate vital observing elements in missions.	• Ensure requirements are specific and updated. • Ensure that ARGO and GODAE are identified with GOOS.

Table 2: Decisions

DECISION	ADVANTAGES	CAUTIONS
To rationalise into two GOOS modules.	• Simplifying focus on priorities. • Most direct path to the implementation of C-GOOS. • Possible reduction in WG's and meetings. • Stronger external profile. • Better national identification with GOOS especially C-GOOS.	• Widening sectoral focus may not interest some users. • Possibly less attention to specific observation requirements. • Chosen pilot and flagship projects may exclude participants.
To define a relationship with IGOS.	• Prominence and priority for GOOS. • Oceans Theme is the first to be developed. • Better governmental awareness. • Resolution of present confusion of roles of the EOS's.	• More strain on GPO resources. • Deflection from regional priorities.
Detailed methods for interfacing with user community.	• Getting rationales correct. • Assigning priorities within GOOS. • Integrated development of products and services. • Widening sponsorship and participation base.	• Demand on resources and time. • Unreal expectations of user community. • Imperatives on the delivery of products.
Requests to embrace observation systems or elements that are not placed within GOOS plans.	• Rapid implementation and widened participation. • Could improve relationships with other programmes.	• Poor constraints on quality and conformity with GOOS principles. • May distort the perception of GOOS. • May be used opportunistically and without commitment.
Use of the "GOOS label".	• A clear identifier. • Encourages participation by acknowledgment. • Encourages trust in GOOS products.	• May alienate those who cannot comply.
The independent development of regional GOOS's.	• A powerful means of recruiting national participation (e.g. EuroGOOS). • A platform for pilot experiments. • A valuable interface with user community. • An efficient, pragmatic approach.	• Monitoring/servicing may overload GPO. • Driving agendas may not acknowledge the GOOS Principles.

Table 3: Long-term issues

LONG-TERM ISSUE	APPROACH
Global vision for EO will take time to evolve. Presently rhetorical. GOOS may be captive to the process, not first-in-line to gain credit.	Need robust demonstrations of the power of ocean observations. Within reach: • Argo and GODAE. • Storm-surge. • Micro-weather (e.g. 1998 Sydney-Hobart). • Coastal modelling, linked to OCS and applied to environmental problems.
Benefits mainly recognisable only in the long term.	A strategy to follow-through on successes, especially with respect to C-GOOS and climate
Visibility within governments.	Target progress and success reports to sensitive national departments, especially environment portfolios. National 'agents' will be important in this.
Needs recognition of value and acceptance by ministries and departments not presently committed to long-term marine infrastructure.	• Encourage (and if necessary, resource) studies applied to particular situations, e.g. El Ni☆o, oil spill, environmental perturbation, storm surge, focussing on economic value of improvement. • Identify areas suitable to be seen as foreign aid, disaster relief, economic cooperation.
Priorities may be irrelevant, unpalatable or of low priority in national strategic agendas.	• Reality-check on GOOS plan; should we sacrifice good parts to gain popularity? • Don't expect to change national agendas.
GOOS observations become an essential part of long-term earth system monitoring and national marine management.	Attention paid to • Comprehensiveness of observations in relation to specific sectoral need. • Assurance of quality, continuity, conditions of access • Region-specific need. • Capacity to integrate observations of different types. • Universality of data formats and protocol.

ANNEX V

STATUS OF AN OCEAN pCO_2 OBSERVING SYSTEM

From AJ Watson, Chair, IOC/SCOR CO_2 panel (a.watson@uea.ac.uk)

Introduction

On February 21, 2000, at the SOLAS meeting at Damp, Germany, a sub-set of the SCOR-IOC CO_2 advisory panel met to review the current status of an ocean observing system for sea surface pCO_2. Panel members present were: AJ Watson, DWR Wallace, L. Merlivat, A. Poisson, A. Dickson, T. Johannessen. Other interested parties present were: L. Dilling (NOAA office of global programmes), S. Doney, N. Lefevre.

Summary

(i) Proven technology is now commercially available to enable the measurement of surface ocean pCO_2 and related parameters from drifting buoys and ships of opportunity.

(ii) This equipment could be used to put in place an observing system that would enable seasonal and high-resolution spatial monitoring of air-sea CO_2 fluxes. If such a system were implemented globally, or even if only in the Northern Hemisphere oceans, it would greatly contribute towards better characterization of the oceanic sink for anthropogenic CO_2. It would also enable substantially better monitoring of the distribution of the terrestrial sinks for CO_2, and would thus contribute an important element in making the Kyoto agreement workable.

(iii) Plans are advanced to commission a ship of opportunity network in the N. Atlantic to enable seasonal resolution of CO_2 ocean - air fluxes over this region.

(iv) In the N. Pacific, one regular ship of opportunity line is being run and others are planned.

