

G GLOBAL
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WORLD METEOROLOGICAL
ORGANIZATION

INTERGOVERNMENTAL
OCEANOGRAPHIC COMMISSION

**REPORT OF THE THIRD SESSION OF THE
JOINT SCIENTIFIC & TECHNICAL COMMITTEE**

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TABLE OF CONTENTS

1.	ORGANIZATION OF THE SESSION	1
	1.1 Opening of the Meeting	1
	1.2 Approval of the Agenda	1
	1.3 Conduct of the Meeting	1
2.	REPORT OF THE CHAIRMAN	2
3.	INVITED REPORTS	3
	3.1 Reports from Sponsoring Organizations	3
	3.2 National Activity Updates	4
4.	CONSIDERATION OF THE GCOS PLAN.	4
	4.1 Review of the Comments Received	4
	4.2 Discussion	5
5.	OUTCOME OF THE IGM-WCP	5
	5.1 Relevance for GCOS	6
	5.2 Integrated Proposal	6
6.	GCOS IMPLEMENTATION ISSUES	6
	6.1 Action Plan	6
	6.2 The ENSO Proposal	11
	6.3 Space-based Observations	11
	6.4 Data Issues	11
	6.5 External Co-ordination	12
7.	OTHER BUSINESS	13
	7.1 Intersessional Activities	13
	7.2 Arrangements for JSTC-IV	13
8.	CLOSURE	13
9.	IN CAMERA SESSION.	13

ANNEXES:	I. List of Participants	
	II. Agenda	
	III. National Activity Updates	
	IV. Action Plan for the Global Climate Observing System	
	V. Terms of Reference of GCOS Panels and Task Groups	
	VI. GOOS Climate Implementation Panel	
	VII. JSTC Statement on Ocean Implementation	

REPORT OF JSTC-III

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Meeting

1.1.1 Sir John Houghton, Chairman of the Joint Scientific and Technical Committee (JSTC) for the Global Climate Observing System (GCOS), opened the Third Session of the JSTC at the Cosener's House in Abingdon, U.K. on November 1, 1993 at 9:00 am and welcomed everyone present. Twelve of the members of the JSTC were in attendance; two of those absent had designated representatives. The four sponsoring organizations were also represented. Several invited guests and visitors were in the audience. For the attendance list, see Annex I.

1.1.2 The Chairman thanked the Rutherford Appleton Laboratory for its assistance in arranging the meeting, and for providing staff to assist with meeting activities.

1.2 Approval of the Agenda

1.2.1 The proposed agenda was discussed and approved with only slight modifications to the order. The Report of the Chairman was deferred until the afternoon to accommodate additional invited guests. See Annex II.

1.2.2 Although not explicitly included in the agenda, a special session of the JSTC members and sponsors was held in camera to discuss organizational and related business of the Committee. This session is discussed in Section 9.

1.3 Conduct of the Meeting

1.3.1 In his opening remarks, the Chairman noted that the development of GCOS to date has been difficult since the programme is so complex and interconnected. He reminded the audience that GCOS was addressing, in an end-to-end fashion, the data essential to the climate community, including modellers. He expected that this meeting would focus on **practical** items and actions which would advance the programme. In this context, he highlighted the key agenda items for the meeting: the discussion of the **Draft Plan**, and the consideration of activities for the next intersessional period.

1.3.2 The Director, Joint Planning Office (JPO), provided an overview of the documentation tabled for the meeting. He reiterated the need for consideration and reaction to the comments on the **Draft Plan**, and for recommendations for action to be taken during the next phase of GCOS planning. For these items, he proposed that several working groups

could be established during the meeting to develop particular agenda items which would be considered in plenary session.

2. REPORT OF THE CHAIRMAN

2.1 The Chairman presented his report to the members and invited guests. He reviewed the sequence of events which led to the establishment of the GCOS and described the current situation with regard to GCOS planning. He briefly reviewed the steps that led to the preparation of the *Draft Plan* for GCOS, and pointed out the essential next steps were to identify the components of the Initial Operational System (IOS), and to develop plans specifically for the GCOS data system and the GCOS space-based observations. He noted that the Plan had been widely reviewed, and urged the JSTC members to provide the necessary input to further refine GCOS to enable governments to consider providing national support for its implementation.

2.2 A general discussion followed the report. Many provocative questions were raised by the audience and sparked a fruitful discussion. Examples of some specific questions and comments follow:

Question: How are priority actions for GCOS identified and selected?

Comment: The JSTC must be presented with appropriate information, and should determine the priority among the various disciplines.

Question: How are user requirements identified?

Comment: User communities are being approached and invited to describe data currently in use, and their future requirements.

Question: What mechanisms are being considered to obtain national support for GCOS? Should an intergovernmental board be established for GCOS resources?

Comment: An intergovernmental board should be established. The Integrated Proposal for the World Climate Programme may be a vehicle for such a proposition.

Question: What methods will GCOS employ to address data gaps and data provision in developing countries? How will GCOS assist developing countries to go forward?

Comment: GCOS may be able to assist countries with proposals by indicating that the proposals are consistent with global climate observational objectives. GCOS may recommend some enhancements to observing systems for international co-operation. GCOS could develop a data system which is responsive to developing country needs.

Question: How will the Integrated Proposal for Climate, requested by countries at the Intergovernmental Meeting on the World Climate Programme (IGM-WCP), be developed?

Comment: The structure for developing the proposal calls for the participation of the Co-ordinating Committee on the World Climate Programme and an advisory panel of government representatives. The proposal will follow the thrusts outlined at the IGM-WCP.

Question: How will GCOS co-ordinate with related activities such as the Global Ocean Observing System (GOOS), the Global Terrestrial Observing System (GTOS) , the Committee on Earth Observation Satellites (CEOS), etc.?

Comment: Co-ordination is now occurring through close contact among the various programmes. Although the responsibility for the climate components rests with GCOS, the design of the appropriate observing systems, and implementation of components must be an iterative and continuing co-operative process with other programmes.

3. INVITED REPORTS

3.1 Reuorts from Sponsoring Organizations

3.1.1 The World Meteorological Organization (**WMO**) was represented by the Director of the World Weather Watch (**WWW**) Department, Dr. Rasmussen, and the Atmospheric Research and Environment Programme (**AREP**) Department, Dr. Delsol. The WWW Director noted that the Organization was pleased to serve as the host for the Joint Planning Office and that it looked forward to co-operation in the development of the GCOS. He noted that there were many organizational elements in WMO that were considering their roles in the implementation of the GCOS, and were interested to contribute actively. He suggested that it was timely for specific relationships between elements of WMO and GCOS to be developed. The members expressed appreciation for the support indicated by the WMO representatives from the Secretariat, from the Technical Commissions and working groups who were in attendance.

3.1.2 The Intergovernmental Oceanographic Commission (**IOC**) was represented by the Director of the GOOS Support Office, Dr. **Scherer**, and by the Chairman of the Intergovernmental Committee for GOOS (I-GOOS), Dr. Glass. The Director of the Support Office reported that the Memorandum of Understanding among the sponsors of the GOOS had been agreed. The I-GOOS is to be sponsored by IOC, WMO, and UNEP; the scientific and technical committee for GOOS, the J-GOOS, will additionally be sponsored by ICSU. Membership of this latter group and several other panels were being established. The responsibility of these groups will be to plan and develop the system. The Director stressed the close interaction between GCOS and GOOS in developing their "common part", the climate component for the ocean. He also emphasized that the global observing systems

would have to present a common case to governments, since resources are very limited. On a related topic, he noted that a recent OECD Megascience Forum Expert Meeting in Japan highlighted the role of GOOS in ocean observations.

3.1.3 The United Nations Environment Programme (UNEP) representative, Mr. Alusa, reviewed recent changes in UNEP related to the development of the Global Terrestrial Observing System (GTOS). An initial meeting, scheduled for December, would initiate the GTOS planning. He also discussed the financial situation with UNEP, and in particular, the future support of the climate activities. The UNEP Governing Council expects future activities to be proposed in a co-ordinated budget, and expects assistance from external sources such as the Global Environmental Fund (GEF). However, he reiterated that UNEP remains supportive of the activities of GCOS, particularly since GCOS will contribute important data to meet the requirements of the World Climate Impact Assessment and Response Strategies Programme (WCIRP).

3.1.4 The representatives of the International Council of Scientific Unions (ICSU) were Drs. Townshend and Anderson. Dr. Townshend cited the progress made in the definition of GCOS to date. He noted, in particular, the clarification of the roles of GCOS vis-a-vis ICSU programmes, and urged a continuing close collaboration and specification. With regard to the Committee on Earth Observation Satellites (CEOS), he suggested that co-ordination among the various user communities and affiliates was essential. He noted that components of the International Geosphere-Biosphere Programme (IGBP), such as the Biospheric Aspects of the Hydrological Cycle (BAHC), would help specify requirements for the observing systems. Finally, noting that terrestrial and ecosystem views are not well represented on the JSTC, he suggested that the membership be broadened to include better representation of these communities.

3.2 National Activity Updates

3.2.1 The Chairman noted that the national responses to the GCOS were not progressing very effectively. He noted that in the United Kingdom, for example, there were many agencies expressing interest, but there was no single point of responsibility. Similar problems seemed to be present in many countries. The Chairman noted that it is very important for GCOS that there be proper co-ordination at national level between all the agencies involved in GCOS support. The formation of national GCOS committees is an important way of developing the required co-ordination. Members of the JSTC and others present at the meeting were urged to take whatever action they could in their own countries to ensure that appropriate national structures are put in place.

3.2.2 The Chairman invited brief statements on recent national activities from the members and others present at the meeting. These statements are summarized in Annex III.

4. CONSIDERATION OF THE GCOS PLAN

4.1 Review of the Comments Received

4.1.1 The Director, JPO, reviewed the documents prepared for the meeting concerning the *Draft Plan*. The Plan was distributed at the IGM-WCP to all attendees. Subsequently about 400 copies were distributed to individuals and agencies with a request for comment, particularly with regard to the scientific issues and the recommendations made in the Plan. Over **60** comments were received and were summarized in documents for the meeting. The Director noted that comments were of **several** types: (1) those addressing the general concepts of the GCOS; (2) those addressing general issues discussed in the Plan document; (3) those raising specific technical issues; and (4) those of an editorial nature. The last were incorporated as appropriate in a revised draft made available at the meeting. The comments addressing specific technical points were shared with the leaders of the respective working groups from JSTC-II who were requested to respond to the comments from the reviewers.

4.2 Discussion

4.2.1 The first two categories included several key issues which were discussed at some length in the plenary session. The comments were helpful in providing a broad range of opinion and input to guide the revision of the Plan. After the very useful discussion, the Chairman summarized the central points which had been raised. The recommended changes include:

The addition of an “Executive Summary”,

A more discursive “Preface” stating the purpose of the document, and noting progress made to date in the development of the GCOS,

More emphasis on the “deliverables” and a description of the added value of GCOS,

A clearer presentation of what the GCOS is, what it is not, and what it has to offer,

A description of how research activities **will** transition to operational programmes, noting in particular the relationship to WCRP and IGBP,

A better definition of the Initial Operational System (**IOS**),

Additional emphasis on economic issues, the resources needed, and the cost/benefit ratio,

The addition of a concluding summary.

4.2.2 After further discussion, it was resolved that the comments and revisions would be incorporated into a revised version early in 1994, circulated to the JSTC for comments, and published in the spring of 1994.

