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

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1. ORGANIZATION OF THE SESSION

1.1 OPENING OF THE SESSION

The Chairman, Worth Nowlin, opened the meeting at 09:00 and welcomed the participants (listed in Annex I) to Paris, thanking them for making themselves available to work on this important activity. He then invited the sponsors of GOOS to state their interests in the programme, beginning with Patricio Bernal, the new Executive Secretary of the Intergovernmental Oceanographic Commission (IOC).

Dr Bernal welcomed the new initiative represented by the creation of the GOOS Steering Committee (GSC), noted that this was the first meeting of the new body, and wished the Committee success in its deliberations. He considered it essential that the Committee strive to transcend the discipline boundaries within which different communities of scientists live, so as to produce a truly interdisciplinary observing system. And he called for interaction with the research community to ensure that the processes on which good forecasts are based are better understood, so as to make the forecasts as accurate as possible. He wished the Committee success in facing these challenges, reminding the members that the sponsors rely on the GSC for leadership advice and guidance in developing GOOS.

Geoff Holland, Chairman of IOC, told members that GOOS was a critical and important part of the IOC programme, and that he felt that IOC would be judged as a success or failure by its ability to take GOOS forward. He was impressed by the scientific talent assembled to consider the issues, and wished the GSC success.

On behalf of the United Nations Environment Programme (UNEP), Arthur Dahl indicated that UNEP was pleased to be a full partner of GOOS, and to contribute funds to GOOS activities. UNEP's view is that it is now time to move beyond research programmes as the means of making global observations, and that an operational system is called for. Nothing less will do if we are to establish and monitor the long term trends that characterise much environmental change, which is why all three global observing systems (GOOS, GTOS, the Global Terrestrial Observing System, and GCOS, the Global Climate Observing System) should be seen as complementary and mutually supporting parts of a unified and holistic approach to viewing the world, rather than as three entities competing for the same funds. UNEP sees GOOS as a very important link in the information chain; GOOS must now demonstrate that it can deliver.

On behalf of the World Meteorological Organization (WMO), Bob Landis indicated continued strong support for the development of GOOS. The WMO is looking for closer linkage between itself and the IOC in the generation and management of marine data, an issue which will be considered later this year by the Executive Councils of both organizations. WMO and IOC commissioned a consultant group to study closer WMO-IOC co-operation in implementation of marine meteorological and oceanographic measurements.

On behalf of the International Council for Scientific Unions (ICSU), Allyn Clarke indicated that it was important to maintain synergy between the development of observing systems and the research communities on whose work the development of such systems would be based, not least because long term observing systems were research tools in their own right for the study of long period phenomena.

The Chairman welcomed these statements of support and encouragement, noting that GOOS was not just an IOC programme, but was shared by four major sponsors. He explained that the primary goals of the meeting were to enable the panel members to become acquainted with one another, to help them to learn about GOOS and its related programmes, and to begin constructing an implementation plan, building on items that had already been implemented. He expects much of the work of the panel to be done inter-sessionally by e-mail, and it was his objective to emerge at the end of the meeting with a comprehensive action plan to enable concrete achievements to be made.

The Director of the GOOS Project Office (GPO), Colin Summerhayes thanked the IOC, ICSU and WMO for financial support for this meeting.

1.2 ADOPTION OF THE AGENDA

The Provisional Agenda (Annex II) was accepted with following changes: 5.5 (Integrated Global Observing Strategy) was moved to the head of section 5, to be followed by 5.1 (GCOS), 5.4 (GTOS), 5.3 (Space-based Observations), and 5.2 (Data and Information Management); in addition, 6.3 (Regions) was moved ahead of 6.2 (Implementation) to allow Peter Dexter to be present to lead the discussion on 6.2.

A list of background documents was provided (Annex III). Colin Summerhayes provided information on logistics, administration and social events.

2. VIEWS OF THE CHAIRMAN OF I-GOOS

Angus McEwan, Chairman of the Intergovernmental Committee for GOOS (I-GOOS) gave a presentation on the future of GOOS, including its new organizational arrangements. He emphasized that all those involved in the planning and implementation of GOOS needed to recognise, and to explain to others, that this was an ambitious venture which would take time to bring to a satisfactory conclusion. What we are trying to achieve has never been done before, and must be done empirically from first principles. The task would be simpler were we dealing just with one issue, like climate, but the Member States of the IOC had made it plain that a comprehensive observing system was what was required, addressing all of the major issues facing ocean users; those issues included those of coastal seas, living resources, and pollution as well as weather and climate. McEwan explained that while the purpose of the GSC was to be responsible for the design and implementation of GOOS, the purpose of I-GOOS was to provide a forum for interaction with governments, whose approval and resources would ultimately be needed to achieve the implementation. He stressed that we are not designing another science programme. Instead we are following a new paradigm which will ensure that GOOS is an essential component of the infrastructure for the national and international management of the marine environment. In this context, science is a driver, but not the only one.

We must recognize that some governments think that there are already enough (even too many) observing systems, which means we need to build a strong case. The route to success is to design and work to a plan.

He outlined the structural changes that had been thought necessary to streamline GOOS and enable it to focus on the task of implementation. The new structure provides: (i) clearer lines of authority and reporting pathways; (ii) removal of the distinction between planning and implementation; (iii) removal of "them" (international science) and "us" (governmental); (iv) tighter management, including improved direction of the GPO; and (v) a blueprint for other observing systems. For the GPO, the new structure offers more clearly defined tasks and specific responsibilities for staff; closure of the planning-task-reporting loop; and (potentially) access to other resources.

Future issues that both the GSC and I-GOOS could consider include: (i) the growing proliferation of tasks; (ii) the need for prioritization of tasks; (iii) development of commitments to implementing tasks; (iv) the need to consider a distributed support system involving specialised seconded staff at regional centers; (v) the need to bring in more resources to achieve the programme; and (vi) the development of effective interfaces at the national level.

McEwan drew attention to the need to be aware that plans and reality diverge. GOOS has recently published the "Strategic Plan and Principles", and is about to publish "The GOOS 1998", which together are idealisations of GOOS. This leads to the question of how now to recruit participating countries and their agencies. In taking this forward we need to recognize that countries are motivated and/or constrained by: national self interest; policy; global image (good global citizenship); political reality; and resources. Agencies are motivated (i) by the need to deliver on national objectives (which involves consideration of such issues as: social values; environmental concerns; industrial profit and competitiveness; and global concerns, conventions and obligations), and (ii) by a global altruistic vision.

The impact of GOOS plans, documents, products and initiatives is, or should be, to demonstrate:

(i) an ordered and coherent definition of what a purpose-built system would need;
(ii) a general rational for participation;
(iii) detailed bench-mark specification of the components;
(iv) standards and standardized best-practice;
(v) generically useful and applicable products;
(vi) an international framework for participation, palatable to governments; and
(vii) a context for global observation, especially space-based.

He went on to consider potential obstacles to GOOS implementation, and what the GOOS bodies could do to overcome these. The obstacles and actions are listed in Annex V.

3. REPORT BY THE DIRECTOR OF THE GOOS PROJECT OFFICE (GPO)

The Director of the GPO (Colin Summerhayes) presented a report on the activities of the GPO since the meeting of the fourth Joint Scientific and Technical Committee for GOOS (J-GOOS-IV) in Miami, April 1997. The GPO is now supporting the work of two additional GOOS Panels, Coastal and LMR, and also the Tropical Atmosphere Ocean (TAO) Implementation Panel. Because we have not yet been able to recruit a replacement for the Global Sea-Level Observing System (GLOSS) Technical Secretary, Janice Trotte has carried out this function, though to the detriment of setting up an international GOOS network of contacts. Recruitment to the UNESCO post is a top priority; action is in hand (Action item 1).

Planned staff changes will make maintaining a level of high quality support a problem, particularly with the loss of George Grice [Technical Secretary to the Living Marine Resources (LMR) Panel] and Bill Erb (Technical Secretary to the Capacity Building Panel) at the end of 1998, and the impending departure of Janice Trotte in May 1999. We plan to request secondments from Member States for particular tasks (Action item 2). Support posts do not have to be in Paris.

Secretarial assistance was reduced during the year by the loss of one post, placing an additional burden on professional staff, particularly in support of GLOSS. The loss was only partly offset by the offer of some part time secretarial assistance, which was used for managing the needs of the LMR Panel and the contracts for the GCRMN (Global Coral Reef Monitoring Network). There is still a serious shortfall of secretarial assistance in relation to need. A long term solution is required (Action item 3).

The amount of co-ordination carried out by the office has increased significantly. The GPO now has closer and more effective contacts with the sponsors, with GCOS and GTOS, with EuroGOOS and NEAR-GOOS, with CEOS, with the regions, with major national organizations in Japan and the USA, and with other UN agencies through Earthwatch. We are currently exploring links with the International Atomic Energy Agency (IAEA) of the UN (Action item 4).

The amount of promotion/communication has also increased significantly, with more papers on GOOS being delivered at conferences and/or published, with displays on ocean forecasting and/or ocean data products in two pavilions at EXPO 98 in Lisbon (UN Pavilion and Pavilion of the Future), with reintroduction of the GOOS News (two issues in 1997; 2 planned for 1998), and with revamping of the Web page (Action item 5).

Involvement in planning increased significantly, with more participation in planning meetings and in producing key planning documents ("Strategic Plan and Principles" and "The GOOS 1998").

Sufficient external financial resources have been obtained to maintain the work programme approved at I-GOOS-III. The IOC continues to provide the bulk of the funds to support GPO activities. More funds will be required to support the expanded work programme envisaged by the GSC. The GPO will work to obtain these (Action item 6). The success of the programme will depend on the willingness of external agencies to fund specific activities.

The GPO programme is largely driven by requirements that until now have been placed upon it by two separate committees, I-GOOS and J-GOOS, between which coordination was weak. The GOOS Steering Committee was designed to overcome this weakness in the structure of GOOS, and is leading to the development of a more focussed programme for the GPO to follow.

Actions 1 to 6: (GPO)

1. Complete recruitment to GLOSS Technical Secretary post;
2. Request secondments from Member States for particular GOOS tasks;
3. Request IOC Executive Secretary to increase secretarial support;
4. Develop GOOS link to IAEA;
5. Issue two GOOS Newsletters in 1998;
6. Obtain additional external funds for GOOS support.

4. GOOS DESIGN ACTIVITIES

4.1 GENERAL GOOS DESIGN

4.1.1 Strategic Plan and Principles

Under this agenda item the Committee reviewed the status of key GOOS design documents including the GOOS Strategic Plan, and The GOOS 1998. Colin Summerhayes tabled published copies of "The GOOS Strategic Plan and Principles" and thanked Angus McEwan for taking the lead in finalizing the document.

4.1.2 The GOOS 1998

Nic Flemming introduced "The GOOS 1998".The report had been commissioned following a requirement from J-GOOS-III for development of a science plan to clarify what GOOS is all about. It was intended to be a comprehensive description of GOOS and of its future direction, to provide a blueprint for implementation, and to encourage investment in GOOS. An *ad hoc* Planning Committee had been convened to oversee the drafting of the document inter-sessionally , and a consultant (Peter Ryder, ex-Operations Director for the UK Met Office) engaged to undertake the gathering and consolidation of information and drafting of the document. An initial outline was reviewed at J-GOOS-IV. J-GOOS-IV formally endorsed the activity and agreed on a timetable for completion of the report, targeting the International Year of the Ocean and the GOOS Agreements Meeting. In summary:

- J-GOOS-III initiated the Planning Committee;
- J-GOOS-IV required consistency with Principles and Strategy document;
- J-GOOS intended publishing "The GOOS 1998" as a J-GOOS document;
- J-GOOS-IV implicitly recognized the document was going beyond consolidation and information by raising issues that had not been resolved by J-GOOS. J-GOOS (now the GSC) was intended to address these issues inter-sessionally.

GSC members had been provided with a draft of The GOOS 1998 prior to the meeting. N. Flemming asked the committee to endorse publication, and to provide feedback on factual errors. Earlier this year a previous draft had been sent to 100 scientists and operational people for review and comment. All but one of the comments were favourable, and several operational agency people had pronounced themselves pleased with it, and made comments to improve the text. The general feedback from operational agency staff was that the document would help them in the task of convincing their governments that GOOS would be a good investment; it is likely to be well received.

The GSC agreed the document was a valuable contribution to the GOOS background literature. The document represents a consolidation of existing material and has a content suited to the task of informing, and detailing the prospects of GOOS for governments, agencies, commercial companies, etc. To do this, it is more important that the document takes a form which is accessible and informative, rather than representing a reference for scientific and technical detail. The document covers both existing systems and planned and developing systems, again for the purposes of providing information and alerting potential participants and users to the potential and relevance of GOOS. Constructive suggestions were offered to improve the document, including substantial revision to the final sections.

The GSC stressed that the document is a summary document, rather than a definitive prescription for GOOS. It is seen as a document which, for GOOS itself, consolidates the information contained in the many existing documents, and for the external community, provides an accessible and reliable account of the prospects for GOOS and the framework which is being developed to implement GOOS. The document contributes to the task of convincing governments and agencies to participate in the implementation of GOOS.

Action : 7. Publish revised version of the GOOS 1998. Director GPO and Chair Planning Committee to set the schedule.

4.1.3 A GOOS Brochure

Among the items needed for promoting GOOS is a new glossy brochure to replace the one that is now out of print. The idea is to spread information, prevent misinformation, and provide a touchstone for what GOOS is. The target audience is broad, including potential sponsors, partners, and users. In the short term we need to target the UN's Commission on Sustainable Development (CSD), which during 1999 will review progress toward implementing the recommendations of Agenda 21's Chapter 17 on Seas and Oceans.

Members agreed that a lively and colourful presentation is needed, and asked the GPO to follow the GCOS model, explaining the why and how of GOOS, the module approach, the GOOS-Initial Observing System, and the way forward.

Action : 8. Develop GOOS brochure. Director GPO with assistance from T. Malone, J. Hall and M. Fogarty.

4.2 STATUS OF MODULE DESIGN

The chairs of the 4 science design modules of GOOS reviewed progress and plans of their panels, to enable the committee to consider: what is still required for the design of GOOS? what should be included in the design of each module?

4.2.1 Climate Module

Design and implementation of the climate module was reviewed by Neville Smith, Chairman of the Ocean Observing Panel for Climate (OOPC) which is sponsored by GOOS, GCOS, and the World Climate Research Programme (WCRP). He noted that the GCOS Joint Scientific and Technical Committee (JSTC) and J-GOOS-IV had charged the panel to revise the Ocean Observing System Development Panel (OOSDP) Plan. At present, updates are represented by the OOPC reports and the report from several workshops. The first installment might be a follow-up to the Bulletin of the American Meteorological Society (BAMS) article [Nowlin et al 1996, v. 77 (10) 2243-2273] which summarized the recommendations of the OOSDP. The OOPC paper drafted for the Workshop on the Implementation of Global Ocean Observations for GOOS/GCOS, which was held in Sydney in March 1998 (subsequently referred to as the Sydney Workshop), consolidated requirements and recommendations for the climate module of GOOS. Possibilities will be explored for developing a more comprehensive update, first published as an OOPC document, and subsequently as a peer-reviewed paper, with updates appearing on the OOPC Web site.

