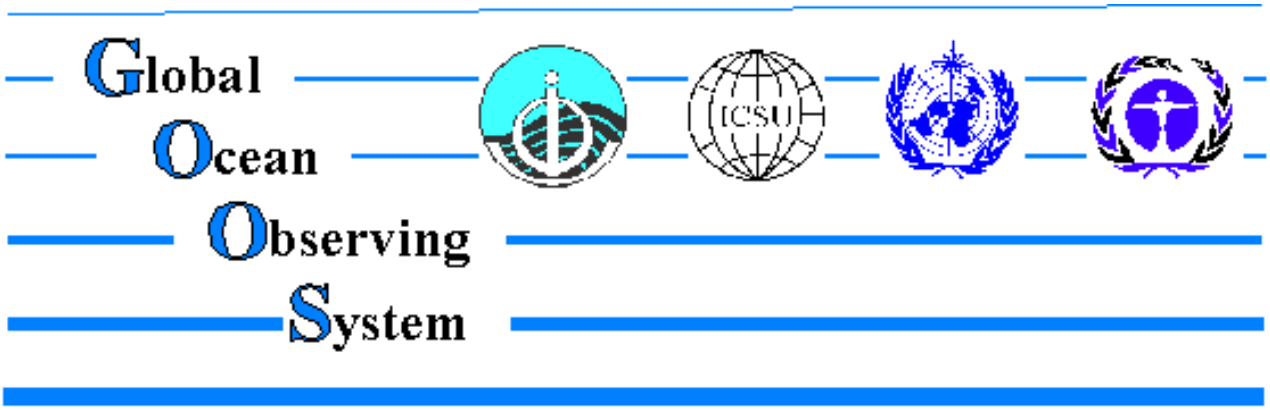

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

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

Second Session
Beijing, China
26 - 29 April 1999

GOOS Report No. 73

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Paris, August 1999
English only

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ANNEXES

1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SESSION

The second session of the Global Ocean Observing System (GOOS) Steering Committee (GSC) was called to order by its Chairman, Prof. W. Nowlin, on Monday April 26th 1999, at 0900, in Beijing, China, at the Xiyuan Hotel.

1.2 WELCOMING REMARKS BY HOST AGENCY

The meeting was hosted by the State Ocean Administration (SOA) of the Peoples Republic of China, whose Deputy Administrator, Mr. Chen Lianzeng, welcomed the participants (listed in Annex II). Mr. Chen noted that it was an honour for SOA to host this high-level scientific meeting, and extended a warm welcome to the members of the GSC and other participants. The transformation of marine sciences from research to operational oceanography that GOOS is undertaking meets the goals of Chapter 17 of Agenda 21, which calls on IOC (the Intergovernmental Oceanographic Commission of UNESCO) and other organizations to develop GOOS to underpin management and sustainable development of the marine environment. Mr. Chen welcomed the creation of the GOOS Initial Observing System, and the balanced development of GOOS now evident with the creation of GOOS Living Marine Resources and Coastal Panels. He noted China's considerable interest in GOOS, and its leadership in the formation of NEAR-GOOS, the N.E. Asian regional GOOS programme, which China currently chairs. To help expedite the development of GOOS in the region, China has recently prepared master plans for the development of coastal stations, a data buoy network and an upgraded marine environmental forecasting service. China is also considering putting more data on the NEAR-GOOS Internet Web site. Mr. Chen concluded by noting that this meeting provided an excellent opportunity for observers from Chinese organizations to become aware of GOOS, and for observers from China and Japan to consider how their mutual interests in GOOS might best be advanced in the regional context. He wished the meeting success and the participants a pleasant stay in Beijing.

The Chairman thanked Dr. Chen for his warm welcome, noting that China supports GOOS in many ways, not least by hosting the present meeting.

Dr. N. Flemming, representing the IOC, offered the official thanks of the IOC to the SOA for hosting the meeting. GOOS is the flagship project of the IOC. It is important that GOOS develops smoothly and efficiently in a way that involves all IOC Member States; this in turn requires that serious thought be given to how to build the capacity of the less well equipped Member States so that they could participate in and benefit from GOOS.

Peter Dexter, representing the World Meteorological Organization (WMO), reiterated thanks to SOA for its support. The WMO is pleased with the progress that GOOS is making, is looking forward to assisting in the growing implementation of GOOS, and will continue its financial support for GOOS coordination.

In the absence of Allyn Clarke, the ICSU representative, who was recovering from an illness, Geoff Brundrit brought greetings from ICSU to the participants, and thanks to the SOA for its generous hospitality. ICSU encourages exchanges of ideas and data of the kind that are being carried out through GOOS, and is keen to assist in fostering links to research programmes like those developed through the International Geosphere-Biosphere Programme (IGBP).

The Chairman noted that the other main sponsor of GOOS, UNEP, had sent apologies for being unable to be represented at this meeting, along with a statement of continued support.

The Chairman then introduced Haiqing Li, Chairman of the Local Organizing Committee (LOC), who introduced the Chinese observers from the National Marine Environmental Production Centre, National Ocean Data Centre, Institute of Ocean Technology Development, SOA HQ and SOA Department of Environmental Production, and the members of the Secretariat of the LOC who were present to help with the running of the meeting and to assist participants. The Chairman thanked Dr. Li for the smooth organization, efforts and facilities provided by the LOC and its Secretariat.

The members of the Panel and other observers then introduced themselves. Dr. Mike Bewers represented Tony Knap, Chairman of the Health of the Ocean (HOTO) Panel; Dr. Ned Cyr represented Warren Wooster and Dagoberto Arcos, Co-Chairmen of the Living Marine Resources (LMR) Panel.

The Chairman thanked participants for coming and wished them a successful four days. He noted that there have been a number of important developments in GOOS recently, and that he is pleased with progress in GOOS on several fronts. Nevertheless there is still much to do, hence the need for this meeting.

1.3 ADOPTION OF THE AGENDA

The provisional agenda (Annex I) was adopted, with the proviso that item 10 be taken directly after item 4 because Dr. McEwan, who was involved with item 10 (work programme and budget) had to leave early.

Additions to the Agenda included presentations given by (i) Howard Cattle, on the UK's operational Forecast Ocean Atmosphere Model (FOAM); (ii) Ilana Wainer, on pre-operational research on modelling the confluence of the Brazil and Malvinas currents; (iii) Liliane Merlivat, on new techniques for CO_2 measurement in GOOS; and (iv) Ralph Rayner, on activities of offshore service companies, customers *versus* users, and the development and value of this market.

1.4 WORKING ARRANGEMENTS

Dr. Li, Chairman of the LOC, noted the various local arrangements. Dr. Summerhayes, Director of the GOOS Project Office (GPO) set out the timetable and introduced the list of documents (Annex III).

2. VIEWS OF THE CHAIRMAN OF I-GOOS

Dr. Angus McEwan, Chairman of the Intergovernmental Committee for GOOS (I-GOOS) addressed the Committee, offering his views on the future of GOOS and reporting on the IOC Executive Council's (IOC-EC) interest in and actions on GOOS.

GOOS has a future. GOOS is recognized. People know what it is, though these perceptions are not uniform. Planning to date provides an excellent foundation, and documents like The GOOS 1998 provide an excellent source of information about GOOS for policy-makers and others. It is impossible to predict the future shape of GOOS precisely because each country in implementing its contribution to GOOS will have to work within its own constraints of funding, resources, regional aspirations, and so on. The physical observational part of GOOS will develop quite well, not least because it is being built on subsystems already developed by the IOC and the WMO either separately or in concert, particularly for weather, climate and sea-level observations and forecasts. Other parts of GOOS will likely develop in a more complex way representing the broad spectrum of user interest. Development of GOOS will depend to a large extent on regional alliances like those seen in NEAR-GOOS and EuroGOOS, which differ from one another though consistent with the GOOS Principles. For instance, PacificGOOS, which involves a large number of island states with limited resources, is unlikely to develop quite like either NEAR-GOOS or EuroGOOS, because of the conditions special to the island countries of the southwest Pacific. This is not a problem.

Pilot project are useful demonstrators of how GOOS may work in the future. GOOS should encourage them to start, then let them grow while encouraging them to move in the right general direction and to stay within the general framework; too tight a control would probably be counter-productive.

At its meeting in November 1998, the IOC-EC strongly endorsed the present balanced development of GOOS and praised the progress that was being made. The IOC-EC endorsed the development of the proposed Joint IOC/WMO Technical Commission for Oceanography and Marine Meteorology (JCOMM) (agenda item 5.2.1), and the partnership for an IGOS (Integrated Global Observing Strategy) (agenda item 6.1).

Recognizing that there was concern by several Member States about whether the level to which GOOS is resourced by the IOC was adequate, given that it is IOC's flagship programme, the IOC-EC appointed a Working Party to look into GOOS resources and to report back to the IOC Assembly in July 1999. Careful analysis of annual GOOS-related non-salary expenditure across the IOC suggests that it is around $1 million out of a total of $3.2 million, or about one third of the IOC's programme budget, which does not seem unreasonable for such a major international venture. About half of the expenditure involves income to the IOC Trust Fund from various sources, the other half involving income from UNESCO through IOC's Regular Programme.

There was concern about the extent to which the existence, function, and usefulness of GOOS are appreciated by the IOC's parent body, UNESCO. This concern arises because while the Government Departments that are represented in the IOC governing bodies (like the Assembly) have a largely scientific and technical remit that is focussed on or includes the oceans, the Departments that are represented in the UNESCO governing bodies (like the General Conference) are largely concerned with Education. This situation makes for a disconnect in the process of decision-making regarding IOC affairs, both nationally and within UNESCO, that may be detrimental to GOOS development at both national and international levels.

Partly as a consequence, GOOS has a difficulty in visibility and communication. This issue must be addressed in a thoroughly professional way so as to attract national support at appropriate levels, which in turn demands appropriate planning and resourcing.

In discussion it was noted that one way to achieve national recognition of the need for implementation of GOOS may be the development in each country of strong inter-agency committees that could work towards development of a common approach to ocean policy issues. The case for such national committees is eloquently spelled out in the report on GOOS-AFRICA (see agenda item 5.4.1.3).

Participants noted that solving the communication issue requires identifying who are the targets for communication.

ACTION 1: GPO to identify potential targets for communication and to investigate ways of improving communication regarding GOOS and its resource requirements.]

3. REPORT BY THE DIRECTOR GPO

3.1 GPO ACTIVITIES

Colin Summerhayes presented the report on GPO activities. There have been several staff changes. Umit Unluata joined the IOC and took over from Neil Andersen the job of Technical Secretary for the HOTO Panel. Ned Cyr was seconded to the IOC from NOAA to replace George Grice as Technical Secretary for the LMR Panel. Thorkild Aarup joined the IOC and became Technical Secretary for both the Coastal GOOS Panel and the GLOSS (Global Sea Level Observing System) programme. Justin Ahanhanzo was re-assigned from elsewhere in the IOC to be Technical Secretary for GOOS-AFRICA and MedGOOS. Bill Erb, who had been Technical Secretary for the GOOS Capacity Building Panel returned to the USA, as did John Withrow who co-ordinated GOOS data requirements and remote sensing. Naoko Ichiyama returned to Japan and was replaced by Rimi Nakano, who forms the GPO liaison with NEAR-GOOS. The secondment of Janice Trotte from Brazil was extended for a further year; Janice will handle GOOS developments in South America. Recruiting began to fill a joint GOOS and IODE (International Ocean Data and Information Exchange programme) data post. Between them the 11 scientific staff occupied with GOOS in 1999 represent 7.2 person-years of effort *per* year, or about the same as in 1998. Secretarial support increased slightly to the equivalent of 3.5 person-years of effort *per* year.

A high level of co-ordination is being maintained with GOOS sponsors, with the Global Climate and Terrestrial Observing Systems (GCOS and GTOS), with regional GOOS bodies, with CEOS (the Committee on Earth Observing Satellites), with major research programmes (the World Ocean Circulation Experiment, WOCE; the Joint Global Ocean Flux Study, JGOFS; the Climate Variability study, CLIVAR; the Land-Ocean

Interaction in the Coastal Zone Study, LOICZ; the Global Ecosystem Dynamics study, GLOBEC), with major national organizations in Europe, Japan and the USA; and with regional organizations like ICES (International Council for the Exploration of the Sea), or international ones like the IUG (International Union of Geographers).

Promotion of and communication regarding GOOS have remained at a high level, with several papers on GOOS being delivered at conferences and/or published, with involvement in two pavilions at EXPO-98 in Lisbon, with publication of the GOOS News, with improvement of the GOOS Web site (http://ioc.unesco.org/goos), and with publication of The GOOS 1998. This last took place under the able management of Nic Flemming at the Southampton Oceanography Centre, with financial assistance from the US National Science Foundation (NSF), the European Commission (EC), and the Japanese Ministry of Education and Science (MONBUSHO).

Including The GOOS 1998 and a brochure setting out the aims and objectives of the three global observing systems, fifteen GOOS reports have been published since GSC-I. Three more are in press, and a further five plus a brochure on the Integrated Global Observing Strategy (IGOS) are in the final stages of preparation.

Considerable efforts have been made to attract external funding for the co-ordination activities of the GPO, principally to support the costs of meetings, but also to support some staff activities such as the data post. Attempts to obtain some resources from the UN's Turner Fund, jointly with WMO, have not yet succeeded, but the Fund is open for bids annually and the GPO will try again in the future. It was noted that bids without UNEP as a partner might be unsuccessful.

The Committee expressed its thanks to the GPO Director and staff for their efforts during the year.

ACTION 2: GPO to investigate further the possibility of working with the G3OS to obtain funds from the Turner Fund.

3.1.1 Progress against actions from GSC-I

The Chairman noted that a great deal of progress had been made against the 55 actions set at GSC-I, and that the majority of actions had been carried out. Those still believed necessary were reformulated as actions items from GSC-II. These follow:

ACTION Item 8 from GSC-I called for GPO to develop a GOOS brochure. This task was postponed in 1998, because of lack of time. Members agreed that a GOOS brochure should be produced. It should contain product examples taken from various Web sites, including the IGOSS Electronic Products Bulletin. There should be examples from all disciplines, including for example some output from the Continuous Plankton Recorder, representing all modules, and showing intended products (i.e. from the research area) if no actual operational products are available. The brochure should include an organizational flow chart for GOOS, an outline of the data and information management plan (from the G3OS Information Centre) and lists of Web addresses from key GOOS sites and product centres (including, for instance, the Australian Bureau of Meteorology; the UK Met Office, NOAA, the TAO Web site and so on). Work should start in August. Ehrlich Desa, of NIO, Goa, offered to print the brochure at no cost, as a GOOS contribution from India.

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.

ACTION 4: (GSC-I ACTION Item 28): GPO to develop data inventories for C-GOOS and LMR. (During the year, it was agreed that this task would be shared with LOICZ. The project was due to be started by the IOC/GOOS data person (John Withrow), but he left the IOC late in 1998. His proposed replacement was not able to start as planned at the beginning of 1999. Recruitment of additional staff to the GPO has now allowed a plan to be agreed with the Chairman of C-GOOS to start the task in May 1999).

ACTION 5: (GSC-I ACTION Items 53 and 54): GPO to develop a data base of national contacts and to promote development of national committees. (This has been on hold due to lack of staff time, but is now beginning).

ACTION 6: (GSC-I ACTION Item 11): HOTO Panel to develop a list of priorities. (Delay in meeting this requirement was occasioned by departure of HOTO Chair; his replacement is working on it).

ACTION 7: (GSC-I ACTION Item 9): Develop a new sea-level advisory mechanism to complement GLOSS. (This proposal was put to the IOC Executive Council in November 1998. They instructed the GPO to solicit the views of the GLOSS Group of Experts before reaching a decision). GSC-II asked Geoff Brundrit to ensure that this matter was brought to a successful conclusion at the GLOSS-VI meeting in Toulouse (May 10-14, 1999).

ACTION 8: (GSC-I ACTION ITEM 50): GPO to arrange external review of GOOS by agencies and users. (The GSC wishes this action to take place sometime in the next 2-3 years).

ACTION 9: (GSC-I ACTION ITEM 30): Develop methodology for economic evaluation of GOOS. (The working party to do this did not meet, but some of the necessary actions were carried out, and progress is being made within EuroGOOS). The Action will be carried out by Nic Flemming, Geoff Brundrit, and Ilana Wainer.

ACTION 10: (GSC-I ACTION ITEM 27): Panels to interact with Convention Secretariats as key end users, involving them as appropriate in Panel meetings. (Liaison by OOPC with the Secretariat for the Framework Convention on Climate Change is taking place through GCOS. Other panels need to build linkages to other relevant Secretariats (there are some links already in HOTO, though not yet with Global Plan of Action for Protection of the Marine Environment from Land Based Activities).

3.2 GOOS SPONSORS

Colin Summerhayes advised the Committee of the results of the meeting of the sponsors of the global observing systems (June 1998). A brochure describing a strategy that linked the three observing systems (the G3OS) had been finalized and was now published. Plans were made collectively for the recruitment of a new panel chair for GOSSP (Francis Bretherton was subsequently appointed). The sponsors strongly endorsed the need for JCOMM. The IAEA (International Atomic Energy Agency) was considered as a possible additional UN sponsor of one or other aspects of the G3OS; it's work may be relevant to HOTO, and this needs to be further explored. The sponsors expressed concern about the weakness of the mechanisms for funding the global observing systems, though no solution was forthcoming during the meeting. Changes in the structure of UNEP might make it easier for UNEP to contribute to the costs of the G3OS in future. The sponsors further endorsed participation in IGOS, recommending changes to the wording of the partnership agreement.

4. GOOS PLANNING

4.1 GENERAL GOOS DESIGN

3000 copies of The GOOS 1998 were printed, and most had been distributed. A small reserve was saved for distribution at the IOC Assembly in July 1999. Nic Flemming, Chair of the Working Party that had finalized the document, thanked the members of the GSC who had participated in that exercise. He reminded the Committee that the purpose of the document was primarily for the education of decision makers and other potential users, and was meant to be a springboard for the future. Feedback had been very positive, and several GSC members noted that The GOOS 1998 had proved to be a most useful 'marketing' document. The Director of the GPO reported that the IOC has now placed a contract to put The GOOS 1998 on the GOOS Web site, which would enable it to be seen by a far wider community at much lower cost than would be incurred by a second print run.

Members noted that the GOOS concept was already influencing governments widely. The Vth Framework Programme of the EC specifically addressed the need for support for global observing systems; individual countries, like Australia, India and the USA, for example, had started to develop ocean policies in which ocean observing systems are expected to play a prominent role. Many countries now have national GOOS committees which are influencing the development of operational oceanography at the national level. The GOOS 1998 is seen as helpful to these efforts and to spreading the GOOS concept yet more widely.

The Committee was reminded that annually since 1992 the GPO has produced a GOOS Status Report, the last one (IOC/INF-1113; GOOS Report 59) having been compiled in 1998 for the year 1997. The GSC was asked if such annual reporting was still needed, noting that no report had been prepared for 1998 because of the issue that year of The GOOS 1998 document. Members were reminded that the Conference of the Parties (COP) to the Framework Convention on Climate Change (FCCC), at its meeting in Buenos Aires, had stipulated the need for annual reporting on the adequacy of the global observing system for climate (which includes GOOS observations related to climate).

A general discussion ensued of audiences, and appropriate media, for GOOS information. Four classes of audience were identified (with appropriate media): most technical/scientific users (Web site), most managers/funders (written updates, e.g. IPCC summary), non-Web accessed technical/managerial (written status report), and general public (news media and Web site to much lesser extent).

Some members felt that the real and potential user community would know enough about current ocean observing systems to turn to the right sites on the Web for the information they required, and so would have no need of a GPO-produced status report. However, the Committee accepted that in some geographic regions there was minimal access to the Internet, so that the GOOS Status Report became a well-copied, distributed and useful document.

It was agreed that at this time, paper annual report is still needed for those member countries lacking ready access to the Web. This paper report (which should be duplicated on the Web site) might be some 15 pages long and contain some combination of (i) an explanation of what GOOS is all about (e.g. an update of the Executive Summary from *The GOOS 1998*, and (ii) descriptions of operational products, along with instructions on how to obtain them from the Internet.

Further, it was agreed that a biennial update of The GOOS 1998 would be desirable. However it need not be as extensive as the 1998 version; it might be modelled on the GOOS annual reports but with more graphics and detail.

To address the growing need for faster access to GOOS products by users, it was agreed that in future the GOOS Web Site should include a directory of Web sites (a "jump site") through which enquirers could immediately obtain up-to-date information about the status of the different components of the GOOS Initial Observing System (GOOS-IOS). The GOOS Web site should facilitate connection to Web sites having live, real-time product displays, not least to demonstrate that the observations promoted by GOOS are leading to the production of products in real-time. Most “readers” will be much more interested in these products than in the systems used to obtain them (which is what the present Status Report focuses on). It was recognized that to do this in a fully comprehensive manner might incur quite a considerable cost. Nevertheless, the GPO could start the process through a pilot project for evaluation at GSC-III. It was agreed that a paper directory of such Web sites distributed periodically would help alert potential "readers" to advances.

It was agreed that although the GOOS brochure had been postponed, one was still necessary - especially to hand to users and decision makers.

ACTION 11: GPO to plan to continue production of brief annual GOOS Status Reports; they would be placed on the GOOS Web site and paper copies would be distributed. In addition the GPO will 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. Eventually this Web site will replace the status reports. Progress will be reported at GSC-III.

ACTION 12: GPO to produce a biennial explanatory document starting with "GOOS 2000", primarily on the Web but in hard copy for developing countries.