5. OUTCOME OF THE IGM-WCP

5.1 Relevance for GCOS

5.1.1 A brief review of the Intergovernmental Meeting on the World Climate Programme (IGM-WCP), "The Climate Agenda" was provided to the members. The meeting, sponsored by WMO, UNEP, IOC, ICSU, and other organizations, was chaired by Sir John Houghton. It was recalled that the *Draft Plan* for GCOS was prepared and tabled for this meeting as recommended at JSTC-II.

5.1.2 The final report of the meeting was distributed and the outcome briefly reviewed. It was noted that there were many supportive comments concerning GCOS at the meeting. In particular, the Statement of the Meeting called for nations to provide support for the development of GCOS, and further recommended that nations should align their climate observational activities to comply with the evolving GCOS plans. However supportive the statements, the IGM-WCP did not address the needs for new resources for programmes such as GCOS. Rather, several countries expressed the need for a comprehensive proposal which would integrate the various components of the World Climate Programme (**WCP**) and associated programmes such as GCOS.

5.2 Inteegrated Proposal

5.2.1 As noted above, some countries attending the IGM-WCP requested that an integrated proposal be prepared to permit governments to better understand the co-ordination and the fiscal requirements of the WCP and associated programmes. The Members were informed of the sequence of steps that had been taken to develop the integrated proposal. The overall guidance in the preparation of the proposal is to come from the Co-ordinating Committee of the World Climate Programme (CCWCP). This committee, composed of representatives of the sponsoring organizations and managers of the various components of the WCP, will meet to consider the contents of the proposal. Additionally, an Advisory Panel will be nominated by the sponsoring organizations to provide external advice.

5.2.2 The CCWCP has suggested that the basic structure of the proposal be patterned after Document 4 of the IGM-WCP, entitled "Future Directions: the Response to UNCED". This document highlighted four thrusts, one of which, "Dedicated observations of the climate system (GCOS)" focused on GCOS. Since observations are fundamental to the other three thrusts as well, the GCOS section will be an important component of the integrated proposal. The Members of the JSTC were invited to participate in the preparation and review of specific components of the integrated proposal as appropriate.

6. GCOS IMPLEMENTATION ISSUES

6.1 Action Plan

6.1.1 One of the principal agenda items of the meeting concerned the action plan for which several documents were tabled. One particular document (Annex IV) proposed several steps to refine observational requirements, assess the current capability to meet them, and recommend appropriate actions to be taken. To proceed, a number of suggestions were made. First, that a few disciplinary oriented panels and cross-cutting task groups be established, Second, that the Initial Operational System should be defined in more detail. Finally, that a series of scientific/technical reports and manuals should be prepared.

Disciplinary oriented panels

6.1.2 In order to refine observational requirements and to make recommendations to JSTC, disciplinary oriented panels were recommended for the atmosphere and the land surface. It was observed that discipline-oriented panels, such as the Ocean Observation System Development Panel (OOSDP), had performed a significant service in defining the ocean requirements for climate. The members agreed that similar panels could perform a key role in defining the atmospheric and terrestrial components for the GCOS. However, members of the JSTC wanted to know if the panels would serve as liaison, or if they would address implementation issues. The members felt that the panels should assume the responsibility for developing those documents which are perceived to be necessary to justify any panel recommendations. After considerable discussion, it was agreed that the JSTC would benefit from the efforts of panels for atmospheric and for terrestrial observations. With regard to the ocean, it was recommended that a follow-on panel be established, in co-operation with GOOS, to succeed the OOSDP when it concludes its work at the end of 1994.

6.1.3 The Chairman invited small *ad hoc* working groups to consider appropriate terms of reference, work plan, and membership for the panels. He invited Dr. Bengtsson to chair the working group for atmospheric observations and Dr. Norse to chair the working group for terrestrial observations. Since the OOSDP plans to complete its work at the end of 1994, consideration of a follow-on panel for oceanography was deferred until the next JSTC meeting. It was recommended that this panel would be jointly sponsored by GCOS and GOOS. However, an *ad hoc* group was invited to consider implementation issues for oceanographic observations related to climate. Dr. **Scherer** agreed to chair the discussion on that topic. The needs for input concerning cryospheric observations was also pointed out. In response, Drs. Meincke and **Rapley** were asked to consider the issue.

6.1.4 After the working groups met, they reported their recommendations to the plenary session. For those for which panels, task groups, or working groups were recommended, terms of reference, work plan, and chairman are included in Annex V.

6.1.5 On behalf of the atmospheric working group, Dr. Bengtsson provided draft terms of reference and a work plan for the Atmospheric Observation Panel. The subsequent discussion refocused attention on the overall plan for GCOS, since the terms of reference for the Panel cited the GCOS plan, still under development. Concern was also expressed about

the prominence of prediction as an objective for GCOS, and the degree to which requirements for detection were to be considered. It was stressed that, to be effective, membership in the Panel should include representatives of the appropriate operational agencies and of WMO programmes such as WWW and GAW. In particular, the Panel should include members of the Commission for Basic Systems (CBS) since CBS will be one of the instruments to implement GCOS recommendations. After further discussion on the scope of the Panel, the JSTC members agreed to establish the Panel, and to accept the terms of reference provisionally, subject to more precise definition at the first meeting of the Panel.

6.1.6 On behalf of the terrestrial working group, Dr. Townshend provided draft terms of reference and a work plan for the Terrestrial Observation Panel. This Panel was recommended to be a joint venture with the Global Terrestrial Observing System (GTOS). It was suggested that the Director, JPO deliver the provisional terms of reference to the first meeting of the Planning Group for GTOS in December and request their input and participation. [Note: The Planning Group for GTOS accepted the offer to participate, accepted the provisional terms of reference, and nominated three of their members as candidates for the Panel]

6.1.7 Dr. **Scherer** presented the results of the group which discussed oceanographic issues. Since there is already a panel addressing the design of an ocean system for climate (OOSDP), the working group focused on implementation issues. As a result, it did not specifically propose a GCOS body be established at this time. Rather, the working group proposed a panel which would address the implementation of ocean observations for climate, and would interpret design priorities from the various modules for implementation via the Intergovernmental Committee for GOOS (I-GOOS). For the climate module, these priorities would be based on a joint design provided by GOOS and GCOS. The resulting document has been included (Annex VI) entitled "GOOS Climate Implementation Panel". It should be tabled for discussion at the I-GOOS meeting in April 1994.

6.1.8 The report of this working group stimulated an important discussion concerning the roles of GCOS and GOOS with regard to the development of a common climate component for the ocean. Since the IOC has established an intergovernmental body, the I-GOOS, to consider the implementation of the various ocean modules of GOOS, it is appropriate that GCOS utilize it, to the extent possible, for the implementation of the oceanographic component for climate. As a result of the discussion, a statement was prepared summarizing the current position (See Annex VII).

6.1.9 With respect to follow-on activity after the present OOSDP comes to an end, it was decided that new terms of reference, focused more on implementation and assessment, would be needed. Also, both GCOS and GOOS should establish the follow-on panel. The JSTC agreed to consider it at JSTC-IV, and recommended that the issue be considered at the appropriate meetings of GOOS bodies.

6.1.10 On behalf of the small working group considering cryospheric issues, Dr. Rapley reported that a special group might be appropriate in the future to consider the requirements for observations of land ice for climate purposes. However, while such a group is under consideration, Dr. Rapley volunteered to conduct a preliminary review of related activities and to identify areas which might benefit from co-ordination via GCOS. It was

noted that the JPO invited the OOSDP to consider the requirements for sea-ice observations. As a result of the discussions about cryospheric observations, the JSTC supported their inclusion as an integral component of the GCOS. It was agreed that GCOS include observations of both land and sea ice in its plans.

Cross-cutting task groups

6.1.11 Two important cross-cutting activities were identified -- space-based observations and data management. In the action plan, a proposal to establish task groups to develop an initial draft plan for these two activities was proposed. It was anticipated that the plan would outline the need for, and the role of, a standing panel to continue the development of these areas for GCOS. The Chairman invited Dr. Ryder to chair a working group on space-based observations, and Dr. Withee to chair one on data issues. Action on these issues is described under agenda items 6.3 and 6.4 respectively.

6.1.12 On behalf of the working group on space-based observations, Dr. Ryder proposed a Space-based Observation Task Group to consider space components of GCOS. The terms of reference and work plan for the Task Group are included in Annex V. The Task Group would be closely linked with other ongoing and planned activities, particularly with the Committee on Earth Observation Satellites (CEOS) and other affiliates of CEOS. It was noted that GCOS had contributed information to the CEOS Dossier, but further refinement of requirements was deemed to be necessary. The Task Group should also consider instrument integration and ground segment needs. The members expressed strong support for the Task Groups. The Director of EUMETSAT, noting the key role of his organization in linking users and providers of space-based data, offered the use of EUMETSAT facilities in **Darmstadt** for the meeting of the Task Group. It will be scheduled in the spring of 1994 and should provide a draft plan for consideration at JSTC-IV, and for presentation to the CEOS Plenary immediately following the JSTC-IV meeting.

6.1.13 Dr. Withee presented the results of the working group on data management and proposed a Data Management Task Group to develop a draft plan for the data system for GCOS. It was pointed out that data issues are central to the success of GCOS, and that a comprehensive plan must be prepared, most likely in stages. The large number of issues to be addressed were clearly indicated in the terms of reference and the scope of work for the Task Group. It was recommended that the Task Group focus on functions required to be performed, rather than requirements of users. As with the Space-based Observation Task Group, part of the effort should be to provide recommendations for a standing panel to continue the development of a data system. After considerable discussion, the members recommended that the Task Group be established with the terms of reference as given in Annex V.

6.1.14 During discussions under agenda items 2 and 3, several people commented that socioeconomic benefits likely to follow from the GCOS should be evaluated, and that future plans and documents reflect these potential benefits. It was pointed out that this issue is not being addressed by other bodies, and could be of considerable value for the future of GCOS. Consequently, an additional group was proposed and invited to consider socioeconomic issues. Dr. Briscoe was asked to chair the discussion. In the subsequent plenary session, he reported that the group had developed terms of reference and a work plan for a Working

Group on Socioeconomic Benefits of GCOS. The specific focus would be on those benefits which result from observations through their impact on climate prediction. The group would consider studies already completed, and make recommendations concerning opportunities for future studies. Dr. Briscoe observed that at a recent megascience forum meeting of the Organisation for Economic Co-operation and Development (OECD), interest was shown in participating in developing studies on economic benefits. It was suggested that OECD be invited to participate in the work of the Working Group. Further, it was noted that current discussions on the climate convention could be of use to GCOS.

6.1.15 It was noted that the terms of reference of the various groups linked their work to the overall GCOS plan, which is still under review and development. Since several activities are proceeding in parallel, it is apparent that the work will require close coordination among the various GCOS bodies. In addition, the ICSU representative, noting the already large number of existing bodies in related organizations, suggested that there would have to be careful coordination as well between GCOS panels and existing organizations. The Committee agreed, and in particular, noted that it will be essential that if influential groups such as the Committee on Earth Observations Satellites (CEOS) is approached by the JSTC of GCOS or panels acting on its behalf, very careful coordination will be necessary, particularly with scientific programmes such as the WCRP and IGBP which are also formally represented as affiliate members of CEOS. In conclusion, the members called upon the Director, JPO to review the terms of reference, develop a consistent format, and considering budget and timetable, establish a schedule for 1994 meetings, and ensure proper coordination.