(v) A number of ongoing measurement programmes, mostly on research vessels running regular routes, are in place which give coverage of specific regions, lines, and time series stations. These data are very valuable, and every effort needs to be given to support these ongoing programmes. The existing data coverage is however widely scattered and does not allow full resolution of any ocean basin.

(vi) The effort continues to draw together the substantial existing data for global pCO_2 into a more widely accessible database. Some funding for this activity has been obtained in the US, and applied for in Europe.

(vii) In the US a committee has been convened to consider the design criteria for a pCO_2 observing system able to deliver the required resolution of air-sea CO_2 fluxes.

The need for a pCO_2 observing system

At present our knowledge of the distribution of sources and sinks in the ocean is based on models, and on historical data collected over the last 30 years. The data have largely been collected by research ships. Recently, “climatologies" of surface ocean pCO_2 have been published in which this data is synthesised into seasonal or monthly pictures of an “average year” using various assumptions and interpolation techniques. The atmospheric pCO_2 has been increasing in a well-documented way during the period in which the data have been collected, but oceanic pCO_2 will not have tracked this atmospheric pCO_2 uniformly everywhere, so inevitably uncertainty and arbitrariness attaches to these climatologies. Furthermore, atmospheric measurements suggest a large year to year variability in the oceanic sink, which the climatologies cannot address at all.

There are important practical reasons for wanting to know more about year-to-year and season-to-season variability in the ocean air-sea CO_2 flux. In order to make the Kyoto agreement verifiable, it is desirable to know how much CO_2 the vegetation of continental regions such as North America and Europe are taking up, and how this changes in response to climate change and policies aimed at reducing net Greenhouse gas emissions. At the continental scale, the terrestrial sink cannot at present be estimated directly. Some constraints

can be put on continental emissions from inversions of atmospheric measurements of the distribution of CO_2, but these need independent constraints to be usefully accurate. An independent estimate of the air-sea flux across ocean basin regions provides a very useful constraint. Currently, most atmospheric inversions use the oceanic pCO_2 climatologies, despite their known drawbacks. An observing network that would monitor these fluxes on the same time scales as the atmospheric flask network operates on (i.e. monthly-seasonally) would be much preferable, with the main regions of importance to Europe and North America being the North Atlantic and North Pacific.

A second reason for wanting such an observing system is that surface ocean pCO_2 is being used as a prime output of ocean GCMs with carbon cycle models. These models represent our current best attempts to synthesise the global marine carbon system. Surface pCO_2 is sensititive to changes in circulation, heat fluxes, upwelling and deep mixing, and biological productivity. Such a monitoring system would therefore enable us to test the ability of our models with regard to these variables.

Status of instrumentation

Automated instrumentation for measurement of pCO_2 on ships of opportunity and drifting autonomous buoys has been described in the literature for several years and is now commercially available. See for example, Cooper et al., 1998 and Hood et al., 1999.

Status of the historical data

Historical data remain scattered, much of it still available only from the original investigators. In recent years, Takahashi and colleagues have published climatologies made up of the data obtained from some of the holders of larger data sets. Some of this data is now publicly available through CDIAC (Carbon dioxide information centre, Oak Ridge, Tennessee). Some remains out of the public domain however. In 1995 an inventory was begun by the SCOR-IOC CO_2 of the data which exist. We estimate that less than 50% of the total data is currently at CDIAC.

Two efforts are now underway to further advance the data base. (i) Andrew Dickson (SIO) has been funded by NOAA for two years to advance centralisation of data. (ii) In Europe funds have been requested via the EU specifically to compile a North Atlantic data base. At present, funds remain insufficient to fully complete and document a global pCO_2 data base.

Status of a pCO_2 observing system

We know of the following regular time series of pCO_2 data which are currently being collected:

(i) At the US time Hawaii and Bermuda time series stations, regular underway pCO_2 observations are made as part of the overall data sets.

(ii) Antarctic supply vessels are being used to provide regular data. These include the French "OISO" programme in the South Indian Ocean, (going between the islands of Crozet, Kerguelen, and Amsterdam), the UK "AMT" section and the Spanish R.V. *Hesperides* through the Atlantic. All these vessels run twice per year.

(iii) Canada maintains time series on line P, and in the Labrador Sea.

Several investigators are now in process of trying to set up observing systems which would enable the Northern Hemisphere oceans to be monitored with sufficient precision to enable useful season-to-season estimates of pCO_2 fields and CO_2 fluxes. Components of this effort are:

(i) In Europe, investigators led by AJ Watson have applied to the EU for funds to set up Ship of opportunity lines as follows: Denmark - West Greenland, Hamburg- Halifax, and UK-Jamaica. The first three of these are regularly run (monthly or thereabouts) merchant vessel routes while the last is an Antarctic supply vessel.