The OOPC met in Grasse, France (April 6-8, 1998). Recommendations from that meeting include the following (those relating to GODAE are presented later in section 6.2.3):

- Reviewing the report of the Time Series Workshop, held in Baltimore in March 1997, the OOPC concluded that the time series stations "Bravo" and Panularis/Station "S" should be added to the GOOS Initial Observing System, in view of their demonstrated contributions as sensors of long term variability related to climate.

- Reviewing the outcome of the Sea-level Workshop held at the University of Hawaii in June 1997, the OOPC endorsed the recommendation that a Working Group for Sea-Level be established to provide scientific advice on the sea-level observations needed for the detection of climate change, and noted that such a Working Group was consistent with the new structure proposed for GOOS Implementation (see section 6.2.1 below). The details of the recommendation are given in Annex VI (Action item 9).

- Reviewing issues associated with the monitoring and prediction of the 1997/98 El Niño, the OOPC noted that an El Niño Conference is being organized by WMO, IOC and other organizations. This would provide a unique opportunity to garner political support for the climate observing system. OOPC agreed to give a high priority to involvement in the process.

- OOPC is also providing information on the status of ocean monitoring systems to the Subsidiary Body for Scientific and Technological Advice (SBSTA) review for the Conference of the Parties to the UN Framework Convention on Climate Change (FCCC). N. Smith is actively assisting GCOS in this process.

- Reviewing issues related to sea-ice, with emphasis on the Arctic Ocean, OOPC agreed that effort should focus on the "ice-covered regions of the oceans" rather than on "sea-ice". OOPC will assume responsibility for oversight of the operational observing system for these regions, with information from the Arctic Climate System Study (ACSYS). The remit would include short range forecasting (sea-ice warning systems). Implementation will come under the review of J-COMM (Section 6.2.1).

- Reviewing activities in the Joint Global Ocean Flux Study (JGOFS), OOPC reiterated that an observing system for the cycling, storage and transport of oceanic carbon is urgently required. The technology for routine unmanned CO_2 measurements has now been developed and is ready for operational use on unmanned buoys. It is likely that global air-sea CO_2 fluxes can be estimated from a combination of satellite-measured SST, ocean colour and wind fields, plus buoy and Voluntary Observing Ship (VOS) pCO_2 measurements. OOPC asked JGOFS to develop the appropriate models, to recommend measurements to be made at time series stations, and to deploy sensors (Action item 10).

- OOPC reviewed the several proposed satellite gravity missions and recognized their complementarity. Knowledge of the geoid is needed to make full use of global satellite altimeter measurements of sea surface height. The importance of continuing altimetric data streams was stressed. Multiple scatterometer missions are needed by climate, service and coastal module. OOPC noted an extremely strong case for an "operational" double swathe scatterometer mission.

- Progress towards satellite remote sensing of information on salinity was noted and encouraged by the OOPC.

- OOPC agreed on a coordinated strategy to better define the global strategy for SST. In future, fewer but better instrumented VOS may be required.

N. Smith showed that errors in heat flux have been substantially reduced in recent years and are now below 10W per m^2, which means that the WOCE standard is achievable and that we now have high quality data with which to test and validate models. There is a need for 10 or so sites at which such measurements are made routinely on an operational basis to support Numerical Weather Prediction; one is needed in the Southern Ocean.

OOPC is proposing to develop a suite of demonstration brochures on: (a) El Niño-Southern Oscillation (ENSO) prediction, (b) Monitoring Sea-level Change, (c) Sea Surface Temperature (SST), (d) Surface fluxes, built around the reference sites, (e) Carbon and Time Series Stations as validation sites, (f) Satellite Technology, (g) Deep Ocean Monitoring, (h) the Ice Covered Ocean, and (i) GODAE.

Actions: 9. Approve formation of the new sea-level group, along the lines of the written statement provided by Neville Smith and Colin Summerhayes (Annex VI). Co-sponsorship should be sought from GCOS and WCRP. The proposed group should not go ahead without external resources to cover its activities. Formation of this new group requires a corresponding change in the Terms of Reference of the GLOSS Group of Experts, which needs to be agreed with the GLOSS-GE Chair. Formal approval for such a change requires formulation of a Draft Recommendation by the GPO for the IOC Executive Council and the IOC Assembly. Actions to be taken by an inter-sessional group comprising Neville Smith, Colin Summerhayes and Philip Woodworth, the Chair of the GLOSS-GE.

10. The GSC asks the JGOFS-SSC to consider the OOPC-III recommendations related to JGOFS activity, noting in particular the need to provide up-dated advice on the observing system; the proposed Workshop on sections, tracers and carbon measurements; the need to develop activities related to standards; and the need to address the conclusions of the Time Series Workshop. Action: GPO to communicate to JGOFS.

4.2.2 Health of the Ocean (HOTO) Module

Progress with HOTO was reviewed by Neil Andersen, Chair of the HOTO Panel, who addressed in particular, implementation, prioritization, the need for workshops, and changes to the membership (Action items 11 & 12). He explained that it had been agreed at the last IOC Assembly that the HOTO programme would be carried out through the GIPME (Global Investigation of Pollution in the Marine Environment) programme of the

IOC. The HOTO Panel accepted that in due course its work would be merged with that of the Coastal Panel and the LMR Panel (Action item 13).

At the HOTO-IV meeting in Singapore (October 13-17, 1997) the criteria for the design of HOTO Pilot Projects was considered, along with outlines for Pilots in the Black Sea, the Red Sea, S.E. Asia, N.E. Asia, and the Arctic. Neil Andersen pointed out that the Red Sea could be used as a test case for HOTO, and to test the results of a previous data workshop which awaited translation by IOC into Arabic. A Black Sea HOTO Pilot Project would add to ongoing activities there, including those run by the IOC and by NATO (North Atlantic Treaty Organization). In addition the HOTO Panel were promoting the idea of widespread use of cost-effective technology for immuno-assays. GSC members noted that the HOTO Strategic Plan contained a listing of geographical regions ranked according to their environmental health, and that the Black Sea was top and the Red Sea bottom of that list. This ranking should be used to prioritize HOTO efforts. Establishing regional HOTO Pilot Projects involving exchanges of data would depend on persuading groups of Member States that there was a common need to develop water quality models for one basin that they all border. Meetings to develop HOTO Pilot Projects would be funded by GIPME, and plans would be reviewed at the next HOTO Panel meeting in 1999.

The relation between the HOTO programme and the UNEP regional Seas programme was examined. In March and April, 1997, there had been a HOTO fact-finding mission to the Far East. During the mission it became apparent that considerable improvement is needed in places in the management of data and information in the region; this is a challenge for IOC and GOOS generally, and especially for the creation of SEA-GOOS (Southeast Asia GOOS) (Action item 14). Around Korea and Japan it was learned that ferries are being instrumented for routine measurement of environmental variables, which is something that might be attempted elsewhere.

As a result of the mission, attempts are being made to link the Northeast Asian HOTO Pilot Project to UNEP's Northwest Pacific Action Plan (NOWPAP) project. Success would enable a GOOS input to NOWPAP, a UNEP Regional Seas initiative. Similar links need to be made elsewhere to capitalize on the Regional Seas infrastructure. Nevertheless it needs to be borne in mind that although there are 11 Regional Seas programmes, UNEP is not in a position to fund more than about 3 of them adequately.

Neil Andersen reminded the GSC that one of the activities of HOTO would be to provide regular assays of environmental health. At this time several different international or intergovernmental organizations have launched environmental assays of one kind or another. He proposed that GOOS (either now or in the future) could provide a cost-effective focus for this activity by providing one major coordinated assay system, rather than several *ad hoc* ones.

The development of models for predicting the trajectories or behavior of environmental variables had provided another focus for the Singapore workshop. An *ad hoc* working group was taking modelling developments forward inter-sessionally, and would need to meet later this year to consolidate its findings and make recommendations. Another group was working inter-sessionally on capacity building and the development of indicators for sustainable development in coastal areas. It would also need a meeting this year (Action item 15).

In discussion, it was agreed that HOTO could meet a common need for standards, as happens at present in the Mussel-Watch programme and in the IAEA (International Atomic Energy Agency) programme. It was suggested that the QUASIMODE project in Europe could provide a model mechanism for the promulgation of standards. GSC members recognized that there would be a cost to doing this effectively.

Changes in the membership of the Panel will be reviewed to agree on a plan for rotation of members.

Actions:

11. GPO to request HOTO Chair for list, with brief descriptions, of GOOS activities underway under the HOTO module, as the basis for prioritising activity and investment.
12. Encourage continued design and implementation of selected HOTO Pilot Projects, and prioritising based on potential impact (Action HOTO Panel).
13. HOTO Panel chair to liaise with Coastal Panel Chair to arrange data sharing and dissemination activities (Action T.Malone and new HOTO Chair).
14. The GPO was requested by HOTO-IV to work with S.E. Asian data centres to improve data and information management in the region (GPO to carry out).
15. Endorse the holding of workshops on modelling and on capacity building and indicators of sustainable development (funded externally) (GPO to arrange).

4.2.3 Living Marine Resources (LMR) Panel

Progress with the LMR Module was reviewed by the former Co-Chair, Patricio Bernal, and subsequent additional comments were provided by the Technical Secretary of the Panel, George Grice. Both presentations focused on the results of the Panel meeting on March 23-25, 1998. This was the first formal meeting of the Panel, which had been preceded by two *ad hoc* Panel meetings in 1993 and 1996. The recently published report of the previous meeting (Dartmouth, Massachusetts, March 1996) was distributed during the meeting.

In defining its remit, the Panel recognized that there was potential for overlap with the work of the Coastal and HOTO Panels. It decided that its remit includes coastal seas, where it would focus initially on offshore conditions dominated by oceanic processes, and then work towards the areas where the Coastal Panel was active. However, it did not see estuaries as part of its remit. Coordination between the Panel Chairs should prevent overlap. Coordination with GLOBEC (Global Ecosystems Experiment) will ensure that the LMR Panel stays abreast of major ecological research developments, and ideally the LMR Chair should attend GLOBEC Plenary meetings (Action item 16).

The Panel defined the biological, chemical and physical variables required for monitoring fish and the other components of marine ecosystems along with their physical forcing. This list will be refined as one plank of the LMR strategy. In considering how to take this list forward the Panel will need to find out which of these measurements are also being proposed by other panels, and to identify gaps (e.g. who is addressing the remote sensing of coral?).

In considering how to make best use of existing systems, the Panel recognized that many of the required variables were already being measured by existing operations especially in coastal seas and exclusive economic zones. To enable it to assess the value of these ongoing exercises to GOOS, the Panel requested the IOC to compile and make available information on the significant monitoring and assessment programmes of its Member States.

The Panel also recognized that a number of national and regional bodies collect and analyse fisheries statistics and make fisheries assessments, but that the data are not presently in a form suitable to assess population changes in the upper trophic levels of marine ecosystems. Accordingly the Panel asked the FAO to identify the existing fisheries analyses that could contribute to the desired assessment and to advise on how it could best be organized and carried out.

Among other things, the Panel would have to work with user communities, for instance to identify appropriate sustainability indicators.

In considering what Pilot Projects might be useful demonstrators of the power of the LMR-GOOS concept of monitoring, analysis and prediction, the Panel concluded that the concept could be tested in several "retrospective" experiments in well sampled regions where significant ecosystem changes such as regime shifts had been observed, to see (i) to what extent the shifts could have been predicted from the variables observed, and (ii) if predictability could have been improved with the measurement of additional variables.

These inter-sessional experiments were proposed for: (i) Baltic; (ii) California Cooperative Ocean Fisheries Investigations (CALCOFI) area; (iii) Japan Sea/East Sea; (iv) northwest Atlantic; (v) northeast Atlantic; (vi) Benguela. In addition it was agreed there could be important lessons for GOOS in the developing LME (Large Marine Ecosystem) programme in the Gulf of Guinea.

Because Patricio Bernal had stepped down from the Co-Chair position on taking up his post as Executive Secretary of the IOC, it would now be necessary to find a new Co-Chair (Action item 17).

Actions:

16. LMR Chair to develop close liaison with GLOBEC and attend GLOBEC Plenary.
17. A new Co-Chair is needed for the panel. GPO to work with FAO, ICSU and GSC Chair to identify a suitable candidate.
18. Make the focus of the LMR module broad, and include the coastal seas in its design (LMR Panel) .
19. LMR should complete its first draft design plan for implementation in 18 months to mesh with the development of the Coastal GOOS plan, so as to help develop overall GOOS implementation as speedily as possible. This may mean arranging LMR meetings closer together than originally planned (LMR Chair).

4.2.4 Coastal Module

Progress with the Coastal Module of GOOS was reviewed by Tom Malone, Chair of the Coastal GOOS (C-GOOS) Panel. His presentation focused on the results of the Panel meeting on March 30-April 1, 1998. This was the first formal meeting of the Panel, which had been preceded by an *ad hoc* Panel Workshop in Miami in February 1997.

Tom Malone noted that the challenge for C-GOOS is large, but the benefit of doing it right is potentially enormous. The charge is to promote the design and implementation of end-to-end systems that are responsive to user needs in the coastal zone. C-GOOS will advise a broad range of users on how to develop local measuring systems to meet their particular needs, while encouraging the use of common methods and standards to enable global aggregation where necessary to address large scale problems.

T. Malone explained that the C-GOOS meeting had evaluated the results of the Miami Workshop, agreed on a set of goals, determined the scope of its activities, and drawn up an Action Plan to achieve its goals. A strategic plan would be drawn up and Pilot Projects started during 1998-99, and an implementation plan would be drawn up in 1999-2000 while the Pilots continued.

The Panel had decided that its geographic limits were the landward limit of marine influences and the seaward limit of land influences. Within these limits it had defined 4 operational categories of operation representing the interests of different user groups.

(i) preserve healthy coasts;
(ii) promote sustainable use of resources;
(iii) mitigate coastal hazards;
(iv) ensure safe and efficient marine operations.

For each category a set of issues had been identified. A future task, being carried out inter-sessionally, was to determine the variables that should be monitored to address these issues.

As did the LMR in considering how to make best use of existing systems, the C-GOOS Panel recognized that many of the required measurements were already being made by existing operations in coastal seas and exclusive economic zones. To enable it to assess the value of these ongoing exercises to C-GOOS, the Panel asked the IOC to compile and make available information on the significant coastal monitoring and assessment programmes of its Member States. The GSC agreed that C-GOOS has to find out (i) what is in place, and (ii) what has to be done to get the information in real time; it then has to work out (iii) how we can benefit from what is in place, and (iv) how we can integrate information across the disciplines and into useful

predictive models. In doing so, C-GOOS fully intends to liaise closely with ongoing GOOS operations like those in NEAR-GOOS and EuroGOOS. It will also liaise extensively with the main coastal research programme, LOICZ (Land Ocean Interactions in the Coastal Zone).

The Action Plan included 7 potential pilot projects, and assigned inter-sessional working groups to consider their potential as GOOS demonstrators, their costs and their likely impacts. The projects (listed below) are generic and cover a full range of scales and disciplines. Others will emerge in due course. Their development would be prioritized at future meetings.