4.2 STATUS OF GOOS MODULE PLANNING

4.2.1 Ocean Observations Panel for Climate (OOPC)

Neville Smith reported on progress with OOPC. The OOPC last met in April 1998, before GSC-I (**see GOOS Report 61)**, and is due to meet again in Woods Hole, May 17-20, 1999. Its primary interests are (i) seasonal to inter-annual prediction (e.g. ENSO), and (ii) climate change, but it also has an interest in (iii) short-range ocean/marine forecasting. The 1997-98 El Niño created considerable interest in these issues, and provided unprecedented opportunities to establish long-term support for the ENSO observing system. Through initiatives of the USA, Japan, Australia and others we now have long-term commitments to that system, thus meeting one of the major goals of GOOS and GCOS. As noted in more detail under agenda item 6.3.1, the attention of the COP to the FCCC is now focussed on GOOS and GCOS as the means for providing information important for monitoring performance under the Climate Convention; if this attention can be converted into commitment we will have come a long way towards establishing the observing system recommended by the OOSDP (Ocean Observing System Development Panel) in its 1995 report.

4.2.1.1. Strategy

In terms of strategy, the OOPC has pursued several lines. The establishment of a body whose primary mission was implementation of ocean observations for climate was suggested by OOSDP, and pursued subsequently by OOPC. We are now close to the realization of this aim through the formation of the proposed JCOMM, which will enable coherence and efficiency and will herald a new era in operational ocean observations (see agenda item 5.2.2). The OOPC has worked inter-sessionally to help develop the Action Plan for GOOS/GCOS (described below in section 5.2, and to help to develop JCOMM.

The OOPC has also led the push for greater integration between satellite remote-sensing data and *in situ* data, especially through assimilation into advanced numerical models, and had conceived the Global Ocean Data Assimilation Experiment (GODAE) as a necessary step towards achieving those aims. As discussed in agenda item 5.3.1, GODAE has attracted support from many agencies and has enjoyed encouragement and endorsement from appropriate intergovernmental agencies. Through the Argo pilot project (see agenda item 5.3.2) we are about to see a revolution in direct observation of the upper ocean. GODAE is a central element in the OOPC's strategy.

4.2.1.2 The Upper Ocean Thermal Salinity Network

A GOOS/GCOS Implementation Workshop in Sydney (March 1998) identified the need for improvement in the upper ocean thermal network and the practices used to assemble and process data. TOGA (the Tropical Ocean Global Atmosphere research programme) and WOCE (the World Ocean Circulation Experiment) were instrumental in implementing a Ship-Of-Opportunity Programme (SOOP) network using XBT's (expendable bathythermographs) and in developing (with IGOSS (the Integrated Global Ocean Services System)and IODE) advanced data exchange and evaluation procedures. OOPC is now working with NOAA (US National Oceanic and Atmospheric Administration) and JAFOOS (the Joint Australian Facility for Ocean Observing Systems) to conduct a review of the network design and its data and information management. The goal is to assess all SOOP lines against scientific objectives, and on the basis of that assessment produce a renovated SOOP plan for review at a workshop in autumn 1999 for input to the OCEANOBS 99 Conference in St Raphael (see agenda item 5.2.3). A workshop to advance this assessment is scheduled for 10-12 August 1999 in Melbourne.

4.2.1.3 A Study of SST For Climate

Through an OOPC/AOPC (Atmospheric Observation Panel for Climate) Workshop on Global SST (Sea Surface Temperature) Data Sets, held at Lamont-Doherty Earth Observatory in November 1998, the OOPC focussed on problems related to the gathering, analysis and interpretation of SST data. The SST network needs

renovation. While we know that detection of climate change requires precision and accuracies of the order of 0.1°C, larger differences in global SST can appear because of uncorrected biases in satellite data; differing inputs of "sea-ice data" (incorporation of sea-ice data can skew the products of models by more than 0.1°C); and data assembly. Furthermore we continue to be hampered by data gaps in large areas, like the Southern Ocean, and by confusion between the use of skin temperature (the surface temperature as measured by satellite remote-sensing), and the bulk temperature of the upper ocean (as measured by *in situ* devices). An OOPC/AOPC Working Group is to be formed to consider these issues, identify the sources of differences in different analyses, and recommend actions necessary to ensure the quality and consistency of SST analyses.

4.2.1.4 Surface Fluxes

The OOPC is collaborating with the Working Group on Numerical Experimentation (WGNE) on a project to establish and routinely use several surface flux reference sites for the validation and development of numerical weather prediction models.

4.2.1.5 POGO-the Partnership for Observation of the Global Ocean

Representatives of several major oceanographic institutions concerned with basin-scale to global scale ocean observations met in Paris in March 1998 under the leadership of Scripps Institution of Oceanography (SIO), Woods Hole Oceanographic Institution (WHOI), and the Southampton Oceanography Centre (SOC) to explore the ways in which they might collectively contribute to the requirements for sustained global ocean observations that are emerging from the designs for GOOS, GCOS, and CLIVAR. They included IFREMER (France), JAMSTEC (Japan), the CSIRO (Australia) and the Institut für Meereskunde, Kiel (Germany). Their deliberations were informed by input from the IOC Executive Secretary, the Director of the GOOS Project Office, and the OOPC Chair, among others. The institutions noted that there are several areas in which a partnership between them and related institutions might help to meet the goals of the OOPC, including providing information from surface reference sites, setting up and collecting information from oceanographic observatories (time series moorings), and carrying out hydrographic and trans-ocean sections.

The meeting participants agreed that a partnership was desirable, drafted POGO terms of reference and a charter, and arranged to have the first full-scale POGO meeting in December 1999.

POGO expressed keen interest in GODAE and Argo, and an interest in assisting any implementation related to ocean observatories (time-series) and hydrography. The OOPC noted that no detailed definition of an implementation plan was available for either time-series stations or hydrography. The OOPC was however strongly supporting a selected number of surface reference sites and developing a strategy in co-operation with WGNE. For time-series stations, the OOPC had agreed that a plan should be developed and subject to extensive review as was done for Argo. It was planned to have such a document ready for the St Raphael Conference. This Plan would also be presented to the 1st formal meeting of POGO. Both OOPC and the CLIVAR UOP believe the development of a North Atlantic pilot project may be a feasible outcome from this study. There is already strong interest from several European countries and from sections of the US community. For hydrography, papers are being developed for the St Raphael Conference. POGO intends using the outcomes from the St Raphael meeting as a guide to where it might deploy its energies.

The partners also considered how they might use their facilities to contribute to outreach and capacity building activities on behalf of GOOS.

In discussing this item, GSC Members welcomed the heightened interest of the major institutions that was evident from the meeting, but expressed concern that the development of POGO might lead to some confusion about the priorities for funding required to implement the GOOS design. As one example, Argo currently heads the list for new climate observations but, although interest in time series was evidently high among the POGO participants, time series observatories were not necessarily proven to the point where they should be considered as the basis for a major GOOS pilot programme.

A small GSC working group met with the GSC Chairman to discuss the matter off-line, and a letter was formulated to express the sentiments and concerns of the GSC to the POGO partners. It was agreed that GSC

representatives (probably Professors Nowlin and Malone) should attend the proposed POGO meeting in December to help ensure that the POGO partners have a clear view of GOOS requirements and to work with them on defining priorities for the future.

ACTION 13: Chairman to write to POGO Chair expressing interests and concerns of the GSC in POGO, and to arrange appropriate interactions between GOOS and POGO.

ACTION 14: Chairman and Tom Malone to attend 1st POGO Meeting in December 1999; Neville Smith and Colin Summerhayes will also attend.

4.2.1.6 Report on the Adequacy of Observing Systems

The OOPC provided the major role in constructing the report that GCOS presented to the 4th meeting of the Conference of the Parties (COP-IV) to the Framework Convention on Climate Change (FCCC) (see agenda item 6.3.1).

4.2.1.7 The Climate Conference

Much of the OOPC's efforts during 1999 will aim towards the development of consensus on the design of an observing system for climate. This topic is addressed in detail in agenda item 5.2.2.

4.2.1.8 Summary

For climate change the challenge has been to obtain the attention and respect of those bodies with key roles, like the Intergovernmental Panel on Climate Change (IPCC) and the Conference of the Parties to the FCCC. The GCOS-led report on the Adequacy of the Global Observing System for Climate was a critical first step in gaining this respect, and the positive response to that report is an important milestone. The OOPC is committed to doing what it can to provide substantial support to the continuation of this process.

As a community, we are enjoying respect and support at a level the Chairman of the OOPC has not seen before in over a decade of working within the ocean observing system for climate. Nevertheless, for all the progress that has been made, we still cannot state with conviction what is the preferred blend of observations needed for the observing system. We need a detailed implementation plan setting out the preferred mix of methods and platforms, a problem shared with CLIVAR, whose implementation plans rely very heavily on those of GOOS and GCOS. The upcoming international Conference of Ocean Observing Systems for Climate (agenda item 5.2.2) is critical to obtaining such an implementation strategy.

The OOPC Chairman considered the initial ocean observing system as called for by GOOS and GCOS as now being within reach, and the prospects for implementing many of the required enhancements to the present observing systems as now being very good. This is an unprecedented opportunity, and one which should be exploited in such a way as to establish an observing system that will stand the test of time. The Conference, COP-V, GODAE (with Argo), and JCOMM provide excellent and complementary ways to ensure that it does so.

Among the shortcomings in planning and implementation for the climate module, more work is needed on:

(i) ice - here OOPC needs to engage the Arctic community (ACSYS and the Arctic buoy group of the DBCP) more closely;

ACTION 15: Howard Cattle to feed the SST workshop results into the next ACSYS Panel meeting, in June 1999.

ACTION 16: OOPC to improve communication with the Arctic buoy programme of DBCP.

(ii) carbon - here OOPC needs to persuade JGOFS to become more engaged in specifying the requirements for long time series observations, perhaps at the BATS and HOTS sites. Such requirements have been requested but were not yet forthcoming.

ACTION 17: Julie Hall was asked to bring the question of time series requirements up at the JGOFS Steering Committee meeting (May 10-14 in Japan), to stimulate a response to the OOPC.

4.2.2 LMR Panel

Ned Cyr, representing Warren Wooster and Dagoberto Arcos, introduced the report of the LMR Panel, which met in March in Montpellier, France. At that meeting the Panel made concrete steps towards design of a generic operational observing system and identifying the products that might be required from it. A specific regional example of this system was given for Chile, where a very comprehensive end-to-end operational system exists which includes monitoring and assessment, models, products and identified capacity-building needs. Having identified the system and what it can deliver then enables gaps to be identified.

In practice, it would be very difficult to conduct effective fisheries-independent surveys of open ocean fish stocks, and to assess the status and changes in the biota associated with sea mounts. Therefore, the panel has chosen to focus its attention on living marine resources in coastal seas. However, monitoring the status and changes in large oceanic ecosystems is possible using, e.g. remote sensing and ships of opportunity, and appropriate observations to assess ecosystem change should be included in the panel's strategic design. The panel is not considering estuarine observations in its current design.

Following the GOOS development guidelines, the LMR Panel is considering (i) the adaptation of existing systems, and (ii) the development of pilot projects to illustrate or test how the LMR components would work in practice. The Panel considered that two existing systems merited immediate inclusion in the GOOS Initial Observing System; others will be considered in due course. The first two are (see agenda item 5.1 for details):

(i) the International Bottom Trawl Survey, which is run by the International Council for the Exploration of the Sea (ICES) in the North Sea;

(ii) the Continuous Plankton Recorder (CPR) Survey, which is run by the Sir Alistair Hardy Foundation for Ocean Science.

A task for the next LMR Panel meeting will be the definition and selection of pilot projects. Other potential pilot projects, such as the Large Marine Ecosystem monitoring and assessment projects, will require further assessment.

The Panel has begun liaising with other appropriate groups, such as the FAO, ICES, and GLOBEC, and the group promoting the proposed Census of the Fishes.

Two more meetings are proposed:

(i) December 1999 to: finalise the design strategy; consider a capacity building plan; identify a suite of pilot projects and further contributions to the GOOS Initial Observing System;

(ii) May 2000 to consider an implementation plan.

A meeting in Chile would provide panel members the opportunity to interact directly with the stakeholder community in designing an observing system.

The GSC felt that the LMR Panel's generic table represented a good mix of biological variables, ranging from plankton to fish, and that the panel is blending an ecosystem and a fisheries approach in a sensible way. It was recognised that part of the FAO's involvement on the Panel was to ensure that the observing system design exploited and did not duplicate FAO activities.

The GSC expressed concern that the LMR plan not remain too narrowly focussed, while realizing that it must be selective in the beginning. Although no mention had been made of biodiversity, the Panel will be considering this issue. The Panel was advised to contact the Secretariat for the Biodiversity Convention as a potential end user. Straddling Stocks also must be considered. Sports fisheries were identified as another end user group whose interests need to be considered in the design . In addition there is the need to consider the artisanal fisheries that are so important to developing countries.

ACTION 18: LMR Panel (i) to get in touch with the Secretariat of the Biodiversity Convention, and the Convention office responsible for Straddling Stocks, and (ii) to consider sports fisheries and artisanal fisheries, so as to determine the requirements of these potential users.

4.2.3 HOTO Panel

Mike Bewers represented the Chairman of the HOTO Panel, Tony Knap. The HOTO strategy is well developed, and has been well-reviewed externally. Individual countries are now asking HOTO for help in designing national monitoring plans based on the overall design. HOTO continues to have strong links with the GIPME (Global Investigation of Pollution in the Marine Environment) programme.

There has been no HOTO meeting since HOTO-IV in Singapore in October 1997. The former Chairman (Neil Andersen) stepped down and was replaced by Tony Knap. Also there is a new HOTO Technical Secretary (Umit Unluata) in the IOC Secretariat. A HOTO meeting, on sustainable development indicators, is planned for November 9-13, 1999; its focus will be on human health, so further meetings will be required to develop a wider range of indicators. The meeting on modelling proposed by HOTO-IV has been postponed until 2000.

The main HOTO Pilot Project, which the GSC agreed should be adopted as a GOOS Pilot Project, is RAMP (Rapid Assessment of Marine Pollution). RAMP is being initiated in Brazil and hopefully will spread soon to other areas (see *GOOS News* 6 for a description).

There have been no significant developments on implementing the blueprints for the HOTO regional pilot projects described in the report of the Singapore meeting. Of these projects, the Arctic, the Caribbean, the Black Sea and N.E. Asia areas seem to be favourites for further development, resources permitting. The Panel now needs to make efforts to prioritize and implement its pilot projects (see ACTION 6).

HOTO is already interacting with the Secretariats of the major Conventions, such as the London Dumping Convention, where the main concern is the quality of marine sediments.

In discussion, the Members indicated a need for close linkage between HOTO pilot projects and UNEP's Regional Seas programme, so as to exploit effectively the existing infrastructure and government support implicit in that programme.

Members questioned whether a full-scale HOTO Panel meeting is needed in the year 2000, bearing in mind the impending 'merger' of the HOTO, LMR and Coastal Panels. While HOTO does not need to meet for further discussions on design, the design phase having been completed with publication of the HOTO Strategic Plan in 1996, HOTO Panel activities must continue, including increasing involvement in implementation and the further specification of indicators.

4.2.4 Coastal GOOS (C-GOOS)

Tom Malone reported on progress in C-GOOS. Given the importance of capacity building to the successful design and implementation of C-GOOS, the Panel decided at its first meeting, to conduct its business in developing countries and to begin each panel meeting with a one-day stakeholders' workshop. The stakeholders' workshops have enjoyed limited success to date, but through them the panel has developed a much greater appreciation of what will be required for developing nations to participate in and gain from coastal observing systems. C-GOOS-II was held in Curitiba, Brazil (Oct 29-Nov 1, 1998), and C-GOOS-III was held in Accra, Ghana (12-15 April, 1999).

4.2.4.1 Stakeholders' Workshops

At the stakeholders's workshop in Curitiba (October 29, 1998), the opening ceremony included speeches from a representative of the State of Parana, a representative of the President of the Federal University of Parana, the Director of the Brazilian Navy Hydrographic Office, the President of the University of Rio Grande, and the Vice-Director of the Centre of Marine Studies. The meeting was organized around two general issues: (i) social and economic needs, and (ii) operational oceanography. For the most part the speakers emphasized current activities rather than needs. However, during a preceding workshop organized by a member of the C-GOOS Panel (Eduardo Marone) needs had been identified for a regional network for coastal hazards (Curitiba, October 26-28). Speakers in the stakeholders' workshop included representatives of Brazil, Argentina, and Colombia.

These discussions set the stage for the development of two C-GOOS Pilot Project proposals: (i) a storm surge forecasting system for the east coast of South America (Eduardo Marone) and (ii) a coastal current forecasting system for the west coast of South America (Oswaldo Ulloa).

At the stakeholders' workshop in Accra (April 12, 1999), opening addresses were made by senior representatives of several Ghanaian marine scientific and technical organizations, including the Director-General of the Council of Scientific and Industrial Research. The meeting was organized in three main sections: background, regional issues, and discussion. Presentations covered coastal hazards, oil and gas exploration, fisheries, the Gulf of Guinea Large Marine Ecosystem (LME) project, sustainable management of the west African coastal ocean, and GOOS-AFRICA.

Recommendations stemming from the meeting included the following:

- involve stakeholders, NGOs, and scientists in the design and implementation of C-GOOS;
- network nations and institutions to collate and disseminate existing data relevant to C-GOOS (e.g. SST data);
- build capacity to collect and analyze basic information on tides and SST;
- improve electronic communications including access to Internet and to data on regional and global scales including satellite down-links;
- assist GOOS-AFRICA to standardize measurement and to develop procedures for quality assurance and data management;
- support GOOS-AFRICA to enable it to promote development of GOOS in Africa.

GSC Members recognized the importance of involving stakeholders in the design process from the beginning, but acknowledged that, in practice, it was proving less easy to get participation from industry than from government users.

ACTION 19: Make available to all module panels' members, and on the GOOS Web site, Julie Hall's modification of Bud Ehler's document on the involvement of stakeholders in the planning process.

4.2.4.2 Panel Meetings

(i) C-GOOS-II

A report of the C-GOOS-II meeting was published as GOOS Report No. 63. Much the meeting was taken up with briefings on programmes relevant to the terms of reference of C-GOOS. Although these were informative, they raised concerns among panel members that C-GOOS might be redundant. However, it was agreed that there is a real need for co-ordination and focus which C-GOOS can provide. The Panel began to develop a strategic design plan. The design envisages the global coastal ocean observing system as a sustained integrated measurement programme monitoring a core set of key properties and processes common to a significant number of issues or indicators of change identified in Table 1 of the C-GOOS-II report. The purpose of the system would be to:

- resolve patterns of variability on scales relevant to the problems of interest (e.g. bottom water hypoxia, harmful algal blooms (HABs), loss of tidal wetlands, decline in fish stocks, and coastal erosion);
- document the global extent of local to regional patterns in these indicators of change;
- provide the larger scale perspective required to distinguish between locally-generated patterns and those generated by regional to global scale forcings;
- enable more robust, global interpretation of results from research programmes like LOICZ, GLOBEC and GEOHAB by providing the larger scale spatial and temporal context needed to interpolate among sample sites and extrapolate to other systems.

The global observing system provides a framework for pilot projects which are intended to be the building blocks of a fully integrated and sustained C-GOOS. The Panel identified a set of pilot projects and a pilot project format incorporating the C-GOOS design process. Pilot projects must serve at least one of the following purposes:

(i) develop and refine the C-GOOS design process;
(ii) identify core variables for the global network;
(iii) carry out enabling research to develop new technologies for the operational observing system;
(iv) develop models needed to translate data into useful products; and
(v) show the utility (proof of concept) of the GOOS, end-to-end, user-driven approach.

The Panel recognized that much of what is required for an integrated observing system in coastal waters is not yet operational. Research programmes (like LOICZ) provide the scientific basis for C-GOOS and are important to its design, implementation and evolution, through identifying core variables and through enabling research.

(ii) C-GOOS-III

At the C-GOOS-III meeting in Accra, the Panel reviewed and evaluated the global network design and agreed on a preliminary design strategy. It also reviewed and evaluated the pilot project proposals, identifying a short list to develop to the full proposal stage. It identified high priority joint projects with other groups such as OOPC, GLOSS, GTOS and LOICZ. The panel agreed on the content and organization of the strategic C-GOOS plan.

The elements of an initial global network should be: (i) satellite remote sensing, (ii) an enhanced global network of tide gauges (GLOSS +), (iii) enhanced arrays of instrumented moorings and fixed platforms, (iv) voluntary observing ships (VOSs), (e.g. ferries), and (v) a network of coastal laboratories (coastal ocean watch).

(i) Remote sensing will provide information on (a) surface height, from altimetry, for currents and climate variability; (b) winds and air-sea interaction, from scatterometry; (c) productivity, turbidity and pollution, from ocean colour; (d) sea-ice and wind-wave-current interaction, from synthetic aperture radar (SAR); (e) sea-ice, scalar winds and atmospheric moisture, from passive microwave sensors; and (f) sea-ice, SST, coastal and coral reef assessments from visible/infrared scanners.

(ii) Sea level is arguably the most important physical variable to measure along a coastline. C-GOOS must interact with GLOSS in evaluating the needs for new sea-level sites.

(iii) An enhanced array of instrumented moorings and fixed platforms, involving more sites and more sensors, will lead to: (a) improved forecasts of extreme weather; (b) more accurate atmospheric forcing fields for hydrodynamic models; (c) more accurate algorithms for interpreting remotely sensed data; (d) improved ecosystem models for predicting the effects of anthropogenic stress on water quality and on the capacity of ecosystems to support living marine resources.

(iv) Ferries and other VOSs provide an opportunity to measure core variables across critical shelf sections, useful for estimation of fluxes.

(v) Coastal laboratories, schools, and NGOs can be networked into a Coastal Ocean Watch to monitor

environmental conditions in the coastal zone. This could provide a cost-effective means of describing regional to global distributions of core properties in the near-shore environment as well as data for validation of remote sensing algorithms. Such a network has considerable potential for promoting public awareness and engaging developing countries.