(ii) In the US, NOAA OGP has set up a committee to design an observing system by looking at suitable routes, analysing correlation scale lengths, etc. In addition plans are underway to instrument the AX7 (Miami - Straits of Gibraltar) line, the Norfolk, VA to Bermuda line and possibly other merchant lines in the Atlantic

(iii) There is an existing co-operation between Japan (Y. Nojiri, National Institute for Environmental Studies) and Canada (CS Wong, Institute of Ocean Sciences) to collect regular data between Vancouver and Japan using the commercial vessel M/V Skaugran.

References

Hood EM, Merlivat L, Johannessen T (1999). Variations of fCO_2 and air-sea flux of CO2 in the Greenland Sea gyre using high-frequency time series data from CARIOCA drift buoys J. Geophys Res, - Oceans 104: (C9) 20571-20583

Cooper, D. J., Watson, A. J., and Ling, R. D. (1998). Variation of pCO_2 along a North Atlantic shipping route (UK to Caribbean): a year of automated observations. *Mar. Chem.*, **60**, 147-164.

ANNEX VI

EUROGOOS INVESTMENT STRUCTURE

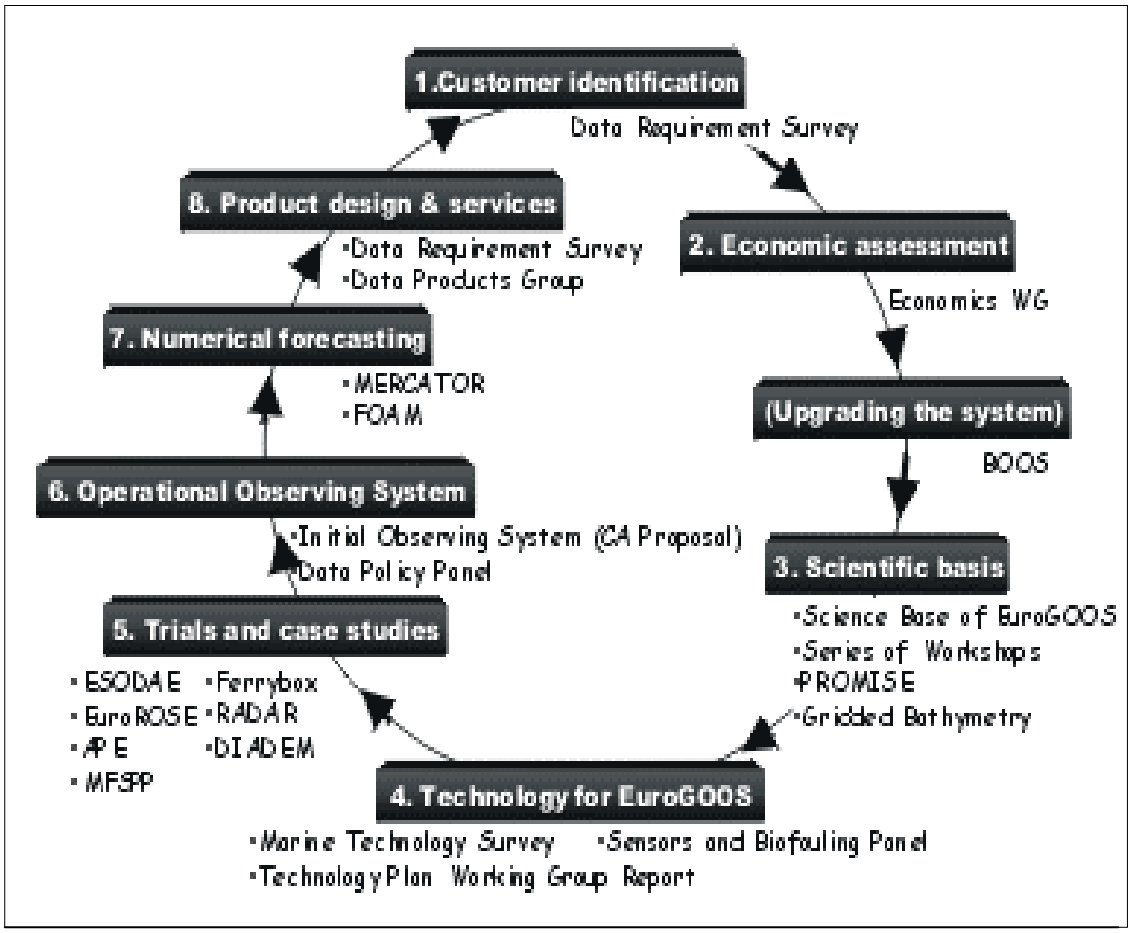


Figure 1 : Connections between components of investment in EuroGOOS model of costs, benefits and investments