- Eastern South Pacific circulation in relation to west coast South America.
- Remote sensing-sea truth in coastal waters.
- Harmful algal blooms in the East Indies.
- Western Pacific margin biodiversity.
- Disaster mitigation and storm surge modeling, with special reference to the Bay of Bengal.
- Networking metadata.
- Northern Adriatic environmental problems.

The Panel feels that it needs four meetings (including the first) to enable it to deliver an implementation plan after 2 years, so plans meetings in Brazil (November 1998), West Africa (March 1999), and Turkey (fall, 1999). Each meeting would be associated with a Workshop to introduce GOOS to the regional user community, and to find out more about user needs.

Given that coastal issues had been identified as of the highest priority by the attendees at the four GOOS Capacity Building Workshops, the GSC agreed that the C-GOOS programme should have the highest priority, and approved the proposed schedule of meetings (Action item 20).

Actions:

20. Twice yearly schedule of Panel meetings and workshops to be arranged (GPO and Panel Chair).

21. Representatives of the GTOS Coastal Panel should be invited to attend C-GOOS meetings, and vice versa, to ensure appropriate coordination and consideration of the terrestrial view (Panel Chair).

22. At future Panel meetings, C-GOOS needs to consider specific user needs (Panel Chair).

4.2.5 General Module Panel Issues

Actions:

23. Significant cross-panel attendance is required between the Coastal, LMR and HOTO Panels (GPO and Panel Chairs).

24. Consider merging the designs of the C-GOOS, LMR, and HOTO when the initial designs for these modules are complete (GSC).

25. To demonstrate the relevance and utility of observations GOOS Panels need to develop sets of synthetic and simplistic sustainability indicators to capture the essence of what scientists are measuring. Such integrative indicators are potential GOOS outputs and must be meaningful to policy makers (Panel Chairs).

26. More consideration needs to be given by GPO and HOTO and Coastal Panel Chairs as to how to exploit, interact with, and coordinate with the UNEP Regional Seas programme.

27. The GPO should interact with appropriate Convention Secretariats (including the GPA Secretariat in the Hague) to determine the information and products they require.

28. Information about existing observing systems in coastal seas must be collected and analyzed by the GPO and appropriate panels to help build a GOOS infrastructure for HOTO, LMR, and C-GOOS in coastal seas.

4.3 *IN SITU* AND TIME SERIES OBSERVATIONS

Neville Smith reported on the outcomes of (i) the meeting on *In Situ* Observations for the Global Observing Systems (Geneva, 10-13 September, 1996) and (ii) the Ocean Climate Time Series Workshop (Baltimore, 18-20 March, 1997), and members were invited to decide if there is a current need to foster activities in this field.

In view of the importance of deep measurements for monitoring slow and long-term change, the OOPC recommends a workshop be held (i) to re-examine the conclusions of the OOSDP report in the light of subsequent research results; (ii) to assess the readiness of measurement methods for operational implementation; (iii) to assess the appropriate global system for CLIVAR; and (iv) to draft revised recommendations for the ocean Observing System for Climate of GOOS/GCOS, including elements which should now be adopted as part of the GOOS-IOS. The outcome will be important in helping to identify for the SBSTA report the kinds of gaps in present monitoring systems (e.g. in repeat hydrographic sections; carbon measurements and the carbon inventory; and geochemical tracers). The focus should be on the deep, slowly varying components of the ocean circulation (physics, dynamics, tracers, carbon), and new opportunities provided by technological advances. Potential co-sponsors include CLIVAR and JGOFS, along with OOPC.

In particular, it was recommended that pCO2, fluorescence and nitrate sensors should be deployed at JGOFS time series stations to enable full exploitation of SeaWIFS data (see Action 10). In addition, repeat measurements should be made at 5 year intervals key time series stations (such as BATS and HOTS) using carbon isotope ratios, CFCs (chlorofluorocarbons), and carbon tetrachloride as tracers.

The GSC supported the OOPC recommendation to seek immediate actions and plans for deep ocean trans-basin sections, including tracers, carbon and hydrography.

Tom Malone reported that the issue of establishing high resolution time series in coastal seas would be addressed in spring 1999 at a workshop sponsored by US GOOS. It would address the R & D needs, assimilation of data into models, and visualization of data. He envisaged this being followed in due course by an international workshop addressing the same requirements on a global basis. This would provide an opportunity to raise awareness in developing states, as a contribution to capacity building.

5. COORDINATION WITH OTHER OBSERVING SYSTEMS

5.1 STATUS OF THE INTEGRATED GLOBAL OBSERVING STRATEGY (IGOS) DEVELOPMENT AND ITS RELEVANCE TO GOOS

Arthur Dahl of UNEP explained the development of the integrated strategic plan for the global observing systems that had been developed by the sponsors of GOOS, GCOS and GTOS and was recently published as Annex III to the Report of the second meeting of the Sponsors Group for the Global Observing Systems (otherwise known as the G3OS) (Geneva, 15-16 September, 1997). In support of the integration of the G3OS as three elements of a common strategy, a brochure had recently been produced by the sponsors and published by ICSU (The Global Observing Systems, ICSU, 1998). A. Dahl noted that the Committee on Earth Observation Satellites (CEOS) had independently developed an IGOS, in consultation with representatives of GOOS, GCOS and GTOS, and that this strategy was supported by IGFA (the International Group of Funding Agencies for global change research). CEOS and the sponsors of the G3OS are now working together to develop a single Integrated Global Observing Strategy (IGOS).

Integration ultimately enables us to become more efficient in the way we make observations, forcing connections between *in situ* and space based data, bringing together operational and long-range research programmes, connecting disciplines, and linking spheres (ocean, atmosphere, cryosphere, biosphere). As one element of the strategy CEOS has proposed 6 pilot projects that demonstrate the virtues of integrated strategic planning (integrating space-based and *in situ* data). Two of these are marine: one is GODAE, and the other involves ocean colour. CEOS would welcome from the GSC suggestions for additional projects which would demonstrate the value of an integrated approach. As another element of the strategy, CEOS asked that GOSSP (the Global Observing Systems Space Panel) become the main avenue for communicating to the space agencies the integrated needs of the G3OS community for space-based observations.

The G3OS sponsors, CEOS and IGFA all believe that an IGOS is essential (i) to build confidence at the level of governments that we are demonstrating cost effectiveness and eliminating duplication, (ii) to convince funding agencies to invest in the long-term continuity of observations required to monitor and forecast global change, and (iii) to show the Conventions Secretariats (who need observations to demonstrate that the

Conventions are effective), that we are responding to their information needs by building strategic links. The common message will go to governments through each sponsors' group of Member States, and one next step is to seek support for IGOS from the IOC Executive Council, which meets in November (Action item 29).

Nic Flemming pointed out that although efforts to persuade national governments and their agencies to invest substantial resources in global observing systems have been linked logically and politically to the published governmental agreements on Global Conventions, the political will to create such systems is weakened by governmental reluctance for investments which will only pay off in 10-20, or even 50 years time. Governments are driven by short-term crises, emergencies and economic returns on investments. The short-term needs of industry, food production, energy supply and public health dominate thinking. This situation can be exploited by encouraging investment in observing systems which provide economic and social benefit in the short-term, but that lead to long-term observations. Cumulative investment in such systems, over decades, will create a long-term observing system.

For this approach to be effective, there is a need for economic and social benefit analysis on all time-scales from days to decades, including economic and industrial benefits as well as public good benefits, all within the constraints of sustainable development. In this context, EuroGOOS has established an Economics Working Group.

Short-term observing objectives alone will tend to produce a diverse system, with spatial and temporal gaps, and with discontinuities in technology and calibration. Some variables which are needed for global long-term and climate change study would be omitted or would not be measured with sufficient accuracy or stability. In the context of an IGOS, GOOS has the responsibility to provide the overall control of development and integration of local observing systems, linking *in situ* and space-based remote sensing data, filling space-time gaps, and providing long-term scientific integrity.

The GSC should establish an inter-sessional group to investigate the justification for using short- and medium-term economic arguments to generate investment in long-term observing systems (Action item 30).

Actions: 29. Encourage IOC Executive Council to endorse development of integrated global observing strategy linking UN agencies, CEOS and IGFA (GPO).

30. Form an inter-sessional working group to consider Nic Flemming's draft statement regarding the use of short- to medium-term economic arguments as levers to generate investment in long term observing systems. [N. Flemming (Chair), E. Desa, I. Wainer, G. Brundrit, J. Tschirley].

5.2 REPORT FROM GTOS

Jeff Tschirley, Director of the GTOS Secretariat, presented a report on GTOS, as the basis for identifying potential joint GOOS-GTOS activities. GTOS has a structure similar to that of GOOS and GCOS, with co-sponsors, an Executive Secretariat, and a Steering Committee.

There are growing ties to GCOS and GOOS through joint panels including GOSSP and J-DIMP (Joint GOOS, GCOS, GTOS Data and Information Management Panel). The GTOS Coastal Panel, which has not yet fully defined its coastal programme, provides another potential avenue for linking GOOS and GTOS.

5.3 REPORT BY THE DIRECTOR OF GCOS JOINT PLANNING OFFICE (JPO)

Tom Spence, Director of the GCOS JPO, reported on progress in GCOS and joint GCOS-GOOS activities, with a view to highlighting issues and activities needing ongoing and/or improved coordination. He began by tabling a draft copy of the report of the GCOS JSTC for information. He explained the working of GCOS and its three main technical panels, the Atmospheric, Terrestrial and Ocean Observing Panels for Climate (AOPC, TOPC, and OOPC), noting that GOOS and GCOS were linked through joint sponsorship of the OOPC, GOSSP and J-DIMP.

As in GOOS, planning continues, and a full GCOS Implementation Plan should be published in early 1999. Like GOOS, GCOS has an Initial Observing System which on the ocean side is identical with the GOOS Initial Observing System (GOOS-IOS).

T. Spence sees the main challenges for GCOS in the immediate future as being: (i) gaining international support and national commitment; (ii) devising and implementing a data and information management system; and (iii) the integration of space-based and *in situ* information. At this time, it is particularly important that a widely usable data and information management system be quickly developed to serve the initial needs of the user community. Observations by themselves are not enough if they cannot be widely used.

T. Spence noted that the third Conference of the Parties to the UN FCCC at Kyoto (2-10 December, 1997) had (i) recognized concerns raised by intergovernmental organizations with regard to the long-term sustainability of global observational systems, (ii) urged governments to provide the necessary resources to reverse the decline in the existing observational networks and to support the regional and global observational systems being developed by the G3OS, and (iii) requested SBSTA to consider the adequacy of the observational systems and report back to the fourth Conference. It has been agreed that the Inter-agency Committee on the Climate Agenda (IACCA) will take the lead in preparing the report, and GCOS is taking the lead in drafting the report in consultation with the other observing systems. T. Spence tabled the draft of the report to SBSTA and requested comprehensive input (as opposed to comment) from competent ocean experts to beef up the ocean observing sections. The report must be completed and delivered by September.

In discussion, it was noted that, although the WCRP is a co-sponsor of GCOS technical panels (e.g. of OOPC), the International Geosphere-Biosphere programme (IGBP) is not. There is a need to engage research organizations like WCRP and IGBP in thinking through the consequences of the emerging need for long-term research in terms of building observational networks. GTOS is already making overtures to IGBP, and the GSC agreed it should either join the GTOS approach or follow a parallel track.

It was also noted that, to demonstrate the relevance and utility of climate change measurements, there is a need to develop synthetic and simplistic sustainability indicators to capture the essence of what scientists are measuring - for instance a climate change index representing deviation from some trend. GOOS Panels should be encouraged to produce sets of indicators that integrated observations in this way (e.g. in the coastal zone, an index of loss of coastal resource). Such indicators are potential GOOS outputs and must be meaningful to policy makers.

Action: 31. Members to make specific contributions to GCOS to help prepare the report to SBSTA and the Conference of the Parties to the Climate Convention on what critical elements are missing from ocean observing systems, or where those systems are deteriorating.

5.4 JOINT GCOS-GOOS PLANNING FOR SATELLITE OBSERVATIONS

John Townshend introduced the topic of the Global Observing Systems Space Panel (GOSSP). He proposed certain changes in the way GOSSP is manned and operates, recognizing that one of the problems with the panel as previously constituted was that it was too large and over-loaded with representatives of space agencies. What is required instead is a small group of experts who are not from the space agencies, so that the ownership clearly rests with the G3OS. This will ensure that the people stating the requirements are different from the people responding to them. G3OS proposes, CEOS disposes.

J. Townshend reminded GSC members that CEOS sees GOSSP as one of its primary avenues for communication about the needs of the three global observing systems (see section 5.1), but stressed that GOSSP is by no means the only route for communicating requirements. CEOS needs GOSSP to get a more or less complete overview. Bob Landis reminded members that the WMO's working group on satellites provides another avenue for communication of user requirements. He also pointed out that the G3OSs should not rely solely on any of these mechanisms, but should also be advising governments of their requirements through the intergovernmental process.

Whatever the route for communication, members agreed that the process was iterative, and that GOSSP is important, for instance as a means of persuading CEOS that there must be continuity from mission to mission despite changes in technology. Neville Smith noted that the OOPC felt that GOSSP is necessary (i) to convince agencies that we have a coherent, integrated approach within each sector(GOOS, GCOS, GTOS), and (ii) to provide integration across the observing systems. The new GOSSP must address both needs. The advantage of GOSSP dealing with CEOS was that it obviated the need for us to go to each of the agencies with the same story.

Members found it gratifying to see that GOSSP recommendations were being listened to; the European Space Agency (ESA) and others, for example, are already adapting their strategies to meet GOSSP requirements. Nevertheless, GSC members were concerned that the pleas of the G3OS for continuity, quality, and availability of data were not being given much attention by CEOS agencies. One way to attract more attention to these requirements might be to couch them in terms of technological challenges of the kind that space agencies like to get their teeth into.

In the ocean realm, some felt that we lacked the benefits experienced by the meteorological community through their Coordinating Group on Meteorological Satellites (CGMS), and that there might be advantages to creating an equivalent body for the oceans. A big difference between CEOS and the CGMS is that CEOS has no money while the CGMS can dispose of resources, for instance to design and build new sensors. However, it was felt that one of the advantages of the GOSSP-CEOS process is that it provided integration across environments.

Members agreed that GOSSP should go forward as recommended, and that the next meeting should take place by the end of September. Suggestions were requested for the position of Chair. The committee recommended that efforts should be made to attract space agency sponsorship for GOSSP meetings.

Actions: 32. Nominations are sought for a new Chair; GSC members should pass suggestions to the GPO.

33. The next meeting should take place by the end of September, and resources to facilitate meetings should be sought from, among others, NASA (GCOS and JPO).