Initial Operational System

6.1.16 With regard to the Initial Operational System (IOS), the Action Plan recommended that consultants and experts be employed to assess the current systems and to develop recommendations for candidate components of the **IOS**. The Plan further recommended that, where possible, experts should be invited to develop documents regarding the **IOS** for upcoming meetings. The Director, JPO noted that specific individuals have been identified as experts for the Atmospheric and Terrestrial Observation Panels, and for the Space-based, and Data System Task Groups.

Documents

6.1.17 The Action Plan identified a number of documents which should be prepared as the planning process continues. A series of reports was proposed to address the data requirements for climate change detection and global climate models. The members agreed that these reports would be helpful. Additionally, the plan recommended the preparation of a series of manuals which would be developed to describe, for a specific parameter, the uses and value of the data, the present observing methods, and the future approach to its measurement. At this time, the members felt that a "fact sheet" might be an adequate start with further details to be provided in the future.

6.2 The ENSO Proposal

6.2.1 At JSTC-II, the El Nino Southern Oscillation (**ENSO**) phenomena was discussed. As a result of its importance for seasonal and interannual variability, ENSO was given a high priority for the GCOS. The Tropical Ocean Global Atmosphere (TOGA) programme of the World Climate Research Programme (**WCRP**), which has pioneered much of the recent work in predicting ENSO phenomena, ends in December 1994. Since the observing systems for TOGA are making contributions, not only to the research activity, but also to the quasi-operational forecasting of El Nino, some components of these systems should be continued under the GCOS aegis.

6.2.2 A draft document describing the operational system needed for seasonal and interannual prediction was presented by Dr. Merle. The document had been prepared in consultation with the scientific community, experts engaged in developing models of the ENSO phenomena, and operational agency representatives. In the subsequent discussion, it was agreed that the document could be more terse, and would be improved by the inclusion of an additional section on the resource implication and cost-efficiency of the observing system. During the subsequent discussion a revised outline was proposed, and Dr. Anderson was invited to assist in improving the document. Since the recommendations in the draft address principally oceanographic observations, it was recommended that the resulting document should be a joint GCOS/GOOS publication.

6.3 Space-based Observations

6.3.1 It is acknowledged that space-based observations will be critical components of the GCOS. As a result, several documents were prepared for the members. The Director, JPO, reported that GCOS had provided input for the Affiliates Dossier for the upcoming CEOS Plenary Meeting which he will attend. He noted that the input is still in a preliminary stage, and requires further refinement and elaboration. An additional document prepared by Dr. Croom was introduced. These documents will be updated and provided as working papers to the Task Group. (See Section 6.1.11)

6.4 Data Issues

6.4.1 From the outset of planning for the GCOS, a comprehensive data system has been identified as a critical element for **the GCOS. The Draft Plan** for GCOS included a brief chapter on the data management issues on which further planning may be based. The members recommended that the Task Group on Data Systems be established. During discussion, the WWW Department Director offered the services of a staff expert to assist in producing initial documents for the Task Group meeting. Using these and other materials, the Data System Task Group should develop a draft data plan. Mr. Vent-Schmidt, Chairman of the German GCOS Committee offered to host the meeting of the Task Group in the Deutsche Wetterdienst in Offenbach, Germany in the spring of 1994. The report of the Task Group will be considered at JSTC-IV. (See Section 6.1.12)

6.5 External Co-ordination

6.5.1 In the original Memorandum of Understanding for GCOS, it was determined that the GCOS should be based, to the degree possible, on existing systems and programmes. To effect co-ordination with the programmes of WMO, letters were sent to the Presidents of the eight Technical Commissions inviting them to provide background material and suggestions concerning future interactions between the commissions and the GCOS. These were compiled into a document for the meeting. In addition, four presidents were in attendance at the meeting, and were invited to make statements concerning the work of their commissions with regard to the GCOS.

6.5.2 The President of the Commission for Marine Meteorology (CMM), Dr. Shearman, noted that the commission would be working closely with two of the GOOS modules, the climate, in concert with GCOS, and marine services. He noted specific working groups which will be interested in future interactions with the JSTC or with its subsidiary bodies. He added that the work on cost/benefits would be helpful for marine programmes.

6.5.3 Dr. Gauntlett, the President of the Commission for Atmospheric Sciences (CAS) pointed to several activities of the commission of relevance to the GCOS. In particular, he noted the atmospheric chemistry component of the Global Atmosphere Watch (**GAW**), and the work of the Working Group on Numerical Experimentation (**WGNE**) which is addressing 4-D data assimilation and climate simulations, inter alia. He also reiterated the value of an intergovernmental body for obtaining resources for GCOS activities.

6.5.4 The President of the Commission for Climatology (Ccl), Dr. Maunder, recalled his attendance at JSTC-II, and noted that CC1 has a strong interest in the development of GCOS. He particularly noted activities of the Commission related to GCOS, and cited in particular the Working Groups on Climate Data and on Climate Change Detection, identifying points of contact in these groups. As Chairman of the Advisory Committee for the Climate Applications and Data (ACCAD), he invited the Director to discuss the JSTC-III meeting and to present the terms of reference for the Data System Task Group at the upcoming ACCAD meeting.

6.5.5 The President of the Commission for Basic Systems (CBS), Dr. Vasiliev, is a member of the JSTC. He provided a brief account of the ways in which CBS is prepared to assist in the implementation of the GCOS. As discussed at the CBS Advisory Working Group meeting in May, he noted that the various CBS Working Groups (Observations, Data Management, Data Processing, etc.) had received preliminary input from the JPO concerning the GCOS plans. In several cases, the working groups look to GCOS for specific recommendations which they could consider for action. In addition, the CBS Advisory Working Group has scheduled a special session to consider the needs of GCOS. Dr. Vasiliev also noted that the CBS will be a source of experts for the GCOS bodies, in particular on atmospheric observations and data systems.

6.5.6 The JSTC noted with appreciation the supportive comments of the Technical Commission Presidents and looked forward to future co-operation. They acknowledged that for meteorological components of GCOS especially, the GCOS should take advantage of the

wide expertise and technical competence of the Commissions. Similarly, with regard to implementation, quality control, and data issues, the JSTC acknowledged the important role for the Commissions. The Members also suggested that each JSTC session could benefit from inviting similar guests and experts who will be instrumental in implementing the recommendations for GCOS.

6.5.7 Dr. Morgan, Director of EUMETSAT, provided a brief comment about the organization, its role, and in particular, its links to the user and provider communities.

7. OTHER BUSINESS

7.1 Intersessional Activities

7.1.1 During the discussion of other agenda items at the meeting, several actions for the intersessional period were suggested and are discussed elsewhere in this report. However, a few additional items were discussed resulting in specific recommendations: (1) renewed efforts should be taken to encourage countries to participate more actively in the planning stages of GCOS, for example by providing resources and experts, and by developing national structures that provide links to GCOS; (2) a GCOS "Newsletter" should be initiated early in 1994 and given wide circulation; and (3) a set of illustrative materials should be prepared for the JSTC members. Finally, a number of specific action items in the Action Plan, many keyed to recommendations in the *Draft Plan*, and many relating to implementation activities should be initiated as appropriate during the intersessional period.

7.2 Arrangements for JSTC-IV

7.2.1 An offer to host the next JSTC was made by Dr. **Bengtsson** on behalf of the Max **Planck** Institute for Meteorology. The Committee accepted the generous offer, and agreed that the next meeting be held September 19 to 22, 1994 in Hamburg, Germany.

8. CLOSURE

8.1 The Chairman closed the general session of the meeting at noon on 3 November 1993.

9. IN CAMERA SESSION

9.1 Following the closure of the JSTC-III session, the Chairman convened a special session of the JSTC, including representatives of the sponsoring organizations, to consider a number of important issues for the Committee, some of which surfaced as a result of discussions and the recommendations in the plenary sessions.

9.2 In response to questions from some members who wished to review the role and the responsibility of the JSTC, particularly in light of the establishment of panels and working groups, Dr. Nowlin prepared a few viewgraphs which provided a framework for discussion. Tables 1 and 2 contain the salient points. Table 1 outlines the three central elements of GCOS: (1) oversight of the climate observing system, (2) design of the system, and (3) implementation of the system. Associated with each of these three elements are particular responsibilities of the JSTC, and particular action points. Table 2 indicates the structure of the JSTC following the recommendations made at the meeting.

9.3 Referring to Table 1, the first central element of GCOS is the oversight of the system. The JSTC recognized its primary responsibility for the total climate observing system. Secondly, it has the responsibility to facilitate the exchange of information among the sponsoring organizations and participating countries and agencies. These responsibilities are discharged through the JSTC and the sub-groups that it has established, or may establish.

9.4 For the second central element, system design for climate, the primary responsibility for the JSTC is to set the overall priority across the disciplines. In this element, however, the JSTC has shared responsibility for design and prioritization by discipline, and shared responsibility with other observing systems with regard to global observations. These JSTC responsibilities will be facilitated by the disciplinary design panels (atmosphere, ocean, terrestrial/ecosystem, and cryosphere), by integrating or cross-cutting task groups or panels (e.g., data, space observations, etc), and by special purpose groups (e.g., socioeconomic benefits). For all these activities, the JSTC must provide the integration.

9.5 For the third central element, implementation of the system, the JSTC noted its responsibility for liaison with implementation groups, for facilitating implementation, and for implementing selected elements as appropriate through its own activities. Finally, it must assess the effectiveness of the implementation on behalf of the overall system. These responsibilities may be discharged by co-ordination with implementation panels, international and intergovernmental bodies, governments, national agencies, or other observational, data system, or analysis groups.

9.6 Based on the recommendations of the meeting, Table 2 illustrates the resulting JSTC structure. It may be noted that there are three types of groups that have been established: (1) background panels, (2) design panels, and (3) integrating/requirement panels.

9.7 As a final issue, the Chairman, reminded members that the JSTC was established in April 1992. Consequently, he informed them that the membership would be reviewed in the next few months. He noted that while the majority of the present members may be invited to continue, this would be the **final** meeting for some members. In thanking all the members for their efforts, the Chairman expressed particular thanks to those for whom the third session would be their final meeting.

* * * * *

JSTC RESPONSIBILITIES	ELEMENTS OF GCOS	ACTION POINTS
<p><u>Primary</u> responsibility for oversight of the total system</p> <p>Facilitate information exchange</p>	<p>OVERSIGHT OF THE CLIMATE OBSERVING SYSTEM</p>	<p>JSTC and its sub-groups</p>
<p><u>Primary</u> responsibility for setting priorities across disciplines</p> <p>Shared responsibility for design/prioritization by discipline</p>	<p>DESIGN OF THE CLIMATE OBSERVING SYSTEM</p>	<p>Disciplinary panels (4)</p> <p>Integrating panels (2)</p> <p>Special groups (1)</p> <p>Integration by JSTC</p>
<p>Liaison with implementation groups and track implementation</p> <p>Facilitate implementation</p> <p>Implementation of selected elements, by direction</p>	<p>IMPLEMENTATION OF THE CLIMATE OBSERVING SYSTEM</p>	<p>Implementation panels</p> <p>International and inter-governmental bodies</p> <p>Governments</p> <p>National Agencies</p> <p>Observational, data, and analysis groups</p>

Table 1. Elements of the Global Climate Observing System

	COMMITTEE	
	Joint Planning Office	
Background groups	Design panels	Integrating/ requirement panels
Working Group on Socio-economic Benefits	Ocean Observation System Development Panel (OOSDP)	Data System Task Group
	Atmospheric Observation Panel	Space-based Observation Task Group
	Terrestrial Observation Panel	
	Cryosphere Panel (TBD)	

Table 2. Structure of the Joint Scientific and Technical Committee

ANNEX1

LIST OF PARTICIPANTS

Members of the Joint Scientific and Technical Committee

Sir John HOUGHTON Rutherford Appleton Laboratory,
(Chairman) **Didcot**, United Kingdom

Professor E.E. BALOGUN Department of Physics,
Obafemi Awolowo University,
Ile-Ife, Nigeria

Dr. L. BENGTTSSON Max **Planck** Institut **für** Meteorologie,
Hamburg, Germany

Ing. C. **CAPONI** **Direccion** General de **Investigacion**
(2nd Vice-chairman) de Agua, **Suelo** y **Vegetacion**,
Caracas, Venezuela

Alternate for Dr. P. GOLDSMITH:

Dr. C. READINGS Directorate of Observation and Environment,
European Space Research and Technology Centre,
Noordwijk, Netherlands

Dr. Y. HARUYAMA Earth Observation Planning Department,
National Space Development Agency of Japan,
Tokyo, Japan

Alternate for Dr. Andre LEBEAU:

Dr. D. CARIOLLE Centre National de Recherches
Météorologiques, M&o-France,
Toulouse, France

ANNEX I, p. 2

- Dr. A. MCEWAN CSIRO Division of Oceanography,
Hobart, Tasmania, Australia
- Dr. J. MEINCKE Institut für Meereskunde,
Universität Hamburg,
Hamburg, Germany
- Dr. W.D. NOWLIN, Jr. Department of Oceanography,
Texas A & M University,
College Station, Texas, U.S.A.
- Dr. SU Jilan Second Institute of Oceanography,
Hangzhou, China
- Professor S. TSUNOGAI Department of Chemistry,
Faculty of Fisheries,
Hokkaido University,
Hakodate, Japan
- Dr. A.A. VASILIEV Hydrometeorological Research Centre
of the Russian Federation,
Moscow, Russian Federation
- Dr. D.M. WHELPDALE Atmospheric Environment Service,
Downsview, Ontario, Canada

(NOTE: Dr. S.G. Tilford (1st Vice-chairman was unable to attend)

Representatives of Sponsoring Organizations

W.M.O.

Dr. J.L. RASMUSSEN, Director,
World Weather Watch Programme Department
Geneva, Switzerland

ANNEX I, p. 3

Dr. F.E. DELSOL, Director,
Atmospheric Research and Environment Programme Department
Geneva, Switzerland

IOC

Prof. M. GLASS, Director,
Programme **Géosphère-Biosphère**,
IFREMER,
Issy-les-Moulineaux, France

Dr. J. MERLE,
IOC Secondment to GCOS JPO,
Geneva, Switzerland

Dr. W. SCHERER, Director,
GOOS Support Office
Paris, France

ICSU

Dr. D. ANDERSON,
Atmospheric Physics,
Hooke Institute, Oxford University,
United Kingdom

Prof. J. TOWNSHEND, Chairman,
Department of Geography,
University of Maryland,
U.S.A.

UNEP

Mr. A.L. ALUSA, Programme Officer,
Climate Unit,
Nairobi, Kenya

Secretariat

Dr. T. SPENCE, Director,
Joint Planning Office for GCOS
Geneva, Switzerland

ANNEX I, p. 4

Mrs. S. KALOMBRATSOS, Administrative Assistant,
Joint Planning Office for GCOS
Geneva, Switzerland

Mrs. R. JEANS, Local Coordinator,
Rutherford Appleton Laboratory,
Didcot, United Kingdom

Mrs. K. FRANCIS, Secretary,
Rutherford Appleton Laboratory,
Didcot, United Kingdom

Other invitees

- Dr. G. ASRAR National Aeronautics and Space Administration,
Washington, DC, U.S.A.
- Dr. D. BENNETT'S Hadley Centre for Climate Prediction and Research,
Bracknell, United Kingdom
- Dr. M. **BERAN** Institute of Hydrology,
Wallingford, United Kingdom
- Dr. M. BRISCOE Office of Ocean and Earth Sciences,
National Oceanic and Atmospheric Administration,
Silver Spring, MD, U.S.A.
- Dr. D. CROOM Rutherford Appleton Laboratory,
Didcot, United Kingdom
- Dr. D. **GAUNTLETT** President, Commission for Atmospheric Sciences
Bureau of Meteorology,
Melbourne, Victoria, Australia
- Prof. J. HARRIES Rutherford Appleton Laboratory,
Didcot, United Kingdom
- Dr. D. LLEWELLYN-JONES Department of Physics and Astronomy,
University of Leicester,
Leicester, United Kingdom
- Mr. N. MATSUURA National Space Development Agency of Japan,
Tokyo, Japan

Dr. J. MAUNDER	President, Commission for Climatology c/o Department of Geography, University College, Dublin, Ireland
Mr. J. MORGAN	European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), Darmstadt-Eberstadt, Germany
Dr. G. NEEDLER	Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada
Dr. D. NORSE	Overseas Development Institute, London, United Kingdom
Dr. C. RAPLEY	Department of Physics and Astronomy, University College London, Dorking, United Kingdom
Dr. P. RYDER	Meteorological Office, Bracknell, United Kingdom
Dr. R. SHEARMAN	President, Commission for Marine Meteorology Meteorological Office, Bracknell, United Kingdom
Mr. V. VENT-SCHMIDT	Deutscher Wetterdienst, Offenbach/Main, Germany
Dr. G.W. WITHEE	National Environmental Satellite Data and Information Service, National Oceanic and Atmospheric Administration, Washington, DC, U.S.A.
Dr. F. S. ZBAR	CBS Working Group on Observations National Weather Service, Silver Spring, MD, U.S.A.

ANNEX II

AGENDA

1. ORGANIZATION OF THE SESSION
 - 1.1 Opening of the Meeting
 - 1.2 Approval of the Agenda
 - 1.3 Conduct of the Meeting
2. REPORT OF THE CHAIRMAN
3. INVITED REPORTS
 - 3.1 Reports from Sponsoring Organizations
 - 3.2 National Activity Updates
4. CONSIDERATION OF THE GCOS PLAN
 - 4.1 Review of Comments Received
 - 4.2 Discussion
5. OUTCOME OF THE IGM-WCP
 - 5.1 Relevance for GCOS
 - 5.2 Integrated Proposal
6. GCOS IMPLEMENTATION ISSUES
 - 6.1 Action Plan
 - 6.2 The ENSO Proposal
 - 6.3 Space-based Observations
 - 6.4 Data Issues
 - 6.5 External Co-ordination
7. OTHER BUSINESS
 - 7.1 Intersessional Activities
 - 7.2 Arrangements for JSTC-IV
8. CLOSURE
9. IN CAMERA SESSION

ANNEX III

NATIONAL ACTIVITY UPDATES

1. Australia

Dr. Gauntlett presented a brief report on GCOS activity in Australia. The heads of the Australian national bodies and departments corresponding to WMO, IOC, ICSU and UNEP have established a GCOS/GOOS Joint Working Group (JWG) to facilitate the most effective and co-ordinated commitment by Australia to global observation systems and to provide an identified interface with the intergovernmental and international bodies. The terms of reference of the group will be extended in due course to embrace GTOS. The group is comprised of representatives of the main agencies responsible for implementing observational systems, national co-ordinating bodies, and national users of such systems. It is chaired by Dr. Gauntlett of the Bureau of Meteorology.

The JWG held its first meeting in March 1993. One of its first actions was the creation of two expert sub-groups to provide advice on all aspects of GCOS and GOOS planning and implementation in Australia.

The GOOS panel first met in August 1993, chaired by Dr. Smith of the Bureau of Meteorology. Australia has made a significant commitment to TOGA, and a priority issue is the development of convincing (including economic) arguments for the operational continuation of the national components of the TOGA observing network. National observational goals were discussed in the context of potential GOOS contributions.

2. Canada

Dr. Whelpdale noted that the initial focal point for GCOS in Canada has been a small ad *hoc* subcommittee of the National Climate Research Committee, the group which oversees the research aspects of the Canadian Climate Program. An early activity of this ad *hoc* group was to arrange for a visit and briefing by Dr. Spence, Director, JPO.

The current economic environment in Canada is resulting in careful evaluation of all climate-related programmes, especially new ones such as GCOS. A number of government departments which are potential supporters of GCOS are experiencing programme reductions.

Nevertheless, a recent session of the Canadian Climate Program Board established a new GCOS Task Group, whose responsibility will be to define the requirements and potential contributions of a Canadian GCOS programme. The needs for effective interdisciplinary and cross-programme co-ordination were considered to be very important. To ensure these needs are met, representation will be sought from the atmospheric, oceanic, terrestrial and cryospheric communities, from the research, data and applications, and socioeconomic

impact sectors, and from the Canadian Global Change Program. In this way interests of GCOS, GOOS and GTOS will be considered together.

Canada has identified a portion of its contribution to the WMO Special Fund for Climate and Atmospheric Environment Activities for GCOS activities. Discussions between the JPO and Canadian representatives continue to outline additional focused projects of mutual interest.

3. China

Dr. Su reported that the Chinese GCOS Committee was about to be formed earlier this year and then domestic political developments interfered with this process. The State Meteorological Administration, which originally was to be the hosting institution for GCOS-China, changed its function from a state institution to a service one (its new name is the Chinese Meteorological Administration). As a consequence the new Chinese Meteorological Administration has less interest in acting as the host institution for GCOS-China, both because it does not think it has the ability to co-ordinate other state institutions and because it is busy to re-structure itself.

The Chinese Meteorological Administration is submitting a proposal to the State Council to establish a national climate centre for China. If this proposal is approved, it will help the cause of GCOS-China.

4. France

Dr. Glass briefly noted the presence of two interagency committees in France: (1) a science interagency group to co-ordinate IGBP and WCRP activities, including funding; (2) a GOOS committee to build support for GOOS, including raising funds.

For the past year, France has provided, via the IOC, the services of Dr. Merle as a seconded expert to the GCOS Joint Planning Office.

5. Germany

Mr. Vent-Schmidt provided a review of German activities related to GCOS.

Organizational matters

Germany has established a standing panel to advise the government on climate aspects. This Climate Advisory Board meets twice a year including experts from

universities, research organizations and governmental organisations as well. The main task relates to the National Climate Research Programme. Besides a Global Change Advisory Board was established with the Ministry of Research for IGBP core projects.

In 1992 it was agreed upon that a GCOS *ad hoc* Committee be jointly established by the Ministry of Research and the Ministry of Transport. This GCOS *ad hoc* Committee will provide scientific expertise to support the JSTC for GCOS. To support this Committee a GCOS Office was established at the German NMS, Deutscher Wetterdienst.

Present activities

The first activities were to prepare a national overview for the Intergovernmental Meeting on the World Climate Programme in April 1993. This assessment is available as a little brochure given to the participants of the IGM-WCP in April 1993.

The brochure describes present activities concerning:

observational programmes in which Germany participates in the well-known programmes such as WWW and GAW and the Voluntary Observing System (VOS)

research projects related to core projects of IGBP and WCRP projects like GEWEX, TOGA, WOCE, CLIVAR

satellite missions, e.g., contributions to METEOSAT

global data centres such as GPCC, GRDC, and MCSS for which Germany took responsibility

data management efforts on inventories and the participation in the establishment of global/regional data centres

Special emphasis is given to the German Climate Computer Centre established at Max-Planck-Institute for Meteorology in Hamburg providing computer resources and archiving facilities for climate modelling.

Short-term activities

Further contributions will be in the near future:

To establish a Global Collection Centre on ship observations together with the UK Met Office within the Commission for Marine Meteorology;

To agree upon the role of GPCC within GCOS. There will be a meeting in Geneva in December 1993 to make sure that GPCC becomes operational;

To propose precipitation measurements on Volunteer Observing Ships (VOS) with special gauges (a technique which was developed jointly together from the university institute for marine research in Kiel and the relevant instrument department of DWD);

To establish a GAW station in Southern Bavaria (now underway) together with a centre for quality assurance;

To participate in the European Climate Support Network as a regional activity on data management and climate modelling;

To detect climate change at the recently established **Potsdam** Institute for Climate Impact;

To establish a regional data centre for the Baltic Experiment, BALTEX as a contribution to GEWEX, at the GKSS, Geesthacht;

Germany has offered to have the Secretariat for CLIVAR. [Note: It has been decided that the CLIVAR Secretariat will be at the Max **Planck** Institute for Meteorology in Hamburg.

6. **Japan**

Dr. Haruyama noted that there is at present no GCOS committee structure in Japan, but that discussions among the Science and Technology Agency (STA), the National Space Development Agency of Japan (NASDA), the Japan Meteorological Agency (JMA), and the scientific community have been held. As a result, there are plans for a GCOS committee to be established in 1994, and a workshop on GCOS is also planned for 1994.

Dr. Haruyama announced that NASDA had agreed to provide an expert, Mr. Matsuura, as a secondment to the JPO effective in December 1993.

He also provided a detailed description of the plans for NASDA which include important GCOS related missions (ADEOS, TRMM, ADEOS II, etc.) and noted additional contributions to GCOS through the development of user requirements for CEOS addressed at a workshop in Japan in May.

Dr. Tsunogai briefly noted the activities on behalf of ocean observations. He noted that, in Japan, many ocean observing vessels are being used chiefly for the operational observations, except two research vessels belonging to Ocean Research Institute, University of Tokyo. Specifically, they include: the JMA (6), Maritime Safety Agency (5), Fisheries Agency (12), STA (3), Agency of Industrial Science and Technology Agency (2), Defense Agency (5) and Fisheries Universities (12). (The figures written in the parentheses are the number of vessels larger than 50 m long.) Each of these vessels has its own operational

purpose. Among these agencies, the activity of the JMA is the most related to the global climatic issue, although it does not completely coincide as noted below.

The operational observation conducted by the JMA started more than 50 years ago and continues to observe the seas around Japan occupying more than 200 stations. The observations were chiefly confined to the upper 1500 m and the vertical profiles of temperature, salinity, dissolved oxygen and nutrients as well as plankton biomass and species were determined four times in a year. The products were distributed to and utilized by various agencies.

Recently the observation system has been expanded and the greenhouse gas observation has been included. The partial pressures of CO₂, CH₄, CFCs (F11, F12 and F113) and N₂O in the surface water and in the air have been measured since 1989, and the water column inventories of total inorganic carbon, alkalinity, CFCs, N₂O and CH₄ have been determined along sections, 137°E 34°N-0°N) twice a year and 155°E (30°N-10°S) once a year, and across the Kuroshio four times in a year.

The Agency of Industrial Science and Technology has also commenced the similar greenhouse gas and chemical tracer observations along a section, 175°E (50°N-15°S), once a year from 1990. This observation will continue at least for five years, but its future has not been decided.

He also noted that Japan will provide fundamental studies for GOOS, and is planning a large vessel to support the activity.

7. Nigeria

Dr. Balogun described the effort to create awareness for GCOS on two fronts: nationally and continentally.

In Nigeria, the Nigerian Meteorological Services and the Federal Environmental Protection Agency have shown interest in GCOS, and have designated units within their organizations to follow GCOS activities. The Nigerian Meteorological Services will coordinate GCOS related activities in Nigeria (with active support from the Institute of Ecology at the Obafemi Awolowo University, Ile-Ife). The co-ordination involves bringing together interested units within the Ministries of Agriculture, Water Resources, Science and Technology, and the Universities. A national meeting to discuss climate change and other GCOS related activities will be held soon.

In the meantime, an international conference, with the Nigerian Meteorological Society, the Nigerian Meteorological Services and the Institute of Ecology, Obafemi Awolowo University, Ile-Ife as co-hosts, on climate change (and GCOS) is being planned for the middle of 1994. A committee set up to plan the conference will report on Nov. 19, 1993.

ANNEX III, p. 6

Opportunities were seized during the meeting of the Society of African Physicists and Mathematicians which held in Nairobi, Kenya in August 1993 and the Conference on Space Science and Technology for Sustainable Development in Africa, held in Dakar in October 1993, to spread awareness on GCOS. The meetings were attended by participants from over 40 African countries.

Dr. Balogun recommended that the co-ordination of GCOS activities on the continental scale should be done by the African Centre of Meteorological Application for Development (ACMAD), which is situated in Niamey, Niger. That prospect will be discussed with the Director of that centre in the near future.

8. United Kingdom

Dr. Ryder conceded that it is **recognised** that there is no national scientific community nor government departmental responsibility for all aspects of climate and hence for GCOS in the UK. However an Inter-Agency Committee for Global Environmental Change (IACGEC) has been formed and has addressed some of the co-ordination issues; for example it has proved an effective forum for developing an inter-agency data exchange policy. It is expected that a sub-group of the IACGEC will be formed to oversee the development of GCOS in the UK. An early task of the sub-group will be to set up a workshop or other forum in which workers active in climate research and service provision can be drawn into the GCOS debate. He noted that the Director General of the Meteorological Office will co-ordinate the development of the UK response. These, coupled with continuation of the GCOS office, should ensure direction and co-ordination of national efforts, and a tight coupling to the JPO in Geneva.

9. United States

Dr. Asrar presented a brief review of a part of the U.S. participation and support of GCOS that is coordinated through the Committee on Earth and Environmental Studies (CEES), under the auspices of its subgroup, the U.S. Global Change Research Program (USGCRP). CEES consists of the representatives of the U.S. Federal Agencies that conduct and/or fund acquisition of *in situ* and space-based observation, and basic research in Earth system science and global change studies. These efforts encompass all aspects of Earth system including atmosphere, biosphere, cryosphere and oceans.

The participating agencies include the National Science Foundation, Departments of Agriculture, Defense, Energy and Interior as well as the National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA). There are three main working groups under CEES: (1) *in situ* and space-based observations; (2) process studies; and (3) modelling and assessment. Each of these working groups consists of at least one representative from the above agencies.

ANNEX III, p. 7

The Observations Working Group of the USGCRP has taken on the responsibility of providing a part of the U.S. contribution to GCOS. To do this, the Working Group is currently developing a document which describes mainly the space-based component of the global observing system.

The U. S. has identified a portion of its contribution to the WMO Special Fund for Climate and Atmospheric Environment Activities to be used for GCOS activities.

10. Venezuela

Venezuela has gone through one of its worst political and economic crises in 1993, involving the removal of its constitutionally elected President, a one-month interim term by the President of Congress, and finally the election by Congress in June of a new President whose main government aim is to guide the country through a peaceful eight-month transition to the new elected administration which will assume power in February 1994. While this solution has eased the political tension, the economic situation is still far from favourable.

This domestic situation has not helped the development of national activities related to GCOS. A workshop planned for early 1993 was finally convened October 21. It was organized jointly by the National Commission of Meteorology and Hydrology, and the National Commission of Oceanology under the aegis of the Science and Technology Ministry. The principal aim of the workshop was to present the GCOS Draft Plan, and to discuss Venezuelan participation in GCOS. Participants were members of the scientific community and their recommendations are meant to help the future administration design its scientific plan.

Notwithstanding the difficulties noted above, some progress has been achieved. The Commission of Meteorology and Hydrology, designated to act as the National GCOS Committee, has obtained a grant from the United States government Trade and Development Agency to prepare a feasibility study on the modernization of the national observational networks, including a data communication network based on VSAT technology. One important aspect is that all involved institutions (Air Force, Navy, Ministry of Environment, Ministry of Agriculture, Civil Aviation, universities, and research institutions) are working in a co-ordinated manner toward the establishment of a truly national network.

On the oceanographic side, the Instituto Oceanografico de Venezuela initiated a network of 20 locations along the coast to observe SST. Projects for next year will involve establishing new GLOSS stations and developing a project on the physical and biological processes of nutrient import and carbon removal in the Cariaco Basin.

ANNEXIV

ACTION PLAN FOR THE GLOBAL CLIMATE OBSERVING SYSTEM

1. INTRODUCTION

- 1.1 The establishment of the Global Climate Observing System
- 1.2 Brief recap of progress to date
- 1.3 Planning for the GCOS
- 1.4 Initial Operational System

2. ACTION PLAN

- 2.1 Defining the observational requirements
- 2.2 Assessing current capability
- 2.3 Recommending action
- 2.4 Support considerations

3. SPECIFIC ACTIONS

- 3.1 ***The Draft Plan***
- 3.2 The GCOS Space Plan
- 3.3 The GCOS Data Plan
- 3.4 The Initial Operational System
- 3.5 GCOS Reports
- 3.6 GCOS Observational Manuals

4. ORGANIZATIONAL ACTIVITIES/ISSUES

- 4.1 Co-ordination and representation
- 4.2 The Integrated Proposal

1. INTRODUCTION

1.1. The establishment of the Global Climate Observing System

It is widely acknowledged that good observations are critically needed to meet climate objectives. At the Second World Climate Conference, the Global Climate Observing System (GCOS) was proposed to meet these observational needs. Over the following year, plans to establish a GCOS were set in motion.

The GCOS was formally established by a Memorandum of Understanding among four international organizations. The objectives of the GCOS were outlined at the Second World Climate Conference (SWCC) in 1990, and reiterated in the Memorandum of Understanding for GCOS.

The objectives are to ensure the acquisition of the data required to meet the needs for:

1. Climate system monitoring, climate change detection and response monitoring especially in terrestrial ecosystems,
2. Application to national economic development,
3. Research toward improved understanding, modelling and prediction of the climate system.

1.2. Brief recap of **progress** to date

The Memorandum of Understanding empowered a Joint Scientific and Technical Committee (JSTC) to develop the GCOS. The members have been given the charge of identifying observational requirements, defining design objectives, and recommending coordinated actions leading to the development of the system. The Joint Planning Office (JPO) has been charged with supporting the JSTC in these tasks.

The First meeting of the JSTC outlined key issues for GCOS to address. After that meeting, a number of task groups were convened by the Joint Planning Office (JPO) to develop an initial set of requirements for observations in the various disciplinary areas. Reports of these task groups and other solicited papers were considered at JSTC-II in light of the need to develop the components of a first operational system.

At JSTC-II, the members established a set of science and application issues which should be considered as the first priorities for GCOS to address:

- o seasonal and interannual climate prediction,
- o earliest possible detection of climate trends and climate change due to human activities,
- o reduction of the major uncertainties in climate prediction.

On the basis of these priorities, and the inputs from the task groups and experts, an initial **Draft Plan** was prepared. It was distributed at the Intergovernmental

Meeting on the World Climate Programme (IGM-WCP), and subsequently circulated widely in the community for review and comment.

At this time, inputs received are being carefully considered to formulate a strategy and develop an action plan which will advance GCOS from the conceptual stage to a functioning programme.

1.3. Planning for the GCOS

The planning strategy for GCOS will follow a systematic approach: determine what is needed and how to achieve it. This includes: first, preparation of appropriate documents describing, in scientific and technical terms, what is required; second, an assessment of the capability of current systems to meet these needs; next, suitably justified recommendations presented to appropriate bodies and agencies; finally, review and oversight to ensure the observing system meets the objectives.

The *Draft Plan* develops an action plan consisting of the following three components:

1. In the light of current climate knowledge and scientific expertise, to evaluate the current observational systems and define the initial operational observing system (**IOS**) to be realized early in the next century;
2. To identify and specify the key observations that are urgently required and which should be added to the operational system at the earliest possible time;
3. To identify future research and development likely to lead to additional operational requirements and additions to the operational programme.

1.4. Initial Operational System

As described in the *Draft Plan* the Initial Operational System should consist of three elements: (1) observational components currently underway, (2) enhancements that may be justified now, and (3) a comprehensive data system.

The first step focuses on the essential ingredients of the initial system. For this, inputs have been solicited from the community. These inputs will continue to be refined and prioritized. An assessment of current capabilities is being made to indicate resources already committed and observational products now available. Comparisons between requirements and available data will suggest where action will be recommended. In the *Draft Plan*, a number of enhancements to existing systems were identified, and specific actions have been proposed to implement them.

Finally, the **IOS** needs a comprehensive data management system. For this task, one of the most important for GCOS, it is essential to develop an overall plan for the system. A specific plan to do this will be described later.

Chapter 2 discusses the steps to develop the requirements which the system should meet, to assess the current capabilities both for observation and data management, to identify deficiencies, and to propose recommendations for implementation. Chapter 3 outlines the specific documents and timetables which will be the principal deliverables from the planning activity. Chapter 4 notes organizational activities and proposals that must be addressed.

2. ACTION PLAN

In this chapter, we outline the actions which should be taken to develop specific recommendations which will then form the basis for implementing the observing system.

2.1. Defining the observational requirements

The development of the detailed observational requirements will be guided by the priority science issues determined by the JSTC as noted above. While for each of these priorities, current observations are being made and data are available, the role for the GCOS will be to identify that critical observational data that will optimally address these priorities. This will be done in close consultation with relevant experts in data collection, modelling and analysis.

The user requirements will be prepared with specific and detailed input from the various user communities. It is essential to know, not only the specific purpose for which the parameter is needed, but details concerning the specific tasks and methods that are currently in use, or are planned for the near future. A scientifically credible argument for the measurements, including their priority, must be made at this juncture.

Given sufficient detail concerning the specific needs for the data, the technical measurement requirements (sampling, coverage, resolution, spatial and temporal issues, accuracy and precision) must be specified. Next, measurement options available to meet the specific needs must be evaluated. Current methodology will be considered at **first**, but the GCOS must anticipate future developments in measurement technology as well.

Finally, a comprehensive evaluation of the appropriate data management system required will be undertaken. It will be important for the GCOS planning to address the full range of data issues beginning with the collection of the observations, the inclusion of appropriate metadata about the observations, the data assimilation and merger issues, the distribution, archiving, and final disposition. At key points in this process, other concerns, such as for algorithms, quality assurance, data continuity, or related items should also be addressed.

2.2 Assessing current capability

While the foregoing activities principally relate to the gathering of information, the GCOS will take the next step to assess current and future observational capability. To

develop an effective methodology to assess ongoing observations and data activities, the GCOS should use panels, the services of consultants for specific assessment tasks, and *ad hoc* groups as necessary. Due to limited resources, existing working groups or other expert bodies be invited to help address these issues.

2.3 Recommending action

As outlined below, the early GCOS planning will focus on the documents necessary to define and describe the system. These will be published in several series including plans for the overall programme and major elements, reports on specific measurement requirements, manuals on key parameters, and proposals for implementation.

The GCOS proposals for action will include detailed requirements, assessments of current observational capabilities, evaluation of deficiencies, and specific proposals to obtain the measurement components. They will be addressed to the appropriate organizations for action. Since GCOS was established by three intergovernmental organizations, a likely route for submission of proposals is via these organizations. Further, since each has a different constituency, it is likely that specific proposals will be more applicable to a particular agency.

Programmes in WMO are expected to participate in meeting GCOS requirements, particularly for meteorological observations, communication networks, modelling interactions, and data management. Liaison and co-operation with the various Technical Commissions, Regional Associations, and other WMO bodies are underway.

For oceanographic requirements for climate, the GCOS recommendations will be developed in close co-operation with the Global Ocean Observing System (GOOS), led by the IOC. Liaison with several of the appropriate subsidiary bodies in IOC has begun.

With regard to terrestrial requirements, appropriate links are still being developed. These will include programmes in hydrology and terrestrial ecosystems. In addition, the GCOS will work closely with those planning the Global Terrestrial Observing System (GTOS) .

Finally, since there will be a strong emphasis on the use of space-based observations for GCOS, requirements must be presented to appropriate space agencies for action. The Committee on Earth Observation Satellites (CEOS) has granted affiliate status to GCOS which will permit GCOS to present its requirements, in conjunction with other affiliates, for action.

2.4 Support considerations

The responsibility for planning for the GCOS rests on the JSTC and the JPO. To date, the resources available have been very limited. Staff for the JPO consists of two

permanent employees and a few short-term seconded experts. It is essential to continue to obtain the expertise of secondments, since permanent staff positions are not available at this time. It is also important to engage national GCOS offices in the planning activities. This arrangement should be considered more widely.

Funds to support planning activities including consultants, meetings, and document preparation are critically needed at this time. Some limited funds have been received from sponsoring organizations and a few countries, but additional funds are needed to meet proposed schedules.

Planning mechanisms available to the GCOS programme include, *inter alia*, programmes and project elements of the sponsoring organizations and their subsidiary bodies, standing panels, working groups, task groups, expert groups, or other specific ad *hoc* bodies, private companies, individual experts as consultants, or national contributions in kind.

Due to financial limitations, it is proposed that the GCOS establish a minimal number of standing panels. They would serve principally to address specific critical areas such as space-based observation and data management, or to integrate the disparate viewpoints in specific disciplines. These bodies will both serve as a continuing source of information to the JSTC and the JPO, and will be available to broaden the interactions with the climate community. Membership on these groups will be highly selective.

For the next two years, a total of five panels are proposed; one for space-based observations, one devoted to data management, and three oriented by discipline. Specifically:

1. It is proposed that the JSTC establish a Space-based Observation Panel. The terms of reference of the Panel would include developing and refining requirements from satellites. This could include, *inter alia* space-based observations, ground activities in support of the observations, and data system requirements specific to space platforms.
[Note: JSTC-III requested the Space-based Observation Task Group to make recommendations concerning such a Panel]
2. It is proposed that the JSTC establish a Climate Data Management Panel to oversee the development of a systematic data structure which will be responsive to the needs of the climate community. Its terms of reference should include, *inter alia*, interactions with representatives of the scientific disciplines, the data specialists, the modelling and user communities.
[Note: JSTC-III requested the Data System Task Group to make recommendations concerning such a Panel]
3. It is proposed that the JSTC establish three disciplinary oriented panels over the next two years. These would integrate the inputs from various sources and make specific recommendations to the JSTC. The panels would be the

ANNEX IV, p. 7

natural extensions of the task groups used to develop initial recommendations. It is proposed to establish:

- o An Atmospheric Observation Panel for Climate,
- o A Terrestrial Observation Panel for Climate,
- o An Ocean Observation Panel for Climate.

The panels will be provided with terms of reference which include: (1) review of observational elements from the appropriate disciplinary areas, (2) participation in activities of related working groups, and (3) develop specific observational criteria for priority parameters identified as elements of GCOS.

[The Atmospheric Panel was established at JSTC-III; the Terrestrial Panel will be developed with the participation of the GTOS; the Ocean Panel will be considered at JSTC-IV, upon the termination of the OOSDP, and with the participation of the WOS].

3. SPECIFIC ACTIONS

3.1 The *Draft Plan*

The initial *Draft Plan* was distributed widely; comments were received from more than 60 scientists. A working document at JSTC-III provided both a representative summary of comments, and several verbatim excerpts. The JPO will incorporate those comments which were limited to editorial issues into a revised plan. The members will ***[did]*** have an opportunity to review these changes at JSTC-III.

In some cases, the respondents raised more substantive issues. For some of these, the advice from the JSTC concerning the disposition would be appropriate. A compilation of such comments has been provided for the meeting. It is proposed that they be considered in a working group of the JSTC.

Having addressed both editorial and substantive issues, a revised draft plan will be prepared by the JPO. It will be distributed by correspondence to the JSTC for comment and final consideration early in 1994, and will be published in final form by the end of March, 1994.

3.2 The GCOS Space Plan

To ensure that data from satellites play a major part in the GCOS, a plan for the space components must be developed with urgency. To properly incorporate space-based observations, the plan must define a comprehensive strategy which will lead from requirements to specific recommendations.

To date the JPO has taken only interim and *ad hoc* steps to initiate space activities for the GCOS. Provisional requirements have been provided through its affiliate status in CEOS. Now, the requirements must be refined and a management structure to support the ongoing space-based activity must be developed.

An *ad hoc* Task Group is recommended to develop a draft plan for the space components by the end of June 1994. This timetable is necessary to permit review of the plan at the JSTC-IV meeting. The draft plan must include detailed guidance for the further evolution of the space-based measurements for GCOS and should link the current requirements for observations with potential missions, instruments, ground-based support, and data issues.

The plan must also include recommendations for a basic management structure which would be used to provide a focus for space-based measurements in the GCOS. An example of such a structure is described in a working document at JSTC-III, "The Space Element of GCOS", prepared by the UK GCOS Office for consideration. The recommendations in the proposal call for a space manager and a space steering committee to address six elements: liaison, expert advice, documentation, enhancements to future missions, new techniques, and data management guidance.

The GCOS Space-based Observation Panel is proposed as a standing panel to oversee the space-based elements of GCOS. The panel should be composed of knowledgeable and representative members. They will be asked to provide guidance to the JSTC, and will serve as a basis for interaction with the space community. The panel will be consulted on a variety of space issues.

In addition to the panel, a permanent JPO staff member is required to focus on space issues. Beginning in December, a satellite expert will be seconded from Japan for a one-year assignment. As noted above, it will be necessary to have such a position filled continuously.

Although not specifically noted in the document, a technical centre should be identified to provide a more direct link to ongoing and planned space-based activities. This centre would be most effective if located in a satellite oriented research or modelling centre.

The JSTC should provide guidance to assist in securing support for these activities.

3.3 The GCOS Data Plan

A comprehensive data plan for GCOS is required with the same urgency needed for the space elements. Similarly, a draft plan for data should be prepared for review by the next JSTC meeting. A specific document has not been prepared for this meeting since Chapter 6 of the *Draft Plan* outlines the need for a data management component, and discusses a number of elements which should be considered in its development.

As an action item, it is proposed that, in parallel with the ad *hoc* task group for space, a Task Group be assigned the task of providing a draft plan by the end of June, 1994. The draft plan for data should begin with an overall data policy for the GCOS. An initial data policy was recommended at JSTC-II, and will be considered for inclusion in the revised ***Draft Plan***.