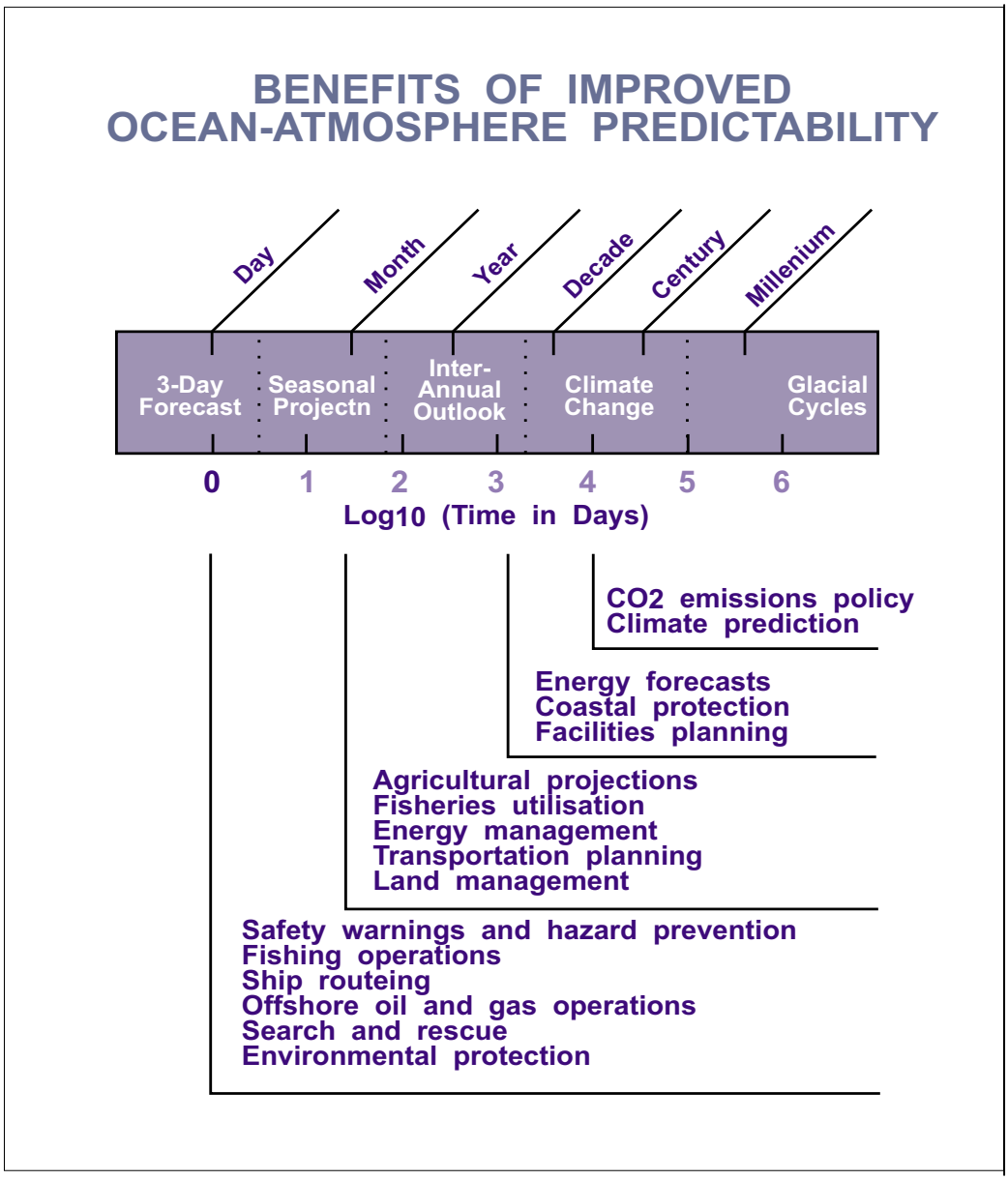


Figure 2 : Timescales on which different types of forecast influence different industries or activities