5.5 THE JOINT DATA AND INFORMATION MANAGEMENT PANEL (J-DIMP)

John Townshend introduced this item. The object of the review was to examine basic needs in data and information management with a view to assessing: (i) the type of mechanism or mechanisms needed to address these needs; (ii) how best to continue or establish the needed mechanism; and (iii) the responsibilities of GOOS and GCOS for such mechanism(s). This provided the GSC with an opportunity to review the activities of J-DIMP to date and to suggest activities for the future. Members accepted that data and information management issues were of growing importance, and that the GSC needed to show users and funders that it was putting more energy into this issue than had been the case in the past.

The GSC accepted that there were useful over-arching and cross cutting roles for J-DIMP, but that more detailed issues are best dealt with at a lower level. Revisions to the tasks under the Terms of Reference were needed to help J-DIMP see what it should focus on and what it should leave alone (Action item 34).

During discussions on data and information management the GSC agreed that a G3OS Information Centre (IC) was likely to be needed to serve the needs of the three global observing systems, as had been agreed at the GCOS JSTC. It was not yet decided what other elements needed to be in the GOOS data and information management plan that would be prepared by J-DIMP in the coming months. At the last GCOS JSTC it had been suggested that each of the global observing systems would need a data facilitator or coordinator to ensure the smooth day-to-day running of their data and information management system. However, no competent GOOS body had yet examined the precise need for this function, so it seemed premature to begin such an activity. The four GOOS technical panels were charged with considering the data and information management issues related to their needs, as one step in building a coherent GOOS data and information management strategy (Action item 35). J-DIMP would examine other aspects of this strategy.

The next J-DIMP meeting is programmed for the week of April 27, 1998, in Hawaii. Key items on the agenda would be: (i) creating a technical advisory group; (ii) metadata; (iii) the needs of developing countries; (iv) a G3OS Information Centre; (v) new G3OS proposals; and (vi) providing information about extreme conditions.

Actions: 34. The J-DIMP tasks under theTerms of Reference (ToRs) should be modified to show what it should focus on and indicate what it should leave alone. Modifications should be submitted to J-DIMP for review and consideration, and for eventual approval by the GTOS SC and the GCOS JSTC (GPO and Chair GSC).

35. Each GOOS technical panel should examine its data and information management requirements as one step in developing a coherent data and information management strategy for GOOS (Panel Chairs and GPO).

6. IMPLEMENTATION ACTIVITIES

6.1 THE ROLE OF GSC IN GOOS IMPLEMENTATION

Within its terms of reference, the GSC has *inter alia* to "[...] *provide oversight of the [GOOS] implementation process, on the basis of the scientific and technical design, and of intergovernmental requirements and resources as expressed through I-GOOS*". The Committee was invited to more precisely define what this oversight should be, and to identify the seeds ("building blocks") that are to be used to implement GOOS. In some cases the more established pathways (e.g. VOS or drifter networks) may be avenues. In others the GSC and its Panels might need to identify national and/or local activities upon which GOOS could be developed. Should several separate, but integrated implementation strategies be developed, or should we be seeking a single strategy (perhaps based on 6.2 below) that is expanded and adapted to new needs as they emerge?

The OOPC had already been given a mandate to develop an implementation plan for the climate module, and this had been taken forward at the Sydney Workshop in March 1998. The GSC could task other Panels with following that lead. Alternatively, the Coastal Panel could be tasked with providing an implementation plan which in due course incorporated plans developed by the HOTO and LMR Panels, most of whose interests lay in coastal seas (including Exclusive Economic Zones). If that were done, how would LMR and HOTO requirements outside coastal seas be dealt with? Members preferred to follow the model set out in The GOOS 1998, and endorsed by J-GOOS-IV, which envisaged eventual development of GOOS implementation into two complementary themes, one for coastal seas and one for the open ocean, each of which would integrate climate, coastal, LMR and HOTO elements. En route to this destination it seemed wise to continue with the present plan of tasking the Coastal, HOTO and LMR Panels with developing separate implementation plans for their sectors over the next 2 years, whilst ensuring through consultation between the three groups that these plans would lend themselves to easy integration in due course.

The GOOS Initial Observing System (GOOS-IOS) has been established from existing operational observing systems. It comprises: the IOC-WMO Ship-of-Opportunity (SOOP) Programme; the WMO Voluntary Observing (VOS) Programme; the WMO-IOC Data Buoy Co-operation Panel (DBCP); the Tropical Atmosphere Ocean (TAO) buoy array; the IOC Global Sea-Level Observing System (GLOSS); the Global Temperature and Salinity Profile Programme (GTSPP); the IOC-IUCN Global Coral Reef Monitoring Network (GCRMN); the WMO's Global Telecommunications System (GTS); and NOAA's Operational Satellites.

Currently, apart from GLOSS and the GCRMN, the GOOS-IOS serves primarily the interests of the open ocean sector, especially the community interested in climate variability. In an extended discussion, many existing observing system elements were recognized that could form a firm foundation for a GOOS Initial Observing System in coastal seas. These included such things as:

- Marine Pollution Monitoring System (MARPOLMON);
- Mussel-Watch;
- the UNEP Regional Seas programme;
- Global Investigation of Pollution in the Marine Environment (GIPME);
- operational environmental measurements from Japanese ferry boats;
- the operations of the Helsinki Commission (HELCOM) and the Oslo and Paris Commission (OSPARCOM);
- networks of laboratories, such as Caribbean Coastal Marine Productivity (CARICOMP) in the Caribbean, (MARS) in Europe, and (NAML) in the USA;
- coastal LTER programmes based on the US Long-Term Ecological Network;

- Arctic monitoring programmes like Arctic Monitoring and Assessment Programme (AMAP);
- North-East Asian Region GOOS (NEAR-GOOS) in northeast Asia;
- the continuous plankton recorder programme (CPR);
- the Global Sea-Level Observing System (GLOSS); and
- the Global Coral Reef Monitoring Network (GCRMN).

The list is not exhaustive.

Suggestions for the way forward included such things as:

- capitalizing on the large commitment of resources for infrastructure that are already committed through the 14 Regional Seas programmes, plus HELCOM and OSPARCOM, which already have action plans for dealing with pollution, and pollution response strategies;

- creating fora, where users with interests in things as far apart as coasts, fish, and radio nuclides, for instance, could be brought together to assist in designing an ideal operational system;

- interacting with the Secretariat (in the Hague) for the Global Plan of Action for the Protection of the Marine Environment from Land-Based Activities (known as the GPA);

- listing present operational systems in coastal seas as the basis for selecting elements that could form the basis for a coastal GOOS-IOS (both the LMR and C-GOOS Panels have charged the GPO with this task);

- linking with ICES and PICES, who are responsible for collating data on regional programmes in the North Atlantic and North Pacific;

- injecting new ideas into the Mediterranean Action Plan;

- bringing southeast Asian laboratories together to agree on a data exchange programme;

- exploiting the ongoing operations and facilities of the IAEA, including their Monaco laboratory;

- exploring the possibility of using operational models developed to meet the needs of the offshore industry, like that developed by oil companies and the US Government (Dept. of Interior) in the Gulf of Mexico.

The Committee agreed that before exploiting these existing elements we have to start by identifying the problems and issues that need addressing, and the products required by the users; then we should pick the existing infrastructure that best meets those needs (or devise new observing elements). In the coastal environment these infrastructural elements were likely to be regional. Ideally the system concepts and technologies should be transportable.

6.2 AN IMPLEMENTATION PLAN FOR THE CLIMATE MODULE

Under this agenda item the Committee was invited to more precisely define the relationship between GOOS and pre-existing "building blocks", and to determine the next steps in formulating an initial implementation plan for the climate module.

6.2.1 Workshop on the Implementation of Global Ocean Observations for GOOS-GCOS

Peter Dexter of WMO reviewed the results of the Workshop on the Implementation of Global Ocean Observations for GOOS-GCOS (Sydney, 4-7 March, 1998). The workshop had been organized because there was a need to put more effort into implementation as opposed to planning. The workshop was convened to consider in particular global physical and related observations to support the common GOOS/GCOS climate module, and other modules as appropriate, and to recognize the need to develop ocean services. The expected outcome was a concrete Action Plan to lead to the implementation of networks to provide the observations needed for GOOS and GCOS, in particular through existing mechanisms.

Since the primary task was to assign implementation responsibilities and actions to existing implementation bodies and mechanisms, the workshop brought together the managers of the primary existing open ocean observing systems including:

- WMO's Commission for Marine Meteorology (CMM) and its Voluntary Observing Ship (VOS) scheme;
- the IOC/WMO Integrated Global Ocean Services System (IGOSS) and its Ship-of-Opportunity Programme Implementation Panel (SOOP-IP);
- the IOC International Oceanographic Data and Information Exchange (IODE) programme;
- the Global Temperature and Salinity Profile Programme (GTSPP) of IGOSS/IODE;
- the WMO/IOC Data Buoy Co-operation Panel (DBCP);
- the IOC Global Sea-level Observing System (GLOSS);
- the TAO Implementation Panel (TAO); and
- the Pilot Research Array in the Tropical Atlantic (PIRATA).

Also represented were:

- the OOPC, GODAE, CLIVAR, I-GOOS, the GSC, GCOS, the GPO, and the WMO's World Weather Watch (WWW).

Several of the existing bodies have already prepared or are preparing implementation plans and strategies for their activities which include reference to the need to serve the interests of GOOS as a new "user" community. These bodies will now review their plans and adjust them where necessary to provide the necessary support for GOOS/GCOS. The managers of the existing bodies agreed that together they constitute a GOOS Initial Observing System as depicted in Section 6.1, recognising that this did not detract in any way from their ability to service their existing clients. In fact bringing them together and requiring them to interact would be to the benefit of all their clients.

The status, capabilities and deficiencies of each of the existing systems were identified. Then the OOPC's observational requirements were reviewed and categorized into three main types: (i) global sea-level; (ii) surface; and (iii) upper ocean/subsurface. Having analyzed the existing systems and what was required in each of the three categories, a number of actions were listed including:

(i) Sea-level:

- Establish a science steering group for sea-level (see section 4.2.1 and Annex VI).

(ii) Surface:

- Ask the SCOR/WCRP Air-Sea Flux Working group to become the science steering group for surface measurements;
- Develop an integrating strategic plan for surface measurements including meteorological data (this may or may not require a workshop);
- Develop and implement a Pilot Project (like GTSPP) to integrate surface data management, quality assurance, archives, standards, and product preparation (may need a small workshop);
- Assess sea-ice observing and data management system, and recommend enhancements to meet requirements.

(iii) Upper Ocean/Subsurface:

- Prepare and hold a workshop to define implementation strategies for upper ocean thermal data;
- Assess need for possible second workshop on data management, quality assurance, duplication of GTSPP, evolving WOCE data centers to operational status etc;
- Improve coordination in implementation management among SOOP, TAO and DBCP.

The GSC endorsed plans drafted at the Sydney Workshop and supported by OOPC for workshops on (i) a comprehensive subsurface ocean implementation plan, and (ii) a comprehensive implementation plan for integrated surface ocean and marine meteorology. The OOPC and the interim implementation advisory group will seek external support for these activities as far as possible.

To implement GOOS effectively the Workshop agreed that there would be considerable advantages in having the existing systems integrated into some common operational infrastructure designed to meet GOOS's needs. To facilitate discussion of what this infrastructure might look like, Peter Dexter reviewed the proposal that will be considered by the WMO Executive Council in June 1998, and by the IOC Executive Council in November 1998, for closer co-operation between the CMM and IGOSS. Both WMO and the IOC recognize the pressing need for a fully coordinated joint mechanism for implementing the requirements for ocean and surface marine meteorological data to support the common GOOS/GCOS ocean climate module, as well as other developing requirements of GOOS. They also see a need to better coordinate and manage

the existing range of marine-related activities of WMO and IOC to reduce duplication and overlap, enhance efficiencies and reduce costs. A recommendation has therefore been made to form a Joint WMO/IOC Committee for Oceanography and Marine Meteorology (JCOMM), with status and responsibilities like those of a WMO Technical Commission. JCOMM would replace the existing CMM and IGOSS. It would have reporting to it several implementation bodies, notably ones for sea-level, surface, and subsurface, the needs for which were identified by the Sydney Workshop. IODE would not be part of the JCOMM structure nor one of the JCOMM implementation bodies, but there was a clear requirement for strong interaction between JCOMM and IODE. It was noted that ultimately the different existing bodies might be consolidated within the three functional groupings under JCOMM (sea-level, surface and sub-surface).

P. Dexter went on to note that because JCOMM will not formally come into existence until after it has been approved by the WMO Congress and IOC Assembly in mid 1999, the Sydney Workshop had invited representatives of IGOSS, CMM, IODE, DBCP, GLOSS and TAO-IP to join an Interim Implementation Advisory Group created to:

- finalize the Implementation Action Plan;
- identify and provide oversight to actions and ensure implementation;
- develop and refine strategies for global surface marine observations and for upper ocean observations;
- coordinate implementation of these strategies; and
- report to the GSC and the implementation bodies.

In discussion it was noted that this GOOS implementation infrastructure discussed in Sydney represents only one dimension of the activity of JCOMM (and IODE and the other existing bodies), which would also service the needs of other communities. It also represents only the physical measurement side of GOOS, the other disciplines of which may be catered for in other dimensions of JCOMM. GSC members made clear their view that it does not make sense to separate the physics from the biology and chemistry, and indicated a need for the planners of JCOMM to take this requirement on board at the earliest opportunity.

Geoff Holland pointed out that IOC can have a technical commission within it, as a subsidiary body, and that therefore a more appropriate title might be JCOMM (Joint Technical Commission for Oceanography and Marine Meteorology).

The GSC agreed (i) that the formation of JCOMM is an important first step towards GOOS implementation, and should go forward (Action item 36); (ii) that the tripartite structure for the subsidiary bodies was appropriate, as was the reporting relationship proposed for existing bodies; and (iii) that the interim implementation advisory group is a useful initiative and should include a TAO representative.

Action: 36. The GPO should draft a recommendation to the IOC Executive Council for support for the proposed co-sponsorship by IOC and WMO of a Joint Committee for Oceanography and Marine Meteorology, using the recommendation to the WMO Executive Council as a model. In due course the recommendation should be taken to the IOC Assembly and WMO Congress.

6.2.2 The GOOS Services Module

Johannes Guddal gave a brief presentation on the work of the GOOS *ad hoc* Services Module Panel, which he had chaired. A preliminary report of the work of this Panel was presented at J-GOOS-IV, and the full report at I-GOOS-III. Guddal envisaged two main GOOS services: (i) infrastructure services like those provided by SOOP, for instance, and (ii) end-user services. The I-GOOS-III report had focused mainly on type (ii) services. It had concluded that many GOOS-like services were already available and covering a broad range of outputs with an emphasis on physical measurements in coastal seas. It had noted deficiencies in infrastructure, standardization, the availability of proper forcing data, and balancing between field data provision and processing capabilities. It had identified some particular trends, including a growing confidence in and demand for operational oceanography.

He recommended first that there was no need to establish a separate Services Module Panel, believing that the technical panels should interact with their specific user communities to identify service requirements. Second, he recommended that more efforts be made to streamline the phases of the production line or end-to-end system that are closest to the users, especially to enable the end user constituencies to recognize the full potential of GOOS. To enable the achievement of this goal he proposed that GOOS might establish a high

quality GOOS products bulletin describing available products and services, and explaining how they were produced and what their impacts might be in different sectors. The bulletin should also provide an outlet for the concerns and interests of the user community, and obtain user feedback. Efforts should be made to start interactions with specific user groups, like the managers of ports and harbors, for instance.