Key properties and processes to be monitored by C-GOOS include: winds; air-pressure and temperature; waves; freshwater inputs; ambient noise; atmospheric deposition; water level; bathymetry; currents; sea temperature and salinity; colour (proxy for phytoplankton biomass); nutrients; suspended solids and turbidity; pCO_2 and oxygen; plankton species; zooplankton biomass; benthic species and biomass; recruitment indices; stock assessment; and chemical contaminants.

Measurements must be routine, sustained and systematic. The operational system will be multi-disciplinary and multi-scale. It will commonly require observations that extend beyond national boundaries, thus involving multi-national co-ordination and collaboration. It will integrate data collected on different space and time scales and from disparate sources, including remotely sensed and *in situ*. It will meet the requirements of multiple users and be adaptable to changing needs. Finally, it will be reviewed periodically to ensure cost-effective delivery of useful products.

C-GOOS will suggest indices to provide quantitative measures of the current states of coastal systems and, of their vulnerability to change, and of likely future change. The following indices are under consideration: (i) a Risk Index - to assess the probability that a particular event will occur or have a certain impact; (ii) a Vulnerability Index - to assess the capacity of an ecosystem or region to "bounce back" following natural perturbation or anthropogenic stress; and (iii) an Ecosystem Health Index - to assess the extent to which an ecosystem or region has been degraded or stressed by anthropogenic activities. More detail will be available in the report of the meeting.

Review of the 12 pilot projects identified at C-GOOS-II led to agreement that 6 projects in two categories should be developed to full proposals for implementation. In the biodiversity and habitat category they are: (i) Western Pacific biodiversity, and (ii) PhytoNet. In the coastal circulation and natural hazards category they are (iii) eastern South Pacific coastal currents, (iv) western South Atlantic coastal hazards, (v) west Africa, and (vi) Viet Nam coastal hazards.

Based on these agreements regarding the basic ingredients of a design for the Coastal Module, inter-sessional actions will focus on: (i) fleshing out the design of the global network; (ii) finalizing the design of the 6 selected pilot projects; (iii) developing-key collaborations (with GLOSS, OOPC, GTOS and LOICZ); and (iv) developing mechanisms for sustaining and enhancing C-GOOS.

4.3 CO-ORDINATION AND INTERACTION BETWEEN MODULES

During the GSC-II meeting representatives of the Coastal, HOTO and LMR Panels met to agree on steps towards the eventual merger of HOTO, LMR and C-GOOS. From the reports of the three panels to GSC-II, they identified some cross-cutting issues that should be addressed through joint inter-sessional panel activities in preparation for the integration of the three panels (see 4.3.1), and they developed a timetable for the merger (see 4.3.2).

4.3.1 Cross-Cutting Issues

4.3.1.1 Contaminant Transport

Contaminant transport from coastal drainage basins to coastal waters must be addressed before an integrated implementation plan can be formulated. The HOTO Panel will take the lead in addressing this issue. It will initiate appropriate contacts with the hydrological community and GTOS (David Norse). Julie Hall, representing the Coastal Panel, will discuss possible collaborations with LUCC (Land Use and Cover Change programme) and LOICZ at the next IGBP meeting in Japan (May 1999) and report back to the HOTO and C-GOOS Panels. Likewise, Tom Malone will discuss the role of GTOS with Bob Christian (GTOS) as part of the inter-sessional assignment to elaborate priorities for collaborations between C-GOOS and GTOS.

4.3.1.2 Coastal fisheries and habitat

The LMR Panel will expand its effort to include the fisheries of coastal seas (estuaries, sounds, seas, EEZs). The Coastal Panel is currently addressing habitat issues in terms of habitat loss and modification and the cause of such changes. The LMR and Coastal panels will each identify 2-3 members who will form an *ad hoc* joint committee to address the issue of habitat loss from a fisheries perspective (i.e. incorporating into the C-GOOS design observations required to assess and predict the effects of habitat loss on the capacity of coastal systems to support fisheries).

4.3.1.3 Indices of stress and response status

The HOTO Panel will take the lead on this issue. The first step is to formulate guidelines for the identification and development of indices. Tom Malone's report to GSC-II provides a starting point for this purpose, and the November 1999 GIPME workshop organized by Tony Knap provides a convenient and timely forum to formulate recommendations for review by the panels. Two representatives each from the LMR and C-GOOS panels will participate in this workshop, the results of which will be used by each panel to develop indices of status, stress, and response (vulnerability).

4.3.2 Time-table for the Integration of HOTO, LMR and C-GOOS

Fall 1999:	C-GOOS-IV meeting to complete strategic design.
Winter 2000:	LMR, HOTO, and Coastal panel chairs and technical secretaries meet to develop a framework for merging the three panels.
Spring 2000:	C-GOOS-V meeting to formulate preliminary implementation plans and evaluate merger plan.
Spring 2000:	GSC-III meetings for discussion and guidance of the preliminary merger plan.
Fall 2000:	GOOS Integrated Panel for the Coastal Ocean (GIPCO) meeting to formulate integrated design and implementation plans for GSC review. The GIPCO panel will consist of representation from each of the three panels.

ACTION 20: HOTO Panel, with assistance from Julie Hall and Tom Malone of C-GOOS, to take the lead in addressing the issue of contaminant transport from coastal drainage basins to coastal waters, initiating appropriate contacts with the hydrological community, GTOS, LUCC and LOICZ, and to report back before the next C-GOOS meeting (November 1999).

ACTION 21: LMR Panel to expand its effort to include the fisheries of coastal seas (estuaries, sounds, seas, EEZs).

ACTION 22: LMR and Coastal panels to each identify 2-3 members who will form an *ad hoc* joint committee to address the issue of habitat loss from a fisheries perspective (i.e. incorporating into the C-GOOS design observations required to assess and predict the effects of habitat loss on the capacity of coastal systems to support fisheries).

ACTION 23: HOTO Panel to take the lead on developing indices of stress and response status, starting by formulating guidelines for the identification and development of indices. LMR and Coastal Panels will assist in this process, starting by nominating two representatives each to participate in the GIPME indices workshop organized for November 1999.

ACTION 24: Coastal, LMR and HOTO panels to follow the schedule set out in agenda item 4.3.2 to develop a plan and time-table for the integration of HOTO, LMR and Coastal Modules.

4.4 DISCUSSION

GSC members congratulated the Coastal Module chair on the remarkable progress achieved by the Panel to date. They asked that the plan differentiate clearly between (i) what is operational (i.e. long-term and sustained) and (ii) what underpinning R & D is needed to further C-GOOS development. It was accepted that the boundary between the two is fuzzy because of the interest of many researchers in long time series.

Members were interested in seeing how the eventual plan would relate to existing systems, noting that these were prolific in some areas (e.g. the North Sea). This will be addressed when the inventory of ongoing coastal observing system components becomes available. In some places (e.g, around the USA, thanks to the efforts of the association of North American Marine Laboratories (NAML)) the existing systems are rather well known; in other areas (e.g. around Europe, thanks to the efforts of EuroGOOS) data on the existing systems is being compiled.

To make effective use in coastal regions of the growing flood of ocean colour data, additional development and validation of algorithms for interpreting ocean colour data are needed. The Coastal panel was asked to encourage such work. Members also asked that the C-GOOS plan be linked to GODAE developments.

It was recognized that local programmes may contribute valuable subsets of data to GOOS.

It was agreed that C-GOOS will not make all measurements for all purposes, so will not be the panacea for all coastal managers. To put the matter into OOPC language: GOOS will not go right to the farmer's gate; that is the job of service providers. C-GOOS will be designed to provide crucial background data sets, primary data products, and boundary conditions essential for investigations at a higher level of detail by other bodies on behalf of coastal seas managers. For example, although C-GOOS may not provide oil spill models, it will provide a coarse grid of observations that can be fed into shelf models that agencies and service companies can then use in their oil spill models.

Members noted that the accuracy of models depends increasingly on high resolution bathymetry. Such bathymetry requirements will be considered in the C-GOOS plan. The plan also needs to consider the measurement and modelling of extreme events.

5. GOOS IMPLEMENTATION ACTIVITIES

5.1 THE GOOS INITIAL OBSERVING SYSTEM (GOOS-IOS)

The Chairman gave an update on the GOOS-IOS. GOOS is meant to develop initially by capitalizing on existing observing systems. The practical implementation of GOOS began in 1998 with the creation of the GOOS-IOS from a number of pre-existing observing systems. Some of these are exclusively contributions to GOOS; others evolved for different purposes, but also address, are compatible with, and satisfy GOOS requirements. In principle, the latter can provide contributions to GOOS as well as to the original group of clients for whom they were initiated.

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

- The operational ENSO Observing System in the tropical Pacific, including the Tropical Atmosphere Ocean (TAO) array of buoys.
- Meteorological measurements from the Voluntary Observing Ship (VOS) network of the WMO.
- Upper ocean measurements of the Ship-of-Opportunity Programme (SOOP).
- Fixed and drifting buoys co-ordinated by the Data Buoy Co-operation Panel (DBCP).
- The Global Sea Level Observing System (GLOSS) network of tide gauges.
- The Global Temperature and Salinity Profile Programme (GTSPP).
- The Global Coral Reef Monitoring Network (GCRMN).
- The Global Telecommunications System (GTS) of the WMO.
- The Global Data Centre of the US National Oceanic and Atmospheric Administration (NOAA).
- Ocean observations from the operational satellites of NOAA and other entities.

The following four components were added to this list during GSC-II:

- The Continuous Plankton Recorder (CPR) programme of the Sir Alastair Hardy Foundation for Ocean Science (SAHFOS).
- 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 CPR has carried out for many years on routes mainly across the North Atlantic and in the North Sea, but is now being extended to other oceans. It has demonstrated links between climate and ocean ecosystems. The LMR panel requested its inclusion in the GOOS-IOS, with the agreement of SAHFOS.

The IBTS has been carried out since 1970 by several North Sea countries acting in concert under the auspices of ICES (International Council for the Exploration of the Sea). It produces data on a range of commercial fish species, along with oceanographic data. The data provide the basis for long time series and climatologies. The survey is an example of what can be achieved at the regional level in GOOS. Its inclusion in the GOOS-IOS was requested by the LMR Panel, with the agreement of the ICES-GOOS Working Party.

The inclusion of time series stations in the GOOS-IOS underlines the importance recognized by the OOPC's Time Series Workshop (GOOS Report No. 33) of collecting time series data to as the basis for mapping trends and developing climatologies of ocean behaviour. These stations form part of a proposed eventual global network.

According to the CLIVAR Initial Implementation Plan (WCRP Report 103, June 1998) the Panularis/"S" time series station should become part of the GCOS/GOOS observing system (i.e. be maintained indefinitely) because of the excellent quality and long duration (45 years) of its record, plus its location (32º 17' N; 64º 50' W, off Bermuda). This station was initiated as the Panularis Station on the initiative of Hank Stommel shortly after the second world war, then changed to Station 'S', probably with a slightly different location, when some biological and chemical measurements were added around the time that WOCE began.

The CLIVAR Initial Implementation Plan also recommended that the BRAVO station (56º 30' N; 51º W, in the Labrador Sea) should be maintained as part of the GCOS/GOOS observing system, because it rates well on most attributes and offers one of the best opportunities for monitoring annual to decadal variability. The BRAVO record is 36 years long. Although broken, it is of good quality, and reaches the bottom, which is essential.

Eventually it may be desirable to include time series stations measuring biogeochemical properties, like those off Bermuda (Bermuda Atlantic Time Series Station - BATS) and Hawaii (Hawaii Ocean Time Series Station - HOTS). However, the specifications for operational ocean biogeochemical measurements must first be described by JGOFS (see ACTION 17, above).

Level 2 contributions to the GOOS-IOS are those for which specific commitments remain to be negotiated. They include:

- Selected ocean observing satellite missions.
- The US PORTS programme.
- Appropriate parts of IGOSS (Integrated Global Ocean Services System).
- 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).
- Appropriate commercial observing systems (like long-lived oil platforms).
- The international Mussel Watch programme (recognising 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 Bloom (HAB) programme.
- Various operational oceanographic observations managed by WMO's Commission on Marine Meteorology (CMM) outside of the VOS.

It was noted that various operational centres currently make contributions to GOOS and agreed that they should perhaps be included in the GOOS-IOS.

ACTION 25: GPO to work with OOPC to consider including in the GOOS-IOS those operational centres which make direct contributions to GOOS by issuing data and information products (including the G3OS Information Centre (GOSIC) as a metadata centre).

Members asked to what extent long-term altimeter projects like TOPEX/POSEIDON and the proposed JASON mission should be considered as contributions to GOOS, along with items like EUMETSAT's scatterometry missions, the SeaWIFS ocean colour satellite, and Service Argos as an operational satellite communication system.

ACTION 26: GPO to work with OOPC to determine which satellite programmes could/should be added to the GOOS-IOS.

In addition to these elements GOOS also includes at this time a set of major pilot projects specifically acknowledged as parts of GOOS. These are:

* the NEAR-GOOS Pilot Project shared by Japan, China, the Republic of Korea and the Russian Federation.
* Five EuroGOOS regional projects (Arctic, Baltic, Mediterranean, NW Shelf, Atlantic).
* The Western Indian Ocean Marine Applications Project (WIOMAP) (which is at present unfunded).
* The Pilot Research Array in the Tropical Atlantic (PIRATA).
* The Global Ocean Data Assimilation Experiment (GODAE), including a major float programme - Argo.

Members agreed with the request of the HOTO Panel that the RAMP (Rapid Assessment of Marine Pollution) pilot project be added to this list (for a description of RAMP, see GOOS News 6).

It is expected that more GOOS pilot projects will be developed over time, and that some or all of these will eventually become integral components of GOOS.

5.2 IMPLEMENTATION PLANNING FOR THE CLIMATE MODULE

5.2.1 Action Plan for the Implementation of Observations for GOOS/GCOS

To forward the development of the GOOS-IOS in the service particularly of the climate module of GOOS and the ocean component of GCOS, two meetings were held in 1998, one in Sydney in March, and one in Paris in November. Those activities led to an Action Plan for the implementation of observations for GOOS and GCOS which will focus on the climate sector and which will involve use of and modification to the GOOS-IOS. The development of the Action Plan was described by Peter Dexter.

To ensure that the elements of the GOOS-IOS that are concerned with climate are as well integrated as possible, and that plans for further implementation develop in an appropriate way, the managers of the existing observing system elements (who attended the Sydney meeting) were asked to work with their respective communities to modify their strategies and plans for the future to recognize (i) the contribution needed from those communities for GOOS and GCOS, and (ii) the additional needs for integration between the different elements of the GOOS-IOS.

At the Sydney meeting in March 1998, an Interim Implementation Advisory Group (IIAG) was formed to assist in further development of the Action Plan and to prepare the ground for the formation of a Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) (see section 5.2.1, below). It is labelled 'interim' as it is seen to fill the gap between the present and when JCOMM is formed. The IIAG met for the first time in Paris in November 1998.

The IIAG includes a representative of the IODE, which is not a specific constituent of the GOOS-IOS, nor of the proposed JCOMM. This recognizes that IODE serves many customers in addition to GOOS. Nevertheless the data centres and data stores of the IODE will form primary resources for GOOS. A close association between GOOS and IODE will enable IODE to adapt in such a way as to meet GOOS requirements more easily as they are identified. Two members of the GSC sit on the IIAG: Angus McEwan and Neville Smith.

Following the Sydney and Paris meetings, the Action Plan has been updated by a consultant (George Needler). GSC members had received the document. Peter Dexter reviewed changes.

It is proposed to present the Action Plan to the first 'interim' meeting of JCOMM in St Petersburg, Russia, in July 1999. Under JCOMM it is intended that eventually the present mechanisms and systems will be overseen by something like WMO's Commission on Basic Systems which will promulgate the regulations and best practice essential to effective operations.

Members endorsed the approach represented by the Action Plan. They suggested several modifications to improve the text, and approved presentation of the (revised) Plan as a guiding document for JCOMM at the St Petersburg meeting.

ACTION 27: Members and GPO to provide advice to Peter Dexter by end May 1999 regarding the updating, improvement and finalization of the Action Plan for Global Ocean Physical Observations for GOOS/GCOS (noting the change in the title).

5.2.2 Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM)

At GSC-I the GSC agreed that the formation of JCOMM is an important first step towards GOOS implementation and should go forward (see GSC-I Report section 6.2.1). Since then both the IOC and the WMO Executive Councils have recommended that JCOMM be formed, and we now await formal endorsement of JCOMM from the WMO Congress (May 1999) and IOC Assembly (July 1999). Anticipating that endorsement, an interim JCOMM meeting is planned for St Petersburg, Russia, in July 1999, and will be attended by the IIAG members.

Following the interim JCOMM meeting in St. Petersburg, it is likely that an interim JCOMM Bureau will be set up to re-organize the elements of CMM and IGOSS into the new JCOMM structure, and then to manage that structure until the first full, formal JCOMM meeting in July 2000.

5.2.3 Climate Conference

Neville Smith introduced the proposal for an international Conference on an Ocean Observing System for Climate, which will be sponsored by GCOS and GOOS on the one hand, and by WCRP and its Climate Variability (CLIVAR) programme on the other hand. The conference, which will take place in S. Raphaël, France, on October 18-22, 1999, will be convened by the OOPC and the CLIVAR Upper Ocean Panel.

A principal climate interest of the ocean research community in the near term is the CLIVAR programme. There is growing recognition that what the OOPC has been designing for GOOS and GCOS will, in fact, be the observational system for CLIVAR, because implementation of CLIVAR needs sustained observations and we do not need nor can we afford more than one sustained observational system. That is why the OOPC's design underpins much of the CLIVAR implementation plan. However, what we need prior to implementation is agreement between the research and operational communities on the kinds and mix of observations. The object of the conference is to gain consensus on what the observing system should and could look like, to enable us to move together towards its implementation.

The conference programme will include sections on:

- users, applications, impacts and investment,
- regional and phenomenological approaches,

- data flow, processing and products,
- specific contributions to the observing system,
- evolution and the future, and
- system-wide perspectives and synthesis.

Each section will include a set of commissioned papers addressing specific issues, and including estimates of costs where appropriate. The papers will be prepared according to a stated formula, and reviewed by the wider community prior to the meeting. The goal is to get people to integrate their individual systems and/or approaches to develop a unified system and approach that will address what is really needed. In a break with tradition, participants will be asked to accept the principle of data sharing from the beginning.

The Committee endorsed this development, and approved the data sharing principle.

5.3 GLOBAL PILOT PROJECTS

5.3.1 The Global Ocean Data Assimilation Experiment (GODAE)

Neville Smith reviewed progress in GODAE. The overall objectives of GODAE are:

(i) the application of state-of-the-art ocean models and assimilation methods for: (a) short-range open-ocean forecasts; (b) boundary conditions to extend predictability of coastal and regional sub-systems; and (c) initial conditions of climate forecast models;

(ii) to provide global ocean analyses and re-analyses for: (a) developing improved understanding of the oceans; (b) improved assessments of the predictability of ocean systems; and (c) as a basis for improving the design and effectiveness of GOOS.

Examples of specific objectives and their drivers/users include:

- extending predictability of coastal and regional sub-systems, to support coastal forecast systems, and regional monitoring and prediction;
- providing open ocean, upper ocean forecasts at lead times of a few weeks to support ship routing, transport, safety at sea, and naval applications;
- integrated analyses for research and development, and re-analysis, to support CLIVAR, GLOBEC and allied research programmes, hypothesis testing, and process studies;
- providing initial conditions for climate forecasts (e.g. Kuroshio, NAO, or ENSO) to support western boundary current prediction, seasonal prediction, and climate change prediction; and
- sustaining and designing a permanent GOOS, supporting GOOS, GCOS, operational oceanography, and multi-purpose applications.

Ocean data inputs to GODAE should be global, complementary, available in real time, and integrated. Remote sensing would provide information especially on SST, sea surface height (altimetry) and sea surface roughness (scatterometry). *In-situ* measurements would provide complementary surface and subsurface data, and provide for the calibration and validation of the satellite data.

Fundamental requirements include:

- Wind products, including estimates of error are a fundamental requirement. Decisions are needed on spatial resolution, temporal resolution, merging data from different platforms, and the number of scatterometers required. Partnership with the satellite community has helped to define what is required.
- High resolution SST, including both bulk and surface skin products. Decisions are needed on spatial

and temporal resolution, merging data from different platforms, and methods for filling space/time gaps (e.g. by models or by other instruments).

- Sea surface height by altimetry and from tide gauges. Decisions are needed on the data sets to use, on techniques for merging data sets, on the numbers of altimeters required and on continuity (operational support).

- Surface radiation field. We can complete surface thermal 'forcing' if the net short wave plus long wave radiation is known. Can it be determined in real time? if so, to what accuracy and on what time scales? How do we validate open ocean estimates?

- Other relevant remote data sets. These may include: (i) ocean colour (a proxy for transparency?); (ii) sea-ice extent; (iii) open ocean precipitation; (iv) salinity (?); (v) ocean state (from SAR and ALT etc).

Pilot Projects or work tasks are necessary to develop the capacity to do GODAE. A GODAE Pilot Project will develop capacity by engaging a section of the community in activities which contribute significantly to GODAE development, e.g. the Argo project - see 5.3.2 below.

Such work tasks will focus on cross-cutting initiatives. These tasks will enhance coordination and standardisation. They will build on existing activities with the aim of enhancing GODAE outcomes. Three areas were identified as high priority:

- data and information management/flow practices,
- linkages to the community beyond GODAE, and
- developing metrics for assessing progress.

A data team will be established for GODAE, to: (i) help determine data requirements from a centralised data server; (ii) identify and gather resources to design and implement data servers, archives, pathways and so on; and (iii) identify resources to develop products and derived products for GODAE. A GODAE linkages action team will be established to ensure GODAE products are defined to meet the needs of meso-scale, regional, coastal and other non-global users. A small task group will be formed to examine possible metrics for measuring GODAE performance. A modelling and assimilation working group will focus on generic issues raised by comparison among results from the global set of regional activities.