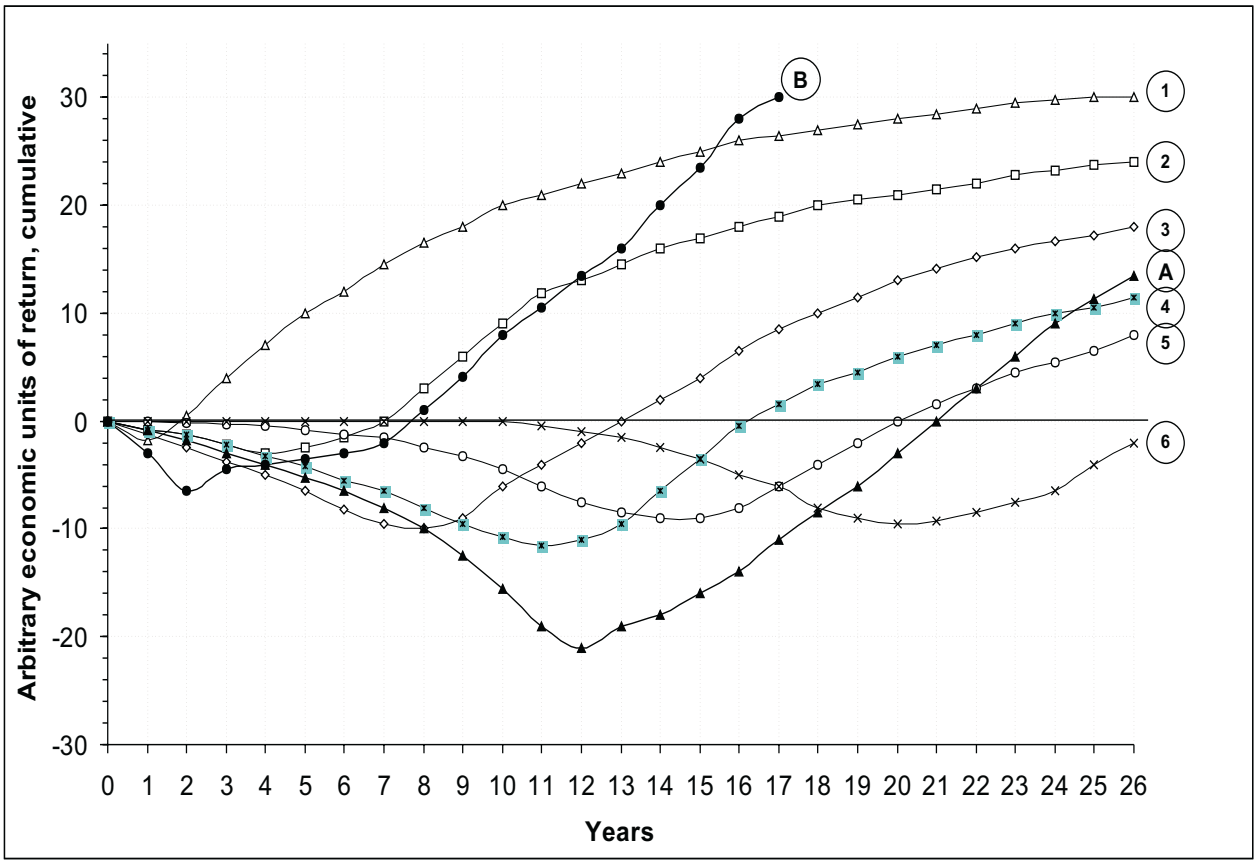