The GSC agreed with the recommendations, recognizing that it would be useful to produce a bulletin electronically as well as in hard copy. A bulletin would show that we were both reaching out to, and listening to the user community. It was recognized that such an initiative could create a lot of work for an already over-stretched GPO, and that there was much to be said for capitalizing on the IGOSS Electronic Products Bulletin. An *ad hoc* group was asked to consider inter-sessionally how this initiative might be taken forward and funded, and to produce a costed proposal (Action item 37). The GSC recognized that a Services Module Panel will not be required; the *ad hoc* Services Panel ceases to exist. Johannes Guddal was thanked for his steering of this activity over the past 3 years.

Action: 37. Consider the establishment of a regular, high quality GOOS products bulletin to disseminate information about, and to discuss products, and to solicit feedback from users. Appoint an *ad hoc* group comprising Guddal (Chair), Desa and Malone, to act on this inter-sessionally. Discuss the bulletin concept at J-DIMP .

6.2.3 GODAE

A Global Ocean Data Assimilation Experiment (GODAE) has been proposed and is being formulated as a pilot project to assist in implementing the global observing system for climate. In reviewing the state of development of GODAE planning, the Committee was invited to define the roles of GOOS and its sponsors with regard to such undertakings.

Neville Smith reviewed developments in GODAE. GODAE addresses the lack of commitment to work on data integration and assimilation and modeling on a long-term basis. It will demonstrate the power of integration of satellite and *in situ* data, the power of model assimilation, and the value of a global system. In a very real sense it is an ocean FGGE [the First GARP (Global Atmospheric Research Programme) Global Geophysical Experiment which established the basis for the World Weather Watch]. It is needed for open ocean analyses and forecasts, and for establishing boundary forcing for all manner of regional models so as to improve forecasting in coastal systems. GODAE will test the feasibility and practicability of global observing, modeling and assimilation that are at the core of GOOS and GCOS. We need it because such a system will never come about by chance, and the potential of such a system will never be realized by a set of randomly assembled parts.

To avoid confusion, it is worth pointing out that GODAE is not a simple system or model, nor a scientific experiment like TOGA, nor a follow on to WOCE.

Among the challenges in developing GODAE are: separating the effects of forcing from inherent instabilities; dealing with novel data streams, like acoustic tomography; and getting to grips with advances in and demands for telemetry, communications and computing.

Several initial test phases will be carried out over the next few years, leading up to the full scale global experiment in 2003-2005, after which (assuming success) GODAE's observing systems and assimilative capabilities will continue as part of GCOS and GOOS. Among the GODAE Pilots prior to the full scale experiment might be one on North Atlantic data assimilation.

It should be borne in mind that the success of GODAE will depend on several new initiatives. For example, GODAE will exploit new float programmes, including the 500 subsurface floats being deployed in the North Atlantic Climate Change Experiment to discover the details of Atlantic circulation. Ultimately, GODAE will require the deployment of some 3000 floats globally.

We now need to attract resources of people, skills, and cash. To assist in taking GODAE forward, still under the umbrella of the OOPC, and to provide resources independently of IOC, the GODAE Patrons group has been created. It comprises NOAA, NASA, CNES, ESA, EUMETSAT, NASDA, JAMSTEC and the Australian Bureau of Meteorology. The Patrons have established the GODAE Fund, which now supports the

GODAE Office, in the Bureau of Meteorology in Melbourne. GODAE is guided by a scientific steering team (GSST) comprising the GODAE Partners, which held its first meeting in January 1998, in Melbourne. The second GSST and Patrons meeting will take place in Tokyo in July 1998. The GSST will report to the OOPC. GODAE is currently developing a strategic plan which should be ready early in 1999.

In discussion it was agreed that more could be done to inform developing countries about the intentions of GODAE and the opportunities it offered, not least to entrain groups now so that they would be able to exploit GODAE when it is operating at full scale. An inter-sessional group was created to consider these issues.

Action: 38. GSC recommended the formation of an inter-sessional group [E. Desa (Chair), I. Wainer and M. Fogarty] to examine opportunities for taking advantage of GODAE within the broader context of GOOS. This would include the relation to the non-physical components of GOOS, the interface between the global physical core of GODAE and regional/local models and applications, and outreach to entrain potential participants in less developed countries.

6.3 REGIONAL UNDERTAKINGS

The Committee received brief statements of the status and plans of major regional GOOS projects. Members accepted that the GOOS policy with regard to such regional undertakings was clearly set out in the GOOS Strategic Plan.

Action: 39. The GPO should continue to encourage development of the existing regional GOOS projects, promote the development of regional GOOS initiatives, and encourage the transfer of techniques and experience from existing GOOS regions to others, where appropriate and requested.

6.3.1 EuroGOOS

Nic Flemming reviewed progress with EuroGOOS, which had started in December 1994. EuroGOOS is not an intergovernmental organization, it is an association of 30 agencies from 16 countries; half of the agencies are operational. Support for GOOS in Europe comes not only through EuroGOOS, but also through the national GOOS committees that have been set up now in many European countries.

Europe's geography forces the attention to focus on regional seas (Baltic, Arctic, Mediterranean, and Northwest Shelf including the North Sea). Recognizing that the boundary conditions for coastal seas are determined far from home, there is also interest in a global approach; in this context EuroGOOS supports an Atlantic project. European seas are well endowed with models and operational systems which have been developed by various user sectors including the oil industry, fisheries, coastal defense managers; pollution response managers; water quality managers and research scientists. In addition there are several international agreements requiring routine monitoring, for instance under HELCOM and OSPARCOM. Most of these models, systems and agreements were active before EuroGOOS was invented; they form the "building blocks" for EuroGOOS to choose from. In the Baltic the local partners are collaborating on a single operational model. The GOOS concept has strengthened their clout in promoting the concept and winning the resources to do it.

EuroGOOS has surveyed users needs, and managed to narrow down the range of measurements to a select a critical few that are both important and feasible. These are variables that can be measured easily and routinely and which are needed for models, with the design of the observing system being linked to the models' requirements. Many observations that people might like to make cannot yet be made routinely, easily and cheaply, so do not yet qualify for the initial observing system design. Blueprints of EuroGOOS's user survey approach may be useful for application elsewhere, and are available on request from Nic Flemming.

EuroGOOS has also surveyed users' technological capabilities and requirements, so as to identify where research and development is needed in the near-term. The priority areas identified include:

- sensor stability and endurance (>30 days);

- ferry instrumentation;
- coastal shelf radar (to 200km +);
- a coastal buoy network;
- satellite mission planning (influencing mission logic);
- towed undulators providing information in real time;
- profiling drifting buoys;
- operational modeling and assimilation;
- acoustic tomography;
- autonomous underwater vehicles;
- airborne LIDAR and CASI.

EuroGOOS then used these specifications of users' requirements as the basis for bids for appropriate project funding. Some funds come from national sources, but in addition 15M Ecu has been made available recently through the European Union for a range of projects. These include such topics as: (i) coastal HF radar; (ii) North Atlantic modeling; (iii) Arctic tomography; (iv) Mediterranean forecasting; (v) real-time data standardization; and (vi) instrumentation of ferries.

EuroGOOS is also keen to extend the range of operational services. To this end it has carried out user requirement surveys in 5 countries. A great deal of similarity has merged across Europe from these surveys, with local departures as might be expected. Key requirements include:

- technology upgrades;
- extending geographic coverage (e.g. from coast to shelf edge);
- extending the type of observations (e.g. from physics to chemistry, nutrient, chlorophyll, sediments);
- designing observational schemes to meet the needs of data assimilation into models;
- providing services to scientific and socio-economic applications;

The next steps include: (i) implementing the funded proposals; (ii) publishing an extended EuroGOOS Plan; (iii) increasing activity on an Atlantic-wide scale; (iv) organizing the 2nd EuroGOOS Conference (spring 1999); (v) carrying out instrumented ferry trials; (vi) obtaining support from EU operational directorates; and (vii) improving economic analyses of costs and benefits of GOOS in the European context.

6.3.2 NEAR-GOOS (North-East Asian Region GOOS)

A presentation on progress with NEAR-GOOS, which is a little younger than EuroGOOS, having started operations in October 1996, was given by Colin Summerhayes, who had recently attended a NEAR-GOOS workshop in Okinawa and visited the NEAR-GOOS operational elements in the Japanese Meteorological Agency (JMA) and the Japanese Oceanographic Data Centre (JODC) .

NEAR-GOOS is similar to EuroGOOS in having a focus on regional seas (Sea of Japan, Yellow Sea and East China Sea) and also a general interest in the local open ocean (northwest Pacific). It differs from EuroGOOS in having an intergovernmental structure involving 4 partner countries: Japan, China, South Korea and Russia. It is a subsidiary body of the IOC regional secretariat for the western Pacific (WESTPAC).

The initial objective of NEAR-GOOS is to promote data exchange by establishing a real time data base (operated by JMA) and a delayed mode data base (operated by JODC). The data bases are accessible through electronic mail by registered users. The primary goal is to improve ocean services on behalf of a wide variety of users in the WESTPAC region. The initial data sets are mostly physical.

Thus far there have been two NEAR-GOOS coordinating committee meetings; operational and implementation plans have been produced; and there have been two NEAR-GOOS training workshops on data and information management. Significant achievements include the following:

(i) there is an intergovernmental agreement on the exchange of ocean data in the region;

(ii) data exchange has begun [it is accepted that it is important to focus on getting it right for a few variables (5 to start with), knowing that more may be added later when people are comfortable with the system];

(iii) data is now being exchanged in real time. Japan and Russia are contributing; Korea is about to contribute; and China should begin contributions soon;

(iv) the JMA is downloading GTS data and making it available to others in real time for the first time;

(v) to overcome the political obstacle presented by any one of the partners being seen as THE centre for data exchange, a decentralized or distributed system has been adopted, in which the data are not "delivered" or "submitted" by one country to another, but instead are "made available" for access on-line. [The extent to which any one of the local centers is accessed by the user community will depend ultimately on the extent and quality of products and the speed of their supply, which may make one or some centers the de facto centers for the region, but in a way that is driven by the market.];

(vi) as at February 1998, the user community had grown to 22, mostly in Japan, and the number of contributors is increasing. New contributors include Japanese fisheries, with their abundant CTD and even ADCP data, which because it enlarges the data base will make the system more attractive to other potential users;

(vii) substantial research is being funded, especially in Japan, to further develop NEAR-GOOS;

(viii) the start-up funding for NEAR-GOOS came directly from UNESCO rather than from IOC, thereby bringing additional resources into GOOS.[It seems unlikely that UNESCO will continue to be a source of funds for NEAR-GOOS. Japanese funding sources (industry) are being sought (some US $3M is thought possible).

While the GOOS Principles call for quality control, it is accepted that the manpower to provide this is not yet widely available, so different standards have to apply here for the time being or else there will be no exchange of data. The JMA will soon propose a quality control mechanism for NEAR-GOOS.

The future growth of NEAR-GOOS will depend on attracting more users to access and contribute to the system. To some extent more users will be attracted when more products are available. The growth of NEAR-GOOS will also depend on promotion and marketing. Part of the reason why there are more users from Japan is because there, the different potential users come together in a NEAR-GOOS committee. Such bodies do not yet exist in the other NEAR-GOOS countries.

The extent to which NEAR-GOOS develops an end-to-end system providing products on line as well as data, in accordance with GOOS Principles, depends on the outcome of discussions at the next NEAR-GOOS meeting (30 June-3 July, 1998). It is already technically feasible to provide some products, such as SST maps, storm surge forecasts, current charts and so on. However, some products may be of such national or commercial interest that they may not be developed collectively. The extent to which numerical models are used in the derivation of products depends on the extent to which such models are available, which in turn depends on ongoing research.

6.4 GOOS PRINCIPLES OF INVOLVEMENT

Given that several Pilot projects and regional undertakings have recently asked, or will ask in the near future, to be considered as "part of GOOS", the Committee was requested to review the relevant Principles of Involvement adopted by I-GOOS-III. The Principles, which provide a blueprint for the designing of GOOS national programmes, were presented by Angus McEwan. He explained that the basic idea had been not to make them too prescriptive. The GSC endorsed the GOOS Principles.

6.5 AN IMPLEMENTATION STRATEGY

On the basis of the discussions under items 6.1 through 6.4, the Committee was requested to agree on an implementation strategy and to begin to set for implementation schedules.

The Committee agreed that the concept of a two-fold division of GOOS into basin and/or global scale versus local/coastal scale would probably be the right approach when the coastal, LMR and HOTO Panels have developed, matured and aggregated. The split into two broad themes (open ocean and coastal) recognized the substantial differences in likely implementation mechanisms between coastal seas and the open ocean. It was agreed that the present approach of GOOS development in several technical modules should be retained until the strategy for implementing the non-physical parts of GOOS was fully defined.

The Committee felt comfortable with the mechanisms that the four module panels were using to develop their implementation plans, and did not feel like imposing narrow constraints or strict definitions at this point in time.

Action: 40. Based on documents and GSC-1 discussions, Chairman to prepare brief white paper on implementation of GOOS, and circulate to GSC members for comment.

6.6 REVIEW CURRENT GOOS ELEMENTS

The committee reviewed the list of observing system elements currently considered as GOOS activities, such as the GOOS-IOS (section 6.1).

7. THE FIRST GOOS AGREEMENTS MEETING

The Committee reviewed the status of planning for the proposed First GOOS Agreements meeting, at which it had been intended (i) that Government representatives would agree to the Principles of GOOS, following which (ii) their operational agency representatives would state commitments. After much discussion about the meeting objectives and possible attendees, the Committee decided that the most sensible way to gain agreement to the Principles of GOOS, was through existing mechanisms. That being so the Director of the GPO was asked to draft a Resolution for Member States to agree to at the next IOC Assembly in July 1999. As for gaining commitments from operational agencies, it was decided to postpone a Commitments Meeting with them until the Resolution had been agreed to at the Assembly, probably in late 1999.

Actions: 41. Recommend to organizing committee and to I-GOOS Officers (Chairman and Vice-Chairmen) that the proposed Agreements Meeting not be held, and that instead the existing intergovernmental machinery be used to obtain agreement via the mechanism of a Resolution presented to the IOC Assembly in 1999, which would itself constitute a GOOS Agreement. GPO and organizing committee to (I) brief the IOC Executive Council, (ii) prepare the Draft Resolution and (iii) get it out within two months to Member States and UNESCO permanent delegations to allow adequate feedback before the Assembly. GPO to request co-sponsors for written confirmation of their agreement with this new approach. GPO to thank the Organising Committee for their efforts on behalf of I-GOOS, and to inform senior officers of I-GOOS and Organizing Committee Chairman.

42. Recommend to organizing committee and to I-GOOS Officers that the Commitments meeting be postponed until after the Agreements Resolution is passed by the IOC Assembly.