GODAE now has a well-developed structure involving a set of scientific and technical 'partners' funded by a set of 'patrons'. The partners are part of the GODAE Scientific Steering Team, which interacts closely with the OOPC, and through it with GOOS, GCOS and the WCRP including CLIVAR and WOCE. The activities are managed/coordinated through the newly established GODAE Office in the Bureau of Meteorology in Melbourne, under the direction of Neville Smith.

National efforts already are contributing significantly to the achievement of GODAE objectives, especially in the USA, France (via the MERCATOR project), Japan, Australia, the UK (Meteorological Office). International efforts include the European Shelf Seas Data Assimilation and Forecast Experiment (ESODAE) funded as a Concerted Action in 1998 by the European Commission (EC).

A GODAE brochure should be available in July 1999. Finalisation of a GODAE Plan is pending the outcome of the Climate Conference in St Raphaël (item 5.2.3 above). For more about GODAE see: : **http://www.bom.gov.au/bmrc/mrlr/nrs/oopc/godae/homepage.html**.

GSC Members applauded the developments taking place within GODAE, and look to enhanced GODAE linkages through the GOOS community, including capacity building related to GODAE.

5.3.2 Argo

To provide the data essential for assimilation into global models of the ocean and coupled ocean

atmosphere models, a continuing stream of data from the upper ocean on a global basis is required as an essential counterpart to the data stream on SST provided by ocean observing satellites. It is proposed that the missing upper ocean data should be provided by a global array of profiling floats. This will begin with a GODAE Pilot Project named Argo (representing the partner project to the proposed satellite altimetry project, Jason). Argo represents a major new increment in direct observations to support and enhance existing elements of GOOS and GCOS, and will go some way towards meeting the requirements of COP-4 that ocean observations be increased to fill major gaps in coverage.

Argo is seen as a key technology for CLIVAR. Consequently, an Argo Science team was formed and drafted a plan which was presented at the CLIVAR Conference at UNESCO, Paris, in December 1998. The goal is 3000 profiling floats, one *per* 300 square kilometres, taking one profile every 14 days for a period of 4 years.

The cost per profile is estimated as around $100, which compares favourably with the cost of $75/profile for XBTs. An implementation plan is now being prepared.

There is substantial commitment already to a major profiling float deployment, with likely contributions from Australia, Canada, the European Union (EU), France, Germany, the UK, Japan, and the USA. It appears reasonable to expect 600 deployments *per* year by around 2001. The Southern Ocean is the region that has received the fewest commitments to date.

Several technical issues remain to be overcome. It is expected that accurate long-life salinity sensors will be available by 2003. New satellite communications systems with high band width and allowing 2-way communications (including Argos, Orbcomm, and Iridium) will enable floats to spend shorter times at surface, minimising energy loss and fouling. Power efficiency is continually improving, allowing deep profiles without impact on power supply. VOSs and aircraft offer means of wide deployment, if feasible. The parking depth question remains unresolved; 2000 m is preferred by most, as it reduces the clustering to which floats would be susceptible at shallow depths.

Argo data will be provided in real-time. Delayed mode, quality controlled data will be available through centres modelled on the present upper ocean data centres and GTSPP. Members applauded the developments proposed and noted the widespread support from individual countries. Argo is considered a vital next step in the development of an operational GOOS. They noted that serious consideration must be given to mechanisms of data access and of product delivery.

Recognising that some concern had been expressed about Argo floats entering national EEZs, and other issues, the following statement was agreed:

Statement on Argo Pilot Programme of GOOS

The GOOS Steering Committee was advised of concerns regarding its operational pilot programme Argo. Concerns included (i) collection of data by profiling gloats in EEZs, and the broad communication of such data, (ii) disposal of used profiling floats on the sea-bed; and (iii) potential dangers to commerce represented by autonomous profiling floats.

It was noted that according to earlier opinions expressed to the WMO, and which were widely promulgated in 1994, the use of oceanographic and meteorological instruments for operational collection of data in the context of WMO and IOC does not require clearance for entry of these platforms into foreign EEZs. These concerns, this time in the context of Argo, will again be brought to the attention of the WMO and to the IOC as well.

The issues of allowing spent floats to remain on the sea-floor, and of potential hazards caused by the floats, are being considered.

The world-wide deployments, since 1990, by WOCE of profiling floats without reported incident seems to mitigate against serious consideration of the Argo floats as hazards. Study has already indicated that the profiling floats contain no hazardous materials. Thus from a scientific and technical viewpoint, disposal on the

sea-floor would seem preferable in terms of safety to parking at the surface while awaiting pick-up.

For more about Argo see:

http:www.BoM.GOV.AU.bmrc/mrlr/nrs/oopc/godae/Argo_Design.html

ACTION 28: WMO representative to ask WMO Congress to recognise that Argo is an integral part of recognised operational programmes (GOOS, GCOS) and of WCRP, and should therefore be supported. GPO to ensure that the case for Argo is presented to the IOC Assembly in the same way.

5.4 REGIONAL ELEMENTS

5.4.1 EuroGOOS, NEAR-GOOS, others

5.4.1.1 EuroGOOS

Nic Flemming reported on EuroGOOS progress and plans. EuroGOOS, which now has 31 members from 16 countries, is presently an inter-agency association. Over the next few years it aims to become an intergovernmental organisation. EuroGOOS's planning activities are funded by its member agencies. It has been successful in attracting funds for EuroGOOS Pilot Projects from the MAST (Marine Science and Technology) programme of the EC (European Commission), and is now preparing project proposals for the EC's Vth Framework Programme.

Funded projects include, among others:

The European Shelf Seas Data Assimilation and Forecast Experiment, which will provide a practical demonstration of the overall capabilities of ocean analysis and assimilation and of forecasting models for the region.

The European Radar Ocean Sensing project, which will develop a transportable tool to monitor and predict significant met-ocean conditions with high time and space resolution especially in coastal and port approach areas, for the benefit of port and coastal managers and vessel traffic.

The Mediterranean Forecasting System Pilot Project, which will develop a strategy for implementing a Mediterranean Forecasting System (involving observation, modelling and data assimilation), to predict marine ecosystem variability in coastal areas.

Proposed are:

The Atlantic Pilot Project, a European contribution to GODAE, aims to design an operational system monitoring the North Atlantic on the basis of real-time observations, modelling and data assimilation. EuroGOOS is actively working to develop partners outside Europe for this initiative.

Ferrybox, which aims to develop a ship-borne instrument package for routine operational monitoring of surface water parameters from ships of opportunity in general and ferries in particular. If successful, this could be deployed on up to 800 routes around Europe, to provide a key element of the observing system.

EuroGOOS held the Second International Conference on EuroGOOS, in Rome, in March, 1999. The meeting focussed on " Operational Oceanography - Extending the Limits of Predictability", attracted 300 attendees, and was complemented by an exhibition by ocean service industries.

To identify customers' requirements EuroGOOS has recently completed a Data Requirement Survey, showing what kinds of products different users require. The results of this survey (EuroGOOS Publication No.12 *Operational Oceanography: Data Requirements Survey*), show there are many common European requirements and will aid in the design of the observing systems to meet the stated needs. EuroGOOS is now

doing an economic assessment of the marine markets in Europe, to determine the scale of potential benefits relative to each industrial sector that can be met by improvements in operational oceanography.

Where possible EuroGOOS is working to upgrade the present system to fully operational level. The first fully operational development of EuroGOOS is BOOS, the GOOS for the Baltic. BOOS brings together into a single common system many different operational systems around the Baltic Sea and provides a good example of how neighbours can share costs. It is designed both to make observations and to feed them into numerical models for forecasts. BOOS could be considered as a prime example of Coastal GOOS in operation.

EuroGOOS is working to improve the science base in support of observing systems around Europe and at the global level (see EuroGOOS Publication No.6: *The Science Base of EuroGOOS*). A key element of this science base strategy is extending the limits of predictability, (in terms of accuracy, time and resolution). In part the strategy has been implemented through a MAST-funded project on Pre-Operational Modelling in the Seas of Europe, whose goal was to optimise the application of pre-operational dynamic models of the North Sea. processes on different time and space scales. A following initiative is the Gridded Bathymetry project to develop a state of the art bathymetric grid on the NW European shelf over depths shallower than 200 m, ultimately for the benefit of the operators of marine transport, ports, and harbours. A proposal will be submitted for EC funding in 1999. EuroGOOS is encouraging the development of numerical forecasting through the two major efforts: (i) the French-led MERCATOR project; and (ii) the UK-led FOAM Project (Forecast Ocean Atmosphere Model), which is operational.

EuroGOOS has also undertaken a survey to determine what technologies could produce a reliable, accurate, long-term data stream with the minimum of sea-going requirement in the European context (EuroGOOS Publication No. 13). The results emphasise: (i) remote sensing by satellite; and (ii) extended use of unmanned technologies such as floats, coastal buoys, long-range coastal radar, autonomous underwater vehicles, and acoustic tomography. Already operational are a chain of deep water meteorological moorings west of the UK, and a programme of drifting buoys. For the future there is considerable interest in extending life for sensors measuring biogeochemical variables for long periods on unmanned platforms. A EuroGOOS Panel on sensors and biofouling is considering this issue.

EuroGOOS is now developing a European Initial Observing System, based mainly on existing elements that are now being identified. EuroGOOS is also considering product design and services, through a Data Products Group.

For more information on EuroGOOS see **http://www.soc.soton.ac.uk/OTHERS/EUROGOOS**/.

In discussion, members questioned whether EuroGOOS data and products will be generally available and asked about the mechanisms that will allow access to the data and that will deliver the products.

5.4.1.2 NEAR-GOOS (N.E.Asian Regional GOOS)

Colin Summerhayes and Su Jilan reported on NEAR-GOOS. It is progressing well. Highlights for the year include a doubling of its data holdings, a significant increase in contributors, and a significant increase in data exchange. NEAR-GOOS is now considering widening the spectrum of observations beyond the physical to include biological and chemical parameters. A joint meeting will be held in 2000 with the representatives of the Northwest Pacific Action Plan, a UNEP Regional Seas programme, to see how HOTO interests can be dovetailed with the traditional interests of the NEAR-GOOS community. There is also a need to determine how recommendations of the LMR Panel can be dovetailed with those of NEAR-GOOS. This may be most easily achieved first through development of the Yellow Sea LME project. A change in the make up of the agencies forming the members of NEAR-GOOS to include those with interests in fisheries and the environment was suggested as one way of expanding NEAR-GOOS's coverage.

Members questioned whether the NEAR-GOOS data and products will be generally available. What mechanisms are available for data access and product delivery?

ACTION 29: (i) LMR to begin discussion with NEAR-GOOS about eventual broadening of NEAR-GOOS to incorporate LMR issues; (ii) GPO to recommend to NEAR-GOOS the addition to its membership of agencies with significant interests in environmental and living marine resources issues.

Further details on NEAR-GOOS can be found on the Web at:

http://ioc.unesco.org/goos/neargoos.htm.

5.4.1.3 GOOS-Africa

Geoff Brundrit introduced GOOS-AFRICA. At the Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM) at Maputo, Mozambique, in July 1998, a GOOS workshop was held focussed on GOOS and the needs of the African user community. At that workshop it was decided to assist the development of GOOS in Africa by forming a GOOS-AFRICA Coordinating Committee, which Brundrit chairs. GOOS-AFRICA is fostering the development of regional developments of GOOS like MedGOOS, which share particular concerns. These include for example, west Africa, east Africa, and the Red Sea region. The idea is to build on present regional projects, such as the Large Marine Ecosystem (LME) activity in the Gulf of Guinea in the west, the Western Indian Ocean Marine Applications Project (WIOMAP) in the east, or the IOC's growing data and information project ODINAFRICA now developing in both east and west Africa. In addition there is potential to capitalise on the interest in coastal tourism and the coral reefs of east Africa and the offshore islands.

Generic priorities identified by the GOOS-AFRICA Workshop at PACSICOM for future funding include:

(i) building up the IODE network of National Ocean Data Centres (NODCs) in Africa;
(ii) building up the network of tide gauges around the African coast;
(iii) facilitating ready access by African scientists to remotely sensed data from the African region, and training them in the use and application of those data;
(iv) improving access to state of the art electronic communication to facilitate data storage, manipulation and exchange.

Proposals for these initiatives will be developed during 1999 and 2000 as part of the post-PACSICOM process.

GSC members agreed on the need to work to improve the ability of African coastal States to make fundamental ocean measurements and to store, manage and process fundamental ocean data so as to extract useful products. It was noted that EuroGOOS is already responsible for funding for the Mediterranean Forecasting System Pilot Project, and intends to assist in funding MedGOOS activities in the future.

The workshop identified as high priority the need to establish National GOOS Coordinating Committees (NGCCs) to develop and strengthen the effectiveness of the national institutional infrastructures in support of operational oceanography and marine meteorology. This would stimulate the development of GOOS on national and regional bases. The NGCCs would be expected to:

(i) Determine user needs and specify the data and products required to satisfy those needs;

(ii) Identify and work to improve existing national capabilities, including human skills and available technology;

(iii) Identify gaps in those capabilities, including inadequacies in present observing and data management systems, and work to correct them, focussing (a) on training and practical assistance related to meeting users' needs in the coastal zone, and (b) on formulating plans to fill gaps;

(iv) Pay special attention to exploiting the opportunities offered by the increasing number and variety of observations of the coastal zone from space satellites;

(v) Promote communication between marine scientists and coastal managers through the development of national, regional and global electronic networking;

(vi) Promote the design and implementation of regionally coordinated strategies for data acquisition, integration, synthesis and dissemination of products to improve coastal zone assessment, and the forecasting and prediction of environmental change;

(vii) Develop regional pilot projects to demonstrate the usefulness of the GOOS system in the coastal zones of Africa, and encourage African participation in ongoing GOOS pilot projects;

(viii) Evaluate costs and benefits as the basis for persuading governments, donor agencies and the private sector to support a data acquisition programme and associated capacity building.

Colin Summerhayes noted that several nations have developed NGCCs; among these the US GOOS Steering Committee has recently been active in developing plans for a national integrated, sustained ocean observing system as a contribution to GOOS.

5.4.1.4 Other Regional Programmes

MedGOOS was initiated at a workshop in Malta in November 1997, to provide a means of looking at the problems of establishing GOOS in the Mediterranean. Subsequently, the members developed a Memorandum of Understanding which was signed during the EuroGOOS Conference in Rome in March 1999. A substantial workshop is planned for Rabat, in November 1999, to address the benefits and costs of implementing GOOS in the Mediterranean Sea.

Since its formation in February 1998, there has been little progress with PacificGOOS. Initially a PacificGOOS Workshop was planned for fall 1999 in Noumea, to initiate planning for long term monitoring and observing in the region's coastal seas. Recently it was decided to move this meeting to spring 2000. When the Perth Office of the IOC opens, we anticipate that the incumbent of that post will be able to spend part of their time working with PacificGOOS to help them develop their strategy, attract funding, and build capacity.

The Intra-American Seas (IAS) Initiative meeting in Miami in October 1998 proposed developing a regional GOOS programme for the Caribbean Sea to maximise the efficiency of observations for understanding complex processes in the region. In parallel with this initiative, the IOC had been developing plans for a Caribbean GOOS Capacity Building Workshop along the lines of the successful Malta and Fiji workshops that had led to creation of MedGOOS and PacificGOOS. The Caribbean GOOS Workshop took place on April 22-24, 1999, in San José, Costa Rica, under the leadership of Jan Stel, with the assistance of Janice Trotte of the GPO, and with representation of the IAS Initiative. It was decided to form an IOCARIBE-GOOS (IOCARIBE is the IOC Regional Programme for the Caribbean).

The International Council for the Exploration of the Sea (ICES) is interested in contributing to GOOS in some way and has formed an ICES Steering Group for GOOS. On March 23-24, 1999, Colin Summerhayes attended a meeting of this group in Bergen. Most ICES countries operate national monitoring and reporting systems where end products do or could contain elements of hind-casting, now-casting and forecasting consistent with the goals and principles of GOOS. It may be possible with the assistance of ICES to establish a permanent integrated information or observing system in the ICES area to capitalise on this prior investment. This could bring into GOOS many agencies related to fishing. The working group identified the ICES International Bottom Trawl Survey of the North Sea as a possible component of GOOS (see 4.2.2 and 5.1 above), and intends to continue to work closely with the GOOS community to identify other opportunities.

In S.E.Asia, there continues to be interest but little action in setting up a S.E.Asia GOOS (SEA-GOOS). However there is some progress in developing the proposed South East Asian Centre for Atmospheric and

Marine Prediction (SEACAMP). The SEACAMP project proposal has now been revised for presentation to the ASEAN (Association for South-East Asian Nations) Secretariat for review for possible funding.

The Black Sea Regional Committee of the IOC is proposing to launch Black Sea GOOS in 1999.

Members were reminded of the offer of Australia to establish an IOC Office in Perth to focus on the development of GOOS in the Australasian region, and to support GOOS capacity building in the region. Following discussion with members of the GSC Executive Committee, a Memorandum of Understanding was signed in December 1998 between the IOC, the Government of Western Australia, and the Commonwealth of Australia agreeing to establish the office, to its terms of reference, and on the tasks of the Head of the Office. The Bureau of Meteorology is in the process of making an office available on its premises in Perth, and is selecting a temporary candidate to occupy the post while the IOC finalised arrangements with UNESCO to create the post and to begin formal recruitment. Priority tasks for the incumbent would be (i) creation of a regional GOOS programme for the eastern Indian Ocean; (ii) assisting with the development of PacificGOOS; and (iii) assisting the IOC's WESTPAC Office in Bangkok with the creation of S.E.Asia GOOS.

ACTION 30: GPO to determine for each regional GOOS programme the degree to which data and products will be openly available and the mechanisms envisioned for data access and delivery of products.

5.5 PRODUCTS BULLETIN

5.5.1 GOOS Services and Products Bulletin

Johannes Guddal presented the plan for a GOOS Services and Products Bulletin (Annex IV). The proposal was well received and strongly endorsed by the Committee, which, working with Guddal, formulated the following specifications:

Purpose: to provide regular and continuous information on the range of products and services associated with GOOS.

Content:

(i) Descriptions of products:

  (a) operational products that are considered consistent with and comply to GOOS standards;

  (b) products from GOOS Pilot Projects which are being developed;

  (c) operational or experimental products that are related to GOOS.

(ii) The context (scenarios) within which the products were developed, with attribution to the contributors of the products, identifying the bodies and individuals who are the guardians/providers of the products;

(iii) Pointers to the metadata, data and files associated with the products;

(iv) A forum for feedback, which should be developed jointly with the data provider.

It was agreed that the Bulletin should be managed by an Advisory Group.

Terms of Reference of the Advisory Group:

(i) to establish a Bulletin according to the outline above;

(ii) to liaise with relevant scientific and technical implementation bodies, including GOOS design panels and JCOMM, especially with respect to standards and quality;

(iii) to provide analyses of the feedback for the benefit of the GSC;

(iv) to consider the appropriate media for distribution of the Bulletin;

(v) to report to the GSC through the GPO.

It was agreed that Johannes Guddal will chair the Advisory Group and be Managing Editor of the Bulletin. The Advisory Group is expected to do its business by e-mail. Technical production is expected to be primarily *via* the Internet, initially on the GOOS Web Page. It was agreed that while hard copy might be desirable it was expensive and impractical to produce, and difficult to distribute effectively. The Bulletin will be a description of products, and in that sense will not be a substitute for the IGOSS Electronic Products Bulletin (IEPB) described below. The products will illustrate the benefits that an observing system can provide. Description of products of types (i)(b) and (i)(c) above might be only pointers to products in the pipeline, so as to build interest by potential users.

ACTION 31: (i) GSC Members and GPO to provide J.Guddal with names of possible candidates for the Advisory Board; (ii) GPO to work with Advisory Board to develop prototype Bulletin on the GOOS Web Site; (iii) Advisory Board and GPO to look for appropriate extra-budgetary support; (iv) Board to liaise with Panels and with JCOMM to ensure adequate products are used for display purposes (e.g. ones that meet appropriate quality standards); (v) GPO to advertise on the GOOS Web site what kinds of products are available and to provide hyperlinks to GOSIC (agenda item 6.5.1) and the IEPB (agenda item 5.5.2) and other appropriate centres.

5.5.2 IGOSS Electronic Products Bulletin (IEPB)

Ron Wilson gave the GSC a presentation on the IEPB, using ftp examples provided by Yves Tourre of the IEPB in Lamont, and downloaded onto a laptop.

The IEPB is surprisingly popular, its Internet site getting 15,000 hits *per* day. It is attractive to users because it is in real time, it also provides time series information, and it provides animations for immediate visualisation. The products are based on data assimilated into models by Ants Leetma to provide a comprehensive picture.

Members were impressed with what the IEPB has to offer, and agreed that the IEPB should be seen as a part of the GOOS Initial Observing System, since it illustrates the point that GOOS is about the construction and operation of an end-to-end data and information management system. The IGOS EPB is in effect a prototype of an eventual GOOS electronic products bulletin, and over time would be expected to be modified to meet developing GOOS requirements. Examples from the IEPB could/should be used in the GOOS Services and Products Bulletin.

It was recognised that similar products developed using different approaches may be available from other sources, and that these too should be advertised from time to time on the GOOS Web page to illustrate the range of available products .

For more information on the IGOS Electronic Products Bulletin see:

http:// iri.ldeo.columbia.edu/climate/monitoring/ipb/introduction.html

ACTION 32: Include the IGOSS Electronic Products Bulletin in the GOOS Initial Observing System.