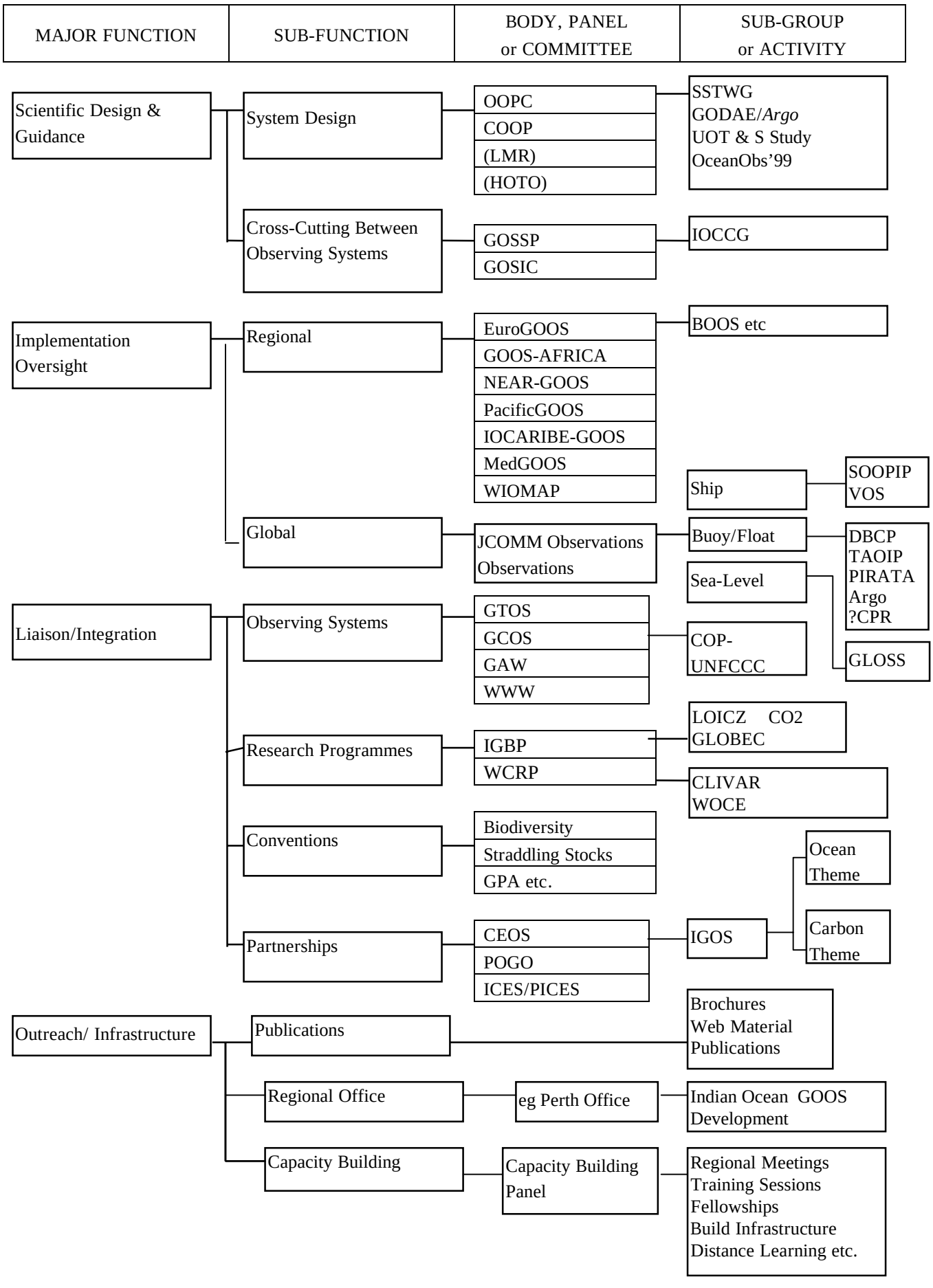