8. CAPACITY BUILDING

Bill Erb presented a paper reviewing progress with the GOOS Capacity Building programme to date and suggesting a strategic outline for the future. Capacity building for GOOS has been directed by an *ad hoc* Panel, appointed by I-GOOS in 1996, though without Terms of Reference. It is chaired by Jan Stel, and Bill Erb is the Technical Secretary. The main initial priority, given that the individual module panels were largely in the planning stage, was to build awareness of GOOS among developing countries.

There have been four workshops to date: (i) Goa, India, November 1996; (ii) Mombasa, Kenya, March 1997; (iii) Malta, November 1997; and (iv) Suva, Fiji, February 1998. At the Malta meeting, considerable progress was made in establishing the basis for a regional GOOS programme -MEDGOOS. The Fiji meeting, co-sponsored by SOPAC, established the basis for a regional GOOS programme -Pacific GOOS. There is every reason to believe that MEDGOOS and Pacific GOOS should be able to develop into strong regional programmes, with a focus on their particular local interests, in the process aiding the steady global development of GOOS. Along the way mechanisms will be emplaced to ensure strong links to the rest of the GOOS community.

The GSC asked (i) whether, and if so where, awareness raising was still merited; (ii) how GOOS Capacity Building should be taken forward now that two new panels have been formed (Coastal and LMR); (iii)

to what extent, and how, the GOOS Capacity Building programme should be integrated with programmes like IOC's TEMA (Training, Education and Mutual Awareness) programme, the START programme (System for Analysis, Research and Training) of IGBP, the WCRP, and the IHDP?

Some members of the GSC were concerned that the programme may be creating expectations that we may not be able to meet. Bill Erb made clear that the work was leading to useful inventories of capabilities, more precise definition of needs, and identification of desirable products. Nic Flemming noted that EuroGOOS was already working with Mediterranean countries to build capacity, and that it was important to note that the Malta and Fiji workshops had led the regional people to start working together, which was a big step forward. Often the solution to expectations would be those communities raising their own resources from donors; they would not necessarily be looking to "us" for material help, only guidance on direction, which we were well-qualified to give.

Although it was clear that the Capacity Building programme must be modified to reflect changing GOOS circumstances, the Committee concluded that regional awareness raising may still be needed in some regions, notably the Caribbean, South America, and Africa, and that regional follow-up is required to nurture new regional groups like MED-GOOS and Pacific GOOS. The GSC recommended a much closer integration between the IOC's GOOS and TEMA programmes, including use of TEMA funds for GOOS Capacity Building (Action item 43).

The GSC felt that there is still a need for continuance of the GOOS Capacity Building Panel, including representatives of each GOOS Panel, so as to present the plans and needs of those panels. To facilitate this linkage, each GOOS Panel should have on it someone responsible for capacity building, who would liaise with the Capacity Building Panel (Action item 44). The Capacity Building Panel should develop a coherent capacity building strategy and plan, including as key elements:

- identifying and tapping possible sources of funding;
- developing links with IOC regional bodies and the IOC Vice-Chairmen responsible for regional developments;
- coordinating GOOS capacity building efforts not only within IOC, but also with the similar efforts of the other sponsors, placing greater emphasis on shared planning, funding and expectations;
- recognizing the need to replace the retiring Technical Secretary;
- focusing on providing practical benefits to developing countries, especially in improving data and information management as the basis for data exchange and product development;
- developing a sustainable programme, ideally through the development of networks;
- placing "Agents" of GOOS in particular regions to provide information about GOOS, assist with GOOS developments, and provide training in observations, data quality control, data transmission and archiving, production of products, and interpretation of products and information (possibly in association with existing local offshore industries).

The Panel considered this was a useful model to follow, since it would bring a GOOS representatives into contact regularly with the people in the area who represented the user community. There is a good precedent in the posting of Jason Rubens to Sri Lanka to set up the East Asian programme of the Global Coral Reef Monitoring Network. In some cases it might be appropriate to use the IOC and/or UNESCO infrastructure that was already in place around the world. In other instances it might be appropriate to start some efforts that were purely GOOS driven and located in relation to GOOS needs. The GSC agreed that local people would generally be preferred to fill "Agents" posts, though there might well be occasions when external candidates were better qualified. It also agreed that it would be preferable to house "Agents" in operational agencies.

In this context, the committee was told that Australia had made a proposal to UNESCO for an IOC regional office to be set up in the Australian Bureau of Meteorology in Perth to focus on (i) GOOS data and information management and coordination, (ii) GOOS capacity building in data and information management in the nearby regions (especially southeast Asia), and (iii) stimulating the development of regional GOOS programmes, for example in the eastern Indian Ocean area. The Committee considered that this possibility was welcome and should be explored further by the GPO, with the following caveats: (i) it was considered premature to start coordination of global data and information management for GOOS before an appropriate body has examined what is required to build a GOOS data and information system; (ii) care should be taken to ensure effective coordination and liaison with the IOC's WESTPAC Office in Bangkok, which was already working with Member States in S.E. Asia to improve data exchange (though not necessarily specifically for GOOS) (Action item 45).

The strategy for Capacity Building would be developed by the Chairman in discussion with members (Action item 46); appropriate funding proposals would be developed by the GPO in consultation with the Executive Committee and the Capacity Building Panel.

It is possible that the European Association of Marine Sciences may be able to assist with training programmes, and Nic Flemming undertook to check this and report back to the GPO (Action item 47). Consideration should be given to the use of START for building capacity and to capitalizing on WMO, UNEP and ICSU initiatives in Capacity Building (Action item 48).

The GSC urgently recommend that IOC provide the staff required to undertake the tasks related to planning and carrying out the GOOS Capacity Building programme, including soliciting external resources, programme execution, and follow up. In the light of the imminent departure of the current support staff (Bill Erb), this matter is now critical (see Action item 2).

Actions:

43. Recommend to the IOC Executive Council that action be taken to integrate GOOS Capacity Building with the TEMA programme and the Regional programme of IOC (GPO) .

44. A Capacity Building Panel is needed. It should be made up of 8 people including Jan Stel (present CB Panel Chair), the IOC/GOOS CB Support, Allyn Clarke and Ilana Wainer. Terms of Reference are required (initially the panel should draft its own for approval by the Executive Committee) (GPO).

45. A key feature of the capacity building strategy should be the provision of local capacity building services to regional groups of developing states. An offer had been made by Australia to site such a service in Perth to attend to needs in the southeast-Asian and eastern Indian Ocean regions. The GSC asked the GPO and the IOC Executive Secretary (i) to take forward the Perth initiative, ensuring that it was coordinated effectively with other IOC/UN initiatives in the region, and (ii) to explore the possibility of setting up other such offices (an offer was received from India).

46. A set of principles is required for a GOOS Capacity Building programme, as the core of a comprehensive GOOS capacity building strategy (Chairman, with e-mail assistance, to draft the strategy).

47. Consideration should be given to using marine service operators working off the coasts of developing countries to provide local training under GOOS auspices. Nic Flemming agreed to approach the European Association of Marine Services for advice on how to implement such activity.

48. Work with WMO, UNEP and ICSU to coordinate, jointly plan and jointly fund capacity building efforts related to achieving GOOS goals (GPO).

9. THE GOOS HANDBOOK

The I-GOOS Strategy Sub-Committee (SSC) had suggested that a GOOS Handbook would be needed as a source of information and advice about GOOS. It would include, for example, needed measurements, and how they should be made. A draft outline of such a Handbook prepared by the SSC was distributed to members of the GSC as the basis for a discussion on the need for such a document.

It was agreed that a central reference document of some kind was needed as a source of information. But it was also agreed that rather than being in hard copy it could be made available on the Web. Volume I should comprise background information already available in the form of the Strategic Plan and soon available in the form of The GOOS 1998. The Strategic Plan is already available on the Web, and The GOOS 1998 would be eventually. Volume II should comprise lists of people. Volume III would be like the technical documents for the World Weather Watch. However, it is likely to take decades to compile (as in the case of the WWW).

The GOOS Brochure should provide a signpost to this information, indicating how it may be accessed via the Web, and pointing out that if hard copy is required it can be obtained from the GPO, and printed and distributed on request.

Action: 49. Recognizing that the GOOS Web page is taking the place of much of Chapters 1 and 2 of the proposed handbook, the GSC recommended using the GOOS brochure to advertise the existence of the GOOS web site as a source of information about GOOS, and the GPO as a source of hard copy where there is no Internet access. For the time being no further action is required on the Handbook. However, the GOOS Web Site must be expanded and maintained to accommodate needs that the Handbook would have filled (Action GPO).

10. OTHER BUSINESS

10.1 EXECUTIVE COMMITTEE

To facilitate the execution of Committee business, an Executive Committee was formed, comprising Worth Nowlin, Angus McEwan, Ken Denman, Julie Hall, and Colin Summerhayes (ex officio).

11. GSC TERMS OF REFERENCE, WORK PLAN AND PROGRESS REVIEW

11.1 TERMS OF REFERENCE

The Committee reviewed its Terms of Reference and decided they were acceptable as written (Annex IV).

11.2 WORK PLAN

11.2.1 Periodic Review And Assessment

Colin Summerhayes presented a proposal for periodic review and assessment of GOOS. The GSC accepted a programme of review comprising the following elements:

(i) brief annual reports at year end from Panel Chairs to the GPO for the IOC Annual Report;

(ii) comprehensive annual reports by panel Chairs and Director GPO to the GSC prior to GSC meetings;

(iii) comprehensive biennial report by Chair GSC to I-GOOS meeting;

(iv) half yearly review of the budget in relation to the work programme, by the GPO and Panel Chairs and the Executive Committee, as the basis for 6-monthly budget requests to IOC for allocations from the IOC Regular Programme funds donated by UNESCO;

(v) 5-year review of overall progress in GOOS, by independent group of experts reporting to GSC, with the first such review in AD2000.

Action: 50. GPO to arrange for an external review of GOOS by representatives of operational agencies and users to take place following completion of the initial implementation plans and after the Commitments Meeting (ie probably in early year 2000).

11.2.2 Work Programme and Budget

The Committee reviewed the work programme and budget submitted by the Director GPO as part of his report. The Director reminded members that normal practice had been for a 2-year work programme and budget to be prepared for approval by I-GOOS at is biennial meeting, and for subsequent approval by the IOC

Assembly. The budget for 1998-1999 had been approved at the 1997 meeting of I-GOOS-III. However, the request by I-GOOS at the 19th Assembly for a budget of approximately US $1 million over 2 years had not been approved in its entirety, the budget approved for GOOS and related services (including IGOSS and GLOSS) by the Assembly being US $0.6 million (half from the IOC's regular programme funds and half from external sources). This placed limitations on what could be achieved, and especially on what might be available from IOC in the form of contributions from the IOC's regular programme funds donated by UNESCO. There was always the potential to bring in more external funds to make up the difference. For instance, the Chairman pointed out that since TAO was now fully funded, the TAO-IP might be approached to see if some of the funding for its meetings could come from TAO funds (Action item 51).

Members agreed that the situation regarding funds had changed. First, in future, it would be the GOOS Steering Committee which approved the work programme and budget. Second, GOOS is going through a rapid growth phase necessitating more meetings than foreseen a year ago when the current budget was approved by I-GOOS and the Assembly. The GPO was charged with doing its utmost to find the extra resources required for the expanded development pace of the GOOS programme. High priority was given to the accelerated schedule of meetings of the GOOS Coastal Panel, and to activities required to implement the actions recommended at the Sydney meeting.

The GSC requested that in future the GPO prepare a 2-year rolling budget to provide at any time a 2-year view of the future, and asked that the 18-month budget prepared by the Director GPO be expanded to meet this requirement (Action item 52).

Given the increasing pace of the GOOS programme, and the resulting increase in the number of meetings, serious consideration needs to be given by the IOC at the highest level to providing appropriate staff resources speedily to support this expanding activity, and by Member States to providing secondees (Action items 2 & 3).

Actions: 51. Bearing in mind that operational funds are now available for the TAO Array in the Pacific, the GPO should work with the GCOS/JPO to establish the possibility of obtaining some external support for meetings of the TAO Panel.

52. GPO to maintain a 2-year rolling budget forecast, reviewed every 6 months. GPO Work Programme and Budget will be prioritised inter-sessionally by W. Nowlin, A. McEwan and C. Summerhayes.

11.2.3 GOOS Contacts and National Committees

The Committee agreed that the GPO should maintain a list of GOOS contacts. Focal points for GOOS are also needed in each country. These might be the Chairs of national GOOS steering committees.

Information from national committees about their activities should be solicited and listed on the GOOS Web page.

Actions: 53. GPO and GSC members to develop list of GOOS contacts in all pertinent countries by August 1998.

54. GPO to approach countries for statements or updates on their national GOOS programmes. This material to be placed on the GOOS Web site.

12. DATE AND VENUE OF NEXT MEETING

The next meeting will be held in April 26-29, 1999, either in Paris; Beijing; Goa; or Dallas, depending on
consideration of (i) cost, and (ii) involvement of the GPO staff.

Action: 55. The GPO is to do comparative costing for decision by the Executive Committee, and is to arrange some talks on marine science and operational modeling and forecasting for the next meeting.

13. LIST OF ACTIONS

(i) GPO

1. Complete recruitment to GLOSS Technical Secretary post.
2. Request secondments from Member States for particular GOOS tasks.
3. Request IOC Executive Secretary to increase secretarial support.
4. Develop GOOS link to IAEA.
5. Issue two GOOS Newsletters in 1998.
6. Obtain addition external funds for GOOS support.

(ii) GOOS, OOPC, LMR and Coastal Programme

7. GOOS document: The GOOS 1998: publish revised version of the GOOS 1998. Director GPO and Chair Planning Committee to set the schedule.
8. GOOS Brochure: develop GOOS Brochure. Director GPO with assistance from T. Malone, J. Hall and M. Fogarty.
9. OOPC: Proposed Sea-level Working Group: Approve formation of the new group, along the lines of the written statement provided by Neville Smith and Colin Summerhayes (Annex VI). Co-sponsorship should be sought from GCOS and WCRP. The proposed group should not go ahead without external resources to cover its activities. Formation of this new group requires a corresponding change in the Terms of Reference of the GLOSS Group of Experts, which needs to be agreed with the GLOSS-GE Chair. Formal approval for such a change requires formulation of a Draft Recommendation by the GPO for the IOC Executive Council and the IOC Assembly. Actions to be taken by an inter-sessional group comprising Smith, Summerhayes and Woodworth, the Chair of the GLOSS-GE.
10. JGOFS: The GSC asks the JGOFS- SSC to consider the OOPC-III recommendations related to JGOFS activity, noting in particular the need to provide up-dated advice on the observing system; the proposed Workshop on sections, tracers and carbon measurements; the need to develop activities related to standards; and the need to address the conclusions of the Time Series Workshop (Action GPO to contact JGOFS).
11. HOTO Activities: GPO to request HOTO Chair for list, with brief descriptions, of GOOS activities underway under the HOTO module, as the basis for prioritizing activity and investment.
12. HOTO Pilot Projects: Encourage continued design and implementation of selected HOTO Pilot Projects, and prioritizing based on potential impact (HOTO Panel).
13. HOTO Data Exchange: HOTO Panel Chair to liaise with Coastal Panel Chair to arrange data sharing and dissemination activities (T.Malone and new HOTO Chair).
14. Improving Data Management in S.E. Asia: The GPO was requested by HOTO-IV to work with S.E. Asian data centers to improve data and information management in the region (GPO).
15. HOTO Workshops: Endorse the holding of workshops on modeling and on capacity building and indicators of sustainable development (funded externally) (GPO to arrange).