5.6 IMPLEMENTATION STRATEGY

Under this agenda item, the Committee first discussed the paper on GOOS Implementation drafted by the Chairman (Annex V) which was designed to elicit discussion of the activities required of the GSC in completing the GOOS design and proceeding with its implementation. The committee then discussed the

relation of GSC to the developing JCOMM and the general need for GOOS organizations at the national level. Finally, the committee considered the need for a regional coordination strategy, which was item 5.4.2 on the provisional Agenda (Annex I).

5.6.1 GOOS Organization

GOOS is a very large and complex project involving many different organizations and nations. It requires very careful planning at many different levels, and there is much that we can learn from the way similarly large and complex successful projects have been executed.

An essential first step towards improved efficiency and effectiveness is to define clearly the GOOS organizational structure with reporting links. Neville Smith produced a draft organizational chart; following discussion and some modification, that chart (Figure 1) was agreed by the members to accurately reflect the GOOS organization related to the GSC. The chart classifies GOOS activities in four main categories: (i) scientific and technical guidance/requirements; (ii) implementation/oversight; (iii) liaison/integration; and (iv) outreach with its infrastructure. It is understood that the chart is not complete (e.g. sub-bodies reporting to LMR, C-GOOS, or HOTO module panels remain to be added); refinements will be made.

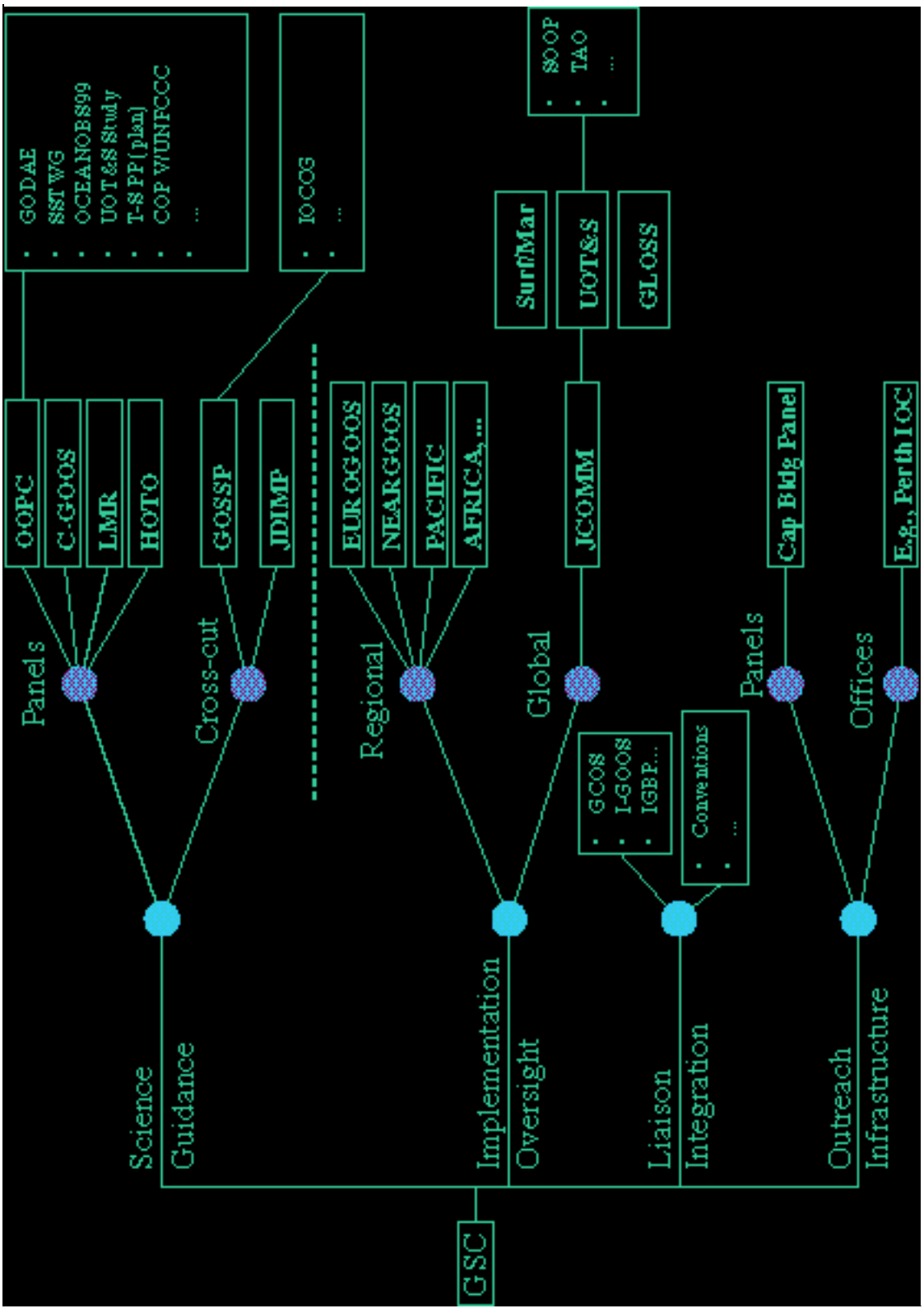

Figure 1

This organizational chart was regarded as only one of a number of possible 'cuts' through the GOOS system. It was recommended that before the next session a working group consider ways of expressing, perhaps using a series of charts) the multi-dimensionality of the GOOS enterprise.

As the next step, the responsibilities/activities of each of the bodies shown in the GOOS organization must be clearly articulated. This is the case through the terms of reference of the various bodies. The Chairman

attempted to more specifically set down the activities of the GSC as one section of the white paper given as Annex V. This was discussed and will be modified to be in coherence with the organizational diagram.

For each of the GOOS-related groups there should be regular reporting. The activity reports to the GSC should include: (i) objectives of the committees or panels; (ii) progress and accomplishments; (iii) plans for the next 2-year period, including schedules of activities; and (iv) resource requirements and means of their acquisition if identified. A document numbering system would make reporting easier and clearer.

ACTION 33: The Chairman will lead an intersessional working group of N. Flemming, A. McEwan, J. Hall, Jilan Su, and any other interested GSC members to continue development of a white paper expressing the organization of GOOS as a means of enabling more efficient and effective development and management of the system. This paper should express the activities required for design and implementation.

ACTION 34: (i) GPO to initiate a document numbering system before the next GSC meeting following the proposed organization chart and (ii) GPO to re-cast the work programme and budget along these lines for future considerations.

5.6.2 Relation of GOOS to JCOMM

JCOMM is developing and will have a preliminary meeting in July 1999. The relation between GSC and JCOMM must be developed in a manner to ensure constructive interaction. It is clear from consideration of Figure 1 that the GSC needs oversight of, or regular reporting from, several bodies that also will report to JCOMM. Avenues of responsibility and reporting links must be established with full knowledge of the responsibilities of both GSC and JCOMM and with sensitivity.

Aside from this general issue, there is a more specific one about data types. Initially at least, JCOMM will deal with physical measurements. However, many GOOS measurements will not be physical. Will a JCOMM-like activity be needed for the non-physical elements of GOOS? If so, should that function be carried out best inside or outside of JCOMM? One mechanism for addressing these questions may be to hold a coordination meeting between the GSC and JCOMM, involving also the science panels and regional bodies. This should be considered in depth at GSC-III, once JCOMM has begun to take shape, by which time the design of the coastal seas element of GOOS will be quite far advanced, making a dialogue more fruitful.

5.6.3 National GOOS Efforts

Members agreed that it has been found useful to build the case for GOOS at the national level. Encouraged are the formation of national GOOS steering or coordination committees as described in agenda item 5.4.1.3, with the addition of a new requirement (ix) "*to promote GOOS development and expansion through appropriate communication*".

ACTION 35: Encouragement to be given by whatever means to individual countries to develop national groups to promote the development of GOOS (e.g. to form national steering or coordination committees along the lines recommended above) including placing suggested responsibilities of such committees on the GOOS Web site.

5.6.4 Regional GOOS Efforts

As described in agenda item 5.4, there is a growing number of regional GOOS activities. Regardless of the differences between them, they are all expected to develop GOOS in compliance with the GOOS Principles and GSC decisions. Nevertheless, their very existence complicates the management of GOOS and requires development of an effective policy of regional coordination. It must be determined how regional GOOS bodies can best be used to build the global system, and to ensure that information flows freely between them as expected. Equally important is the relation between the GSC and the regional bodies. During the discussion of regional elements, members raised questions regarding the official recognition of regional GOOS

programmes and regarding coordination between such programmes. It was agreed that these issues must be considered further inter-sessionally and resolved.

ACTION 36: The Chairman will work inter-sessionally with a small *ad hoc* group to recommend a procedure for formal recommendation of GOOS regional programmes and to promote coordination among regional GOOS programmes. A white paper will be prepared for consideration by the GSC.

In discussing this issue it was recommended that the GSC should give some consideration before its next meeting to the extent to which regional GOOS activities could or should map onto already existing regional programmes, like those of UNEP's Regional Seas Programme, or the ocean regions of FAO, or the Large Marine Ecosystems, or the oceanic regions of the IOC. It was noted that many UNEP Regional Seas, for example, are supported by Conventions to which governments have already made commitments. Thus in developing regional GOOS programmes mapped onto UNEP's Regional Seas programmes, GOOS may be able to benefit from the political efforts that have been made by UNEP in setting up these prior regional entities.

ACTION 37: (i) GPO to provide panel chairs with details of regional GOOS contact points, to facilitate interaction between regional groups and module panels; (ii) GPO to provide information about geographical and other relationships between GOOS and other regional bodies.

6. COORDINATION WITH OTHER OBSERVING SYSTEMS

6.1 THE INTEGRATED GLOBAL OBSERVING STRATEGY (IGOS)

Since the UN Conference on Environment and Development (UNCED) in Rio in 1992, which resulted in Agenda 21, momentum has been gathering for improving national, regional, and international efforts in data collection, analysis and synthesis, and for greater coordination of these efforts. Last year it was reported at GSC-I that the sponsors of the three global observing systems and the members of the Committee on Earth Observation satellites (CEOS) were working together to develop an Integrated Global Observing Strategy (IGOS). Since then, these different players, together with the WCRP, and IGBP have now formed a Partnership for the joint establishment of IGOS. IGOS will unite the major satellite and surface-based systems for observation of the atmosphere, oceans, land and biota, focussing primarily on the observing dimension or the process of providing environmental information for decision making. Cooperation is necessary, since the range of observations needed to understand and monitor Earth processes exceeds the capabilities of any one country or agency, and the information required needs integration at many levels. IGOS is meant to provide a framework enabling data suppliers to respond to requirements set by the user community.

Major thrusts of IGOS are: strengthening space-based/*in situ* linkages to improve the balance between satellite remote sensing and ground- or ocean-based observing programmes; encouraging the transition from research to operational environmental observations; improving data policies and facilitating data access and exchange; stimulating better archiving of data to build long time series needed to monitor climate change; increasing attention to harmonization, quality assurance and calibration/validation for more effective use of data. Lines of communication and dialogue are being established with the principal user groups and institutions.

The IGOS Partnership provides a continuous mechanism to oversee the IGOS process, with meetings arranged twice a year in conjunction with the CEOS Plenary sessions and meetings of the G3OS sponsors group. GOSSP is being used as a central body where providers and users of ocean data discuss and define the future direction of the implementation of the IGOS strategy.

Several years ago CEOS initiated 6 pilot projects, including GODAE. These have now become IGOS projects. CEOS-IGOS are now developing a strategy based on themes instead of projects. The 6 current projects will be integral parts of the developing themes, within which other projects may develop. Use of themes is intended to expedite the planning process and strengthen the development of the necessary databases at national and international levels. Under each theme, sets of requirements will be developed especially for remote sensing. These will be fed through IGOS to CEOS, to influence the planning of satellite missions.

Oceans is one of three themes initially selected. Eric Lindstrom of NASA is leading a group to develop the Oceans Theme. It involves close consultation with the GPO and members of the GSC. Projects like GODAE will still be required to push the strategic process forward and build concrete commitment to particular modules or processes. Members endorsed the development of the Oceans Theme for IGOS.

ACTION 38: GPO to work with Eric Lindstrom to engage Panel Chairs in developing the Oceans Theme.

The IGOS process is designed to promote awareness at national level of the value of global observations and the need for them to be resourced to ensure the arrival of the associated benefits. Towards this end there will be a IGOS presentations and brochures at the UNISPACE Conference in Vienna in July 1999, and at the COP-5 Meeting of the Parties to the FCCC in Bonn in October.

6.2 GTOS

GTOS has recently published its Implementation Plan and its Data and Information Management Plan. Much of its focus in recent months has been on central and eastern Europe. Resources are limited so a meeting of the GTOS Steering Committee has been postponed. Robert Christian of East Carolina University, USA, represented GTOS at the C-GOOS meeting in Accra in April, beginning what we hope will be a growing link between GOOS and GTOS in the coastal domain.

6.3 GCOS

The 8th meeting of the Steering Committee for GCOS took place in Geneva in February. GCOS now has a new chairman, Kirk Dawson, and a new Director, Alan Thomas from NOAA. GCOS endorsed progress in J-DIMP and GOSSP, the activities and proposals of the OOPC, and the development of JCOMM. The main item of business concerned the need to respond to the demands of COP-4 and to develop plans for COP-5 (see agenda item 6.3.1).

Members considered the links between GOOS and GCOS to be satisfactory.

6.3.1 Reporting to COP-5 (FCCC)

At COP-4, in Buenos Aires (Nov. 2-13, 1998), the *Report on the Adequacy of the Global Climate Observing Systems*, prepared by GCOS on behalf of the three observing systems and of the organizations that sponsor the Climate Agenda (FAO, UNESCO, IOC, UNEP, WHO, WMO and ICSU), was presented for consideration of the COP's Subsidiary Body for Scientific and Technological Advice (SBSTA). Several key decisions were made by COP-4 which require nations collectively to make more (ocean and other) observations to demonstrate that they are meeting the needs of the FCCC.

This new requirement bodes well for the growing implementation of GOOS, and especially for its contribution to the ocean component of GCOS. We expect it to lead to improvements in data quality, the filling of gaps, and the sustaining of observations over the long term.

In its decision 14/CP.4, COP-4, recognising the significant national contributions made to the global observing systems for climate, urged Parties, among other things:

(i) to undertake programmes of systematic observation including the preparation of specific national plans, in response to requests from agencies participating in the Climate Agenda, based on the information developed by GCOS and its partner programmes;

(ii) to undertake free and unrestricted exchange of data to meet the needs of the Convention, recognizing the various policies on data exchange of relevant international and intergovernmental organizations;

(iii) to actively support the building of capacity in developing countries, to enable them to collect, exchange and utilize data to meet local, regional and international needs;

(iv) to strengthen international and intergovernmental programmes assisting countries to acquire and use climate information;

(v) to actively support national oceanographic observing systems, to ensure that the elements of the Global Climate Observing System and Global Ocean Observing System networks in support of ocean climate observations are implemented and, to the extent possible, support an increase in the number of ocean observations, particularly in remote locations, and to establish and maintain reference stations.

COP-4 also requested Parties to submit information on national plans and programmes in relation to their participation in global observing systems for climate, in the context of reporting on research and systematic observation.

COP-4 asked SBSTA to work with GCOS in consultation with the observing systems and agencies participating in the Climate Agenda, to inform COP-5 (Bonn, October 1999) about developments regarding observational networks, difficulties encountered (*inter alia*, with respect to the needs of developing countries) and options for financial support to reverse the decline in observational networks.

COP-4 also invited the agencies participating in the Climate Agenda, in consultation with GCOS, to initiate an intergovernmental process for addressing the priorities for action to improve global observing systems for climate in relation to the needs of the Convention and, in consultation with the Convention secretariat and other relevant organizations, for identifying immediate, medium-term and long-term options for financial support.

Finally, in Decision 2/CP-4, COP-4 decided that the Global Environmental Facility (GEF) of the World Bank should provide funding to developing country Parties, to, among other things, "*build capacity for participating in systematic observational networks to reduce scientific uncertainties relating to the causes, effects magnitude and timing of climate change....*".

GCOS has now developed a work plan to enable it to respond to these requirements:

(i) GCOS is proposing to provide guidance to Parties on the various elements to be included in their national plans;

(ii) GCOS is exploring the possibility of establishing an Intergovernmental Board to consider policy and funding issues associated with the development of GCOS, and to act as a vehicle for ensuring the support of governments;

(iii) GCOS is planning to approach the WMO Congress (May 1999) for additional resources to enable it to meet the COP-4 requirements. It is also planning to exploit the opportunity provided by the COP-4's recommendation that GEF funds be made available to assist developing nations to build observing system;

(iv) GCOS is considering developing a series of regional workshops to enable a regional approach to be taken to implementation with the aid of GEF funding.

ACTION 39: GPO, the OOPC and appropriate GSC Panel Members to work with GCOS to prepare the report to COP-5.

6.4 GOSSP

Representing GOSSP chair Francis Bretherton, Neville Smith reviewed progress by the Panel. It is accepted that GOSSP in its new form is a useful vehicle for feeding a coordinated view of GOOS requirements to the space agencies, and CEOS has asked that GOSSP be taken as one of its primary inputs on user requirements.

Among its present activities, GOSSP is revisiting the previous lists of requirements in the WMO database to be sure that they are internally consistent as well as being consistent with the evolving concepts of the advisory panels.

ACTION 40: (i) Panels to ensure that their requirements are accurately reflected in the WMO database; (ii) GOSSP to interact directly with Panel chairs to ensure effective liaison in the development and presentation of requirements.

GSC members endorsed the table of ocean remote sensing requirements circulated by Neville Smith, with the proviso that the Coastal and LMR Panels would both want to vet the requirements provided by the International Ocean Colour Coordination Group (IOCCG) led by Trevor Platt. A mechanism needs to be found to get the IOCCG and Panel activities together so that GOSSP ends up with just one set of ocean colour requirements. IOCCG requirements are considered by the space agencies because the IOCCG oversees one of the 6 IGOS Pilot Projects (see agenda item 6.1). It was noted that the IOCCG focuses on research rather than operational requirements. Members concluded that GOOS should use its panels to vet IOCCG input.

ACTION 41: GPO and GOSSP to develop a mechanism to facilitate integration of ocean colour requirements for IOCCG, LMR and C-GOOS.

Members agreed with the following list of priority measurements from space:

(i) surface topography/altimetry: Precision altimetry of the kind offered by TOPEX/Poseidon or Jason is essential. A second high resolution altimeter, such as ENVISAT, is required. A third altimeter is desirable;

(ii) sea surface irradiance (SST): essential to analyses and forecasts ranging from weather forecasting , through ENSO prediction, to assessment of global warming trends;

(iii) surface wind vectors: At least one scatterometer (or an equivalent) is essential, and a strong case is emerging for a second one;

(iv) ocean colour: agreed to be a priority measurement for ocean biology, and for its use in monitoring the carbon cycle.

6.5 J-DIMP

Ron Wilson, representing the Chairman of J-DIMP, reported on the recent activities of this cross-cutting panel. J-DIMP last met on April 28-May 1, 1998, in Honolulu, jointly with the Atmospheric Observation Panel for Climate.

The revised J-DIMP terms of reference proposed by GCOS in early 1998 and modified by GSC-I (Annex VI) were presented to and acted upon by J-DIMP, although GTOS has yet to comment on them. Although the revised ToRs were acceptable to the GCOS Chair and Director who attended GSC-I, subsequent developments at the GCOS SC meeting in February 1999 suggest a need for GCOS to re-examine the J-DIMP ToRs. The Terms of References should be revised before a new Chair is appointed to replace Tom Karl, who has expressed a wish to step down.

ACTION 42: (i) GSC Chair to write to Tom Karl thanking him for his services to GOOS through J-DIMP. (ii) G3OS Secretariats to work together with their respective chairs to accept or further revise the J-DIMP ToRs as appropriate.

Under the new ToRs, J-DIMP no longer is required to identify data sets; this now becomes the responsibility of the individual observing systems, and for GOOS module advisory panels. At its meeting, J-DIMP considered the development of the G3OS Information Centre (GOSIC) (see agenda item 6.5.1) and the J-DIMP Data and Information Management Plan (see agenda item 6.5.2). Aside from these, J-DIMP has been

working on a Metadata Project jointly with IODE, but it is not ready yet; the project was criticised at the J-DIMP meeting because it relied upon proprietary software and storage in locations difficult to access.

Members decided that J-DIMP had carried out its duties effectively, and the activities it had spawned were now self sustaining in the short term. The panel should be thought of as a reference panel that can be called upon as needed. That being the case there appeared to be no call for a J-DIMP meeting in 1999.

6.5.1 G3OS Information Centre (GOSIC)

GOSIC is intended to provide a single point of entry for access to information on the data requirements and data collection programmes of the G3OS, and for access to the datasets and products that result. GOSIC does not hold any of the data, but provides a user-friendly, Web-based interface with links to the centres holding the data and data products. GOSIC is now up and running as a pilot programme at the University of Delaware under the leadership of Ferris Webster, and can be viewed on the Web at: **http://www.gos.udel.edu**.

The pilot activity has now been funded by NOAA and NASA at the level of $100,000/year for one year of a three year contract. It the pilot activity is successful, the long-term goal is to transfer it to an operational organization. In the meantime plans must be made to extend funding beyond the three-year initial period.

GOSIC will include information on observational requirements of the G3OS, the data flows for the operational observing systems that are implemented, and a registry of datasets and products that are part of the G3OS. The participating data centres will be asked to maintain a metadata record for each G3OS database, in the form of the NASA Global Change Master Directory. Records of data received and processing status will be maintained on-line to automate data tracking and to facilitate remedial action if data flows or product generation are interrupted or delayed. The registry includes relevant historical datasets approved or recommended by science advisory panels. GOSIC includes 30 datasets so far.

GOSIC can be accessed by standard Web browsers, with gateways to a relational database for complex searches. It links directly to other sites on the Web that provide G3OS data and information. It encourages the participation of other sites in supporting the G3OS data and information system, and encourages standardisation in presentation and methodologies between these sites and GOSIC.

The system includes information about data flows, such as the end-to-end data flows of the GTSPP. Plans include implementation of data flow diagrams for other elements of the GOOS-IOS and development of a system to describe data flow for space-based products, starting with SST data. This latter development would constitute an extension of GOSIC beyond that planned in the original proposal.

Staffing consists of one senior person quarter time on development of content, assisted by one person half time on computer and Web-page development. More resources, especially in the area of content development, would speed completion of the pilot version and its conversion to an operational element of the G3OS. The satellite requirements could be added by the provision of one person half time.

GSC members were quite impressed with progress to date. They noted the need for panels to spell out their requirements for GOSIC, and on behalf of LMR suggested that GOSIC might make use of the new FAO fisheries database.

ACTION 43: (i) GOSIC will add to its Web site information flow diagrams for all components of the GOOS-IOS; (ii) GOSIC to consider linking to the new FAO fisheries database.

ACTION 44: GPO to work with GOSIC, GCOS and GTOS to identify and secure resources to enable GOSIC to continue/expand.

ACTION 45: GPO to devote one issue of the GOOS News to GOSIC.

6.5.2 J-DIMP Data and Information Management Plan

Ron Wilson described the development of the draft J-DIMP Data and Information Management Plan, which is now available on the Internet at **http://www.wmo.ch/Web/gcos/scVIII/gcos_sc.html**. This is a generic plan applicable by all three global observing systems.

In general GSC members were happy with the plan, though some specific concerns were expressed.

ACTION 46: Members to provide Ron Wilson by end of May with suggestions for modifications and improvements to the J-DIMP data and Information Management Plan. Comments will be passed to Bill Murray and the plan will be finalised and widely distributed.

7. GOOS DATA AND INFORMATION MANAGEMENT

7.1 A DRAFT DATA AND INFORMATION MANAGEMENT PLAN FOR GOOS

Development of the umbrella data and information management plan by J-DIMP (6.5.2 above) was meant to lead subsequently to the establishment of more detailed data and information management plans for GOOS, GCOS, and GTOS. The GCOS data and information management plan preceded these efforts, being published in 1995, but not yet updated. GTOS published their data and information management plan in October 1998. At about the same time, with the blessing of the GSC Executive, the GPO asked Ron Wilson to draft a data and information management plan for GOOS. The document had been passed to GSC Members for review and the topic was introduced for discussion by Ron Wilson.

The Committee thanked Ron for his considerable efforts to produce this first draft, which, it was recognised, had been done on a time-scale that was not designed to permit adequate prior review by Committee members. After an extended discussion, it was agreed that the draft plan needed considerable modification to convert it into an acceptable data and information system implementation strategy, which should then form part of the introduction to the GOOS section of GOSIC. Members agreed with the approach formulated off-line by Neville Smith and Ron Wilson. The necessary inter-sessional process would start by consulting the panels through their chairs. The plan should address among other things the need for real-time data delivery, which is vital for operational activities.

ACTION 47: Ron Wilson, in consultation with GOOS advisory panels, to revise the GOOS data and information management plan so as to produce a data and information system implementation strategy that will appear as an introduction to the GOOS part of GOSIC.

8. CAPACITY BUILDING AND COST/BENEFIT ISSUES

8.1 GOOS CAPACITY BUILDING STRATEGY

The Chairman introduced the latest version of the Principles of GOOS Capacity Building, including suggested modifications by Dr. Jan Stel, for members to consider adopting and/or revising.

In general, members considered that the draft still needed some improvements. It was felt that the document is becoming too long and much of the new material might be reduced in length. It was suggested that adding a ‘look to the future’ would help explain what we wanted to see emerge in ten years time as a result of the capacity building programme. Some specific changes agreed on were:

(i) that the separation of countries into different categories was unnecessary and should be removed;
(ii) that technology transfer should be addressed in the document;
(iii) that linkages were needed between public and private sector capacity building activities in given regions, to avoid duplication and to exploit opportunity. (This means aiming to bring the private sector along with government into planning for GOOS capacity building.);

(iv) that capacity building should focus on younger trainees and on the development of computer skills, e.g. for the management, manipulation, and exchange of data, and for the use of data with numerical models to produce needed products;
(v) that performance measures be included as a means of measuring success of GOOS capacity building.

In addition it was agreed that an additional item should be added to the Terms of Reference of the Capacity Building Panel, namely, "*Consult and collaborate with the GOOS advisory panels in the planning and implementation of capacity building and the selection of projects on which capacity building efforts are to be focussed*."

ACTION 48: (i) Members to provide feedback to Worth Nowlin on improvements to the capacity building document by end June 1999; (ii) Chairman to revise the document.

During a discussion on how the benefits of capacity building might be quantified, various factors for performance measurement were suggested. One factor is the extent to which trainees use their training. Future capacity building exercises should be evaluated after a certain period to determine their degree of success.

ACTION 49: An Inter-sessional working group comprising Su Jilan, Ilana Wainer, Geoff Brundrit, Ralph Rayner and Worth Nowlin should be formed to investigate possible methodologies for assessing performance in capacity building.

In response to a question about the extent to which the IOC's TEMA (Training, Education and Mutual Assistance) budget would cover GOOS Capacity Building, Colin Summerhayes explained that the current restructuring of IOC meant that in future there would be no discrete TEMA budget. All IOC programmes, including GOOS, were expected to have a capacity building component as part of their budget.

It was noted that establishment of the Perth Office of the IOC (see 5.4.1.4), largely funded by the Government of Western Australia, offers the potential to increase the amount of GOOS Capacity Building in the Australasian region, including South East Asia and the Pacific Islands. Members felt it is important to evaluate the Perth Office by the extent to which it proves to be successful in capacity building. Colin Summerhayes explained that, to satisfy themselves that the investment was worthwhile and as a means of determining whether or not it should be continued, the three partners in the Perth venture (IOC, the Government of Western Australia, and the Commonwealth of Australia) were themselves very keen to set workable goals and measure performance against those goals. The presence of the Chairman of I-GOOS (Angus McEwan), and the Director of the GPO on the review board for the new office will help ensure that the office meets GOOS requirements.

8.2 GOOS CAPACITY BUILDING PROGRAMME

Colin Summerhayes noted that the GOOS capacity building programme for 1999 includes:

(i) Caribbean GOOS workshop, San José, Costa Rica: 22-24/4/99;
(ii) MedGOOS costs/benefits workshop, Rabat, Morocco: 9-12/10/99;
(iii) NEAR-GOOS Training Workshop, Tokyo, Japan: October 1999;
(iv) GLOSS Training Workshop, Sao Paulo, Brazil: Summer 1999.

The provisional GOOS capacity building programme for the year 2000 includes:

(v) PacificGOOS capacity building meeting, Noumea, New Caledonia: spring 2000;
(vi) MedGOOS Pilot Project Meeting (follow up to Rabat workshop);
(vii) GOOS-AFRICA Meeting (follow up to PACSICOM);
(viii) Latin America capacity building workshop (follow up to Curitiba C-GOOS meeting);
(ix) NEAR-GOOS Training Course;
(x) SEA-GOOS awareness raising workshop (similar to the initial meetings that launched MedGOOS and PacificGOOS);
(xi) GLOSS Training Workshop.

Motivations for these proposed workshops differ. GLOSS and NEAR-GOOS meetings offer clearly focussed technical training consistent with the goals of the GOOS capacity building strategy. A general awareness raising workshop might help to launch SEA-GOOS in S.E.Asia. Possibilities for a workshop in South America are related either to the development of C-GOOS pilot projects or to the development of a Caribbean GOOS programme. A GOOS-AFRICA workshop could emerge as a meeting to finalise the proposals to be presented as part of the post-PACSICOM process for establishing operational oceanography in Africa. A PacificGOOS meeting will be necessary to begin planning the implementation of PacificGOOS. The MedGOOS meeting was pencilled in as a logical follow-on to the cost-benefit workshop of 1999, with the likelihood that pilot projects may be identified. The extent to which this provisional programme becomes a reality will depend largely on the ability of local organisers to do the appropriate planning and of the IOC and local organisers to identify the appropriate new financial resources. It was noted that EuroGOOS is developing a plan to assist with GOOS Capacity Building.

Members noted that panels should be intimately involved in determining the capacity building programme. This requirement will be met once the Capacity Building Panel is constituted and begins to meet, since all panels will be represented thereon.

Recognizing the difficulties involved in long-range planning for these kinds of activities, and the general shortage of funds, members approved the provisional programme without setting priorities.

8.3 ASCERTAINING COSTS AND BENEFITS

It was noted that EuroGOOS has set up a group to establish a methodology for establishing costs and benefits in the European context, and that this may prove applicable elsewhere when it is completed. Members agreed that the IOC should encourage Member States to assess costs and benefits of monitoring and forecasting activities as the basis for evaluating the value of investing in GOOS. The discussion concluded by considering areas in which a cost-benefit exercise might be carried out as a means of developing information useful for the regional promotion of GOOS activities. It was agreed that it might be worthwhile to conduct an exercise considering the needs of the sub-equatorial states bordering the South Atlantic, for instance through a workshop in Brazil.

ACTION 50: Nic Flemming to lead a group including Ilana Wainer and Geoff Brundrit to consider developing a South Atlantic costs and benefits workshop resulting in a manual useful in that and other regions.

Further discussion on costs and benefits was aided by a presentation by Ralph Rayner, Managing Director of FUGRO GEOS, on what service companies do, the state of the market from their perspective, and the potential for a link between GOOS designers and commercial service companies.

Ralph began by making a distinction between users and customers. Users take GOOS products directly, and may include academic researchers, institutions, some government agencies, and commercial service providers (who add value to the data and sell it on). Users are ocean information specialists who use data in pursuit of specific scientific objectives or who place data alongside a wide range of other information to address highly specific research or customer needs. Customers are those who actually pay for products. In effect they purchase products to which value has been added by tailoring the output to a specification of need (e.g. for engineering, safety, or environmental protection). Customers are commonly not in the business of oceanography, but engage in activities that depend to some degree on knowledge of the marine environment. Some users are also customers - for instance a national environmental agency that has marine environmental specialists to place GOOS data into context with their specific needs, or an oil company with an oceanographic or environmental department to service internal customers.

Most private sector marine clients (customers) have no internal users and no direct interest in oceanography - their interest is in how the oceans may affect their business. They rely on specialist commercial providers to understand and meet their specific information needs. This usually involves production of highly specific added value products. Examples include: the exploration and/or design departments of an offshore oil and gas company; a merchant fleet owner; a port operator; a coastal developer; a municipal authority. Except

where legislation is a driver, these clients are discretionary - the customer has to be persuaded that the benefits justify the costs.

Customer needs are rarely isolated from their application. For example: metocean data to support deep-water drilling must be married with other engineering data in risk assessment - the standard oceanographic product by itself is not enough. Alternatively, ship routing is not just about providing a forecast; it involves a fusion of information about cargo type, optimising fuel use, minimising risk of vessel damage, and so on.

Since the bulk of provision of metocean and environmental services to private sector customers is from commercial service providers, they are large potential industry users of GOOS data and products. GOOS therefore should seek their involvement in assessing customer needs and determining the areas where GOOS products may create new market opportunities.

In assessing costs and benefits it is important to distinguish between the value of (a) activities underpinned by marine information, and the value of (b) the primary markets for marine information products and services. Dependent activities include those of the main marine industries (oil and gas, leisure, defence, shipping and shipbuilding; equipment; fisheries; environment; ports; construction; research; and telecommunications), which are estimated at 3-5% of GNP for OECD countries. In contrast the primary marine information market for sale of oceanographic instruments, systems, data and data products globally is around $70 million/year, and appears likely to grow at 10% per year for the next decade. [Note this ignores onshore markets in agriculture, water and energy supplies for forecasts based on marine data.]

This analysis shows that although on the one hand development of GOOS will underpin creation of new data products and services for which significant commercial markets can be developed, on the other hand the value of commercial value-added products derived from GOOS activities should not be overestimated. To create and develop these markets we need to create effective partnerships between GOOS and commercial service providers.

Rayner gave several examples of how commercial service operators might act as users for primary GOOS data, converting them into products for paying customers. Commercial oceanographic services are commonly required in: measurement; modelling; observing systems; forecasting; criteria studies; environmental appraisal; and data management. A primary customer for metocean services is the oil and gas sector, which requires information in or for: seismic exploration; environmental appraisal; rig selection; riser design; planning drilling campaigns; exploration drilling; appraisal drilling; engineering design; platform or pipeline installation; and production support. A typical application is MetNet, a system for observing winds, waves, meteorological data and currents on the northwest shelf of Europe, in which offshore data nets are linked to an onshore server from which information is distributed to various databases in real time, for a number of potential uses, such as forecasting for helicopter operations. The data also are exported to the UK Met Office and to other users for wider use, as well as being archived. It provides basic statistics in user friendly formats, for instance showing wind speed, direction and gusting; significant and maximum wave height and crest height; wave periods; air and sea temperatures. Data products include: statistical and modelled design and operating information; database and climatology products; regional hind-casts, site specific, and global forecasts. Forecasts, made in partnership with the UK Met Office include for example: (i) broadcast-based forecast services to merchant vessels; and (ii) site specific forecast products to support specialist offshore operations like drilling, heavy lifting, towing, and laying cables or pipes.

To support customers activities service companies carry out regional studies - for the oil sector in places like the Black Sea, Caspian Sea, Carribean, Patagonian shelf, South China Sea, Mediterranean, Angola/Namibia, and the NW Atlantic Margin. Usually such studies are in partnership with specialised agencies and involve development of detailed bathymetric grids to support advanced numerical models; detailed appraisals of existing data; integrated measuring and modelling programmes; year-long synoptic measurement campaigns across the region; real time installation of buoys; now-casts hind-casts and forecasts; and development of a range of products tailored to support specific offshore operations.

ACTION 51: All advisory panels should invite private sector representatives to work with them on GOOS design.

9. AGREEMENTS AND COMMITMENTS

Members noted that at the request of GSC-I, the GOOS Agreements Meeting intended for 1998 had been postponed and its nature changed. It was now intended to use the mechanism of the IOC Assembly to obtain a strong intergovernmental Resolution on GOOS, which would take the place of the planned Agreements Meeting as a means of encouraging Member States and the IOC to support GOOS development. The Draft GOOS Resolution on this topic had been circulated for comment and improvement; it will be presented to the IOC Assembly in July 1999.

As initially planned, the Agreements Meeting included a Commitments Meeting at which individual Member States could make specific commitments of appropriate parts of their national or regional or global observing systems to GOOS, as a means of growing GOOS further. In line with the changed nature of obtaining agreements, it was decided to postpone the Commitments Meeting until after the IOC Assembly had finalised the GOOS Agreement Resolution. However, recognising that many countries would be present at the Assembly, and mindful of the costs of bringing many of the same people together again subsequently for a Commitments Meeting, it was decided by the Agreements Meeting Organising Committee to hold the Commitments Meeting at UNESCO on July 5th and 6th, 1999, immediately following the Assembly debate on the GOOS Resolution. A Circular Letter was sent to all IOC Member States inviting attendance and asking them to consider what commitments they would like to make at this meeting.

During the ensuing discussion some members noted that there seemed to have been little warning about the Commitments Meeting. Colin Summerhayes reported that although indeed the Circular Letter had just been sent out, the countries who were members of the Agreements Meeting Organising Committee had been warned well in advance, and indeed had started preparing their commitments during 1998 in preparation for the originally proposed Commitments Meeting which was to have taken place in 1998. He envisaged that at least 12 key GOOS countries would make commitments, and noted that this meeting was billed as the 1st GOOS Commitments Meeting, allowing ample opportunity for other Member States to sign up later if they wished.

10. GOOS WORK PROGRAMME, INFRASTRUCTURE AND BUDGET

Colin Summerhayes introduced the work programme and budget for 1999-2000 revised in terms of the GOOS structure proposed by Neville Smith (see 5.6.1 above). In Table 10.1, IOC refers to the IOC regular programme contribution from UNESCO plus a share of the IOC Trust Fund; "Extrabudgetary" refers to funds outside IOC's budget that were donated by sponsors or agencies.

Table 10.1 GOOS work programme and budget for 1999 and 2000

Activity	Total ($) 1999	IOC	Extra-Budgetary	Total ($) 2000	IOC	Extra-Budgetary
1.1 Science Guidance Panels	226	87	139	213	81	132
1.2 Cross Cutting Panels	10		10	20	7	13
Subtotal	**236**	**87**	**149**	**233**	**88**	**145**
2. Implementation Oversight						
2.1 Regions	16	0	16	16	0	16
2.2 JCOMM	140	75	65	103	68	35
Subtotal	**156**	**75**	**81**	**119**	**68**	**51**
3. Liaison/Integration	25	25	0	16	16	0
Subtotal	**25**	**25**	**0**	**16**	**16**	**0**

Activity	Total ($) 1999	IOC	Extra-Budgetary	Total ($) 2000	IOC	Extra-Budgetary
4. Outreach/Infrastructure	20	20	0	48	33	15
4.1 Mechanisms	104	48	56	212	87	125
4.2 Posts	119	42	77	310	47	263
4.3 Capacity Building	**243**	**110**	**133**	**570**	**167**	**403**
Subtotal						
5. GRAND TOTAL	**660**	**297**	**363**	**938**	**339**	**599**

Note that the main differences between 1999 and 2000 are (i) the costs of the Perth Office on line 4.2, most of the costs of which are borne by Australia, and (ii) the capacity building programme on line 4.3, most of the increase in which is attributable to a single large extra-budgetary sum estimated as required for the Noumea meeting of PacificGOOS. The 1999 budget was approved by the IOC Secretariat. It should be noted that this is double the level anticipated at the 1997 IOC Assembly. In this year around 18% of the total budget is devoted to capacity building.

Colin Summerhayes noted that a significant proposal writing effort is required to bring in the extra-budgetary resources recorded in Table 1. If these resources are to be increased, a small group of the GSC would be needed to aid in searching for new resources, and perhaps in preparing proposals as well. Relatively few organisations and countries are direct contributors to GOOS development. While this suggests that there may be potential to obtain contributions from non-donor countries, there may be reasons why some countries do not contribute at present.

Funding of regional activities should come ultimately through regional contributions solicited and managed by regional organisations (e.g. MedGOOS, PacificGOOS). However, the GPO has an important role to play in working with newly formed regional groups to help them get on their feet.

One of the items on line 2.2 of the budget is for support provided by the IOC for the meetings of the TAO Implementation Panel (TAO-IP). It was noted that in contrast with the TAO-IP, the costs of the DBCP are borne by contribution from Member States supporting drifting buoys; members asked why, now that TAO is operational, the costs of TAO-IP meetings should not be on the same footing.

This led to a discussion of the role of the TAO-IP. Recognizing the fundamental importance of TAO data for GOOS, and therefore of the need to assure the long-term prosperity of the TAO system, the members acknowledged that the TAO-IP is needed for the implementation of the array. The GSC also noted the emergence of the JCOMM as the mechanism for implementation of (among others) the climate elements of GOOS, and noted that JCOMM is due to be ratified by the WMO and IOC Governing Bodies during 1999. The TAO-IP clearly should be one of the implementation bodies of the new JCOMM. However, it was noted that the TAO-IP also provides scientific advice, but that a structure for scientific advice is being developed for the JCOMM.

Given this background, the GSC wishes to pose the following question to the TAO-IP with regard to its future evolution: where in the Panel's opinion should scientific oversight reside for the implementation of the tropical mooring arrays TAO and TRITON? The GSC noted that oversight for research now resides with the Working Group for Seasonal-to-Inter-annual Prediction of CLIVAR, with the Upper Ocean Panel of CLIVAR responsible for the overall global system. Within GCOS and GOOS, the OOPC is the relevant panel. However, until now the TAO-IP itself has been regarded also as providing this advice.

ACTION 52: GSC Chairman to discuss with the TAO-IP Chairman the role of the TAO-IP in providing scientific advice given the other science advisory bodies, and the extent to which the panel activities should be supported by IOC funds now that TAO is operational.

The two posts on line 4.2 are (a) the Perth Post (section 5.4.1.4) and a proposed Data Post. The Data Post is in fact shared between IODE and GOOS, the focus of the GOOS half being to compile the inventory of existing coastal observing system elements required by the C-GOOS and LMR Panels. The Director of the GPO explained that the Data Post would have been filled late in 1998, but the original candidate turned us down. An offer has now been made to someone who will start on August 1st.

ACTION 53: Director GPO to work with Panel Chairs to develop an acceptable plan for completing the inventory of ongoing coastal observing system elements in time to meet panel needs.

The GSC considered that the budgets for 1999 and 2000 were the minimum necessary to take forward the international coordination of GOOS, and recommended that they be taken forward to I-GOOS and the IOC Assembly, with the request that a broader range of countries start providing extra-budgetary support. GOOS is the most important of the IOC's activities and should be resourced so as to fulfil its task effectively.

ACTION 54: GPO to take GOOS work programme and budget forward to I-GOOS-IV and the IOC Assembly in 1999, with the recommendation that a mechanism should be found to increase direct support for international coordination of GOOS by spreading the load between a wider range of countries than those presently contributing extra-budgetary support.

11. OTHER BUSINESS

11.1 GSC MEMBERSHIP AND ROTATION OF MEMBERS

It is agreed that the 12-person core membership of the GSC should reflect a balance between user groups, operational experts and scientific researchers. To create this balance, it will be necessary to start a process of rotating members off and bringing on replacements who enable the GSC's profile to become somewhat more operational than it has been. The Director GPO noted that 4 members had served since J-GOOS-I in 1994: Ehrlich Desa, Su Jilan, Ichio Asanuma, and Neville Smith.

The Chairman pointed out that in order to ensure that despite its make-up the Committee received appropriate operational advice he had invited two operational people to attend GSC-II as observers, Howard Cattle of the UK Met Office, and Ralph Rayner, Managing Director of FUGRO-GEOS.

The Chairman asked members to think about potential replacements for the four longest serving members. He noted that in principle even if Neville Smith stood down from the 12-person core committee he still would be required to attend GSC meetings in his capacity as chairman of OOPC. The Chairman noted that in selecting replacements we must consider geographical balance, and asked the three retiring Asian members to consult with colleagues and submit to him the names of potential candidates, preferably from operational sectors, from their regions. Feedback is needed by the end of July.

In closing this item the Chairman thanked the retiring members warmly for their long contribution to the development of GOOS.

ACTION 55: Members to supply, by end of July 1999, the names of potential replacements for the core committee, preferably focussing on individuals with considerable operational experience, or users in the private sector. Special areas of needed expertise include: ensuring human health, mitigating natural hazards, marine services, and preserving/restoring healthy ecosystems.

11.2 DATE AND PLACE OF NEXT MEETING

GSC-III will meet in Paris in April 2000.

12. CLOSURE

The Chairman thanked Haiqing Li and his Local Organising Committee for their excellent support during the meeting, and the SOA Administration for graciously agreeing to host the meeting, in Beijing.

13. LIST OF ACTIONS

ACTION 1: GPO to identify potential targets for communication and to investigate ways of improving communication regarding GOOS and its resource requirements.

ACTION 2: GPO to investigate further the possibility of working with the G3OS to obtain funds from the Turner Fund.

ACTION 3: GPO to start work on a GOOS brochure for production in the year 2000, with assistance from To Malone and Mike Fogarty, and to explore with NIO, Goa, the possibility of printing and distribution at no cost offered by Ehrlich Desa.

ACTION 4: (GSC-I ACTION ITEM 28): GPO to develop data inventories for C-GOOS and LMR. [During the year it was agreed that this task would be shared with LOICZ. The project was due to be started by the IOC/GOOS data person (John Withrow), but he left the IOC late in 1998. His proposed replacement was not able to start as planned at the beginning of 1999. Recruitment of additional staff to the GPO has now allowed a plan to be agreed with the Chairman of C-GOOS to start the task in May 1999].

ACTION 5: (GSC-I ACTION ITEMS 53 and 54): GPO to develop a data base of national contacts and to promote development of national committees. [This has been on hold due to lack of staff time, but is now beginning].

ACTION 6: (GSC-I ACTION ITEM 11): HOTO Panel to develop a list of priorities. [Delay in meeting this requirement was occasioned by departure of HOTO Chair; his replacement is working on it].

ACTION 7: (GSC-I ACTION ITEM 9): Develop a new sea-level advisory mechanism to complement GLOSS. [This proposal was put to the IOC Executive Council in November 1998. They instructed the GPO to solicit the views of the GLOSS Group of Experts before reaching a decision]. GSC-II asked Brundrit to ensure that this matter was brought to a successful conclusion at the GLOSS-VI meeting in Toulouse (May 10-14, 1999).

ACTION 8: (GSC-I ACTION ITEM 50): GPO to arrange external review of GOOS by agencies and users. [The GSC wishes this action to take place sometime in the next 2-3 years].

ACTION 9: (GSC-I ACTION ITEM 30: Develop methodology for economic evaluation of GOOS. [The working party to do this did not meet, but some of the necessary actions were carried out, and progress is being made within EuroGOOS]. The Action will be carried out by Nic Flemming, Geoff Brundrit, and Ilana Wainer.

ACTION 10: (GSC-I ACTION ITEM 27): Panels to interact with Convention Secretariats as key end users, involving them as appropriate in Panel meetings. [Liaison by OOPC with the Secretariat for the Framework Convention on Climate Change is taking place through GCOS. Other panels need to build linkages to other relevant Secretariats (there are some links already in HOTO, though not yet with Global Plan of Action for Protection of the Marine Environment from Land Based Activities)]

ACTION 11: GPO to plan to continue production of brief annual GOOS Status Reports; they would be placed on the GOOS Web site and paper copies would be distributed. In addition the GPO will 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. Eventually this Web site will replace the status reports. Progress will be reported at GSC-III.

ACTION 12: GPO to produce a biennial explanatory document starting with "GOOS 2000", primarily on the Web but in hard copy for developing countries.

ACTION 13: Chairman to write to POGO Chair expressing interests and concerns of the GSC in POGO, and to arrange appropriate interactions between GOOS and POGO.

ACTION 14: Chairman and Tom Malone to attend 1st POGO Meeting in December 1999, with Smith and Summerhayes.

ACTION 15: Howard Cattle to feed the SST workshop results into the next ACSYS Panel meeting, in June 1999.

ACTION 16: OOPC to improve communication with the Arctic buoy programme of DBCP.

ACTION 17: Julie Hall was asked to bring the question of time series requirements up at the JGOFS Steering Committee meeting (May 10-14 in Japan), to stimulate a response to the OOPC.

ACTION 18; LMR Panel (i) to get in touch with the Secretariat of the Biodiversity Convention, and the Convention office responsible for Straddling Stocks, and (ii) to consider sports fisheries and artisanal fisheries, so as to determine the requirements of these potential users.

ACTION 19: Make available to all module panels' members, and on the GOOS Web site, Julie Hall's modification of Bud Ehler's document on the involvement of stakeholders in the planning process.

ACTION 20: HOTO Panel, with assistance from Julie Hall and Tom Malone of C-GOOS, to take the lead in addressing the issue of contaminant transport from coastal drainage basins to coastal waters, initiating appropriate contacts with the hydrological community, GTOS, LUCC and LOICZ, and to report back before the next C-GOOS meeting (November 1999).

ACTION 21: LMR Panel to expand its effort to include the fisheries of coastal seas (estuaries, sounds, seas, EEZs).

ACTION 22: LMR and Coastal panels to each identify 2-3 members who will form an ad hoc joint committee to address the issue of habitat loss from a fisheries perspective (i.e., incorporating into the C-GOOS design observations required to assess and predict the effects of habitat loss on the capacity of coastal systems to support fisheries).

ACTION 23: HOTO Panel to take the lead on developing indices of stress and response status, starting by formulating guidelines for the identification and development of indices. LMR and Coastal Panels will assist in this process, starting by nominating two representatives each to participate in the GIPME indices workshop organised for November 1999.

ACTION 24: Coastal, LMR and HOTO panels to follow the schedule set out in agenda item 4.3.2 to develop a plan and time-table for the integration of HOTO, LMR and Coastal Modules.

ACTION 25: GPO to work with OOPC to consider including in the GOOS-IOS those operational centres which make direct contributions to GOOS by issuing data and information products (including the G3OS Information Centre (GOSIC) as a metadata centre).

ACTION 26: GPO to work with OOPC to determine which satellite programmes could/should be added to the GOOS-IOS.

ACTION 27: Members and GPO to provide advice to Peter Dexter by end May 1999 regarding the updating, improvement and finalisation of the *Action Plan for Global Ocean Physical Observations for GOOS/GCOS* (noting the change in the title).

ACTION 28: WMO representative to ask WMO Congress to recognise that Argo is an integral part of recognised operational programmes (GOOS, GCOS) and of WCRP, and should therefore be supported. GPO to ensure that the case for Argo is presented to the IOC Assembly in the same way.

ACTION 29: (i) LMR to begin discussion with NEAR-GOOS about eventual broadening of NEAR-GOOS to incorporate LMR issues. (ii) GPO to recommend to NEAR-GOOS the addition to its membership of agencies with significant interests in environmental and living marine resources issues.

ACTION 30. GPO to determine for each regional GOOS programme the degree to which data and products will be openly available and the mechanisms envisioned for data access and delivery of products.

ACTION 31: (i) GSC Members and GPO to provide J.Guddal with names of possible candidates for the Advisory Board; (ii) GPO to work with Advisory Board to develop prototype Bulletin on the GOOS Web Site; (iii) Advisory Board and GPO to look for appropriate extra-budgetary support; (iv) Board to liaise with Panels and with JCOMM to ensure adequate products are used for display purposes (e.g. ones that meet appropriate quality standards). (v) GPO to advertise on the GOOS Web site what kinds of products are available and to provide hyperlinks to GOSIC (agenda item 6.5.1) and the IEPB (agenda item 5.5.2) and other appropriate centres.

ACTION 32: Include the IGOSS Electronic Products Bulletin in the GOOS Initial Observing System.

ACTION 33: Chairman will lead an intersessional working group of N. Flemming, A. McEwan, J. Hall, Jilan Su, and any other interested GSC members to continue development of a white paper expressing the organization of GOOS as a means of enabling more efficient and effective development and management of the system. This paper should express the activities required for design and implementation.

ACTION 34: (i) GPO to initiate a document numbering system before the next GSC meeting following the proposed organization chart and (ii) GPO to re-cast the work programme and budget along these lines for future considerations.

ACTION 35: Encouragement to be given by whatever means to individual countries to develop national groups to promote the development of GOOS (e.g. to form national steering or coordination committees along the lines recommended above) including placing suggested responsibilities of such committees on the GOOS Web site.

ACTION 36: Chairman will work inter-sessionally with a small *ad hoc* group to recommend a procedure for formal recommendation of GOOS regional programmes and to promote coordination among regional GOOS programmes. A white paper will be prepared for consideration by the GSC.

ACTION 37: (i) GPO to provide panel chairs with details of regional GOOS contact points, to facilitate interaction between regional groups and module panels and (ii) GPO to provide information about geographical and other relationships between GOOS and other regional bodies.

ACTION 38: GPO to work with Eric Lindstrom to engage Panel Chairs in developing the Oceans Theme.

ACTION 39: GPO, the OOPC and appropriate GSC Panel Members to work with GCOS to prepare the report to COP-5.

ACTION 40: (i) Panels to ensure that their requirements are accurately reflected in the WMO database; (ii) GOSSP to interact directly with Panel chairs to ensure effective liaison in the development and presentation of requirements.

ACTION 41: GPO and GOSSP to develop a mechanism to facilitate integration of ocean colour requirements for IOCCG, LMR and C-GOOS.

ACTION 42: (i) GSC Chair to write to Tom Karl thanking him for his services to GOOS through J-DIMP. (ii) G3OS Secretariats to work together with their respective chairs to accept or further revise the J-DIMP ToRs as appropriate.

ACTION 43: (i) GOSIC will add to its Web site information flow diagrams for all components of the GOOS-IOS; (ii) GOSIC to consider linking to the new FAO fisheries database.

ACTION 44: GPO to work with GOSIC, GCOS and GTOS to identify and secure resources to enable GOSIC to continue/expand.

ACTION 45: GPO to devote one issue of the *GOOS News* to GOSIC.

ACTION 46: Members to provide Ron Wilson by end of May with suggestions for modifications and improvements to the J-DIMP data and Information Management Plan. Comments will be passed to Bill Murray and the plan will be finalised and widely distributed.

ACTION 47: Ron Wilson, in consultation with GOOS advisory panels, to revise the GOOS data and information management plan so as to produce a data and information system implementation strategy that will appear as an introduction to the GOOS part of GOSIC.

ACTION 48: (i) Members to provide feedback to Worth Nowlin on improvements to the capacity building document by end June 1999; (ii) Chairman to revise the document.

ACTION 49: An Inter-sessional working group comprising Su Jilan, Ilana Wainer, Geoff Brundrit, Ralph Rayner and Worth Nowlin should be formed to investigate possible methodologies for assessing performance in capacity building.

ACTION 50: Nic Flemming to lead a group including Ilana Wainer and Geoff Brundrit to consider developing a South Atlantic costs and benefits workshop resulting in a manual useful in that and other regions.

ACTION 51: All advisory panels should invite private sector representatives to work with them on OOS design.

ACTION 52: GSC Chairman to discuss with the TAO-IP Chairman the role of the TAO-IP in providing scientific advice given the other science advisory bodies, and the extent to which the panel activities should be supported by IOC funds now that TAO is operational.

ACTION 53: Director GPO to work with Panel Chairs to develop an acceptable plan for completing the inventory of ongoing coastal observing system elements in time to meet panel needs.

ACTION 54: GPO to take GOOS work programme and budget forward to I-GOOS-IV and the IOC Assembly in 1999, with the recommendation that a mechanism should be found to increase direct support for international coordination of GOOS by spreading the load between a wider range of countries than those presently contributing extra-budgetary support.

ACTION 55: Members to supply, by end of July 1999, the names of potential replacements for the core committee, preferably focussing on individuals with considerable operational experience, or users in the private sector. Special areas of needed expertise include: ensuring human health, mitigating natural hazards, marine services, and preserving/restoring healthy ecosystems.

ANNEX I

AGENDA

1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SESSION
1.2 WELCOMING REMARKS BY HOST AGENCY
1.3 ADOPTION OF THE AGENDA
1.4 WORKING DOCUMENTS

2. VIEWS OF THE CHAIRMAN OF I-GOOS

3. REPORT BY THE DIRECTOR OF THE GPO

3.1 GPO ACTIVITIES

3.1.1 Progress Against Actions from GSC-1

3.2 GOOS SPONSORS

4. GOOS DESIGN ACTIVITIES

4.1 GENERAL GOOS DESIGN
4.2 STATUS OF MODULE DESIGN

4.2.1 Ocean Observing Panel for Climate (OOPC)

4.2.1.1 Strategy
4.2.1.2 The Upper Ocean Termal Salinity Network
4.2.1.3. A Study of SST for Climate
4.2.1.4 Surface Fluxes
4.2.1.5 POGO-the Partnership for Observation of the Global Ocean
4.2.1.6 Report on the Adequacy of Observing Systems
4.2.1.7 The Climate Conference
4.2.1.8 Summary

4.2.2 LMR Panel
4.2.3 HOTO Panel
4.2.4 Coastal GOOS (C-GOOS)

4.2.4.1 Stakeholders' Workshop
4.2.4.2 Panel Meetings

4.3 CO-ORDINATION AND INTERACTION BETWEEN MODULES

4.3.1 Cross-Cutting Issues

4.3.1.1 Contaminant Transport
4.3.1.2 Coastal Fisheries and Habitat
4.3.1.3 Indices of Stress and Response Status

4.3.2 Time-Table for the Integration of HOTO, LMR and C-GOOS

4.4 DISCUSSION

5. GOOS IMPLEMENTATION ACTIVITIES

5.1 THE GOOS INITIAL OBSERVING SYSTEM (GOOS-IOS)
5.2 IMPLEMENTATION PLANNING FOR THE CLIMATE MODULE

5.2.1 Action Plan for the Implementation of Observations for GOOS/CGOS
5.2.2 Joint Technical Commission on Oceanography and Marine Meteorology (JCOMM)
5.2.3 Climate Conference

5.3 GLOBAL PILOT PROJECTS

5.3.1 The Global Ocean Data Assimilation Experiment (GODAE)
5.3.2 Argo

5.4 REGIONAL ELEMENTS

5.4.1 EuroGOOS, NEAR-GOOS, Others

5.4.1.1 EuroGOOS
5.4.1.2 NEAR-GOOS (N.E. Asian Regional GOOS)
5.4.1.3 GOOS-Africa
5.4.1.4 Other Regional Programmes

5.5 PRODUCTS BULLETIN

5.5.1 GOOS Services and Products Bulletin
5.5.2 IGOSS Electronic Products Bulletin (IEPB)

5.6 IMPLEMENTATION STRATEGY

5.6.1 GOOS Organization
5.6.2 Relations of GOOS to JCOMM
5.6.3 National GOOS Efforts
5.6.4 Regional GOOS Efforts

6. CO-ORDINATION WITH OTHER OBSERVING SYSTEMS

6.1 THE INTEGRATED GLOBAL OBSERVING STRATEGY (IGOS)
6.2 GTOS
6.3 GCOS

6.3.1 Reporting to COP-5 (FCCC)

6.4 GOSSP

6.5 J-DIMP

6.5.1 G3OS Information Centre (GOSIC)
6.5.2 J-DIMP Data and Information Management Plan

7. GOOS DATA AND INFORMATION MANAGEMENT

7.1 A DRAFT DATA AND MONITORING MANAGEMENT PLAN FOR GOOS

8. CAPACITY BUILDING AND COST/BENEFITS

8.2 GOOS CAPACITY BUILDING PROGRAMME
8.3 ASCERTAINING COSTS AND BENEFITS

9. AGREEMENTS AND COMMITMENTS

10. GOOS WORK PROGRAMME, INFRASTRUCTURE AND BUDGET

11. ANY OTHER BUSINESS

11.1 GSC MEMBERSHIP AND ROTATION OF MEMBERS
11.2 DATE AND PLACE OF NEXT MEETING

12. CLOSURE

13. LIST OF ACTIONS

ANNEX II

LIST OF PARTICIPANTS

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ANNEX III

LIST OF DOCUMENTS

Document Code	Title	Item	Language
GSC-II/1 .	Agenda	1.3	E only
GSC-II/1	Timetable	1.3	E only
GSC-II/2.	Annotated Agenda	1.	E only
GSC-II/3	Report of the Session		E only
GSC-II/4	List of Documents	1.4	E only
GSC-II/5	List of Participants	-	E only
GSC-II/6	Extracts from Report of IOC Executive (Nov. 1998)	2.1	E only
GSC-II/7	GPO Director's Report	3.1	E only
GSC-II/8	Report of G3OS Sponsors Meeting 5-6 June, 1998	3.2	E only
GSC-II/9	Preliminary Draft Report of the Coastal Panel Meeting (Accra, April 12-16, 1999)	4.2	E only
GSC-II/10	Preliminary Draft Report of the LMR Panel Meeting, (Montpellier, March 22-24, 1999)	4.2	E only
GSC-II/11	The GOOS Initial Operational System	5.1	E only
GSC-II/12	Action Plan for Implementing Observations for GOOS/GCOS	5.2	E only
GSC-II/13	Proposal for an International Conference on Ocean Observing System for Climate	5.2	E only
GSC-II/14	Proposal for Argo	5.3	E only
SC-II/15	GOOS-AFRICA Report	5.4	E only
GSC-II/16	GOOS Services and Products Bulletin	5.5	E only
GSC-II/17	Implementation White Paper	5.6	E only
GSC-II/18	IGOS Partners	6.1	E only
GSC-II/19	UNFCCC, COP-4 Report on the Adequacy of Climate Observing Systems Doc.No.10, Resolutions	6.3	E only

Document Code	Title	Item	Language
GSC-II/20	Draft J-DIMP Data and Information Management Plan	6.5	E only
GSC-II/21	Draft GOOS Data and Information Management Plan	7.1	E only
GSC-II/22	Principles of GOOS Capacity Building	8.1	E only
GSC-II/23	Draft Resolution on the GOOS Agreement	9.1	E only
GSC-II/24	GOOS Project Office Work Programme, Infrastructure and Budget	10.1	E only
GSC-II/25	Draft Proposals and Resolutions from GSC-II for I-GOOS-IV	11.4	E only

INFORMATION AND BACKGROUND DOCUMENTS

GSC-II/26	GOOS Status Report on Existing Ocean Elements and Related Systems for 1997 **[http://ioc.unesco.org/goos]**	4.1	E only
GSC-II/27	The GOOS 1998	4.1	E only
GSC-II/28	GOOS News No. 5 **[http://ioc.unesco.org/goos]**	-	E only
GSC-II/29	GOOS News No. 6 **[http://ioc.unesco.org/goos]**	-	E only
GSC-II/30	Rep. of 2nd Meeting of Coastal GOOS Panel (Curitiba, Oct. 29 - Nov. 1, 1998) **[http://ioc.unesco.org/goos]**	4.2	E only
GSC-II/31	Rep. of First Meeting of LMR Panel (Paris, 23-25 March, 1998) **[http://ioc.unesco.org/goos]**	4.2	E only
GSC-II/32	Rep. of Third meeting of OOPC (Grasse, 6-8, April, 1998) **[http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/oopc.html] or [http://ioc.unesco.org/goos]**	4.2	E only
GSC-II/33	Rep. of 7th TAO & 5th PIRATA meetings (Abidjan, Nov. 9-14, 1998)	-	E only
GSC-II/34	Rep. of First Implementation Planning Meeting for Observations for GOOS/GCOS (Sydney, March 7-10, 1998) **[http://ioc.unesco.org/goos]**	5.2	E only

Document Code	Title	Item	Language
GSC-II/35	Rep. of Second Implementation Planning Meeting for Observations for GOOS/GCOS (Paris, 30 Nov. 1998) **[http://ioc.unesco.org/goos]**	5.2	E only
GSC-II/36	The proposed Joint Technical Committee on Oceanography and Marine Meteorology **[http://ioc.unesco.org/goos]**	5.3	E only
GSC-II/37	GODAE Status Report **[http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/godae/homepage.html]**	5.4	E only
GSC-II/38	EuroGOOS Status Report **[http://www.soc.soton.ac.uk/OTHERS/EUROGOOS/]**	5.5	E only
GSC-II/39	Rep. of Third meeting of NEAR-GOOS (Aug 3-6) **[http://ioc.unesco.org/goos/ng3rep.htm]**	5.5	E only
GSC-II/40	The GTOS Plan **[http://www.fao.org/gtos/PAGES/Implan/Implan00.htm]**	6.2	E only
GSC-II/41	Rep. of the eighth meeting of the GCOS Steering Committee (February 9-12, 1999)	6.3	E only
GSC-II/42	Rep. of GCOS to SBSTA for COP4 (FCCC) on the Adequacy of Climate Observing Systems **[http://www.wmo.ch/Web/gcos/scVIII/gcos_sc.html]**	6.3	E only
GSC-II/43	Executive Summary of Rep. of GCOS to SBSTA for COP4 (FCCC) on the Adequacy of Climate Observing Systems **[http://www.wmo.ch/Web/gcos/scVIII/gcos_sc.html]**	6.3	E only
GSC-II/44	Rep. on the 4th meeting of GOSSP (22-23 October 1998) **[http://www.wmo.ch/Web/gcos/scVIII/gcos_sc.html]**	6.4	E only
GSC-II/45	Rep. of the (4th) meeting of J-DIMP (April 18 - May 1 1998) **[http://www.wmo.ch/Web/gcos/publist.html]**	6.5	E only
GSC-II/46	Rep. of the GLOSS Training Workshop Cape Town (Nov. 16-27	8.2	E only

ANNEX IV

GOOS SERVICES AND PRODUCTS BULLETIN

Submitted by Johannes Guddal, President of CMM

SUMMARY

It is proposed to establish a GOOS Services and Products Bulletin (GSPB). This document describes the background for the proposal and the tentative structure for the proposed bulletin, and suggests, correspondingly, terms of reference in the final section.

MOTIVATION

There is an obvious need to enhance the awareness of GOOS and its benefits, in particular among its various stakeholders. Further, a broader, publicly oriented means of conveying information about GOOS is considered helpful to stimulate attention among more high level decision makers, such as within maritime authorities and industry. Strong needs have been identified among stakeholders and users to learn more from services/products already operationally available, their quality, cost/benefits, and impacts. Further, steps should be taken to ensure and protect high quality professionality in the organization and making of GOOS services and products. The Bulletin, governed and advised upon by qualified experts, must take on this role. Even further, there will be a need to monitor GOOS progress on the global level, as well as to enable regions to compare each others achievements .

RECIPIENTS

Although the GOOS Bulletin information must be open , it is in principle aimed at the stakeholders and end users, such as:

- policy makers (such as implementers of SOLAS and for followups of Agenda 21);
- managers and planners within ocean related authorities and industry;
- operators within the same sectors;
- the public, the media, etc.

FORMAT AND FUNCTIONALITY

The Bulletin must have an easy-to-read format and a logical structure corresponding to GOOS modulization and regionalization. Regional progress and scenarios must also be projected into a global scenario. Strong emphasis should be put on the presentation of user feedback. The Bulletin should be available on the Web, updated monthly, and on paper with 6 monthly editions.

CONTRIBUTIONS; QUALIFICATION AND CRITERIA

Contributions must be accepted by an Editor Board, which in the first implementation phase should be an ad hoc Advisory Panel composed of representatives of GSC and JCOMM. General quality criteria will be defined on the basis of ‘best practice’ considerations and documented scientific/technological qualitification. Representatives from different stakeholders and users will be invited to contribute examples of GOOS product applications within their respective sectors, plus comments on their satisfaction with the products, and the socio-economic impacts. The term ‘operationality’ shall imply that the production process is well documented, so that QA audits are possible, and that there is an active end user community responding to the usefulness of the products.

ORGANIZATION

At GSC I, it was recommended that the Bulletin should capitalize on the IGOSS Electronic Bulletin (IEB). This recommendation was followed up, and positive reponses were obtained from Dr. Yves Tourre, who

is responsible for the IEB. The IEB is already on the Web with a comprehensive set of ocean information products. The following sketch diagram illustrates one possible structure and organization for the Bulletin.

TYPICAL CONTENTS

The contents of the GSP Bulletin typically would be those of the already existing IEB, enhanced with a range of additional contributions from different sources, such as:

- typical existing CMM member (and also private agencies) operational products, for example wave, surge, current, sea ice nowcast/forecast/hindcast;
- new GOOS products within the full range of physical/chemical/biological oceanography, including both models and instrumentation products;
- user satisfaction articles represented from; outstanding users or users constituencies;
- GOOS stakeholders» feedbacks, for instance by environmental policy makers

USER SCENARIOS

A set of user scenarios should be included, to guide potential users in the sense of judging potential candidates for production, and to assess the potential significance and impact within their domains of responsibility. User scenarios will also help to educate policy makers about their need for decision support, particularly in cases when more high level educational services are requested.

TERMS OF REFERENCE

The GSPB shall have the following terms of reference:

(a) The Bulletin shall facilitate the making of reports on the state-of-art of GOOS developments, and provide information on GOOS to GOOS stakeholders, to users within industry and authorities, and to the public.

(b) The contents of the Bulletin shall describe typical operational oceanographical products from the IGOSS domain, and from qualified CMM members as well as private agency products, and new GOOS operational products as they appear through the progress of GOOS reports at the national, regional and global scale.

(c) Contributions shall obey clearly stated criteria of quality assurance and documentation standards. In particular, the issues of free data exchange and product availability shall be emphasised.

(d) Contributions shall be invited from GOOS stakeholders and outstanding users, in order to present the end user application of products, their quality, their compliance with QA requirements, user satisfaction, cost/benefit, and, if possible, socio-economic impacts.

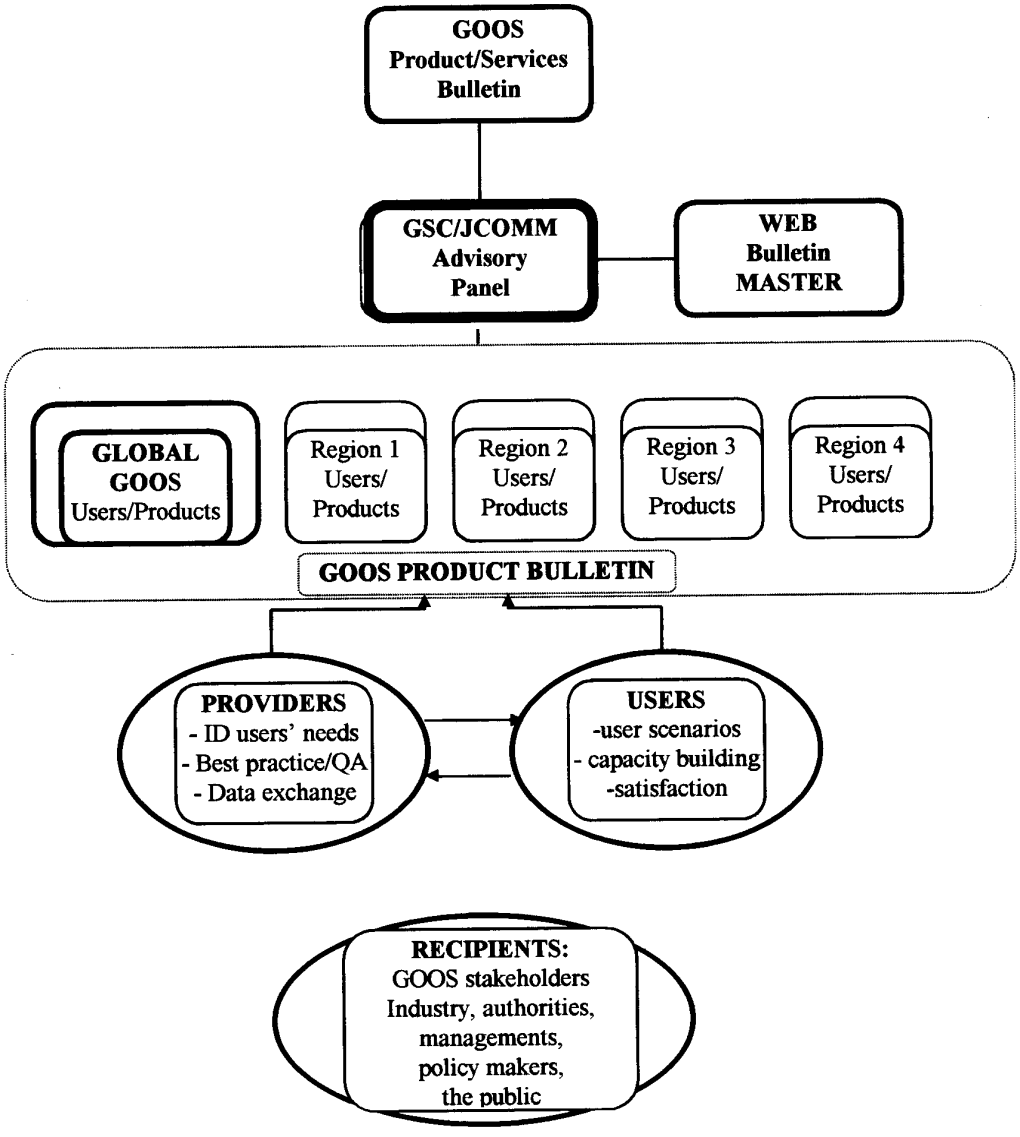
(e) The Bulletin shall in its first phase be managed by an *ad hoc* Advisory Panel appointed by GSC and JCOMM. As new GOOS products appear, the panel must be reorganised in order to reflect the roles of the other sectors of operational oceanography; the chemical and the biological.

(f) The Web part of the Bulletin shall have a GSC/JCOMM appointed Web master. Web updates will be required monthly.

(g) The Bulletin shall be published in paper on a 6 monthly basis. Responsible candidate organizations are to be found to manage production and distribution.

(h) The funding of the Bulletin must be discussed; possibly funding may be obtained by subscription.

(i) The scope of the Bulletin may be revised at a later stage. Possibly, at some stage, the Bulletin could advertise Capacity Building services in parallel to conventional nowcast/ forecast/hindcast/climatological products.



Sketch diagram of the GOOS Services and Products Bulletin

ANNEX V

GOOS IMPLEMENTATION

I. ROLE OF THE GOOS STEERING COMMITTEE

We may ask what are the principal questions related to the development of a sustained observing system for socioeconomic needs. Based on those questions we may define the required activities of the GOOS Steering Committee. A suggested set of questions and Committee activities follow. It is noted which might be considered design and which implementation activities.

Who are users? What do they need?
! Assemble requirements of users for data, products, and information.
Design

What sustained observations are required?
! Translate users needs into requirements for long-term, systematic observations.
Design

What analyses and products are needed?
! Specify products/analyses needed to add value to data for users.
Design

Are users getting what they need?
! Monitor performance of observing system elements.
Implementation

Who will implement actions to meet requirements?
! Transmit requirements to organizations coordinating implementation or initiate mechanisms.
Implementation

How can existing system be improved?
! Consider system changes and recommend those that would improve performance.
Implementation

What additions to system are needed?
! Devise other paths to implementation, as necessary.
Implementation

To examine whether these activities are reasonable and adequate, we must consider the activities required for implementation of GOOS.

In addition, we must recognize that there are different modes of implementation; GOOS must allow for differences between global and regional (or even more specific) initiatives. We must consider how observational elements are added to a sustained observing system.

II. PHASES OF GOOS IMPLEMENTATION

It is stated in the GOOS Strategic Plan that there are five overlapping phases in the implementation of GOOS:

(i) Design
(ii) Operational demonstrations and pilot projects
(iii) Identification (initiation) of an initial observing system
(iv) General implementation building up to a permanent system
(v) Continued assessments and improvements to the system

This seems reasonable and complete. However, there are activities required for implementation that are only implicit in this list. They may be needed in many or all phases of implementation. A prime example of an omission is recognition of the need for capacity building, if a truly global system is to result. The GOOS organization must recognize and provide for such activities as part of implementation.

III. MODES OF GOOS IMPLEMENTATION

The mode of implementation for specific GOOS observing system elements or sub-systems will depend on the degree to which the observations involved are planned to be global in scope. For example, climate-related, physical observations are by their nature seen to be part of a global network. And thus, the planning frameworks for such measurements (e.g. OOPC, JCOMM, and GODAE) are global in scope.

On the other hand, there may be networks that are regional or objective-specific, and the GOOS organization should not discourage them or make it too difficult for them to conform to the GOOS framework. NEARGOOS fits into this category, and one can imagine that GCRMN and other discipline-related elements do as well. The GOOS organization should not try to force coral reef monitoring into a global framework when only a limited number of countries are interested. To be considered part of GOOS, it is adequate that such elements comply with a set of consistent principles while delivering benefit to the countries interested. If countries participating in such observing system elements view themselves as part of the GOOS family, it is likely that they will be better disposed or positioned to contribute to the global portions of GOOS.

There is concern that the fragmentation caused by welcoming into GOOS many regional and discipline-oriented observing elements implies that resources for those activities will be lost to the more generalized GOOS systems. This concern assumes that resources used for one GOOS activity will rob from another. This is not likely to happen at the national level; as an example, the resources for implementing a coastal network are not likely to come from the same national source as resources for monitoring climate change or for improved marine meteorological and ocean services.

Such fragmentation of effort could be a problem at the international level. As an example, the GOOS project Office could become too thinly spread in support of a myriad of regional and discipline-oriented activities; that already is the case to an extent. However, the GPO (as well as the efforts of the general GOOS organization) exist to deliver as well as possible to the whole spectrum of need for coordinated ocean observations.

IV. ACCEPTANCE OF OBSERVING SYSTEM ELEMENTS INTO THE GOOS

The observing system designs are based on user requirements. Many products are needed, and there are a variety of methodologies for making the observations needed to attain many of these products. In many cases, therefore, selections must be made among competing methodologies. Those involved with the design and implementation of the GOOS should understand the avenue by which a specific observing system element moves from a research concept to selection as part of a sustained observing system to meet user needs.

It is recognized that many elements of the required ocean observing system already exist. A critical initial task is to integrate these activities and to develop and implement effective data management activities so as to attain the Initial Observing System. At the same time, augmentations to the system must be considered, because we know that many needs can not be met with existing elements. Deciding what elements to add to the system and when requires setting priorities. Priority must be based on user needs and on proven readiness.

There is a natural, generic sequence of events leading to the inclusion of a specific element into an integrated ocean observing system. The generic sequence in time order is:

(i) development of an observational/analysis technique within the research and/or operational communities;

(ii) community acceptance of the methodology gained through pilot projects demonstrating the utility of the methods and data;

(iii) pre-operational use of the methods and data by researchers, application groups, and other end users, with particular emphasis on ensuring compatibility with previous systems;

(iv) Incorporation of the methods and data into an operational framework with sustained support and for sustained use in support of societal objectives.

To illustrate the stages of progression through this sequence, examples are cited of (1) an observing system element that recently reached the operational stage, (2) an ongoing pilot project, 3) a sampling methodology fully vetted by the research community and now recommended as a pilot project, 4) a methodology used extensively by the atmospheric science community for research, analysis, and forecasting and now ready to be tested as an ocean observing system pilot project, and (5) examples of sampling methodologies still being explored by the research community but with potential as a future sustained observing system element. There are many such nascent observing system elements.

An example of an observing element that has progressed through research, pilot project, and pre-operational stages to become operational is the observing system in the tropical Pacific Ocean for detection and prediction of ENSO events operated by NOAA. The conceptual base for understanding ENSO events has origins four to five decades ago. The observational base for detection began to be developed in the 1960s. In the 1980s the Tropical Ocean-Global Atmosphere (TOGA) research program began to develop scientific understanding and predictive capability for ENSO events, particularly El Niños. An observing system pilot project in the tropical Pacific together with predictive modeling were initialized in the 1980s and maintained until the end of TOGA in 1995; this resulted in reasonable scientific understanding and significant predictive skill. NOAA then maintained the ENSO observing system element in pre-operational phase until two years ago when it became a sustained, operational component of the Global Ocean Observing System and the U.S. ocean observing system.

An ongoing multidisciplinary pilot project in the coastal ocean is the first of a series of Long-term Ecosystem Observatories (LEOs) situated on the inner continental shelf off New Jersey to obtain high resolution, long-term measurements from a broad corridor of marine and coastal habitats, between the watershed of the Mullica River estuary to the deep sea. This pilot program is a test bed for new technologies designed to carry out unattended, long-term measurements over a range of disciplines. A 10 km electro-optic cable links two long-term outposts or nodes to a shore laboratory at Rutgers University and forms the basis for a real-time connection between the undersea world and the Internet. Beginning with a successful period of intensive operations during the summer 1998, this pilot has proved successful in attaining its ambitious initial objectives.

An example of a sampling methodology that has been developed and extensively used in research is the profiling float. This instrument drifts with ocean currents at a deep reference depth (say 2000 m) and periodically (say bi-weekly) cycles to the surface obtaining profiles of salt and temperature and reporting via satellite. This technology was developed as part of the World Ocean Circulation Experiment and tested globally as part of that program from 1990 to the present time. At present this technology is being proven further in the Atlantic Circulation and Climate Experiment. A recommended pilot project for the observing system is Argo This project is designed to provide enhanced global coverage of temperature and salinity in the upper 2000 m of the ocean as well as deep reference speeds during the period 2003-2005 by maintaining an array of profiling floats.

Combined with other in situ and remotely-sensed data, the Argo data set will be assimilated into numerical ocean models to demonstrate capabilities of an integrated ocean observing system for multiple users.

The third quarter of the 20th century saw meteorology evolve from a field of science and curiosity into one in which practical forecast skill was realized and accepted as a major objective. This was made possible by three factors: the evolution of scientific knowledge of the atmosphere, the ability to numerical solve equations with computers, and a global observational network. The Global Ocean Data Assimilation Experiment (GODAE) is seen as a one-time, major effort to demonstrate our ability to deliver timely, useful ocean products, derived from a global ocean data set, and assimilated into skillful numerical models to extract the greatest benefit from the observations. This could move oceanography to state in which operational activities are undertaken routinely with useful and practical outcomes. The main objectives of GODAE are: 1) the application of state-of-the-art ocean models and assimilation methods for short-range open-ocean forecasts, for boundary conditions to extend predictability of coastal and regional subsystems, and for initial conditions of climate forecast models, and 2) to provide global ocean analyses and re-analyses for developing improved understanding of the oceans, improved assessments of the predictability of ocean systems, and as a basis for improving the design and effectiveness of the global ocean observing system. Specific purposes are manifold, including:

- To demonstrate the feasibility of a global observing system to integrate disparate data sets and produce useful products,
- To estimate conditions within the global ocean on time scales of weeks to months and their variability,
- To develop optimal observing strategies, and
- To provide information for initialization of climate models and for boundary conditions for coastal zone models.

GODAE is recommended as a pilot project by both GOOS and GCOS Steering Committees as well as the Committee on Earth Observing Satellites (CEOS).

There are many examples of scientific observational methodology still in the research and development stage with potential for contributing to a user-based, sustained, ocean observation system. We give here only two examples of these nascent observing system elements. One is Acoustic Thermometry of Ocean Climate (ATOC). This research technique uses measured travel times of sound waves to estimate temperature along paths between transmitters and receivers and can also be used to estimate velocity components along the paths. The technique shows promise for estimating temporal differences in heat content within the ocean over long time and space scales, especially when combined with space-borne measures of sea surface height and numerical ocean models. A second nascent technology involves the use of Deep Earth Observatories on the Seafloor (DEOS) being developed as a major observing program centered on a diverse suite of earth and ocean science problems. Now in the planning and research phase, a system of seafloor observatories offer potential for obtaining long time series for various user needs.

Requirements, knowledge, and techniques change with time, so there must be the mechanisms in place to ensure that the observing system changes accordingly, but without losing the required continuity of products. There must be resources (human and financial) to carry out ongoing review of user needs against system output, to assess and recommend new technical developments, examine strategic sampling tradeoffs, and the like needed to ensure that the observing system is properly operating and evolving to take advantage of new developments without compromising the long data records.

ANNEX VI

J-DIMP TERMS OF REFERENCE AS MODIFIED BY GSC-I

Recognizing the need for a comprehensive approach to formulate, implement, and oversee data and information management of the global observing systems, the GCOS Joint Scientific and Technical Committee, the GOOS Steering Committee, and the GTOS Steering Committee have established a Joint Data and Information Management Panel (J-DIMP).

The data and information management system for the three global observing systems, G3OS, should be developed, to the degree possible, to accommodate data and products from the various components of the global observing systems. To guide this development, the J-DIMP should consist of a core group of members representing the various global observing communities, as well as representatives from contributing disciplines, programs, and agencies. J-DIMP membership should encompass a broad range of expertise and include research scientists, who use and understand global data sets, and data and information management experts responsible for significant components of existing operational and research oriented global information management systems.

The J-DIMP should be 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. Particular agenda items may require additional experts be invited to participate on an *ad hoc* basis.

Terms of Reference as accepted by both the GOOS and GCOS Steering Committees (see Annex D-V of Report of 4th Session of J-DIMP, Hawaii, 28 April - 1 May, 1998):

1. In concert with the G3OS science requirements and associated user communities, formulate and develop the G3OS Data and Information Management Plan(s);

2. Monitor the overall implementation of the data-related elements of the plans;

3. Make reports and present recommendations, as required, to the steering committees of GCOS, GTOS and GOOS on information management issues.

Consistent with these terms, the J-DIMP has the following responsibilities. Note that these differ from the original responsibilities as proposed by GCOS (see both versions in Annex D-V of the 4th session of J-DIMP), but were modified by GSC-I with the full agreement of the Chairman of the GCOS Steering Committee and the Director of the GCOS Joint Planning Office, who attended GSC-I for a discussion on this matter. These are the responsibilites currently accepted by J-DIMP, and published by it in the G3OS Data and Information Management Plan.

* periodically review the G3OS data and information management plan(s) and principles of monitoring;

* as required, commission studies needed by specific observing system components;

* review adherence of G3OS to cross-cutting principles of data and information management;

* advise on implementation of data and information management as requested by the senior science committees and sub-panels of the G3OS, to ensure that, for example, data and products are provided as required and archiving activities are adequate;

* act as a G3OS focus in relation to policy issues, e.g. proposals and actions threatening the availability of environmental data;

* consider studies commissioned by specific observing system components and the implications for G3OS data and information management.

ANNEX VII

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
CEOS	Committee on Earth Observation Satellites
CLIVAR	Climate Variability and Predictability
CMM	Commission for Marine Meteorology
COP	Conference of the Parties (of the FCCC)
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 Acency
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 **(UNESCO)**
IOC-EC	Intergovernmental Oceanographic Commission Executive Council
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IOCCG	International Ocean Colour Co-ordinating 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)
NEAR-GOOS	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 (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
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
SEACAMP	S. E. Asia Centre for Atmospheric and Marine Prediction
SEA-GOOS	Southeast Asian GOOS
SEAWIFS	Sea-Viewing, Wide-Field-of-View Sensor
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 Sub-Committee for Training, Education and Mutual Assistance in the Marine Sciences
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