Figure 3 : Hypothetical model of return on investment on different observing system elements (1, 2, 3 – 6).
Curve "A" is the sum of 4 – 6.
Curve "B" is the sum of 1 – 6.
See text for explanation (section 4.3).

ANNEX VII

GOOS ACTIVITY STRUCTURE



ANNEX VIII

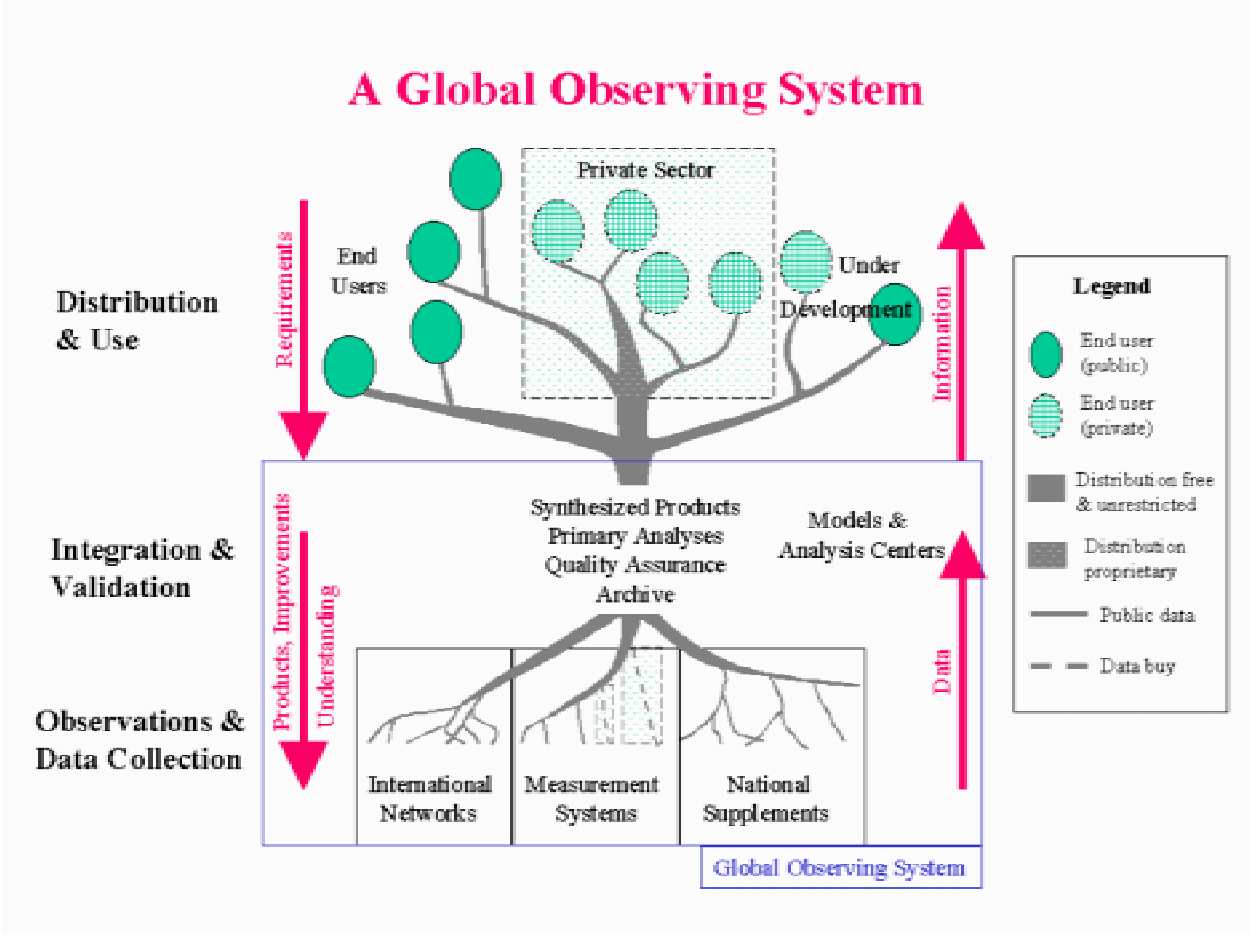
TREE DIAGRAM

Francis Bretherton **(**fbretherton@ssec.wisc.edu)

The Integrated Global Observing Strategy (IGOS: http://www.unep.ch/earthw/igos.htm) is concerned with sustained measurements of the environment that are applied to issues of international concern. It envisages the evolutionary development of several related observing systems, each organized within a coherent theme and responsive to a variety of end uses of overall economic benefit and improved scientific understanding. The diagram below is intended to stimulate discussion of appropriate roles of the public and private sectors in the implementation of this concept.

Within the USA, there is a reasonably settled consensus that the taxpayer benefits most if the results of government-funded data collection are available to the general public as widely as possible, free of copyright or other restrictions and to everyone without discrimination. At the same time, as environmental information becomes more valued, commercial interests want to be involved, with distribution rights on data and derived products a prime concern. Particularly problematic are government-private partnerships, in which individually negotiated agreements over data rights can have many unforeseen consequences. In some other countries government agencies themselves are expected to cover a significant fraction of their costs by selling data and services as if they were a commercial business. These differences among nations are currently exacerbated by the Internet and the globalization of the economy, as well as by recurring fears of economic or military domination. Successful international collaboration depends upon voluntary adherence to a common vision of obligations and expectations, which minimizes the intrusion of these factors.

Many people have freely contributed ideas to development of this concept and the associated graphic. This material may be used freely and without restriction, subject only to a request to honor the spirit in which it is presented.



Key Points

- Environmental observation in the public interest requires the growing several "trees", each with multiple uses around a distinct theme and co-ordinated with other "trees" where necessary. A well-developed example is the system for daily weather prediction.

- For credibility, each trunk must be a responsibility of the public sector, with open scrutiny and assessment of data and synthesized products by the international scientific community.

- Branches imply further distribution or processing. Mature branches - application areas for which the synthesized data products are well understood - are potential candidates for value-added privatization, provided the basic scientific data and core products remain available at marginal cost of reproduction. Where the science is not yet mature, investment in system development should be particularly responsive to research applications.

- Individual roots are potential candidates for data buys from private companies, provided the public sector acquires all rights to further distribution and use of the data and government-sponsored derived products. Where a root serves more than one trunk, close liaison between those trunks is essential. Thus the whole may actually resemble a Banyan tree.

- The incentive to participate in collaborative international science based observing programmes is the sharing of information. This requires free and unrestricted exchange of appropriate data and products at minimal cost to the scientific user. Data subject to use restriction should not be regarded as contributing to the Global Observing System.

- Building capacity and enhancement of environmental understanding enables all nations to participate, and thus fertilizes the entire enterprise.

ANNEX IX

LIST OF ACRONYMS

ACSYS	Arctic Climate System Study
AOPC	Atmospheric Observing Panel for Climate
ASEAN	Association of South-East Asian Nations
BATS	Bermuda Atlantic Time Series Station
CCCC	Climate Change Carrying Capacity
CEOS	Committee on Earth Observation Satellites
CLIVAR	Climate Variability and Predictability
CMM	Commission for Marine Meteorology
COP	Conference of the Parties (of the UNFCCC)
CPR	Continuous Plankton Recorder
CSIRO	Commonwealth Scientific and Industrial Research Organization
DBCP	Data Buoy Co-operation Panel
EC	European Community
EEZ	Exclusive Economic Zone
ENSO	El Niño-Southern Oscillation
ENVISAT	Environmental Satellite
EPB	Electronic Products Bulletin
ESODAE	European Shelf Seas Data Assimilation and Forecast Experiment
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EuroGOOS	European GOOS
FAO	Food and Agriculture Organization of the United Nations
FCCC	Framework Convention on Climate Change
FOAM	Forecast Ocean Atmosphere Model
GCOS	Global Climate Observing System
GCRMN	Global Coral Reef Monitoring Network
GEF	Global Environment Facility
GEOHAB	Global Ecology of Harmful Algal Blooms
GIPCO	GOOS Integrated Panel for the Coastal Ocean
GIPME	Global Investigation of Pollution in the Marine Environment
GLOSS	Global Sea-Level Observing Systewm
GLOBEC	Global Ocean Ecosystems Dynamics
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
GOOS-IOS	GOOS Initial Observing System
GOSIC	G3OS Information Centre
GOSSP	Global Observing Systems Space Panel
GPO	GOOS Project Office
GSC	GOOS Steering Committee
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunications System (of WMO)
GTSPP	Global Temperature-Salinity Pilot Programme
HAB	Harmful Algal Blooms
HOTO	Health of the Oceans
HOTS	Hawaii Ocean Time Series Station
IAEA	International Atomic Energy Agency
IBTS	ICES International Bottom Trawl Survey
ICES	International Council for the Exploration of the Sea
ICSU	International Council of Science
IEPB	IGOSS Electronic Products Bulletin
IFREMER	Institut français de recherche pour l'exploitation de la mer

IGBP	International Geosphere-Biosphere Programme
IGOSS	Integrated Global Ocean Services System
IGOS	Integrated Global Observing Strategy
I-GOOS	Intergovernmental Committee for GOOS
IIAG	Interim Implementation Advisory Group
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IOC-EC	Intergovernmental Oceanographic Commission Executive Council
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IOCCG	International Ocean Colour Co-ordination Group
IODE	International Oceanographic Data and Information Exchange
OOSDP	Ocean Observing System Development Panel
IOS	Institute of Oceanographic Sciences
IPCC	Intergovernmental Panel on Climate Change
IUG	International Union of Geographers
JAFOOS	Joint Australian Facility for Ocean Observing Systems
JAMSTEC	Japan Marine Science and Technology Centre
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
J-DIMP	Joint Data and Information Management Panel
JGOFS	Joint Global Ocean Flux Study
LME	Large Marine Ecosystem
LMR	Living Marine Resources
LOC	Local Organizing Committee
LOICZ	Land-Ocean Interactions in the Coastal Zone
LUCC	Land Use and Cover Change Programme
MedGOOS	Mediterranean GOOS
MONBUSHO	Japanese Ministry of Education and Science
NAML	North American Marine Laboratories Network
NAO	North Atlantic Oscillation
NASA	National Aeronautics and Space Administration (USA)
NEARGOOS	N. E. Asian Region GOOS
NGCCs	National GOOS Co-ordinating Committees
NGOs	Non-Governmental Organizations
NIO	National Institute of Oceanography (India)
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre
NSF	United States National Science Foundation
ODINAFRICA	Ocean Data and Information for Africa
OECD	Organization for Economic Co-operation and Development
OOPC	Ocean Observations Panel for Climate
OOS	Ocean Observing System
OOSDP	Ocean Observing System Development Panel
PACSICOM	Pan African Conference on Sustainable Integrated Coastal Management
PICES	North Pacific Marine Science Organization
PIRATA	Pilot Research Array in the Tropical Atlantic
POGO	Partnership for Observation of the Global Ocean
RAMP	Rapid Assessment of Marine Pollution
SAHFOS	Sir Alister Hardy Foundation for Ocean Sciences (UK)
SAR	Synthetic Aperture Radar
SBSTA	Subsidiary Body for Scientific and Technological Advice
SEA-GOOS	Southeast Asian GOOS
SEAWIFS	Sea-Viewing, Wide-Field-of-View Sensor
SECAMP	S. E. Asia Centre for Atmospheric and Marine Prediction
SIO	Scripps Institute of Oceanography (University of California, USA)
SOA	State Oceanic Administration (China)
SOC	Southampton Oceanography Centre
SOOP	Ship-of-Opportunity Programme

SST	Sea Surface Temperature
TAO-IP	Tropical Atmosphere Ocean Array Implementation Panel
TEMA	IOC Training, Education and Mutual Assistance programme
TOGA	Tropical Ocean Global Atmosphere Research Programme
TOPEX	Typhoon Operational Experiment
TORs	Terms of Reference
UNCED	United Nations Conference on Environment and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
UNISPACE	United National Conference on Outer Space
VOS	Voluntary Observing Ship
WCRP	World Climate Research Programme
WESTPAC	IOC Sub-Commission for the Western Pacific
WGNE	Working Group on Numerical Experimentation
WHOI	Woods Hole Oceanographic Institution (USA)
WIOMAP	Western Indian Ocean Marine Applications Project
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
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 lntercalibration
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 lnternacional 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 lntercalibration
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 CO, 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 C02 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)***
116. 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 Off ices 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
199 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-IBCWIO-IW3), 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 C02 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