16. LMR Chair to develop close liaison with GLOBEC and attend GLOBEC Plenary.

17. LMR Co-Chair: A new Co-Chair is needed for the panel. GPO to work with FAO, ICSU and GSC Chair to identify a suitable candidate.

18. LMR Module Design: Make the focus of the LMR module broad, and include the coastal seas in its design (LMR Panel).

19. LMR Implementation: LMR should complete its first draft design plan for implementation in 18 months to mesh with the development of the Coastal GOOS plan, so as to help develop overall GOOS implementation as speedily as possible. This may mean arranging LMR meetings closer together than originally planned (LMR Chair).

20. Coastal Programme: Twice yearly schedule of Panel meetings and workshops to be arranged (GPO and Panel Chair).

21. GTOS and Coastal GOOS Links: Representatives of the GTOS Coastal Panel should be invited to attend C-GOOS meetings, and vice versa, to ensure appropriate coordination and consideration of the terrestrial view (Panel Chair).

22. Coastal User Needs: At future Panel meetings, C-GOOS needs to consider specific user needs (Panel Chair).

(iii) General Module Panel issues

23. Cross-Panel Linkage: Significant cross-panel attendance is required between the Coastal, LMR and HOTO Panels (GPO and Panel Chairs).

24. Merging Module Designs: Consider merging the designs of the C-GOOS, LMR, and HOTO when the initial designs for these modules are complete (GSC).

25. Sustainability Indicators: To demonstrate the relevance and utility of observations GOOS Panels need to develop sets of synthetic and simplistic sustainability indicators to capture the essence of what scientists are measuring. Such integrative indicators are potential GOOS outputs and must be meaningful to policy makers (Panel Chairs).

26. UNEP Regional Seas Programme: More consideration needs to be given by GPO and HOTO and Coastal Panel Chairs as to how to exploit, interact with, and coordinate with the UNEP Regional Seas programme.

27. Interaction with Convention Secretariats: The GPO should interact with appropriate Convention Secretariats (including the GPA Secretariat in the Hague) to determine the information and products they require.

28. Exploiting Existing Systems: Information about existing observing systems in coastal seas must be collected and analyzed by the GPO and appropriate panels to help build a GOOS infrastructure for HOTO, LMR, and C-GOOS in coastal seas.

(iv) IGOS, GTOS, GCOS, GOSSP, J-DIMP

29. Support for IGOS: Encourage IOC Executive Council to endorse development of integrated global observing strategy linking UN agencies, CEOS and IGFA (GPO).

30. Encouraging Investment: Consider Nic Flemming's draft statement regarding the use of short to medium term economic arguments as levers to generate investment in long-term observing systems. Form an inter-sessional working group to take this forward [N. Flemming (Chair), E. Desa, I. Wainer, G. Brundrit, J. Tschirley].

31. Adequacy of Global Observing Systems: Members to make specific contributions to GCOS to help prepare the report to SBSTA and the Conference of the Parties to the Climate Convention on what critical elements are missing from ocean observing systems, or where those systems are deteriorating.

32. Move GOSSP Forward: Nominations are sought for a new Chair; GSC members should pass suggestions to the GPO.

33. The next GOSSP meeting should take place by the end of September and resources to facilitate meetings should be sought from, among others, NASA (GCOS JPO).

34. Modify J-DIMP Terms of Reference: The tasks under the J-DIMP ToRs should be modified to show what it should focus on and indicate what it should leave alone. Modifications should be submitted to J-DIMP for review and consideration, and for eventual approval by the GTOS SC and the GCOS JSTC (GPO and Chair GSC).

35. Data and Information Management Strategy for GOOS: Each GOOS technical panel should examine its data and information management requirements as one step in developing a coherent data and information management strategy for GOOS (Panel Chairs and GPO).

(v) Implementation

36. Physical Measurements for GOOS/GCOS: The GPO should draft a recommendation to the IOC Executive Council for support for the proposed co-sponsorship by IOC and WMO of a Joint Committee for Oceanography and Marine Meteorology, using the recommendation to the WMO Executive Council as a model. In due course the recommendation should be taken to the IOC Assembly and WMO Congress.

(vi) Services

37: Services/Products Bulletin: Consider the establishment of a regular, high quality GOOS products bulletin to disseminate information about, and to discuss products and to solicit feedback from users. Appoint an *ad hoc* group comprising J. Guddal (Chair), E. Desa and T. Malone, to act on this inter-sessionally. Discuss the bulletin concept at J-DIMP.

(vii) GODAE

38. Widening Involvement in GODAE: GSC recommended the formation of an inter-sessional group [E. Desa (Chair), I. Wainer and M. Fogarty] to examine opportunities for taking advantage of GODAE within the broader context of GOOS. This would include the relation to the non-physical components of GOOS, the interface between the global physical core of GODAE and regional/local models and applications, and outreach to entrain potential participants in less developed countries.

(viii) Regional Undertakings

39. Regional GOOS projects: The GPO should continue to encourage development of the existing regional GOOS projects, promote the development of regional GOOS initiatives, and encourage the transfer of techniques and experience from existing GOOS regions to others, where appropriate and requested.

(ix) Implementation Strategy

40. White Paper: Based on documents and GSC-1 discussions, Chairman to prepare brief white paper on implementation of GOOS, and circulate to GSC members.

(x) GOOS Agreements Meeting

41. GOOS Agreements Meeting: Recommend to organizing committee and to I-GOOS Officers (Chairman and Vice-Chairmen) that the proposed Agreements Meeting not be held, and that instead the existing intergovernmental machinery be used to obtain agreement via the mechanism of a Resolution presented to the IOC Assembly in 1999, which would itself constitute a GOOS Agreement. GPO and organizing committee to (i) brief the IOC Executive Council, (ii) prepare the Draft Resolution and (iii) get it out within two months to Member States and UNESCO permanent delegations to allow adequate feedback before the Assembly. GPO to request co-sponsors for written confirmation of their agreement with this new approach. GPO to thank the Organizing Committee for their efforts on behalf of I-GOOS, and to inform senior officers of I-GOOS and Organizing Committee Chairman.

42. GOOS Commitments Meeting: Recommend to organizing committee and to I-GOOS Officers that Commitments meeting be postponed until after the Agreements Resolution is passed by the IOC Assembly.

(xi) Capacity Building

43. GOOS and TEMA: Recommend to the IOC Executive Council that action be taken to integrate GOOS Capacity Building with the TEMA programme and the Regional programme of IOC (Action GPO).

44. Capacity Building Panel: A Capacity Building Panel is needed. It should be made up of 8 people including Jan Stel (present CB Panel Chair), IOC/GOOS CB Support, Allyn Clarke and Ilana Wainer. Terms of Reference are required (initially the panel should draft its own for approval by the Executive Committee) (Action GPO).

45. Regional Centers for Capacity Building: A key feature of the capacity building strategy should be the provision of local capacity building services to regional groups of developing states. An offer had been made by Australia to site such a service in Perth to attend to needs in the southeast-Asian and eastern Indian Ocean regions. The GSC asked the GPO and the IOC Executive Secretary (i) to take forward the Perth initiative, ensuring that it was coordinated effectively with other IOC/UN initiatives in the region, and (ii) to explore the possibility of setting up other regional offices, which do not necessarily have to be UNESCO facilities (an offer was received from India).

46. Capacity Building Strategy: A set of principles is required for a GOOS capacity building programme, as the core of a comprehensive GOOS capacity building strategy. Chairman, with e-mail assistance to draft the strategy.

47. Involving Industry in training: Consideration should be given to using marine service operators working off the coasts of developing countries to provide local training under GOOS auspices. Nic Flemming agreed to approach the European Association of Marine Services for advice on how to implement such activity.

48. Support from Co-Sponsors of GOOS: Work with WMO, UNEP and ICSU to coordinate, jointly plan and jointly fund capacity building efforts related to achieving GOOS goals (GPO).

(xii) GOOS Handbook

49. Action on Handbook: Recognizing that the GOOS Web page is taking the place of much of Chapters 1 and 2 of the proposed handbook, the GSC recommended using the GOOS brochure to advertise the existence of the GOOS web site as a source of information about GOOS, and the GPO as a source of hard copy where there is no Internet access. For the time being no further action is required on the Handbook. However, the GOOS Web Site must be expanded and maintained to accommodate needs that the Handbook would have filled (Action GPO).

(xiii) GOOS Review Programme

50. Review Mechanism: GPO to arrange for an external review of GOOS by representatives of operational agencies and users to take place following completion of the initial implementation plans and after the Commitments Meeting (i.e. probably in early year 2000).

(xiv) Work Plan

51. TAO Meeting: Bearing in mind that operational funds are now available for the TAO Array in the Pacific, the GPO should work with GCOS to establish the possibility of obtaining some external support for meetings of the TAO Panel.

52. 2-Year Rolling Budget: GSC endorsed a proposal for the GPO to maintain a 2-year rolling budget forecast, reviewed every 6 months, with the GPO Work Programme and Budget priortised inter-sessionally by W. Nowlin, A. McEwan and C. Summerhayes.

(xv) GOOS Contacts

53. GOOS Contacts: GPO and GSC members to develop list of GOOS contacts in all pertinent countries by August 1998.

54. National GOOS Information: GPO to approach countries for statements or updates on their national GOOS programmes; this material to be placed on the GOOS Web site.

(xvi) Next Meeting

55. The GPO is to do comparative costing on different meeting venues for decision by the Executive Committee, and is to arrange some talks on marine science and operational modeling and forecasting for the next meeting.

14. CLOSURE

The meeting closed at 17:00 on Thursday April 23, 1998.

ANNEX I

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ANNEX II

AGENDA

1. **ORGANIZATION OF THE SESSION**

   1.1 OPENING OF THE SESSION
   1.2 ADOPTION OF THE AGENDA
   1.3 WORKING ARRANGEMENTS

2. **VIEWS OF THE CHAIRMAN OF I-GOOS**

3. **REPORT BY THE DIRECTOR OF THE GPO**

4. **GOOS DESIGN ACTIVITIES**

   4.1 GENERAL GOOS DESIGN
   4.2 STATUS OF MODULE DESIGN (5 modules)
   4.3 *IN SITU* AND TIME SERIES OBSERVATIONS

5. **CO-ORDINATION WITH OTHER OBSERVING SYSTEMS**

   5.1 REPORT BY DIRECTOR OF GCOS JOINT PLANNING OFFICE
   5.2 THE JOINT DATA AND INFORMATION MANAGEMENT PANEL (J-DIMP)
   5.3 JOINT GCOS-GOOS PLANNING FOR SATELLITE OBSERVATIONS
   5.4 REPORT FROM GTOS
   5.5 STATUS OF THE INTEGRATED GLOBAL OBSERVING STRATEGY (IGOS) DEVELOPMENT AND ITS RELEVANCE TO GOOS

6. **IMPLEMENTATION ACTIVITIES**

   6.1 THE ROLE OF GSC IN GOOS IMPLEMENTATION
   6.2 AN IMPLEMENTATION PLAN FOR THE CLIMATE MODULE
   6.3 REGIONAL UNDERTAKINGS (EuroGOOS, NEAR-GOOS, MEDGOOS, WIOMAP, others?)
   6.4 GOOS PRINCIPLES OF INVOLVEMENT
   6.5 AN IMPLEMENTATION STRATEGY
   6.6 REVIEW CURRENT GOOS ELEMENTS

7. **THE FIRST GOOS AGREEMENTS MEETING**

8. **CAPACITY BUILDING**

9. **THE GOOS HANDBOOK**

10. **OTHER BUSINESS**

11. **GSC TERMS OF REFERENCE, PROGRESS REVIEW AND WORK PLAN**

    11.1 TERMS OF REFERENCE
    11.2 PERIODIC REVIEW AND ASSESSMENT
    11.3 WORK PLAN

12. **DATES AND PLACE OF NEXT GSC SESSION**

13. **ADOPTION OF THE SUMMARY REPORT**

14. **CLOSURE**

ANNEX III

LIST OF DOCUMENTS[1]

Document Code	Title	Item	Language
WORKING DOCUMENTS			
GSC-I/1 prov.	Provisional Agenda	1.2	E only
GSC-I/1 Add. Prov.	Provisional Timetable	1.3	E only
GSC-I/3 prov.	Summary Report of the Session- (To be prepared during the meeting)	-	E only
GSC-I/4 prov.	Provisional List of Documents (This document)	1.3	E only
GSC-I/5 prov.	Provisional List of Participants	-	E only
GSC-I/6 prov.	GPO Director's Report	3	E only
	Draft of The GOOS 1998	4.1	E only
	Draft GOOS Brochure	4.1	E only
	2-page Preliminary draft Report of the GOOS Coastal panel meeting (Paris, March 1998)	4.2	E only
	2-page Preliminary draft Report of the LMR panel meeting (Paris, April 1998)	4.2	E only
	2-page Preliminary draft Report of the OOPC meeting (Grasse, April 1998)	4.2	E only
	The HOTO Strategic Plan	4.2	E only
	Report of the HOTO-IV meeting (Singapore, Oct.1997)	4.2	E only
	GOOS Marine Meteorological & Oceanographic Services Panel Report (June 1997)	4.2	E only
	GCOS JSTC Report (Holland, 1997)	5.1	E only
	J-DIMP Tokyo Report (1997)	5.2	E only
	Joint IGOSS-IODE Strategy for data & Information Management for GOOS	5.2	E only
	Data Coordinator	5.2	E only
	GOSSP Report (May 1997)	5.3	E only
	CEOS Integrated Global Observing Strategy paper	5.5	E only
	G3OS Integrated Global Observing Strategy paper	5.5	E only

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

Document Code	Title	Item	Language
	G3OS Brochure	5.5	E only
	Preliminary draft report of the GOOS-GCOS workshop on implementation of global observations (Sydney, March 1998)	6.2	E only
	GODAE Status Report	6.2	E only
	First GOOS Agreements Meeting Plans	7	E only
	GOOS Capacity Building report	8	E only
	GOOS Handbook Layout	9	E only
	GOOS Actions, recommendations and Resolutions	10	E only
	GOOS Terms of Reference	11.1	E only

INFORMATION AND REFERENCE DOCUMENTS

IOC/INF-1091 (GOOS No. 41)	Strategic Plan and Principles for GOOS	-	E only
	GLOSS meeting Report (Pasadena, March 1997)	-	E only
	NOAA-IOC Workshop on socio-economic aspects of the Global Ocean Observing System: assessing benefits and costs of the climate and coastal modules (Bethesda, May 1996)	-	E only
	Report of OOPC Ocean Climate Time-Series Workshop (Baltimore, March 1997)	-	E only
	Report on *in situ* observations for the Global Observing Systems (Geneva, Sept. 1996)	-	E only
	NEAR-GOOS meeting Report, second session and operational manual (Bangkok, May 1997)	-	E only
	EuroGOOS Plan	-	E only
	Report of the EuroGOOS Projects Meeting	-	E only
	GOOS Status Report on Existing Ocean Elements and Related Systems (Apr. 1997)	-	E only
	Global Coral Reef Monitoring Network Strategic Plan	-	E only
	TAO Implementation Panel Report (Reading, Nov. 1997)	-	E only
	Report of the LMR ad hoc Panel meeting (Dartmouth, 1996)	-	E only
	Report of the GOOS Coastal workshop (Miami, Feb. 1997)	-	E only
	The US Coastal Module of the Global Ocean Observing System, Workshop Report (Dec. 1996)	-	E only

The Strategy for EuroGOOS	-	E only
The NRC Report on GOOS	-	E only
The Proceedings of the EuroGOOS Conference	-	E only
Report of the J-GOOS-IV Meeting (Miami, Apr 1997)	-	E only
Report of the I-GOOS-III Meeting (Paris, Jun 1997)	-	E only
Report of the G3OS Sponsors Meeting (Geneva, Sep. 1997)	-	E only
GTOS Draft Implementation Plan	-	E only
Draft Recommendations on GLOSS from GLOSS Implementation Plan 1997	-	E only
GOOS News No. 3	-	E only
GOOS News No. 4	-	E only
WMO Bulletin Article	-	E only

ANNEX IV

TERMS OF REFERENCE OF THE STEERING COMMITTEE FOR THE GLOBAL OCEAN OBSERVING SYSTEM

1.1 The GOOS Steering Committee shall:

(a) be responsible for all the scientific and technical aspects of GOOS design, and undertake appropriate activities to support the design process;

(b) coordinate and take responsibility for GOOS planning and provide oversight of the implementation process, on the basis of the scientific and technical design, and of intergovernmental requirements and resources as expressed through I-GOOS;

(c) provide guidance to the Director of the GOOS Secretariat in the duties to be performed by the GOOS Secretariat staff;

(d) submit reports to the sponsoring organizations and to I-GOOS at appropriate times.