The Draft Plan specifically identified four critical steps: (1) assemble user requirements, (2) assess existing system architecture to propose an appropriate version for GCOS, (3) consider the various system elements (collection, quality assurance, distribution, archiving, etc.), and (4) develop recommendations.

The GCOS Data Management Panel is proposed as a standing panel to oversee the data elements of the GCOS. The panel should be composed of knowledgeable and representative members. They will be asked to provide guidance to the JSTC, and will serve as a basis for interaction with the users and the data management community. The panel will be consulted on a variety of data issues.

In addition to the panel, a permanent JPO staff member is required to focus on the data issues. An expert should be seconded on a continuing basis.

As with the satellite recommendation, a technical centre should be identified to provide a more direct link to ongoing and planned data activities. This centre would be most effective if located in connection with a major archive.

The JSTC should provide guidance to assist in securing support for these activities.

3.4 The Initial Operational System

The Initial Operational System (**IOS**) was briefly described earlier. As a key element in the overall plan for the GCOS, it is important to propose mechanisms and a schedule to produce appropriate documentation about the **IOS**.

The **IOS** consists of existing observational programmes whose components contribute needed data, enhancements to these existing programmes, and an overall data system. Thus, the documents clearly will depend on preparation of others now in preparation. However, to begin work on the **IOS**, it is proposed to employ a consultant to develop a draft outline and define key components of the document.

The consultant should first address ongoing observational components with adequate reference to existing publications, manuals, and guides to indicate, for GCOS users, what is currently being observed, and where and in what format the data reside. Second, he should address enhancements which have been identified to date in the ***Draft Plan***, and update readers on the progress toward their implementation. The final portion would describe the components of the data system. This must be **based** on the GCOS data plan which will be in preparation simultaneously.

3.5 GCOS Reports

It is recognized that it will be appropriate for the GCOS to prepare and publish reports on specific issues. These are intended to be scientific or technical documents presenting an observational perspective on issues related to selected topic. It is expected that the development of such reports will require the assistance of many individual scientists, but it is proposed that the overall co-ordination, final preparation, and publication be done by the JPO staff with final review by the JSTC.

The first entry in such a series is the proposal "An Operational Ocean Observing System for Short-term Climate Prediction", a working document submitted for JSTC-III. This document is a proposal to secure continuing support for the Pacific measurements currently being used for seasonal to interannual prediction (eg., ENSO). It includes a discussion of the scientific rationale, the value of the data for applications, the technical specifications of the observing system, the links to modelling and data systems, and issues for the future. After its consideration by JSTC, it will be published early in 1994 and distributed through appropriate sponsoring channels for consideration by the appropriate countries.

As a second example, a detailed assessment of the observational requirements for climate change detection should be undertaken by a Task Group as a contribution to the debate on climate change. As the requirements for observations to address this issue are being developed, it will be important for the GCOS to assemble the information for wider distribution. The JPO proposes to engage appropriate individuals to initiate a draft outline and to begin a first draft version. Subsequently, the JPO will oversee the review by the JSTC and final preparation of this document for publication by the end of 1994.

A third topic for consideration is the observational requirements for global climate models. At this time, models are currently under active research and development. However, observational data sets required by the models have only recently been identified. A systematic study of model requirements including those for initial conditions, boundary conditions, or validation will be a significant contribution. Again, broad scientific involvement is required, so the JPO will work with a Task Group of experts to develop the report for publication in 1995.

To date, the terrestrial components of the GCOS have not been fully delineated. Although a task group addressed these issues, and it was discussed at JSTC-II, there has been no comprehensive consideration of the terrestrial requirements. It is proposed that an expert **secondment** be obtained for this critical area. A first task will be to develop an overview document providing a definitive perspective of the key elements needing attention. In addition, it will be necessary to provide links to the planning activities of the GTOS.

Finally, the GCOS should take the leadership role in developing an effective methodology for assessing observational requirements. Once the requirement for a particular parameter has been established, it will be necessary to specify measurement and sampling constraints. The measurement accuracy and the spatial and temporal sampling must be determined in a way that optimizes an equivalent of a cost-benefit ratio. Similarly, when alternative methods exist, it is essential to select the most effective method. To date, particularly for complex problems such as the climate, little definitive work has been done to guide the specification of such observational requirements. A GCOS report on this issue would be an important contribution. It is proposed that work on this topic be initiated by two consultants in 1994, with a review of progress at JSTC-IV. Following the review, a schedule for publication will be developed.

3.6 GCOS Observational Manuals

It is proposed that the GCOS develop and publish a suite of manuals designed to provide useful information on key climate parameters. The manuals would be oriented toward a wide audience of climatologists or other prospective users who wish to know what data are being collected, how they are being used, what data are planned for collection in the future, and what gaps remain to be addressed.

A working document 10 was submitted to JSTC-III as an example of such a manual for Sea Surface Temperature (SST). This draft has been prepared by the UK GCOS Office for consideration and comment by the JSTC members. The document addresses user requirements, an assessment of current SST measurements, sampling strategies, surface-based and space-based measurements, likely gaps, and GCOS recommendations.

Based on a parameter-by-parameter evaluation, key ones should be selected for consideration by a small Task Group that would draft the components of such a document. A few atmospheric and oceanic variables could be addressed during the next year. It is proposed that the JSTC consider the list which follows to recommend a subset of parameters be selected. ***[JSTC-III recommended this be assigned lower priority for the present time.]***

4. ORGANIZATIONAL ACTIVITIES/ISSUES

4.1 Co-ordination and representation

Since GCOS is sponsored by four organizations, there is considerable demand to meet sponsor requirements for documents, budgets, timetables, etc. These are being met currently by the JPO, but occasionally, outside assistance is necessary.

As GCOS matures, there will be expanding requirements to be represented at national, regional, and international functions. These functions often present opportunities for GCOS, but it is impossible for them to be met by limited JPO staff. It will be necessary to rely on JSTC members, national GCOS office staff, or others to provide adequate representation.

It is proposed that the **Director/JPO** provide materials of a general nature about the programme for use by JSTC members and others. These will require regular updating.

During the upcoming year, the **Director/JPO** intends to participate in, by submitting documents or attending in person, planned meetings of WMO, IOC, UNEP, and ICSU.

4.2 The Integrated Proposal

At the Intergovernmental Meeting on the World Climate Programme (IGM-WCP), the resource requirements for the World Climate Programme and associated activities such as GCOS were discussed. The meeting adopted a statement calling for the development of an integrated proposal on behalf of the WCP and associated activities. This proposal is to be co-ordinated by the Co-ordinating Committee for the WCP (CCWCP), with guidance from a panel of government or national representatives.

Initial meetings of agency and programme representatives have recently occurred, and secretariat staff have been assigned to the task. The documents submitted to the IGM-WCP will form the basis for the integrated proposal, but for the component on “Dedicated Observation of the Climate System”, much work remains to be done.

For GCOS, the development of this proposal is particularly significant. The need is for planning, support for the organizational structure, and most significantly, support for the observations themselves. Participation of the JSTC in the preparation of the GCOS component of the Integrated Proposal is essential.

ANNEX V

TERMS OF REFERENCE OF GCOS PANELS AND TASK GROUPS

1. Atmospheric Observation Panel

Recognizing the need for specific scientific and technical input concerning atmospheric observations, the Joint Scientific and Technical Committee for GCOS hereby establishes an Atmospheric Observation Panel for climate with the following terms of reference.

Terms of Reference:

- o In accordance with the GCOS Plan, and in consultation with relevant existing bodies, to formulate and design a long-term systematic observing system for the atmosphere as an integrated part of GCOS, with the objective to monitor, understand and provide information for the possible prediction of the dynamical, physical and chemical processes that determine the state of the atmosphere from seasonal to multi-decadal time scales;
- o To collate, review, prioritize, and publish data requirements and observing system specifications to ensure the best possible support for GCOS;
- o To solicit implementation support from the relevant research or operational programmes (e.g., WWW, GAW, WCRP);
- o To co-ordinate the activities with other GCOS panels and task groups to ensure consistency of requirements with the overall programme;
- o To report regularly to the JSTC.

Tentative Work Plan:

- o Finalize membership and issue invitations;
- o Circulate Task Group reports and related documents for review and update;
- o Formulate and design a detailed specification for the Initial Observing system (**IOS**) considering specifically:

ANNEX V, p. 2

- i) Major components of currently operational system (e.g., resolution, accuracy, coverage, time lines),
 - ii) Enhancements to existing operational systems in the GCOS plan,
 - iii) New operational components,
 - iv) Data aspects including assimilation;
- o First meeting of the Panel to discuss the IOS draft (Apr 1994);
 - o Review and finalize draft documents for the **IOS** (Jun 1994);
 - o Report recommendations to CBS Task Group on GCOS (Jun 1994);
 - o Make recommendations to CBS meeting (Aug 1994);
 - o Provide report to JSTC-IV (Sep 1994).

Chairman: Dr. L. Bengtsson

2. Terrestrial Observation Panel

Recognizing the need for specific scientific and technical input concerning terrestrial observations, the JSTC hereby establishes a Terrestrial Observation Panel for climate with the following terms of reference.

Terms of Reference:

- o In accordance with the GCOS Plan, with the cooperation of the Global Terrestrial Observation System (GTOS), and in consultation with relevant existing bodies, to plan, formulate and design a long-term systematic observing system for those terrestrial properties which control the physical, biological and chemical processes affecting climate, and which are essential to provide information concerning the impact of climate and climate change. These actions should be carried out through the assessment of existing operational systems and determining those additional requirements needed to satisfy the GCOS plan;

ANNEX v, p. 3

- o To review the needs of the user communities for the data from GCOS, to help ensure timely provision of data sets at appropriate space and time scales, in suitable forms, paying particular attention to the needs of developing countries;
- o To seek review and implementation support from the operators of other relevant research or operational programmes (e.g., WCRP, IGBP, GEMS, GRID) and to collate, review, publish, and prioritize data requirements and observing system specifications;
- o To recommend actions to address the gaps in present and planned systems;
- o To co-ordinate activities with other GCOS panels and task groups to ensure consistency of requirements with the overall GCOS programme;
- o To report regularly to the JSTC and Planning Group of GTOS.

In order to accomplish the Panel will:

- o Review the reports of the GCOS Task Group on Land Surface Processes;
- o Revise and update these reports, with the intention to publish the resulting document;
- o Review, in co-operation with GTOS, the observational activities and modalities from:
 - i) relevant core projects and activities of WCRP (e.g., GEWEX, ISLSCP, ISCCP, etc.) and IGBP (e.g., GCTE, BAHC, DIS, etc.),
 - ii) elements of the Human Dimensions of Global Change Programme (e.g., those on land use and land cover change),
 - iii) **ICSU's** SCOPE and similar activities,
 - iv) relevant programmes of international agencies (e.g., FAO, UNEP);
- o Determine and document other present and foreseeable user needs;
- o Review existing information systems, and in particular their capability to provide the climate community with the terrestrial data needed;
- o Identify major gaps in current observing systems, including temporal and spatial resolution, and propose prioritized options for removing them;

- o Review existing and proposed mechanisms for implementation and assess their ability to meet existing and foreseen needs for terrestrial data;
- o Make recommendations to address the deficiencies.

Tentative Work Plan:

- o Propose Panel to GTOS Planning Meeting;
- o Finalize membership and issue invitations;
- o Initial meeting of the Panel (Before Jun 1994);
- o Prepare initial report on activities (Jul 1994);
Prepare report to the GTOS Planning Group (**TBD**);
- o Prepare proposals on additional observations required and possible mechanisms to obtain operational measurements for JSTC-IV (Sep 1994).

chairman: To be designated

3. Data System Task Group

Recognizing the need for a comprehensive approach to the various data management activities of the Global Climate Observing System, the JSTC hereby establishes an ***ad hoc*** Data System' Task Group for a limited period to develop a plan for consideration. The Task Group has the following terms of reference.

Terms of Reference:

Based on the guidance in the ***Draft Plan*** for GCOS, the Data System Task Group will be established with the objectives to:

¹ The data system is defined as the system which handles data of interest to GCOS and performs the functions of acquisition, quality control, distribution, metadata documentation, archiving, performance monitoring and directory/inventory assistance. The GCOS data system is planned by the ***ad hoc*** data system group, but will be carried out or implemented by institutions or countries.

- o Develop a plan, in concert with GCOS science panel requirements and the GCOS user community, for a data system which will handle and provide data and data products to assist in climate monitoring, climate change detection, understanding, prediction and impact assessment;
- o Make recommendations to the GCOS planners regarding the data system, **specifically** including mechanisms to facilitate its implementation;
- o Develop a data policy under which the data system works;
- o Work with other GCOS panels, the space task group, and relevant data groups at WMO, IOC, UNEP, and ICSU;
- o Prepare a draft data work plan for the next 2 to 5 years which may be used to continue planning and to initiate implementation;
- o Outline and propose to the JSTC the responsibilities of a standing Data System Panel which would ensure data systems are developed and made available to meet GCOS objectives.

Scope:

The plan shall consider *infer alia the* following:

- i) the continual documentation of the data available, including data products up to and including level III, from the data system;
- ii) the use of models for the assimilation of data in order to generate level III data sets;
- iii) the monitoring of the data system to identify gaps and system performance;
- iv) the accessibility of data to the wide variety of users;
- v) an information system which describes the type and location of data sets including levels I, II, and III;
- vi) the role of national and world data centres and specialized data centres (e.g., TOGA data centres) which could contribute to the operational data system;
- vii) a data system requirements translation process which involves a dialogue with the other GCOS science panels and the needs of developing countries;
- viii) the incorporation of necessary historical data into the data system, perhaps using CLIVAR guidelines;

- ix) reprocessing, production and distribution of satellite and *in situ data sets*;
- x) effective user interface to the GCOS data systems elements;
- xi) activities over the next 5 years which will lead to or facilitate implementation.

Tentative Work Plan:

- o Finalize membership and issue invitations;
- o Discuss data system plans at **ACCAD** meeting;
- o Prepare initial documents for a draft plan;
- o Develop initial data system plan and review data policy at first Task Group meeting (Mar 1994);
- o Review plan and complete revised draft of the initial data plan (Jun 1994);
- o Complete final draft with expert groups (Jun 1994);
- o Begin assessment of existing data systems (Jun 1994);
- o Provide draft plan to WMO CBS meeting for comment (Aug 1994);
- o Provide draft plan and recommendations to JSTC-IV (Sep 1994).

Chairman: Dr. G. Withee

4. Space-based Observation Task Group

Recognizing the need for a comprehensive approach to the various space-based observational activities for the Global Climate Observing System, the JSTC hereby establishes an ad hoc Space-based Observation Task Group for a limited time. The Task Group has the following terms of reference.

Terms of Reference:

Based on guidance in the ***Draft Plan*** for GCOS, the Task Group will be established with the objectives to:

- o Develop a plan for the space-based observation components of GCOS, considering the GCOS requirements from the science panels and the needs of the GCOS user community;
- o Develop, define, integrate, interpret, and promote the space-based observational requirements of the user communities carrying out climate studies and providing related advice and services;
- o To recommend how these requirements may be met, including, when possible, proposed responsibility for implementation and funding;
- o To define and propose to the JSTC the responsibilities of an ongoing **Space-based Observation Panel** that should exploit space systems in meeting the objectives of GCOS.

In order to accomplish this the Task Group will:

- i) maintain close contact with the user community, collaborators, and potential suppliers, to encourage innovation and achieve the closest possible match between user requirements and technical solutions;
- ii) prepare and maintain documents that:
 - (a) describe the prioritized capabilities required of the space agencies and their sustaining industries and research activities,
 - (b) reassure the user community that their needs are being properly recognized,
 - (c) advise and assist developing countries in exploiting the data and services which will result from space-based observations;
- iii) generate a GCOS Space Plan which will define the activities necessary to:
 - (a) establish an Initial Operational System for climate, comprising the space and associated ground segments, and including validation activities and integration with *in situ data* sources,
 - (b) identify the enhancements to present components of the operational system that are required to satisfy the needs of the user community,
 - (c) secure a operational observing system, designed to meet those needs, which will overlap with and follow on from the end of the currently planned space missions, extending to about 2030.

Tentative Work Plan:

- o Finalize membership and issue invitations;
- o Develop documents including a first draft plan and statement of requirements;
- o Participate in the WMO CBS WG on Satellites (Mar 1994);
- o Initial Meeting of the Task Group in Darmstadt (**EUMETSAT**) to review and refine documents (May 1994);
- o Participation in the CEOS User Requirement Workshop (May 1994);
- o Submit draft plan, including the statement of requirements, to **JSTC-IV** (Sep 1994);
- o Present updated Statement of Requirements to CEOS Plenary (Sep 1994).

Chairman: Dr. P. Ryder

5. Working Group on Socio-economic Benefits

All the nations of the world should derive socioeconomic benefits from the climate system observations proposed as part of the Global Climate Observing System (GCOS). Specific assessments of these socio-economic benefits are essential to obtain a commitment by governments to the resources needed for the development and operation of a GCOS. As a result, the JSTC hereby establishes a Working Group on Socio-Economic Benefits¹ with the following terms of reference.

Terms of Reference:

- o To review and summarize the work already done by nations and international bodies that is relevant to the problem of assessing the socioeconomic benefits of the GCOS;
- o To advise the sponsoring bodies (**WMO**, IOC, UNEP, ICSU) and participating groups (GOOS, GTOS) on those studies that should be undertaken to further

¹ Socioeconomic benefits are interpreted as including societal and economic benefits beyond fiscal matters, such as preservation of life and property, improved quality of living standards, and health matters. Where possible, non-fiscal benefits will be translated into fiscal equivalents using standard methods.

the understanding of the socioeconomic benefits of the GCOS and the means by which the studies can be accomplished;

- o To develop and maintain liaison with IPCC Working Group II, the OECD Environment Directorate, international and intergovernmental agencies such as WMO, UNEP, and FAO, and other such professional/expert groups with interest in socioeconomic matters as may be appropriate;
- o To act on behalf of the JSTC for GCOS as a point of oversight, communications and information in matters relating to the socioeconomic benefits of a GCOS, whenever designated;
- o To report progress and recommendations to the JSTC.

Tentative Work Plan:

One principal stimulus for the schedule of activities is the need to present the findings of the Working Group to the April 1994 meeting of the IOC Committee for GOOS, the body charged with implementing the ocean aspects of GCOS.

Therefore, the activities of the Working Group are as follows:

- o Identify extant published and informal/unpublished literature related to the value of climate forecasts for seasonal and longer outlooks and for climate related natural disasters (e.g., floods and droughts). Cull the literature for the significant items, and summarize these in a document;
- o Establish contact with the OECD Environment Directorate;
- o Based on the above activities, prepare recommendations for required additional studies;
- o Draft report of activities for report to J-GOOS meeting;
- o Present report to the IOC Committee for GOOS (Apr 1994), and an updated version to the Second WMO Conference on the Economic and Social Benefits of Meteorological and Hydrological Services (Sep 1994);
- o Finalize and print report for presentation to JSTC-IV (Sep 1994).

All activities of the Working Group will be carried on by electronic mail, facsimile, and post, to the extent possible. One meeting will be planned for early March 1994 for review and consideration of the draft report.

Chairman: Dr. M. Briscoe

ANNEX VI

GOOS CLIMATE IMPLEMENTATION PANEL

Background:

At the Third Session of the JSTC for GCOS in Abingdon, November 1993, a small working group was tasked to develop terms of reference, work plan, and typical membership for a panel to consider the implementation of oceanographic components for climate. The group, chaired by Dr. W. **Scherer**, developed the following guidance.

Terms of reference:

- o Interpret the design priorities provided by the J-GOOS design panel of the appropriate modules¹ and develop them into an optimal sampling scheme, time sequence of staging the observations, the types of output products and their hierarchy, and cost estimates;
- o Coordinate the national contributions through I-GOOS to ensure the goals of the implementation plan are met;
- o Facilitate the participation of developing countries in the implementation through I-GOOS;
- o Liaise with responsible GOOS related activities and agencies, such as GLOSS, IGOSS, and CEOS, to ensure the compatibility with and effectiveness of the global ocean observing system.

Work Plan:

- o Approve the implementation panel according to the schedules of I-GOOS;
- o Review the design plans as they emerge and develop them into an integrated observing system. Using the priority ratings provided by the design panels, develop an implementation plan;
- o Ensure the continuation of any threatened ocean observing systems (**eg.**, the extended ENSO observation array) needed for GOOS.

Membership:

A relatively small group including experts with actual observation experience; appropriate physical, chemical, and biological expertise; at least one corresponding member from each design panel; expertise of appropriate implementation groups (**WOCE**, surface velocity, XBT, TAO, sea level (GLOSS), DBCP, etc.); and appropriate geographical distribution.

¹ For case of the ocean climate module, this includes a joint design provided by GOOS and GCOS.

ANNEX VII

JSTC STATEMENT ON OCEAN IMPLEMENTATION

Background:

At the Third Session of the Joint Scientific and Technical Committee (JSTC) for GCOS in Abingdon, November, 1993, a statement summarizing the discussion concerning the implementation of oceanographic observations for climate was presented and adopted after some modification. The statement should be considered as a guideline for future collaboration between the JSTC, and the appropriate Global Ocean Observing System (GOOS) bodies, the Joint Scientific and Technical Committee (J-GOOS) and the Intergovernmental Committee for GOOS (I-GOOS).

The Statement

1. The formulation and ongoing evolution of the (conceptual, scientific) design of the ocean component of the GCOS, which should be essentially the same as the climate module of GOOS, is now the responsibility of the Ocean Observation System Development Panel (OOSDP). That Panel will submit its final report in December 1994. A follow-on design panel will be appointed jointly by the GCOS JSTC and the J-GOOS.
2. The JSTC notes its responsibility to prioritize observations recommended as part of the GCOS, bearing in mind that this must be an overall prioritization cutting across discipline lines and may therefore give different priorities than those which might be recommended by the OOSDP.
3. The JSTC recognizes that the J-GOOS has a similar responsibility to prioritize measurements recommended by the ocean observation design panels across all the GOOS modules.
4. The JSTC recognizes that the I-GOOS should have the primary responsibility for the implementation of the ocean component of the GCOS. However, the JSTC recognizes that other bodies will also be involved in implementation and the JSTC will seek avenues as appropriate, to implement its priority recommendations.
5. To facilitate the communication and collaboration between the JSTC and J-GOOS, they should have at least one member in common. Further, to facilitate implementation, the JSTC should make its plans and recommendations known to the J-GOOS. Similarly, the J GOOS should make its plans and recommendations known to the JSTC.