1.2 Specifically, the GOOS Steering Committee will:

(a) establish subordinate bodies, as appropriate, with as far as possible the chairs being selected from among the membership of the GOOS Steering Committee;

(b) identify observational requirements ("user needs") and products in co-operation with I-GOOS; define design objectives; and recommend co-ordinated actions by the sponsoring organizations and other relevant organizations and agencies;

(c) advise the Intergovernmental Committee for GOOS (I-GOOS) on all scientific and technical aspects of GOOS as well as on resource requirements, and take into account the proposals of I-GOOS in this regard;

(d) collaborate with the steering committees of the other global observing systems (GCOS and GTOS) and with other appropriate bodies;

(e) review and assess the progressive development and implementation of the components of GOOS;

(f) identify and encourage research efforts, in close co-operation with the on-going research programmes (such as IGBP and WCRP) in order to promote studies of importance for the development of GOOS;

(g) encourage the development of new technologies needed for GOOS.

ANNEX V

POTENTIAL OBSTACLES TO PROGRESS AND REMEDIAL ACTIONS IDENTIFIED BY I-GOOS

(from Chairman of I-GOOS)

Obstacle	Action
* perceived irrelevance to national priorities.	• carefully targeted, realistic cost-benefit studies; • prioritize deliverables focussed on national need; • encourage regional programmes; • identify real capacity-raising components.
* concern at ongoing commitment to a 'permanent' system.	• build design not critically dependent on permanency; • built-in robustness; • accept and encourage incremental development.
* invisibility.	• good promotional material; • use UNESCO (and other - FAO, WMO) networks.
* dispersion of responsible national contacts, agencies, ministries.	• encourage national committees and contact points; • generate usable specialist product material and prospectuses; • target reluctant countries.
* low resources at agency level.	• encourage adaptation of existing systems; • target practicing scientists to participate in GOOS activity.
* agency indifference.	• make systems and products that are targeted to core business of national agencies.
* poor acceptance of globalized framework for local effort.	• focus on benefits of standardization, rationalization; • provide positive incentives linked to participation (e.g. products).
* absence of national infrastructure in particular observations.	• use regional alliances to createlocalizedd proto-GOOS activity; • define GOOS capacity raising projects.
* lack of commercial, industrial interest.	• create purpose-specific projects; address industry specific needs (e.g. insurance, mariculture); • seek direct industry sponsorship.

ANNEX VI

RECOMMENDATION ON NEW SEA- LEVEL GROUP

Noting

(i) The outcome and recommendations of the OOPC/CLIVAR Sea-Level Workshop and, in particular, the enhanced interactions between GLOSS and scientific panels of the climate observing systems (represented by OOPC and CLIVAR UOP);

(ii) The functions and terms of reference of the present GLOSS Group of Experts and, in particular, their dual role in implementation and scientific oversight;

(iii) The outcomes of the Sydney Implementation Workshop and, in particular, the recommendation to create a joint body over-seeing implementation of the ocean observing system for climate (the so-called JCOMM) and the recommendation to include a Sea-Level Programme (see attached schematic); and

(iv) The emergence of requirements and dependencies on sea-level data from the non-climate modules of GOOS.

Recommend

The establishment of a Sea-Level Working Group, co-sponsored by GCOS/GOOS through both the JCOM and the GSC (via OOPC) and by the WCRP through its CLIVAR (UOP), with terms of reference to:

(i) Provide scientific guidance to the Sea-Level Programme on the technical and practical implementation of the sea-level elements relevant to GOOS, including those of the ocean observing system for climate (of GCOS/GOOS via OOPC) and the sustained climate observing system of CLIVAR (via the UOP) [hereafter the observing system];

(ii) Evaluate the effectiveness and efficiency of the sea-level network with respect to the goals of the observing system, and provide the appropriate feedback and advise to the relevant scientific panels (e.g. OOPC, UOP);

(iii) Provide advice and guidance to groups involved in the management of sea-level data;

(iv) Update, at appropriate intervals, in collaboration with the GLOSS (GE) and other participants in the sea-level Sub-Programme the Implementation Plan;

(v) Provide regular reports, in collaboration with GLOSS, to JCOMM and to the GSC (via the OOPC).

The GSC will, at the appropriate time, consider mandating responsibility for other the coastal sea-level (non-global) elements to the SLWG.

The IAPSO Commission for Mean Sea-Level and Tides will be invited to consider joining the SLWG.

In accordance with the conclusions of the Sydney meeting, the GLOSS-GE would become the core implementation body for the Sea-Level Programme, with appropriate representation on the JCOMM.

Resources

The intention is to keep the impact of the new structure to net zero; this can be achieved if (a) GLOSS-GE met somewhat less frequently, though it is not obvious this is appropriate at this time, and (b) if the informal offers of interested research agencies and others are exploited to provide the bulk of the support for the SLWG.

ANNEX VII

LIST OF ACRONYMS

ACSYS	Arctic Climate System Study of WCRP
ADCP	Acoustic Doppler Current Profile
AMAP	Arctic Monitoring and Assessment Programme
AOPC	Atmospheric Observing Panel for Climate
C-GOOS	Coastal Panel of GOOS
CALCOFI	California Cooperative Ocean Fisheries Investigations
CARICOMP	Caribbean Coastal Marine Productivity
CASI	Compact Airborne Spectrographic Imaging
CB	Capacity Building
CEOS	Committee for Earth Observation Satellites
CGMS	Coordinating Group on Meteorological Satellites
CLIVAR	Climate Variability Research Programme
CMM	Commission for Marine Meteorology
CNES	Centre National d'Etudes Spatiales (France)
CPR	Continuous Plankton Recorder Programme
CSD	Commission on Sustainable Development
CTD	Conductivity, Temperature, Depth Instrument
DBCP	Data Buoy Co-operation Panel
EC	European Commission
ENSO	El Niño Southern Oscillation
ESA	European Space Agency
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EuroGOOS	European GOOS
FAO	Food and Agricultural Organization
FCCC	Framework Convention on Climate Change
FGGE	First Global Geophysical Experiment
G3OS	Global Observing Systems (GOOS, GCOS & GTOS)
GCOS	Global Climate Observing System
GCRMN	Global Coral Reef Monitoring Network
GIPME	Global Investigation of Pollution in the Marine Environment
GLOBEC	Global Ocean Ecosystem Experiment
GLOSS	Global Sea-Level Observing System
GLOSS-GE	Global Sea-Level Observing System - Group of Experts
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
GOOS-IOS	GOOS Initial Observing System
GOSSP	Global Observing Systems Space Panel
GPA	Global Plan of Action
GPO	GOOS Project Office
GSC	GOOS Steering Committee
GSST	GODAE Scientific Steering Team
GTNET	Global Terrestrial Observing Network
GTOS	Global Terrestrial Observing System
GTSPP	Global Temperature and Salinity Profile Programme
HELCOM	Helsinki Commission
HOTO	Health of the Oceans
I-GOOS	Intergovernmental Committee for GOOS
IAEA	International Atomic Energy Agency
IC	Information Centre
ICES	International Council for the Exploration of the Sea
ICSU	International Council for Science
IGBP	International Geosphere-Biosphere Programme
IGFA	International Group of Funding Agencies (for Global Change Research)
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System
IHDP	International Human Development Programme

IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange Programme
IPCC	Intergovernmental Panel on Climate Change
J-DIMP	Joint GOOS, GCOS, GTOS Data and Information Management Panel
J-GOOS	Joint Scientific and Technical Committee for GOOS
JAMSTEC	Japan Marine Science and Technology Centre
JCOMM	Joint Commission for Oceanography and Marine Meteorology
JGOFS	Joint Global Ocean Flux Study
JMA	Japanese Meteorological Agency
JODC	Japanese Oceanographic Data Centre
JSTC	Joint Scientific and Technical Committee
LIDAR	Laser Radar (Light Detection and Ranging)
LME	Large Marine Ecosystem
LMR	Living Marine Resources
LOICZ	Land-Ocean Interactions in the Coastal Zone
LTER	Long-Term Ecosystem Research Programme
MARPOLMON	Marine Pollution Monitoring System
MEDGOOS	Mediterranean GOOS
NAML	North American Marine Laboratories Network
NASA	National Aeronautical & Space Agency
NATO	North Atlantic Treaty Organization
NEAR-GOOS	North-East Asian Regional GOOS
NGO	Non-governmental Organization
NOAA	National Oceanic and Atmospheric Administration (USA)
NOWPAP	Northwest Pacific Action Plan
OOPC	Ocean Observing Panel for Climate
OOSDP	Ocean Observing System Development Panel
OSPARCOM	Oslo and Paris Commission
PICES	North Pacific Marine Science Organization
PIRATA	Pilot Research Array in the Tropical Atlantic
SBSTA	Subsidiary Body for Scientific and Technical Advice
SCOR	Scientific Committee on Oceanic Research
SEA-GOOS	Southeast Asian GOOS
SOOP-IP	Ship-of-Opportunity Programme Implementation Panel
SSC	Strategy Sub-Committee (of I-GOOS)
SST	Sea Surface Temperature
STA	Science and Technology Agency (Japan)
START	System for Analysis, Research and Training
TAO	Tropical Atmosphere Ocean (buoy array)
TEMA	Training, Education and Mutual Awareness Programme
TEMS	Terrestrial Ecosystem Monitoring Site
TOGA	Tropical Ocean and Global Atmosphere
TOPC	Terrestrial Observing Panel for Climate
ToRs	Terms of Reference
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VOS	Voluntary Observing Ship
WCRP	World Climate Research Programme
WESTPAC	IOC Sub-Commission for the Western Pacific
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WWW	World Weather Watch

In this Series, entitled

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

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

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82. Second Meeting of the UNEP-IOC-ASPEI Global Task Team on the Implications of climate Change on Coral Reefs
83. Seventh Session of the JSC Ocean Observing System Development Panel
84. Fourth Session of the IODE Group of Experts on Marine Information Management
85. Sixth Session of the IOC Editorial Board for the International Bathymetric chart of the Mediterranean and its Geological/Geophysical Series
86. Fourth Session of the Joint IOC-JGOFS Panel on Carbon Dioxide
87. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific
88. Eighth Session of the JSC Ocean Observing System Development Panel
89. Ninth Session of the JSC Ocean Observing System Development Panel
90. Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
91. First Session of the IOC-FAO Group of Experts on OSLR for the IOCINCWIO Region
92. Fifth Session of the Joint IOC-JGOFS CO_2 Advisory Panel Meeting
93. Tenth Session of the JSC Ocean Observing System Development Panel
94. First Session of the Joint CMM-IGOSS-IODE Sub-group on Ocean Satellites and Remote Sensing
95. Third Session of the IOC Editorial Board for the International Chart of the Western Indian Ocean
96. Fourth Session of the IOC Group of Experts on the Global Sea Level Observing System
97. Joint Meeting of GEMSI and GEEP Core Groups
98. First Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
99. Second International Meeting of Scientific and Technical Experts on Climate Change and the Oceans
100. First Meeting of the Officers of the Editorial Board for the International Bathymetric Chart of the Western Pacific
101. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
102. Second Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
103. Fifteenth Session of the Joint IOC-IHO Committee for the General Bathymetric Chart of the Oceans
104. Fifth Session of the IOC Consultative Group on Ocean Mapping
105. Fifth Session of the IODE Group of Experts on Marine Information Management
106. IOC-NOAA *Ad hoc* Consultation on Marine Biodiversity
107. Sixth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
108. Third Session of the Health of the Oceans (HOTO) Panel of the Joint Scientific and Technical Committee for GLOSS
109. Second Session of the Strategy Subcommittee (SSC) of the IOC-WMO-UNEP Intergovernmental Committee for the Global Ocean Observing System
110. Third Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
111. First Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate
112. Sixth Session of the Joint IOC-JGOFS CO_2 Advisory Panel Meeting
113. First Meeting of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GLOSS)
114. Eighth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño" ***(Spanish only)***
115. Second Session of the IOC Editorial Board of the International Bathymetric Chart of the Central Eastern Atlantic ***(Also printed in French)***
116. Tenth Session of the Joint IOC-IHO General Bathymetric Chart of the Oceans (GEBCO)
117. IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Fifth Session, USA, 1997
118. Joint Scientific Technical Committee for Global Ocean Observing System (J-GOOS), Fourth Session, USA, 1997
119. First Session of the Joint IOC-WMO IGOSS Ship-of-Opportunity Programme Implementation Panel, South Africa, 1997
120. Report of Ocean Climate Time-Series Workshop, Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate, USA, 1997
121. IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS), Second Session, Thailand, 1997
122. First Session of the IOC-IUCN-NOAA *Ad hoc* Consultative Meeting on Large Marine Ecosystems (LME), France, 1997
123. Second Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), South Africa, 1997
124. Sixth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico ***(also printed in Spanish)***
125. Seventh Session of the IODE Group of Experts on Technical Aspects of Data Exchange
126. IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), First Session
127. Second Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME)
128. Sixth Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1997
129. Sixth Session of the Tropical Atmosphere - Ocean Array (TAO) Implementation Panel
130. First Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS)