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REPORT OF THE FIFTH SESSION OF THE
JOINT SCIENTIFIC & TECHNICAL COMMITTEE
FOR GCOS

(Hakone, Japan, October 16-19, 1995)

November 1995

GCOS - 22

(WMO/TD No. 722)

UNITED NATIONS
ENVIRONMENT PROGRAMME

INTERNATIONAL COUNCIL
OF SCIENTIFIC UNIONS

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SUMMARY OF THE SESSION

The fifth session of the JSTC was held in **Hakone**, Japan from 16-19 October 1995. The meeting opened with a scientific lecture on the evening of the 16th by Prof. T Matsuno. Sir John Houghton opened the formal meeting on the **17th**, and chaired the meeting on the 18th. For the final day, the chairmanship passed to the current JSTC Chairman, Prof. John Townshend who completed the final agenda items.

The Committee received the Chairman's report from Sir John Houghton, reports from the Director of the Joint Planning Office (JPO), from representatives of the sponsoring organizations, from Members on national activity, and by the Chairmen of the five GCOS panels. During the session, several small ad hoc working groups were established to review the reports and plans of these subsidiary bodies, and to make recommendations to the plenary session. In addition, an ad **hoc** working group considered mechanisms to assist in the development of the overall global observing systems, and identified opportunities to enhance national participation in their implementation. The proposals of the working groups were discussed and many recommendations adopted by the JSTC for action.

The Chairman updated the JSTC regarding the political agenda on climate and stressed that GCOS is a key element in the future strategy needed to address the scientific understanding of climate, including its uncertainties and potential impacts.

The Director of the JPO noted the suite of GCOS documents that had been published since JSTC-IV by the JPO (e.g., plans for the overall programme, space-based observations, data management; reports of the panels; newsletters; brochures; and published articles). He informed the JSTC that the GCOS/GTOS (Global Terrestrial Observing System) Plan for Terrestrial Climate-related Observations, the GCOS Observation Programme for Atmospheric Constituents, and the latest edition of the Newsletter would be published before the end of 1995. The completion of these important plans and documents brings GCOS to a new phase -- implementation. The Director noted the progress made with the implementation of several significant elements, but challenged the JSTC to participate actively with the establishment of the Initial Operational System which incorporates existing components and enhancements to existing components which are needed and feasible now.

The Chairman of the Atmospheric Observation Panel (AOP), Prof. **Bengtsson**, presented highlights of the AOP activities this past year, including a report on its second session held in Japan in March 1995. The Panel, working with appropriate bodies of the World Meteorological Organization developed and proposed a GCOS Upper-Air Network of approximately 150 sites which is now being implemented by participating countries. The Panel is currently developing a similar surface network to consist of about 800 sites. Finally, he noted that the Panel has formulated a strategy to encourage additional atmospheric constituent and aerosol measurements. For 1996, no meeting of the Panel is scheduled, but representatives **will** be invited to participate in three joint meetings (surface observations, ocean-atmosphere interactions, and atmospheric constituent observations).

A report of the **GCOS/GTOS** Terrestrial Observation Panel (TOP) was presented by its retiring chairman, Prof. Townshend who will be succeeded by Dr Cihlar in 1996. The Panel had its second meeting in UK in April. The Panel developed Version 1 .0 of the Plan for Terrestrial Climate-related Observations on behalf of GCOS and the climate component of GTOS. The Plan addresses three areas: 1) biosphere, 2) hydrosphere, and 3) cryosphere, and outlines the variables required and observational opportunities to acquire data in each. The JSTC approved its publication. The Panel will next meet in South Africa in April 1996 where it will develop projects for implementation of selected elements of the plan.

Prof. Nowlin, Chairman of the Ocean Observing System Development Panel (OOSDP) provided its final report to the JSTC, and briefly reviewed the key elements of the report. He noted that the OOSDP will be superseded by an Ocean Observation Panel for Climate (OOPC), jointly sponsored by GCOS, GOOS, and WCRP. Its Chairman will be Dr. Smith, former member of the OOSDP. The JSTC reviewed recommendations which will be provided to the OOPC for its initial session in the US in March 1996. The JSTC urged the OOPC to consider important elements from the OOSDP which require further development, and to prepare recommendations for cost-effective implementation of the critical observations. It was agreed that emphasis should be on establishing an end-to-end process including data collection, analysis, and distribution of products for the user communities.

By correspondence, Dr Ryder tendered his resignation as Chairman of the **Space-based** Observation Panel (SOP). Prof. Harries, a charter member of the SOP, has accepted to chair the Panel. He described the work of the SOP which led to the publication of the GCOS Plan for Space-based Observations. The strategy adopted by the Panel was to: 1) collect and integrate the requirements obtained from AOP, TOP, OOSDP and other sources, 2) obtain and collate plans from the space-data providing agencies, and 3) compare the results to assess the degree of compliance. The Panel organized its assessments in terms of seven GCOS "missions" which are developed in detail in the body of the plan. The JSTC urged the widest dissemination of the Plan and close collaboration among the Panel and appropriate space agencies, and user communities. It was agreed that the Plan will assist both the GTOS and Global Ocean Observing System (GOOS) in their articulation of space-based observational needs. In addition, the JSTC strongly endorsed the co-operation between GCOS and the Committee on Earth Observation Satellites (CEOS) in the development of an integrated strategy for global space-based observations, and agreed to jointly participate in several meetings to co-ordinate observing requirements and agency missions in 1996.

Mr Withee, Chairman of the Data and Information Management Panel (DIMP) reported on activities during this past year. Like the SOP, the DIMP has produced a Data and Information Management Plan for GCOS. The Plan develops an "end-to-end" concept, and relies on a distributed data system for cost effectiveness. The Panel emphasized the need for full participation by developing countries and considered a variety of distribution modalities which could benefit them. The Chairman of the GTOS Scientific and Technical Planning Group proposed that the GTOS Working Group on Data be merged with DIMP to jointly address data issues. The DIMP Chairman welcomed this suggestion and noted that participation of representatives of both GOOS and GTOS had participated in earlier meetings of the Panel. For the coming year, the JSTC approved a series of actions to establish an

information centre for GCOS, and to work with established data centres to provide needed services to the climate community. The JSTC, noting the need for national support to carry out the principal activities advanced in the Plan, requested the JPO and the DIMP Chairman to develop formal recommendations to seek support for data management activities. The next Panel meeting will be in Japan in May 1996.

The JSTC reviewed the WMO policy and practice for exchanging meteorological and related data and products. Noting that the WMO Congress resolution did not include several of the data sets being considered as part of the GCOS, the JSTC agreed to take an active role in formulating data requirements and to participate with appropriate WMO bodies.

The JSTC accepted the resignation of Dr Briscoe as Chairman of the Socio-economic Working Group. The JSTC briefly reviewed the status of the Working Group and noted with approval that a review of the value and benefits of forecasts, based on previous published work, had been published. The JSTC agreed that there is a continuing need to better **define** the benefits of the GCOS programme, and concluded that a few experts should be invited to consider the impact of an improved observing system, specifically in socio-economic terms. The JPO agreed to contact members of the Working Group to identify potential candidates who could contribute to such studies, and approach potential sponsors for support.

During considerable discussions regarding the involvement of both developed and developing countries in GCOS, it was noted that a primary need is to describe the benefits of participation in the GCOS programme. The JSTC recommended that the GCOS Panels specifically identify such benefits and itemize particularly those data products which critically depend on observations from developing countries.

The JSTC discussed the potential integration of observing components, focusing on climate-related issues. Now that some countries are seeking strategies to address overall global observational needs, the JSTC recognized that GCOS could provide a paradigm for integrating programmes. The JSTC observed that it is essentially integrating components from nearly all elements of the earth system to meet climate objectives. The JSTC agreed that it should provide a strong partnership with international agencies, national governments, or other activities seeking to develop integrated approaches to observations, both from **space-based** and *in situ* platforms. The JSTC further agreed that an initial step should be the assembly of a comprehensive inventory of existing systems which could then be enhanced as outlined for the GCOS Initial Operational System.

The JSTC discussed the overall implementation plan for GCOS. With the completion of the terrestrial plan, the JSTC agreed that such a comprehensive plan could be initiated and agreed to assist. The JSTC emphasized that the plan should establish priorities and products that are required, but should be realistic in its expectations based on limited resources likely available.

The sixth session of the JSTC will be held in Canada, 28 October - 1 November, 1996.

REPORT OF JSTC-V

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Meeting

1.1.1 Dr **Ito**, Head, **Office** of the Climate Programme, Japan Meteorological Agency (JMA), informally opened the fifth session of the Joint Scientific and Technical Committee (JSTC) at the Hakone Highland Hotel, Hakone, Japan on October 16, 1995. On behalf of the local sponsoring organizations, JMA, the Science and Technology Agency (STA) and the National Space Development Agency of Japan (NASDA), he welcomed the attendees. He invited Dr Tokioka of the JMA and Mr Hirosawa of the STA to provide additional introductory remarks.

1.1.2 Dr Tokioka, Director of the JMA Long-range Forecast Division, also welcomed the participants to Japan. He emphasized the significance of global issues in Japan, and noted that global issues such as climate required a co-ordinated global response. In this vein, he recognized the important role of programmes such as GCOS in developing such a response, and was pleased that the JSTC had chosen Japan for this meeting.

1.1.3 Mr Hirosawa, on behalf of Mr Nakamura, Director of the Office of Earth Science and Technology, STA, noted the importance of GCOS in STA, and its associated activities, NASDA and the Japan Marine Science and Technology Centre (JAMSTEC). He expressed his pleasure that the JSTC was meeting in Japan and pledged the continued support for GCOS activities by STA.

1.1.4 Sir John Houghton, Chairman of the JSTC, expressed his appreciation for the warm welcome that attendees had received. He took note of the very pleasant surroundings of the meeting, and thanked the Japanese hosts for their preparation, and generous support. He added his welcome to the participants.

1.1.5 Dr **Ito** introduced the featured speaker for the evening, Prof. Matsuno of Hokkaido University and Chairman of the Japanese Study Committee for GCOS. Prof. Matsuno provided an overview of climate change in Asia, and focused on recent unusual climate events since 1989 in Japan. He related these events to El **Niño** and anomalies in conditions on the Tibetan Plateau. He indicated that there will be considerable focus on these conditions in the near future, since much of the weather and climate in Eastern Asia is **influenced** by them.

1.1.6 Prof. Matsuno also outlined the substantial observational efforts in Japan which will address climate issues and may be considered as contributions to GCOS. He reviewed atmospheric activities of the JMA and the academic community with regard to atmospheric dynamics and constituents, including plans for an automated meteorological data system. He

described the oceanographic investigations and monitoring efforts of JMA, JAMSTEC, the Japan Marine Safety Agency, and the Japan Fisheries Agency. He noted the work of the National Institute for Environmental Studies addressing carbon dioxide on volunteer ships. Finally, he noted the extensive space-based observation plans of NASDA which include the upcoming **ADEOS** and TRMM missions, as well as plans for the Earth Observation Research Centre for data analysis.

1.1.7 The Chairman and members of the JSTC and other attendees expressed their appreciation for his presentation. The informal meeting concluded with a reception hosted by JMA, STA and NASDA.

1.1.8 The Chairman formally opened the fifth session at **9:00** am, October 17, 1995. He again thanked the JMA, STA, and NASDA for organizing the meeting and for securing very comfortable facilities in pleasant surroundings.

1.1.9 The Chairman welcomed the members of the JSTC, and noted that three were unable to attend, Mr Winokur, vice-chairman, and Drs Whelpdale and **Zhou**. He particularly welcomed Prof. Taira, Ocean Research Institute, University of Tokyo as a new member, and Prof. Chen, Chinese Academy of Meteorological Sciences who was attending on behalf of **Dr Zhou**. The Chairman expressed his appreciation to the representatives of the sponsoring organizations, and to the other participants and guests for their attendance (See Annex I).

1.2 Approval of the Agenda

1.2.1 The Chairman presented the proposed agenda (See Annex II). Noting that the past year saw the publication of a number of key plans and documents on GCOS, he reminded the meeting that it was particularly important that it concentrate on implementation activities over the coming year. He observed that significant discussion time should be allocated to the agenda item on co-operation with national programmes and suggested the agenda be revised to accommodate the change. The Chairman noted that a special presentation on Climate Information and Prediction Services (CLIPS) would be given during an evening session, and suggested it be included in agenda item 4. With these changes the agenda was adopted.

1.3 Conduct of the Meeting.

1.3.1 The Chairman explained that he would chair the first two days of the meeting (agenda items 1 • 7.3) and that the new chairman of the JSTC, Prof. Townshend, would chair the last day (agenda items 7.4 • 10). He proposed a working schedule for the meeting. The first day would be devoted to his report, those of the Director of the Joint Planning **Office** (JPO), sponsoring organizations, individual national reports, and chairmen of the GCOS panels (agenda items 2 through 6). The second day, *ad hoc* working groups would be invited to discuss specific implementation issues (agenda item 7). The **final** day would reconvene in plenary session to discuss issues developed by the working groups and to complete other remaining agenda items.

2. **REPORT OF THE DIRECTOR, JOINT PLANNING OFFICE**

2.1 The Chairman of JSTC invited Dr **Spence**, JPO Director, to present a report on GCOS activities since JSTC-IV. The Director briefly commented on progress of the GCOS panels, noting that more detailed reports would be coming from the respective chairmen. He reported on a number of meetings that had been attended by either members of the JSTC or staff of the JPO.

2.2 The Director noted the GCOS documents that had been published since **JSTC-IV** which included Version 1 .0 of the GCOS Plan and of the plans for Space-based Observations and Data and Information Management. In addition, seven reports of the panels and various working groups had been completed along with 2 newsletters, and a brochure for the Conference of the Parties to the UN Framework Convention on Climate Change. Three articles had appeared in various other publications with two more in press. The **final** element of the **planning** documentation, the **GCOS/GTOS** Plan for Terrestrial Climate-related Observations, was to be published next month.

2.3 With the completion of these important plans and documents, the Director noted that GCOS was entering a new phase. For the next few years, activity would concentrate on implementation. The Director noted the progress made with the implementation of several significant elements (the GCOS Upper-Air Network (GUAN), a surface network for atmospheric observations, the TAO Implementation Panel (TIP), an International South Atlantic Buoy Programme (ISABP), and the participation and co-ordination of a number of data centres), but urged the JSTC to participate actively with the development of additional components.

2.4 He noted the various sources of support for GCOS planning to date. The four sponsoring organizations have been supportive to varying degrees and in a variety of ways. In particular, the World Meteorological Organization (**WMO**) has funded JPO staff and many secretariat offices have contributed to GCOS. Scientific and technical programmes of WMO, notably the World Weather Watch (**WWW**), the Global Atmosphere Watch (GAW), the World Climate Programme (**WCP**), the World Climate Research Programme (**WCRP**), and the Hydrology and Water Resources Programme (**HWRP**), have been very supportive. In addition the WMO Technical Commissions and Regional Associations have assisted GCOS. The United Nations Environment Programme (**UNEP**) has provided funds which have supported a number of activities and the partial support for a staff member at JPO. UNEP has also contributed to co-ordination of the global programmes through its support of the Global Terrestrial Observing System (GTOS), the Global Reference Information Directory (GRID), and the Global Environmental Monitoring System (GEMS) and through EARTHWATCH. The Intergovernmental Oceanographic Commission (**IOC**) has supported GCOS through the activities of the Global Ocean Observing System (GOOS), and its established programmes such as the Integrated Global Ocean Services System (IGOSS) and Global Sea Level Observing System (GLOSS), and with WMO, through the Data Buoy Co-operation Programme (DBCP). The International Council of Scientific Unions (**ICSU**) has supported the effort with modest financial contributions, but extensively with scientific support, and through its World Data Centres (**WDC**). Significantly, several national governments have provided support either financially or in kind.

2.5 The Director noted that presently there are three full-time and one part-time staff in the JPO. During the year however, two experts were seconded by Japan: Mr Matsuura (NASDA) spent 15 months, and Mr Shida (JMA), six weeks. In addition, personnel were shared with WWW on data and information management activities. During 1995 four consultants were employed (UK, USA, Canada (2)) for a variety of projects.

2.6 For the future, the Director urged that efforts be taken to prioritize activities from the published plans and to act. This requires increased interaction with national activities to obtain support from individual countries, agencies and programmes. All avenues will need to be explored. To make this happen the action must come from not only the JPO, but also members of the JSTC must become more proactive. The GCOS message has not been universally understood, so to obtain even modest increases in national support, better mechanisms for commitments must be developed.

2.7 The Director related that GCOS has received many strong words of support, but there have also been several discouraging events during the past year. There will be a major reduction in WMO funding for the next financial period; there is great uncertainty concerning funding from UNEP; and resources from IOC are limited. National support has been similarly curtailed. For example, due to budgetary restrictions in the US, the EPA project has been reduced from three to two years.

2.8 The Chairman congratulated the Director on his report and noted the considerable satisfaction of the JSTC in the progress achieved by the Director and other members of the JPO during the year. However, he noted that there is considerably more to do. This coming year should prove to be very exciting as we move forward to implement the programme. He suggested that key elements of the material presented by the Director be included in the report of the meeting (See Annex III).

3. REPORT OF THE CHAIRMAN

3.1 The Chairman, in his oral report, noted that the political agenda on climate remains high profile and that scientific knowledge regarding climate change and its impacts, including also knowledge of uncertainties form the basis for discussions regarding actions. Improvements in observations and hence GCOS are key to improvements in understanding and a reduction in uncertainties.

3.2 The Chairman recalled that the Intergovernmental Panel on Climate Change (IPCC) would soon be releasing its next assessment which concludes that anthropogenic **forcings** are increasing the rate of climate change. The assessment will indicate the importance of aerosols which add a large unknown to overall climate change. He cited this as an opportunity for GCOS to help fill a critical gap. He reiterated the great need for national foci for GCOS to help nations organize national responses. He observed that it is only through the development of **national** committees and structures that GCOS will likely receive the support needed. He urged that GCOS establish direct dialogue with governments to establish and co-ordinate needed observations.

3.3 The Chairman also stressed the need for GCOS to concentrate on implementation issues during the coming year. He mentioned the need for an “end-to-end” system. He stated that the GCOS plans must show a continuous link from the initial requirements and observations through to the delivery of information to be used in the assessments. Emphasis should be on protocols and standards. He urged that the JSTC help GCOS prioritize its work to successfully accomplish a number of important goals.

3.4 He reiterated his commendation of the JPO, and in particular to the Director, in producing the great number of high-quality documents and in its other accomplishments since JSTC-IV which he said were due, in large part, to the work of the Director. The Chairman observed that, while much has been accomplished by the limited JPO staff, it is essential to **find** ways to share the work and the responsibilities of the office. He was particularly pleased with the three major plans already published and looked forward to getting the GCOS/GTOS Plan for Terrestrial Climate-related Observations published in the near future. But, he stressed the need to be sure that all GCOS publications receive a thorough external scientific review.

3.5 The Chairman noted the confusion generated by the development of three global systems. He proposed that GCOS take steps to assist in clarifying the issues associated with the systems. In particular, he observed that the strategy put forward by GCOS, namely: 1) development of requirements, 2) assessment of current systems, and 3) recommendations for improvements, were being adopted by the systems. He also noted that the plans for space-based observations and for data management should be of great value to the other systems as they proceed. He agreed to support a common approach to the observing system to the degree possible.

4. INVITED REPORTS

4.1 Reports from the Sponsoring Organizations

World Meteorological Organization (WMO)

4.1.1 Mr Landis, Director of the World Weather Watch Department, gave the report of the World Meteorological Organization (**WMO**) and provided a detailed document itemizing the interactions among the various WMO programmes and GCOS. He reported that there is strong support from the last WMO Congress for GCOS. It approved a new resolution to continue the development of GCOS.

4.1.2 He noted that, in addition to providing financial support to GCOS, WMO supports a number of programmes, including observations, assistance, and education and training programmes. These programmes have been closely co-operating with the planning and implementation of GCOS. Mr Landis noted that in many cases, these programmes already provide a number of the observations that are required by GCOS; in other cases, they are developing additional elements to augment observations in accordance with the GCOS plans. During the early years of GCOS, WMO staff have been very active in assisting GCOS, particularly in the development of the GCOS Upper-Air Network (GUAN) and in

meetings of the Atmospheric Observation Panel (AOP) in Tokyo this past year and previously in Hamburg.

4.1.3 Mr Landis noted that the WMO marine activities would be discussed in agenda item 6.3, but pointed out that the DBCP established the International South Atlantic Buoy Programme (ISABP) in part to meet GCOS requirements. At present there are 11 institutions participating in ISABP deploying approximately 50 buoys which transmit sea surface temperature and other information. An additional initiative is being proposed by the DBCP in concert with the JPO of GCOS for the Indian Ocean¹.

4.1.4 The last session of the WMO Commission for Basic Systems (CBS) Working Group on Satellites agreed to a critical review of **WMO's** satellite data requirements. Many of the documents utilized by the CBS Working Group on Satellites were input to the GCOS Space-based Observation Panel to ensure close co-ordination between the two groups. In addition WMO and GCOS have been developing a relational database of satellite requirements. WMO also has a database of the expected performances and mission parameters for the plans of all satellite operators.

4.1.5 Mr Landis reported that there was especially close co-operation between the WWW and GCOS in the area of data management and the two groups share a staff member, Mr **McGuirk**. The GCOS and CBS data management plans are very similar and in fact have common goals. The WMO Distributed Database (DDB) being developed by CBS is of relevance to GCOS. Mr Landis also noted that the WMO Congress had considered the issues of data sharing and commercialization which have significance for GCOS. It was agreed that this topic should be considered later in association with other data management topics.

4.1.6 The Chairman specifically wished the minutes to reflect the gratitude of the JSTC for the long-term commitment of WMO to GCOS. He observed that without WMO there would be no GCOS. He noted that the financial support is greatly appreciated, but the contribution of individual programmes such as WWW, GAW, WCP, WCRP, and HWRP are vital to the success of GCOS, and the organizational contributions to assistance programmes and to education and training are similarly critical.

Intergovernmental Oceanographic Commission (IOC)

4.1.7 The IOC was represented by Mr Rebert, ad **interim** Director of the GOOS Support Office (GSO). On behalf of IOC, he expressed strong support for GCOS and appreciation for the close co-operation that has developed between the GCOS and GOOS programmes .

4.1.8 He recalled that during 1993, IOC had seconded an expert to GCOS JPO in Geneva, but said that a continuation of that arrangement was not possible over the next year. However, IOC will continue to support GCOS indirectly through the development of the climate module of GOOS and in other ways.

¹ A meeting to plan the International Buoy **Programme** for the Indian Ocean has been scheduled for 12-14 February in **Goa**, India.

4.1.9 Mr Rebert reminded the JSTC that the Ocean Observation Panel for Climate (OOPC) would be supported co-operatively by GCOS, GOOS, and WCRP. He also updated the Committee on the two regional GOOS programmes for the European and Northeastern Asian regions, EUROGOOS and NEAR-GOOS respectively. He reported that a “priorities meeting” was being hosted by the US in **May**² to which countries would be invited to discuss the various components of GOOS, and to provide guidance on priority activities. The meeting would be followed by an I-GOOS planning meeting and, in 1996, by an I-GOOS session which could gather resources for implementation of the high-priority elements that were identified.

4.1.10 Dr McEwan, vice-chairman of the IOC-WMO-UNEP Committee for the GOOS (I-GOOS) and GCOS representative on the Joint Scientific and Technical Committee for GOOS (J-GOOS), reported on recent developments from his perspective. He noted that since JSTC-IV, three significant meetings have occurred: the I-GOOS Strategy Subcommittee meeting was held in Geneva March 27-30; J-GOOS-II, in Paris April 24-26; and I-GOOS-II, in Paris June 6-9.

4.1.11 Dr McEwan reviewed some key points with the implementation of GOOS. He noted that the GOOS Support Office is currently understaffed, that the benefits for many of the modules need to be articulated, and that several still require better definition. He did note that the climate and ocean health modules were relatively well designed, principally due to the work of the OOSDP and the Health of the Ocean Panel. He informed the JSTC that a new GOOS document is in preparation.

4.1.12 Dr McEwan observed that the coastal module is likely the key to the success of GOOS since it appears to have the widespread backing of IOC member states. Some JSTC members were concerned that many countries may support only the coastal aspects of GOOS and consider that they are then fully supporting GOOS. If this happens, some members felt that many critical climate observations may not be accomplished. Prof. Norse noted that the coastal zone is an area of interest among all the observing systems, but particularly between GTOS and GOOS, chiefly through carbon sediments via riverine inputs.

4.1.13 The Chairman expressed appreciation for the two reports, and for the close relationship between the IOC and GCOS. He urged that the minutes reflect the need for co-operation and mutual support between GCOS and GOOS to continue.

United Nations Environment Programme (UNEP)

4.1.14 Unfortunately, due to a travel limitation in UNEP, no representative was able to attend JSTC-V. As a result of the travel restriction, the JPO Director invited a brief statement from UNEP which he summarized for the Committee.

4.1.15 The statement conveyed **UNEP's** regret that it was unable to send a representative to the JSTC. The statement congratulated the JSTC and its constituent panels, together with the JPO, on the considerable progress made over the past year.

2 This meeting has subsequently been postponed.

4.1.16 The statement noted that the UNEP Governing Council had endorsed the “Climate Agenda”, and in particular, the proposal that UNEP be responsible for co-ordinating international activities under Thrust 3 of the Climate Agenda, “Studies of climate impact assessments and response strategies to reduce vulnerabilities” . However, funding levels now available would make it very difficult for UNEP to implement Thrust 3. Consequently, efforts are being made to raise extra money and to encourage other organizations to take initiatives with regard to impact assessments in partnership with UNEP. As the programme evolves and subject to resource availability, it is hoped that the important work enunciated in the GCOS Plan can get modest financial support.

4.1.17 In particular, the statement from UNEP recognized the efforts of the **GCOS/GTOS** Terrestrial Observation Panel (TOP) for its draft plan that meets needs of both GCOS and GTOS. It stated that UNEP remains convinced that collaboration of this type is essential for the efficient and cost effective planning and implementation of the Global Observing Systems and it is encouraging the linkages between GCOS, GOOS and GTOS mentioned in the GCOS plan, and the GTOS plan under development. UNEP, as a sponsor of all three Global Observing Systems, recognized the need for a common, integrated policy and strategy for the support of all three systems. As a result, the Environmental Assessment Division will oversee **UNEP’s** participation in all three systems.

4.1.18 In conclusion, the statement said UNEP looks forward to continuing its partnership in **GCOS** and will continue to support the ongoing work of the JSTC to the best of its ability, despite the financial constraints referred to above.

4.1.19 In addition to the foregoing statement, a brief facsimile was transmitted separately to the Chairman of JSTC. It conveyed the news that UNEP funding would not be available for 1996-97 for GCOS. In response, the JSTC urged the Chairman to send a letter to UNEP seeking clarification of and expressing concern with this decision. In addition, he invited members of the JSTC to contact UNEP representatives in their respective countries to support the GCOS activities.

International Council of Scientific Unions (ICSU)

4.1.20 The report of ICSU was given by Prof. Townshend. He reported that ICSU remains very supportive of GCOS and has been impressed with the accomplishments to date. The programme received very favourable comments from the ICSU Advisory Committee for the Environment. He noted that the primary interest in GCOS from the ICSU perspective is in implementation. **ICSU will** continue to support GCOS financially, though it is recognized that the financial support **will** continue to be limited. The Council does, however, provide a valuable link between GCOS and the scientific associations around the world.

4.1.21 Prof. Townshend noted the continued evolution of the International **Geosphere-Biosphere Programme (IGBP)** and the World Climate Research Programme (**WCRP**). For example, the former is in the process of developing a number of new “Core Projects”. He offered to approach ICSU to try to elicit the new observational requirements arising as a result of these new projects. He observed that the IGBP was interested to develop a closer working relationship with **GCOS** and play a more formal role in GCOS implementation. As Chairman of the IGBP Data and Information System (IGBP-DIS), he agreed to provide a

contact with IGBP activities. He noted that he and the Director would attend the IGBP Scientific Advisory Council meeting in Beijing, China the week following the JSTC meeting, and would make appropriate presentations and statements at the council meeting.

4.1.22 The Chairman noted the support of ICSU, and appreciated the interest shown in advancing the implementation, as for example in the publication of the articles on GCOS in the ICSU newsletter *Science International* (e.g., Issue No. 58, December 1994).

4.2 National Activity Updates

4.2.1 The Chairman invited the JSTC members to briefly review recent activities in their countries. In addition to the verbal reports summarized below, several members of the JSTC provided detailed reports of activities in their countries (See Annex IV).

4.2.2 The report from the United States was given by Dr Kennel. He noted that the US supports scientific planning for all three Global Observing Systems. The US is actively developing a concept for an Integrated Global Observing Strategy (IGOS) to provide a co-ordinating mechanism for the global observing systems. The US recognizes that much coordination is already occurring between the systems and cites the **GCOS/GTOS** Terrestrial Observation Panel (TOP) as but one example. However if the observing system plans are to convince governments to provide funding, more needs to be done. As an example, the observing systems must clearly link their observations to products that can be used by society. It is also critical that the observing systems receive adequate scientific review. In this regard, the US National Academy of Sciences (NAS) is considering reviewing and providing advice on the US concept for an integrated global observing strategy and providing advice to the global observing systems. Dr Kennel **also** stressed the need to separate scientific and operational needs, pointing out the importance of analysing gaps between requirements and planned measurement. Such activity is being done by CEOS and GCOS.

4.2.3 Dr Schiffer, National Aeronautics and Space Administration (NASA) provided additional detail concerning the US Government infrastructure to support the global systems, Under the interagency Committee on Environment and Natural Resources (CENR), a Task Force on Observations and Data Management has been established. He noted that the Task Force has established a Secretariat to support its role in co-ordinating US planning related to international global observing system programmes. He agreed to co-operate in particular with the GCOS **JPO** in fostering the objectives of the GCOS programme.

4.2.4 Members of the JSTC welcomed the statement by the US representatives and felt it reflected similar situations in their own countries. There was unanimous support for the US position. The Chairman noted that GCOS is already doing much of what was called for by the US strategy, and he pledged that the programme would participate actively in the further development of the strategy and its implementation in the future. The Chairman and some JSTC members commented in particular that the NAS panel and review would be a very positive development.

4.2.5 Prof. Norse, Chairman of the GTOS Science and Technology Planning Group (STPG) stressed that a “common view” be taken to the observing systems. He specifically noted the close collaborations needed with regard to space observations and data

management, and for future implementation of *in situ* observations. In addition to the close co-operation between GCOS and GTOS in the development of the plan for land surface observations for climate, he noted the links between GTOS and GOOS in the coastal zone.

4.2.6 Dr McEwan provided a brief report on activity in Australia. He noted that there has been little progress over the last year in developing a national GCOS programme in Australia, although fortunately, there was progress on some GOOS-related issues. He observed that there is a AUS \$53 million programme on coastal management, and that commitments have been made to continue Australian participation in the Tropical Ocean Global Atmosphere Programme (TOGA) expendable bathythermograph (XBT) deployments for the short-term. Both have relevance to GCOS. He noted that a secretariat to support the participation of Australia in the observing systems is being considered. In addition, a group on marine data management has been established and Dr McEwan chairs the group.

4.2.7 A brief report on activity in Canada was provided by Dr Needler. He noted that an *ad hoc* Panel had been formed by two national boards, the Canadian Climate Board, and the Global Change Programme Board. In the spring of 1995, it produced an extensive report on GCOS from a Canadian perspective which includes discussions of potential economic advantages to Canada as a result of Canadian participation in GCOS. It also outlines the sort of contribution Canada might make to the implementation of GCOS. The report has been accepted by the two parent boards. A more permanent GCOS committee is being formed under the Canadian Climate Board to further **define** possible Canadian contributions to GCOS and to seek means of implementing them.

4.2.8 The Chinese report was given by Prof. Chen. Since JSTC-IV, China has made considerable progress in organizing an interagency group to develop the Chinese components of GCOS. A plan for a National GCOS Committee has been prepared and submitted for approval.

4.2.9 A National Climate Center has been established under the China Meteorological Administration. The centre's primary task focuses on operational activity and the improvement of short-term climate predictions. It is also involved with national and international research projects such as Asian Monsoon studies. It distributes a number of products including monitoring reports, climate assessments and climate predictions. The Japan-China Asian monsoon experiment and the Chinese-American South China Sea Monsoon Experiment have been implemented. Prof. Chen also described an important new national research programme -- the Tibetan Plateau Field Experiment (**TIPEX**).

4.2.10 The report on German activity was presented by Prof. Bengtsson. He noted that Germany has been supportive of GCOS since 1993 and has a GCOS office located at the Deutscher Wetterdienst (DWD) in Offenbach, Germany. He raised three organizational matters of particular interest to the JSTC: 1) the German Remote Sensing Data Centre of the German Aerospace Research Establishment is prepared to contribute as a GCOS Support Centre; 2) the International CLIVAR Project Office is now fully operational and the new director is Dr Coughlan from Australia; and 3) an International Office has been established for the BALTEX, the Baltic Sea Experiment.

4.2.11 Prof. Balogun reported on the increased awareness of GCOS in Nigeria. It is hoped that a national committee can be put in place after the Conference on Climate Change being held in Lagos, Nigeria in November. The Conference is being sponsored by the Nigerian Meteorological Service and the Nigerian Meteorological Society with some financial support from WMO and the International Centre for Theoretical Physics in Trieste, Italy. He appreciated the widespread interest shown in attending the Conference, and attributed this interest in part to the publicity given by GCOS (Newsletter # 3) and the Director of the **JPO**.

4.2.12 Dr Vasiliev reported the Russian Federation had a history of activities to resolve ecological problems including anthropogenic climate change. The Russian Federation ratified the UN Framework Convention on Climate Change in 1994. Two significant ongoing research projects are: 1) "Global Change in Environment and in Climate", and 2) "Estimations and Forecasts of Climate Change and Its Consequences" being conducted at the Russian Federal Service for Hydrometeorology and Environmental Monitoring with the participation by Academicians Izrael and Budyko from the Institute of Global Climate and Ecology. He noted a number of other ongoing programmes related to climate change.

4.2.13 He noted that the Interagency Commission of the Russian Federation on Climate Change Problems has been formed. The new commission is chaired by Dr **Bedritsky**, Head of the Russian Federal Service for Hydrometeorology and Environmental Monitoring. There are 30 representatives on the commission representing the state planning, industrial, agricultural and environmental ministries and the scientific community.

4.2.14 Mr Haruyama made a brief report on activities in Japan. He reminded the JSTC that Prof. Matsuno had reviewed a number of programmes and plans for observations in support of GCOS and the other global observing systems. He also reported on the activities of the Japanese GCOS Study Committee. Three GCOS newsletters have been published in Japanese, and a new brochure, "GCOS in Japan" has been distributed.

4.2.15 The Chairman made particular note of the significant contributions **from** Japan during the past year, and expressed his gratitude for them. He noted that, in addition to JSTC-V, Japan hosted the second session of the Atmospheric Observation Panel (AOP) in conjunction with an international meeting on climate. The JPO Director expressed his personal appreciation to Japan for the two experts that had been seconded to the JPO during the year, noting their contributions particularly to the development of the space plan and other related publications during the year.

4.2.16 The **Chairman** recognized some of the numerous and significant contributions being made by Japan to GCOS. In particular he noted the:

- o Long-term continuation of high-quality meteorological observations under the framework of the WWW programme;
- o Enhancement of observations of atmospheric constituents such as greenhouse gases in the **framework** of the GAW programme;
- o Contributions from Japanese Geostationary Meteorological Satellites;

- o Earth Observing Satellite programmes (ADEOS-I; -11 and TRMM);
- o Data centres including the WDC for Greenhouse Gases and the Climate Data Centre of JMA, the Japan Oceanographic Data Centre of Marine Safety Agency, and the Earth Observation Data Analysis Research Centre of NASDA, all with accessibility to international scientific communities;
- o JAMSTEC observing programmes in the Pacific Ocean involving buoys and observations from ships;
- o Co-ordination of oceanographic observation and data-flow through the regional GOOS programme in the Northeast Asia region, NEARGOOS;
- o Observations and modelling in support of El Niño-Southern Oscillation (ENSO) studies, including activities to improve 4-dimensional data assimilation techniques;
- o Observations and research in support of the Global Energy and Water Cycle Experiment (GEWEX), in particular, GAME, the GEWEX Asian Monsoon Experiment.

4.2.17 The JSTC expressed its appreciation for these important contributions and welcomed future initiatives being developed by Japan in response to GCOS needs. The Committee noted in particular the activities in support of quality assurance, and data management and dissemination on behalf of GCOS.

4.2.18 The JSTC recognized the important contributions from the other countries as well. It noted with concern that while some countries have a clearly focused group to interact with GCOS, many do not. As a result, the GCOS message is not getting through to the appropriate contacts within many nations. The Director of JPO reviewed steps which had been taken during the past year to increase participation. Letters had been dispatched to ministers of foreign affairs by the Secretary-General of WMO on behalf of the sponsoring organizations. In addition, the other sponsoring organizations were invited to communicate a similar letter to their counterpart contacts. In response, several countries had indicated their actions on behalf of GCOS. These were tabulated and reviewed by the JSTC.

4.2.19 The JSTC offered several suggestions to increase the visibility of GCOS over the coming year. Examples include:

- 1) Organize sessions (either formal sessions or poster sessions) at major scientific meetings that show GCOS activities;
- 2) Relate some GCOS products to short-term planning activities;
- 3) Continue to press the message through sponsoring organizations to national governments;
- 4) Plan a major meeting for GCOS participants in 1997.

Individual members of the JSTC agreed to develop additional proposals and suggestions to the JPO for consideration (See section 5.0).

4.3 The Climate Information and Prediction Services

4.3.1 Mr Kininmonth, Australian Bureau of Meteorology, was invited to the JSTC meeting to provide a special evening presentation on the Climate Information and Prediction Services (CLIPS) programme. During the past months, several WMO Members have developed a new component of the World Climate Applications and Services Programme which will focus on the preparation and dissemination of climate information and predictions. Since such activity will require a reliable and effective observational database, GCOS may be expected to play an important role in the success of CLIPS.

4.3.2 Mr Kininmonth reminded the JSTC that the ability to predict climate has major implications for a variety of commercial sectors. In an increasing competitive market place and with major concern over environmental hazards, water resource availability, sustainable development, and agricultural productivity the ability to predict future climates becomes even more critical. Several recent advances have allowed for great improvement in the ability to predict climate over a period of several weeks to a few months, particularly in mean conditions that can be expected.

4.3.3 The major objectives of CLIPS are as follows:

- 1) To provide an international framework to enhance and promote economic, environmental and social benefits from climate information and predictions;
- 2) To facilitate the development of a global network or regional/national centres, including communications and training; these centres to act as a focus for the provision of climate information and prediction services;
- 3) To demonstrate the value and ultimate socio-economic benefit of climate information and prediction services, and the connection of those benefits with global observing, monitoring, prediction and applications;
- 4) To encourage development of operational climate predictions for periods and regions that are feasible, and directed towards useful, user-oriented applications.

4.3.4 Mr Kininmonth stated that a close co-operation between CLIPS and GCOS was essential. Finally, he noted that a brochure had been published on CLIPS³.

4.3.5 The JSTC was informed about an International Forum to be held in Washington to initiate an International Research Institute for climate prediction. It was noted that such an organization would be a primary user of GCOS information for its products.

3 WMO No. 832, available from WMO or the JPO

5. CO-OPERATION WITH NATIONAL PROGRAMMES

5.1 The Chairman reminded the JSTC that, despite the progress in developing and publishing comprehensive plans, there are few well-established national activities in support of the programme. He noted the solicitation, first in 1992, and then in 1995, by the WMO Secretary-General to ministries of foreign affairs asking that national committees and focal points be established to provide clear linkage to the GCOS programme. The response to these solicitations has not been encouraging to date. He urged that new approaches be investigated.

5.2 However, he recognized that a small number of countries have established effective committees to develop national responses to the GCOS programme. For them, it is important that the JSTC and the JPO develop channels of communication to enable the national committees and GCOS to develop fruitful partnerships.

5.3 The Chairman requested that the JSTC seriously address these issues, first in brief plenary session, and subsequently in a small ad *hoc* group which could develop specific recommendations for the JSTC to consider.

5.4 Prof. Norse expressed **scepticism** that letters from the sponsoring organizations would have much effect in many of the developing countries. He felt that it would be through the provision of user-friendly products that GCOS would develop national support. He noted that a positive response will occur when the observing systems can provide items needed to address national priorities and issues.

5.5 Dr **McEwan** noted that national committees need a national “champion” to obtain a positive response in many countries. He felt that national representatives on the international bodies and committees could be called upon to assist in promoting and developing national inputs.

5.6 Mr Withee noted that intergovernmental meetings often provide an appropriate forum for discussion of programmes such as GCOS. The JPO Director reviewed the discussions at the WMO Congress on such international meetings. The conclusion there was that such meetings should be developed as a “medium-term” activity, and that they should address the more comprehensive issues associated with the suite of observing systems. Nevertheless, a specific meeting of GCOS participating countries was seen to be an important goal for 1997, and the JSTC agreed to participate in its **planning** .

5.7 The Chairman summarized the discussion to this point by noting that we now have sufficient material and documentation to describe the programme to the various countries. He proposed that the JSTC Chairman write to appropriate individuals (who must be identified in many cases) and provide information about GCOS to include:

- o Accomplishments to date;
- o Most useful and beneficial results from the programme;
- o Most urgent needs and requirements.

He also encouraged efforts to increase publicity about GCOS.

5.8 The Chairman invited Dr Kennel to chair an ad hoc group to consider national co-operation in GCOS, and the implementation issues of the observing systems in general (See section 7.6).

6. GCOS PLANNING

6.1 Report of the GCOS Atmospheric Observation Panel

6.1.1 Prof. Bengtsson, Chairman of the Atmospheric Observation Panel (AOP), presented highlights of the AOP activities this past year. The Panel had its second session in Tokyo in March (See GCOS-17). The Panel, working with the WWW and the Commission for Basic Systems (CBS), had developed and proposed a GCOS Upper-Air Network (GUAN) of approximately 150 sites which has now been agreed by nearly all the participating countries. The Panel, working with WWW and Working Groups of the Commission for Climatology (Ccl), has been developing a similar surface network to consist of about 800 sites. At AOP-II, the Panel formulated a strategy to encourage additional atmospheric constituent and aerosol measurements. A draft document prepared by Mr. Vet was introduced for review and approval.

6.1.2 Prof. Bengtsson reported on the results of the Asheville meeting, "Long-term Climate Monitoring of the Global Climate Observing System". He praised the work of Dr Karl of the National Climatic Data Center (NCDC) for his superb organization for the meeting which was attended by nearly 100 internationally recognized scientists who discussed the needs for long-term monitoring for climate change detection, and for climate change prediction. The results of the meeting will be available in a forthcoming edition of *Climatic Change* and a hard-cover edition (See also GCOS Newsletter #3). Prof. Bengtsson reviewed a selection of the important recommendations from the Asheville meeting for the Committee. Many dealt with questions of data quality and consistency. He reminded the Committee that, while weather observations require low error, climate observations require low bias to ensure that extended observations may be intercompared.

6.1.3 Prof. Bengtsson reviewed a few recent scientific results from modelling activities for the Committee. He noted recent successes in several long-term calculations in which high correlation with observations was obtained. He also reported on models of El Niño and of the ozone distribution.

6.1.4 For the consideration of the Committee, Prof. Bengtsson identified several key issues including the need for:

- o Close co-operation between GCOS and the programmes of the WCRP and IGBP;
- o Mechanisms to ensure commitments to a comprehensive data assimilation system;

- o More definite identification of the user community and the applications requiring GCOS data;
- o Closer communication and links among the GCOS panels to enable their efforts to be better integrated.

6.1.5 Members raised a few technical issues with regard to satellite observations, particularly with regard to radiation and cloud absorption, and asked that the Panel give them full consideration in future meetings.

6.1.6 Prof. Bengtsson was thanked for his report and for the significant progress made by the AOP during the year. He was invited to chair an *ad hoc* working group to review the work of the Panel and provide advice to the JSTC concerning specific issues for the next year (See section 7.1).

6.2 Report of the GCOS/GTOS Terrestrial Observation Panel

6.2.1 The report of the GCOS/GTOS Terrestrial Observation Panel (TOP) was presented by its Chairman, Prof. Townshend. Since his selection as the Chairman-elect of the JSTC, he has resigned as Chairman of TOP. The new TOP Chairman will be Dr Cihlar, Canada Center for Remote Sensing. Unfortunately, he was unable to attend JSTC-V.

6.2.2 Prof. Townshend noted that the TOP, which jointly supports both GCOS and GTOS, had its second meeting in UK in April (See GCOS-18). The Panel has developed a draft of Version 1 .0 of a plan for the terrestrial observation requirements of GCOS and the climate observations of GTOS. The draft was tabled for the review and comment by the Committee and is currently under review by several dozen experts. The plan provides a solid foundation for the further development of the requirements and implementation.

6.2.3 He noted that the plan addresses three key areas: 1) biosphere, 2) hydrosphere, and 3) cryosphere. While the specialists developing the biosphere had made significant progress in outlining a sampling scheme involving a hierarchy of scales and identifying appropriate projects for the scheme, both the hydrosphere and cryosphere specialists need to consider the advisability of developing such a strategy to meet their needs in a similar fashion.

6.2.4 The Panel Chairman also updated the Committee on related activity by GTOS. It has been in contact with over 500 existing *in situ* sites which fall within the hierarchical sampling scheme. The organizations responsible for these sites have indicated an initial willingness to participate in GTOS and GCOS. It was noted that at least some of these sites could be used as a pilot project to begin implementation of some of the terrestrial observations. It is also important to assure that historical data from these sites will be made available via the Internet.

6.2.5 Unlike the data systems for atmospheric variables, a comprehensive data management system does not exist for many elements of the terrestrial ecosystem. The Panel recognized the need to convince established data management groups to take lead roles in developing the system for the terrestrial components of GCOS.

6.2.6 The JSTC expressed its appreciation to the outgoing chairman, Prof. Townshend, and warmly welcomed the new chairman, Dr Cihlar. The JSTC pledged full support for the activities of the TOP in the future.

6.2.7 The JSTC was very pleased with the progress made by the TOP, and agreed to provide input to the draft plan submitted. Attendees noted that as the TOP Plan is implemented, tier 1 activities should be co-ordinated with relevant WCRP and IGBP programmes (e.g., Biological Aspects of the Hydrological Cycle, BAHC) to develop joint strategies which would help to perpetuate the essential observations.

6.2.8 The Chairman invited Prof. Townshend to chair an ad hoc working group to review the work of the Panel, provide comments on the plan, and to develop plans for the next year for the consideration of the JSTC (See section 7.2).

6.3 Report of the Ocean Observing System Development Panel

6.3.1 Prof. Nowlin, Chairman of the Ocean Observing System Development Panel (OOSDP) noted that it concluded its work with the publication of its report, "Scientific Design for the Common Module of GOOS and GCOS: An Ocean Observing System for **Climate**"⁴ which was distributed to attendees. He reminded the Committee that it had accepted the report in final draft version at JSTC-IV. Prof. Nowlin briefly described the key elements of the report and its focus on eleven principals goals. He outlined how the OOSDP had evaluated, assessed, and prioritized the observations required to meet these goals.

6.3.2 He noted that the report was also provided to J-GOOS at its second session in April. There it was proposed that a large meeting be convened to review the document. The JSTC agreed that such a review, while useful, was not the essential next step, but rather that selected observational elements for which a consensus has already been expressed should be targeted for implementation.

6.3.3 Prof. Nowlin reported that the OOSDP would be superseded by an Ocean Observation Panel for Climate (OOPC), jointly sponsored by GCOS, GOOS, and WCRP. The Chairman of the OOPC will be Dr. Smith, Australian Bureau of Meteorology, and former member of the OOSDP. Unfortunately Dr. Smith was unable to attend JSTC-V. Prof. Nowlin reminded the JSTC that the terms of reference and early focus of the OOPC were outlined at JSTC-IV. It was agreed that the OOPC should consider any important elements which were overlooked or left incompletely specified by the OOSDP. The focus of the OOPC should clearly be on making recommendations that would lead to implementation of the critical observations in an optimal and cost-effective manner.

6.3.4 Prof. Nowlin noted that the OOSDP focused primarily on the needs of the scientific community and therefore emphasized the critical observations needed for research purposes. He recommended that the OOPC focus primarily on the user requirements and the products that are needed for application. It was agreed that the data by itself were

⁴ Available from Department of Oceanography, Texas A&M University, College Station, TX 77843, USA, or from the JPO.

insufficient; it is necessary to actually produce products that can be used. This requires a full data assimilation methodology.

6.3.5 Dr Needler, member of the OOSDP and of the OOPC, agreed with the emphasis in the work plan for the OOPC outlined by Prof. Nowlin. He agreed that many of the observational elements could be implemented soon, but that the OOPC would have to assess observing trade-offs to achieve the minimal required set of observations.

6.3.6 Dr Needler reminded the JSTC that CLIVAR was developing a suite of **upper-ocean** requirements in a newly-formed Upper Ocean Panel (UOP) with Dr Leetmaa as Chairman. He and Dr Smith agreed that very close interaction will be required between the two panels. It is planned that Dr Smith will attend the UOP meeting in December.

6.3.7 The Chairman thanked Prof. Nowlin and Dr Needler for their reports, and for their efforts in producing the excellent OOSDP report. The JSTC was pleased to learn that Dr Smith would chair the OOPC, and warmly welcomed him. The JSTC agreed to provide its full support for the Panel activities in the future. The Chairman invited Prof. Nowlin to chair an ad **hoc** working group to develop advice for the OOPC, and to consider **ocean**-related issues for its review and recommendation (See section 7.3).

6.4 Report of the GCOS Space-based Observation Panel

6.4.1 Sir John Houghton noted that Dr Ryder, former Chairman of the Space-based Observation Panel (SOP), had submitted his resignation as Chairman due to his increased responsibilities in the UK Meteorological Office. He and the JSTC warmly thanked Dr Ryder for his excellent leadership of the SOP, and for his efforts in the preparation of an exceptionally **fine** plan for space-based observations. The JSTC encouraged Dr Ryder to continue to share his council on GCOS in the future.

6.4.2 The JSTC Chairman introduced Prof. John Harries, Imperial College, as the new SOP Chairman. He noted that Prof. Harries was a charter member of the SOP and would continue the superb work initiated by Dr Ryder. He invited Prof. Harries to review the work of the SOP.

6.4.3 Prof. Harries described the recent activities of the SOP which led to the publication of the Plan for Space-based Observations, Version 1.0 (GCOS-15) and the Guide to Satellite Instruments (GCOS-16) prepared by Mr Matsuura during his tenure at the JPO. He took the opportunity to review the major elements of the plan, noting that it was based on observational requirements obtained from AOP, TOP, and OOSDP. Their specific inputs formed the basis of the seven GCOS “missions” which were subsequently developed in detail in the body of the plan. He illustrated his presentation by showing the sequence whereby the SOP used the specific requirements to evaluate the missions and instruments of the space agencies to finally arrive at a measure of compliance with the GCOS requirements. Finally, he indicated the need for close partnership between CEOS and GCOS, and agreed to work to strengthen it where possible.

6.4.4 Dr Mitchell, Smith System Engineering, was invited to report on the study done by the company on behalf of GCOS and with the generous support of NASDA. The

study was an attempt to initiate a prioritizing procedure based on input from the GCOS panel members. A questionnaire was circulated and evaluated to test a methodology for providing priority ranking first within the disciplines, and eventually across the disciplines. Although the results were preliminary, the study did provide an opportunity to consolidate the GCOS space requirements. Based on the results, future studies are now being formulated.

6.4.5 As a related issue, Prof. Townshend reported on the recent Committee on Earth Observation Satellites (CEOS) which he and the JPO Director had just attended. He informed the JSTC that the space plan had been provided to CEOS for their review and comment. In addition, the Director provided a briefing on the GCOS programme to an informal session devoted to global observations. At that session, it was proposed that a close co-ordination be established among the various observing systems, and GCOS was singled out as an important link in such co-ordination. A meeting sponsored by CEOS may be scheduled in 1996 to review this issue. The JPO agreed to co-operate fully with this activity of CEOS.

6.4.6 Members warmly welcomed the news that Prof. Harries would chair the SOP and offered him their full support for the future. The JSTC particularly expressed pleasure with the development of the space plan, and with its distribution to CEOS and other **space-**related organizations for review and action (e.g., EUMETSAT, CGMS (Co-ordination Group for Meteorological Satellites)). Some specific issues were raised by participants regarding the linkage to developing countries (addressed in a brief chapter of the plan), the need to avoid duplication with CEOS working groups, and the continual need to focus on overall costs of satellite elements.

6.4.7 The Chairman thanked Prof. Harries, Dr Mitchell, and Prof. Townshend for their reports. He invited Prof. Harries to convene an *ad hoc* working group to consider the next steps with regard to the space-based observations, consider interactions with CEOS, and to make other recommendations to the JSTC as appropriate (See section 7.4).

6.5 Report of the GCOS Data and Information Management Panel

6.5.1 Mr Withee, Chairman of the Data and Information Management Panel (DIMP) presented the report of the data and information activities during this past year. Like its counterpart, the SOP, the DIMP has produced a Data and Information Management Plan for GCOS, Version 1 .0 (GCOS-13). The plan relies on a distributed data system that should not be expensive; in fact cost was of major consideration in its design. It is anticipated that existing data activities will be utilized to a considerable extent.

6.5.2 The plan calls for the development of an “end-to-end” system using of a variety of distribution modalities ranging from full Internet connection to production of **CD-**ROM’s and diskettes. It was emphasized that developing countries will require access to all GCOS data sets, and although several developing countries are now beginning to get Internet connections, the DIMP has recommended that GCOS help these countries obtain and utilize the software necessary to fully access and take advantage of the Internet. He stressed the need for GCOS to become involved in developing and distributing operational products and that such products clearly indicate they were produced by GCOS.

6.5.3 Mr Withee reported on other progress made by the DIMP, and by the JPO related to data and information management. For example, GCOS has installed a **homepage** with gateways to an ever-increasing number of existing data centres which have agreed to participate with GCOS. In addition, Mr Withee illustrated a pilot data project running on a NOAA computer on behalf of GCOS. It is a prototype of data distribution services which could be provided to GCOS users to locate and obtain information.

6.5.4 He reported that the DIMP spent considerable time discussing quality control and how GCOS could assure the quality of the data on the GCOS system. As an initial action, the Panel recommended that appropriate metadata be developed and included with any data that is referenced on the GCOS data and information system. Similarly, the DIMP recommended that a number of data holders be invited to collaborate with well-respected reviewers who would consider the state of the data documentation. About 20 such data types and reviewers were identified. Letters will be addressed to the data holders and reviewers to enlist their participation in this endeavour. Mr Withee noted that the DIMP debated the value of a “GCOS label”, but did not recommend its use.

6.5.5 The JSTC expressed pleasure with the considerable progress made in addressing data and information issues and commended the DIMP and Mr Withee for their efforts. Members were interested to know the role of the DIMP in the “fusion” of related data sets, in the quality control procedures which could be implemented, the resources required for the data management activities, and approaches to improve the communication of information to developing countries. Regarding “GCOS labels”, the JSTC asked that the issue be reconsidered at the next DIMP meeting before a final conclusion is reached.

6.5.6 Mr Withee responded to the questions raised by the discussion. He indicated that data “fusion” topics had been discussed, and that joint pilot studies could be developed at the next DIMP meeting. He reminded the JSTC that considerable thought had been given to various quality assurance activities, but that much of the responsibility lies with the originators of the data. He conceded that resources for data management were limited, but that with the rapid progress being experienced in the communications arena, much could be done in the near future to improve data management and dissemination. He observed that technology is advancing to the stage where many data centres should be able to put actual data sets on-line, rather than just **catalogues** or metadata. Finally, he described efforts to assist developing countries through pilot studies to see how data access systems function.

6.5.7 During the earlier discussions, a letter from Dr Ryder was introduced to the Committee. In it, he urged GCOS to develop an “operational” perspective in which commitments would be obtained to deliver products according to an agreed plan and schedule. He noted that a serendipitous approach would not succeed in providing reliable products to users. The JSTC was strongly in agreement with the thrust of the letter, and felt it **would** motivate a significant discussion under the agenda item relating to co-operation with national programmes (See section 7.6).

6.5.8 The Chairman thanked Mr Withee for his comprehensive report, and the work of the Panel during the year. He noted the evolving use of Internet in the distribution of

information on GCOS (e.g., GCOS **Homepage**⁵) and urged the DIMP to continue their efforts to provide useful information via Internet. He invited Mr Withee to assemble an *ad hoc* working group to consider data issues and to make recommendations for consideration by the JSTC regarding future work and projects of the DIMP (See section 7.5).

7. IMPLEMENTATION ISSUES

During the second day the *ad hoc* groups noted above were established to discuss atmosphere, ocean, land surface and space-based observations, and data management. The groups were tasked by the JSTC to specifically:

- o Identify issues for immediate implementation;
- o Identify other high priority tasks;
- o Identify successes to date (e.g., available products) and identify those that should be completed in the near future;
- o Identify cross-cutting issues with the other GCOS Panels.

In addition, an *ad hoc* working group on implementation was tasked to address the following questions:

- o How may more effective dialogue be generated with national governments and potential participating agencies?
- o How may GCOS requirements for observations and data management best be implemented?
- o How may an optimal strategy for GOOS, GTOS, and GCOS be developed nationally and internationally?
- o How may countries contribute to and benefit from GCOS?
- o **How** should an integrated GCOS implementation plan be prepared?

Where feasible, the working groups were asked to identify specific individuals or groups who should take responsibility for the action indicated. These are indicated in **bold type**.

7.1 Atmospheric Implementation Issues

7.1.1 Prof. Bengtsson chaired the small *ad hoc* working group to discuss the critical issues with respect to implementation of atmospheric observations for GCOS. On behalf of

5 Internet address: <http://www.wmo.ch/web/gcos/gcoshome.html>

the working group, Prof. Bengtsson presented the results of the discussions and proposed a suite of actions and recommendations for consideration by the JSTC.

Long-term climate monitoring

7.1.2 An international meeting of experts took place in Asheville, 9-11 January 1995, with the task to provide scientific recommendations for the long-term monitoring of climate. The **JSTC** should endorse the recommendations from the meeting and should highlight the following points:

- o The separation of an anthropogenic climate signal from a background of the complex natural variability of the climate system requires the longest possible homogeneous data records. The frequent changes in observing systems and in the processing and assimilation of the data have made it virtually impossible to separate real climate changes from natural variability. Therefore, data producers, when introducing new observing systems, should be urged to assess the effect of the new system on long-term climate monitoring as a standard practice. Comprehensive metadata should be given high priority;
- o Long-term monitoring requires comprehensive spatial coverage; instrument accuracy must be balanced against the spatial coverage. Satellite and *in situ* data should be fully integrated and be seen as a part of the same system;
- o Reanalysis activities should be continued and should be repeated at regular intervals (e.g., 10 years) using the best possible available data-assimilation systems. In this context the possible effects of changes in the database should be considered as well;
- o It is important to gather information on the occurrence of extreme weather phenomena and steps should be taken to create a database on, *inter alia*, drought, floods, tropical storms and similar extreme events. A starting point for gathering such information should be a review of the World Climate Programme and its existing database.

7.1.3 The working group reviewed and restated the data requirements for climate monitoring. The proposed variables include parameters which have been found to change relatively fast in numerical climate change experiments. Monthly averages are adequate with longer time scales for glaciers, ice sheets (decadal scale) and biomass. The following were identified:

- o Atmospheric temperature and moisture through the depth of the atmosphere (e.g., from microwave soundings), and carefully-checked radiosonde data from reanalysis;
- o SST and upper-ocean thermal content;
- o Clouds, radiation balance and aerosols;

- o Solar irradiance;
- o Sea ice coverage and thickness;
- o Sea level;
- o Glaciers and ice sheets;
- o Biomass;
- o Radiative gases (including water vapour).

Data requirements for seasonal to interannual climate prediction

7.1.4 Although the detailed observational requirements for seasonal to interannual prediction will continue to evolve, a routine system for ENSO prediction, including coupled ocean/atmosphere/land surface data assimilation, is currently being established. The working group identified the following data needs:

- o Atmospheric observations are adequate assuming the requirements for numerical weather prediction (medium range) are met;
- o Upper-ocean thermal structure measurements and sea ice coverage;
- o Land surface data to determine soil moisture (potential evaporation) and snow cover;
- o Cloud and radiation data (mainly for model development and model validation).

7.1.5 These data need to be available in quasi-real time (e.g., daily). The working group recommended that **JSTC** request CBS to contact WMO Members to assure that relevant data, including precipitation (at the highest possible resolution), snow cover, and information on soil conditions are operationally exchanged on a global scale.

Climate change experiments

7.1.6 Climate change experiments require the same data as do seasonal-to-interannual climate predictions but additional information on vegetation changes and the state of the ocean to greater depth (e.g., temperature, salinity, and currents) are required.

7.1.7 The **JSTC** should ensure that all its panels work closely together and develop detailed requirements in cooperation with representatives of appropriate research programmes, especially CLIVAR and GEWEX.

Implementation of GCOS baseline networks

7.1.8 The proposal by AOP to establish a specific baseline network for upper-air data has now been carefully reviewed by CBS and by WMO Members (See Annex V). It is now being implemented by the participating countries. A number of guidelines were proposed to ensure “best practice” in the collection of data from the stations. The Chairman, **AOP**, should convey these guidelines which include:

- 1) long-term continuity;
- 2) provision of detailed metadata;
- 3) use of high altitude soundings (up to 5 **hecto-Pascals**);
- 4) rigorous quality control at stations;
- 5) back-up release in case of failure; and
- 6) co-location with atmospheric constituent measurements (e.g., GAW stations).

7.1.9 The JSTC was informed on the ongoing work on the establishment of a surface reference network based on similar considerations as the upper-air network. The number of stations has been limited to about 800. Criteria for selection include: record quality, representativeness of location, and prospect for continuity in the future. Measurements should include: air temperature (daily mean, maximum and minimum), precipitation, atmospheric pressure, humidity, cloud, sunshine, and wind. The next steps will be taken by a joint meeting between the Commission for Climatology (**CCI**) and **AOP representatives** in UK in March 1996. The proposed network should be ready for circulation for comments by June 1996.

7.1.10 The JSTC was also updated on the work underway to consider a global network of atmospheric constituents based upon existing operational programmes (e.g., GAW) and research programmes in WCRP and IGBP. The working group agreed that comprehensive atmospheric chemical data are necessary for the quantification of radiative forcing, for model validation, to elucidate biogeochemical cycles such as the carbon cycle, and for environmental damages (e.g., sulphate and ozone).

7.1.11 The working group reviewed the draft document prepared by Mr. Vet, “GCOS Observation Programme for Atmospheric Constituents: Background, Status, and Action Plan”, and recommended that the **JSTC** agree to its publication. In addition, the JSTC was invited to take note of the proposals for observational components for atmospheric constituents in the document. The working group agreed that the document provides an excellent and comprehensive summary and should be published as soon as possible.

7.1.12 In view of the rapid evolution of systems to monitor atmospheric composition, the working group agreed that it is premature to recommend the establishment of a comprehensive atmospheric composition reference network at this time. Nevertheless, the group noted that the global stations of GAW and the Network for Detection of Stratospheric Change (NDSC) form a suitable nucleus for such a network. It was noted that the provision of information on the vertical distribution of chemical species is a more pressing requirement than additional surface measurements for certain key applications (e.g., model validation). Therefore, where appropriate and feasible, surface observations at the sites should be supplemented with routine vertical profile or multi-level measurements. The working group urged that the **AOP** address responsible agencies and recommend that comprehensive, very high quality measurements be provided at these sites.

7.1.13 The number and distribution of measurements of the longer-lived greenhouse gases were thought to be adequate to assess radiation forcing and model validation. However, long-term climate-related measurements of aerosols remain problematic. Recent initiatives of the International Global Atmospheric Chemistry (IGAC) project to study the radiative aspects of regional aerosols are welcomed, as are the instrument development and testing projects within GAW. The working group recommended the **AOP** give ozone and aerosol measurements a high priority, and that it request the Commission for Atmospheric Sciences (CAS) to enhance and develop these programmes in GAW as quickly as possible. The working group noted with interest the plans for an International Tropospheric Ozone Year and strongly supported this initiative.

JSTC recommendations based on the Working Group report

7.1.14 The JSTC commended the working group and its chairman for a thoughtful review of the issues, and in particular for the review of atmospheric observational requirements. It endorsed the recommendations from the Asheville Workshop, and agreed to work to implement them where possible. The JSTC expressed appreciation to the AOP for its work in developing an upper-air network, and especially to the various WMO bodies for their efforts in partnership with WMO Members in establishing it. The JSTC requested that the Chairman of **the AOP** prepare a letter to the CBS Working Group on Observations noting appreciation for its efforts, and setting forth the guidelines for “best practice” in the operation and monitoring of the stations.

7.1.15 The JSTC supported the approach being taken to develop the surface network as well. It agreed that a careful review of existing observing stations by reputable experts at the meeting scheduled in March 1996 should result in a comprehensive list of quality stations for submission to appropriate bodies for consideration. The JSTC requested a progress report on the surface network from the **AOP Chairman** at JSTC-VI.

7.1.16 Regarding atmospheric constituents, the JSTC recognized the efforts of the AOP and, in particular, the contributions of Mr. Vet toward the implementation of an observational component to address atmospheric constituents for GCOS. It added its favourable comments to those received on Mr. Vet’s report and recommended that the JPO publish **it**⁶.

7.1.17 The JSTC agreed that additional steps should be taken now to ensure, in particular, the overall integrity of the chemical measurement systems. These should include the establishment of procedures to monitor operational aspects such as station reporting and quality, access to and full use of the data, and the availability of metadata. In this regard, the JSTC recognized the key role that the monitoring centres, such as the GAW World Data Centres and the Quality Assurance/Science Activity Centres, are currently performing. It fully supported the analyses of the previously collected data sets, both as a quality assurance step, but also as a basic service for potential data users (e.g., the World Data Centre for Greenhouse Gases in Japan, the Ozone Mapping Centre in Greece). The JSTC recommended that its views be communicated to CAS and to the GAW programme by the **Chairman of**

6 Published as GCOS-20. Now available from JPO or on Internet.

AOP so appropriate actions to ensure data quality and access for users may be continued and improved where feasible.

7.1.18 In order to further advance these important atmospheric constituent aspects of GCOS, JSTC recommended holding a workshop to evaluate further customer needs for climate-related atmospheric composition measurements (including e. g . , modellers, GCOS panelists, policy makers, representatives of synthesis groups) and requested the **Chairman and select members of the AOP**, with participation of the **JPO and other organizations** (e.g., **GAW, IGAC**) as appropriate, conduct such a workshop during 1996.

7.1.19 Finally, the JSTC agreed with the working group that the various elements of the GCOS programme be more closely co-ordinated. In particular, the JSTC recommended that the **Chairmen of AOP and OOPC** prepare a joint meeting of representatives of the two panels be held in 1996 to discuss issues of mutual interest, and especially those associated with air-sea interactions with focus on longer-term issues and requirements.

7.2 Terrestrial Implementation Issues

7.2.1 The *ad hoc* working group on terrestrial issues was chaired by Prof. Townshend. In addition to the issues requested of the other working groups the JSTC asked that the working group make recommendations regarding the draft TOP Plan. Where possible, the working group identified appropriate individuals, groups, or agencies for action.

Recommended changes to the TOP Terrestrial Plan

7.2.2 The working group recommended that the **JSTC** approve and adopt the TOP plan, and that the **JPO** publish it, taking into account the following additions and changes as appropriate:

- o Text be added in the biosphere section on fire occurrence and extent;
- o A short section be added to the biosphere section on derived variables (e.g., normalized difference vegetation index);
- o Paragraphs on the GEWEX, Flow Regimes from International Experiments and Network Data (FRIEND), and the World Hydrological Cycle Observing System (WHYCOS) be added to the hydrosphere section, and the IGBP Land Use and Cover Change (LUCC) to the biosphere section;
- o Currently tier 1 consists of primarily a description of research programmes, so recommendations should be added advocating the continued collection of certain key observations beyond the experimental period to increase the utility of information from these sites;
- o Illustrations be added where appropriate;
- o A paragraph on **socio-economic** benefits be added;

- o A table showing existing sites be added to the biosphere section;
- o Additional editorial changes to be added the text on the hydrosphere as suggested by Prof. Kaczmarek.

Cross-cutting issues

7.2.3 The working group identified a number of cross cutting issues for consideration by the JSTC. The group recommended that **representatives of the GCOS panels** meet to ensure that the plans are consistent (they do not have to be the same if they are responding to different requirements). Specifically, they suggested that:

- o The **AOP and TOP** assure a common understanding of the need for precipitation data (e.g., the TOP report recommends expanding the number of stations contributing to GPCC regularly to 30,000 to enhance the **IOS** -- feasibility of implementing this number of sites needs to be studied;
- o The apparent difference of opinion between the **AOP and the TOP** in regard to **the** feasibility of collection of soil moisture data on a global basis should be reviewed to permit the two panels to present common requirements;
- o A coordinated activity in defining product requirements for biogeochemical cycles with focus first on carbon should be pursued with both **AOP and OOPC**;
- o Integrated campaigns for seasonal to interannual assessments would benefit from the collection of appropriate data so that terrestrial impacts can be assessed. Liaison with the **AOP and OOPC** should be carried out to **define** data products;
- o The **SOP**, with help from the **TOP**, should undertake a technical and economic feasibility study of using satellites to transmit **in situ** land data;
- o Representatives of the **TOP, AOP and the SOP panels** meet to develop an updated set of recommended space-based requirements for soil moisture and/or surface fluxes which may require additional research;
- o Further coordination is needed between the **TOP, WHYCOS** and the **newly-created GEWEX Panel** for Hydrological Experiments to design a sampling strategy for climate purposes which is adequate but avoids overlaps;
- o A single **GTOS/GCOS** Data and Information Management Panel be formed from the existing panels in GCOS and GTOS.

Key products needing development

7.2.4 The working group identified the following key products which need to be developed through co-ordination between the **TOP** and other bodies.

- o The global land cover initiative being carried out through **IGBP-DIS** to generate land cover products, which are urgently required by several components of GCOS and GTOS, should be pursued;
- o A fire product at a resolution of 1 km such as that recommended through **IGBP-DIS** and being implemented by JRC-Ispra is needed and should be added to the TOP plan;
- o A global digital elevation model with minimum specifications of 1 km horizontal resolution and vertical resolution of **100** m remains an urgent requirement and those agencies working to create this product (**ESA, NASA**) are encouraged to pursue this activity as a matter of urgency;
- o Historical information from at least a sample of the sites at tier levels 2 and 3 should be made available on the Internet and through other media during the coming year;
- o Rainfall data from the **GPCC** should be made available through the Internet as soon as possible;
- o Biomass data on a global scale are required. This might be assisted by use of the land cover product being created (**IGBP-DIS**), but other approaches are possible. The **TOP** urgently needs to consider a strategy for the creation of such a data base;
- o Models of net primary production urgently require appropriate data for validation. Proposals have been put forward by **IGBP-DIS and Global Analysis, Interpretation and Modelling (GAIM)** for this activity. A sponsor must still be identified.

Priorities for the coming year

7.2.5 The working group recommended the **JSTC** approve the following activities and priorities for the coming year:

- o Further efforts be made to extend the geographical coverage of known biospheric sites, particularly for some developing country regions using all possible avenues by **GTOS via direct communications to countries, institutions or sites**;
- o Develop list of responsibilities for the conduct of **GTOS/GCOS** sites. Specifically indicate the variables that need to be measured and the standards and protocols required for collection and data base production by **GTOS and GCOS JPO**;
- o Finalize the co-ordination mechanism between the contributing organizations for biospheric sites and **GTOS/GCOS**. International coordination of *in situ*

data with respect to the biospheric sections probably should be through organizations within countries rather than at the national level by **GTOS**;

- o Complete site **characterisations** and examine them against the minimal data set proposed by the **TOP**;
- o Review and further **refine** the priority terrestrial variables by **TOP**;
- o Develop a sampling scheme for hydrosphere and cryosphere by **TOP and its sub-groups**;
- o **TOP** should review the feasibility of tier 4 in light of sponsoring agency cost concerns. The roles of this tier is to link the space-based observations to tier levels 2 and 3 and to determine how representative these sites are of terrestrial biomes. One of two approaches could be adopted: 1) a stronger case be made to justify the requirement, or 2) consider using ground-validated land cover databases derived from remote sensing to help provide the link;
- o Develop a brochure to explain TOP efforts to obtain assistance and support for organizations supplying data from tier levels 2 and 4 (**Prof. Norse**);
- o Develop working relationship between TOP and the GPCP and GRDC so that requirements of the Global Precipitation Climatology Project (GPCP) can be better understood and supported (**Dr Kibby**).

7.2.6 It was stated that between BAHC, GEWEX, FRIEND, and WHYCOS there are already a large number of sites in operation. Therefore it was suggested that GCOS should develop a joint strategy with these programmes to have a sub-set become operational. Dr. Norse reiterated that GTOS had been in contact with a number of these sites and that they had already agreed in principle to participate in **GTOS/GCOS**. The working group recommended that a joint meeting with the programme offices be held in addition to contact with the individual sites (**Prof. Norse and TOP Chairman**).

JSTC recommendations based on the Working Group report

7.2.7 The JSTC expressed appreciation to the working group and its chairman for its efforts in identifying significant issues for consideration.

7.2.8 The JSTC was pleased to see the progress made by the TOP, and in particular, the draft of the **GCOS/GTOS** Plan for Terrestrial Climate-related Observations. Subject to the few editorial changes, it endorsed the prompt publication by JPO of the plan as an component to the planning document series’.

7.2.9 The JSTC agreed with the suggestions of the working group regarding the priorities of the **TOP** for the coming year. It particularly invited the **TOP** to develop specific projects which would initiate implementation of the key components.

7.3 Oceanographic Implementation Issues

7.3.1 Prof. Nowlin chaired an ad hoc working group to discuss planning and implementation issues related to the ocean component of GCOS. Where appropriate, the agency for action is indicated in bold type.

Recommendations concerning the OOPC

7.3.2 The working group invited the **JSTC** to consider the following recommendations to the Ocean Observation Panel for Climate (**OOPC**), and to the J-GOOS as appropriate.

- o Since drafts of the OOSDP report received rather extensive mail review, a special meeting for scientific review of the OOSDP report was thought to be unnecessary at this stage. If additional peer review for scientific correctness is needed, the working group recommended it be done by correspondence;
- o The suggested next step in refining the design is to consider and describe examples of useful products (e.g., time series of descriptions, indications of change, predictions, assessments) for each of the OOSDP goals and sub-goals;
- o The suggested following step is to begin to assign priorities to the observational elements based on products to meet user needs. One must consider: What products are feasible? What are the user-needed measurements/products ? It should be noted that scientists are only one class of user;
- o The **OOPC** is encouraged to examine the importance/impact of carbon flux to the ocean from rivers and estuaries, of coral measurements, and of other omissions from the initial design for the ocean component;
- o Considering the terms of reference for OOPC and the CLIVAR UOP, there are sufficient differences to believe that both panels are needed. The OOPC focuses on operational needs for data and products, the UOP on data needs for research;

The **OOPC** should be charged with informing the UOP of plans and activities as part of the GCOS ocean component,

The **OOPC** should be charged with facilitating communication with UOP to **minimize** duplication of efforts between the panels,

- o The World Ocean Circulation Experiment (**WOCE**) has preliminary plans to perform a quality assessment of existing traditional ocean data, including

measurements from floats, drifters, hydrographic stations, moored current meters, etc. It is suggested that the WOCE assessment would be adequate to meet GCOS needs for assessing ocean data quality. The OOPC should consider the WOCE data quality assessment procedures for applicability to GCOS ocean data to be used for climate purposes;

- o A procedure must be instituted to address technical tradeoffs in sampling. An example of a need for considering such tradeoffs is the proposed enhanced IGOSS Ship of Opportunity Programmes (SOOP Plan from sixth Joint **IOC-WMO** Implementation Meeting). That plan proposes continuation of the SOOP XBT lines initiated by TOGA and WOCE. It would be wise to examine the upper ocean heat content estimates derived from SOOP alone versus those derived using some part of SOOP augmented by Profiling Autonomous Lagrangian Circulation Explorer (PALACE) floats. The cost effectiveness of various mixtures of **XBTs** and PALACE should be considered. As salinity profiling by PALACE is proven, that added benefit should be factored into the consideration;

Another example of a tradeoff that should be considered now is the use of surface drifters with thermistors versus VOS with hull-contact thermistors for obtaining accurate SST measurements needed to calibrate satellite retrievals;

The OOPC should consider needed observational elements for which measurement tradeoffs need to be considered. **OOPC** should recommend, for JPO consideration, consultants who could study the tradeoffs and make recommendations.

Recommendations regarding WOS

7.3.3 Extended discussion of the ***ad hoc*** working group was devoted to the effectiveness of the IOC in implementing the ocean component of GCOS, the needs of the GOOS Support Office (GSO), and the needs for continuing interaction between the GCOS JPO and the GSO.

7.3.4 The working group considered that I-GOOS may encounter difficulties in making the contacts with nations and agencies needed for implementation of the climate module. It seemed likely to the group that in many cases national representatives will only report GOOS activities at the I-GOOS meetings. Moreover, J-GOOS is a panel of scientists representing five different perspectives (modules), and thus J-GOOS is not expected to assist effectively with implementation. In practice, this responsibility may devolve to the GSO.

7.3.5 ***The ad hoc*** working group recognized the needs for continuing close interactions between GCOS JPO and the GSO. As one possible approach, it considered the advantages and disadvantages of moving the GOOS office to Geneva so as to be in close proximity to GCOS. Some advantages identified were: (1) better GSO focus on **climate**-related aspects without the distraction of broader aspects of GOOS and its interaction with the programmes of IOC; (2) availability to WMO expertise in planning and implementing

operational activities; (3) a large portion of GOOS ocean observations are provided through atmospheric agencies and are organized via the WMO. Some negatives identified were: (1) potential to diminish the capacity-building possibilities offered by local IOC contacts; (2) the possible neglect of GOOS modules other than climate, since they will rely in some regions on regional IOC programmes; (3) a perceived weakening of the function or influence of IOC.

7.3.6 In summary, while there would be significant advantage to the climate module if the GSO were co-located with the JPO in WMO, at this time the principal effort should be for the IOC to ensure that the GSO is effective in its present location. Thus, the working group recommended that the JSTC Chairman make the following points to the IOC:

- o It is critical that the GSO have a high-level, permanent director as soon as possible;
- o There must be adequate resources (financial and human) to the GSO to complete the initial planning for all modules and to begin implementation;
- o The GSO should have a broad mandate to work toward implementation (in fact, the JPO should also have such a mandate from IOC);
- o Close, continuing co-operation between GOOS and GCOS is mandatory.

Other recommendations for JSTC consideration

7.3.7 Centres are needed for ocean data assimilation. They serve the purpose of fitting (interpolating and extrapolating) the necessarily sparse ocean data using dynamical and thermodynamical constraints. Data assimilation centres also allow the exploration of new climate products, and in addition, are needed for the production of proven products. In co-operation with GOOS, **JSTC** should work to identify appropriate centres.

7.3.8 General classes of ocean measurements needed for the climate module were discussed, and the need for long-term commitments were identified. The working group urged that the **JSTC** strive to develop mechanisms to ensure long-term measurements so that needed products will be forthcoming. The source of such measurement and products will be government agencies, but the working group noted the important contributions from the research community. Although research contributions may be of shorter term, they should be sought and welcomed.

7.3.9 In the report of I-GOOS-II it is stated that a GOOS space plan will be prepared. The working group endorsed their suggested approach of GOOS which is to: 1) use the same format as used in the GCOS Space Plan; 2) accept and include the GCOS space plan for the climate module of GOOS; and 3) complete the plan for other GOOS modules. The working group recommended that appropriate **members** of **the SOP** participate in this preparation.

7.3.10 The working group was pleased to see the progress made by the TAO Implementation Panel (TIP) at its fourth session, and encouraged the publication jointly (**GCOS/GOOS/CLIVAR**) of the meeting report. The working group noted that the JPO had

offered to support the activities of the TIP by providing administrative assistance for their activities, resources permitting. It recommended that the JPO continue to seek funds from IOC to assist the TIP, since it makes a significant contribution to the GCOS ocean component. Due to the limited financial support of IOC to GCOS for such activities, the working group recommended that the JSTC Chairman inform the chairman of the TIP panel that if funds are not provided by IOC to GCOS in a timely fashion, he should approach IOC directly for the support needed to continue TIP activities. The working group recognized that the TIP has interests both in supporting the Pacific array as part of the **GCOS/GOOS** and in expanding this array as required by the **CLIVAR** programme.

7.3.11 The working group noted the upcoming IGOSS meeting in November and recommended that the JPO provide a brief document outlining the significance of IGOSS activity in support of GCOS requirements. It observed that the new IGOSS plan for SOOP should continue, to the degree possible, the observations instituted under the TOGA and WOCE. The group was advised that reductions in the SOOP **XBT** lines may be necessary due to decreased research funding in 1996. In response to this potential reduction of XBT information, it recommended that the JPO make known the importance of these lines in meeting GCOS ocean observations to the IGOSS meeting. The group noted that in the near future, the upper ocean thermal structure, and perhaps salinity observations, may be made from profiling autonomous drifters. It recommended that these emerging technologies be considered for implementation at the appropriate time.

7.3.12 The working group identified as an interdisciplinary issue that there should be increased interaction between **OOPC**, AOP, and TOP (e.g., for OOPC requirements for SST, upper ocean heat content, and sea ice thickness). To open this dialogue, a meeting of **representatives of OOPC, AOP and TOP** is recommended before JSTC-VI.

7.3.13 The working group urged the **JSTC Chairman** to remind the IOC of their commitment to support GCOS and that the IOC should be encouraged to provide a significant financial contribution to the GCOS infrastructure.

JSTC recommendations based on the Working Group report

7.3.14 The Chairman thanked the working group and its chairman for a thorough review of the oceanographic issues. The JSTC again noted the value of the OOSDP report in defining the ocean climate component. It urged that appropriate bodies take action on the elements identified for implementation. The JSTC looked forward to the activity of the follow-on OOPC, and endorsed the principal recommendations for the work programme suggested by the working group. The JSTC agreed in particular with the emphasis on data assimilation and on products to be supplied as a result of GCOS. It urged that the **OOPC** focus clearly on this issue as a critical element of their deliberations. It requested a report at JSTC-VI **from the OOPC Chairman**.

7.3.15 The JSTC also appreciated the thoughtful consideration given by the working group to the close interaction between GCOS and GOOS, and between the JPO and the GSO, and the need for support from the IOC for ocean-related activities. It strongly endorsed the need for a permanent and effective director of GSO. The **JSTC Chairman** agreed to prepare a communication to the Executive Secretary of IOC.

7.3.16 The JSTC supported, as well, the other conclusions of the working group relating to the TIP and IGOSS. The **Director, JPO** was urged to continue his close association with the activities of GOOS, and with relevant implementation groups which will provide ocean observations for GCOS.

7.3.17 The JSTC agreed that internal co-ordination among the GCOS panels should be encouraged, and supported a joint meeting of **representatives of AOP, OOPC, and TOP**.

7.4 Space Issues

7.4.1 The ad hoc working group on space issues was chaired by Prof. Harries. He noted that the Space-based Observation Panel regarded the inputs provided by the three science panels as representing the requirements of the GCOS user community. Within these guidelines and inputs the Panel would iterate GCOS requirements for data from space-borne instruments with the user communities, and with both CEOS and individual space agencies, as appropriate.

7.4.2 In considering priorities for 1996, the working group took note of the request from the CEOS Task Force on Planning and Analysis for a list of GCOS requirements for data from space-borne instruments. It noted that Dr Croom was representing GCOS on the Task Force, and recommended that the JSTC provide full support for their assessments. The working group also anticipated a plenary meeting of CEOS in November 1996, and the desirability of briefing members of CEOS directly on GCOS requirements. For this it would be useful to table a copy of the revised GCOS Space Plan, plus a summary of the principal findings of reports prepared by Smith System Engineering on behalf of GCOS.

7.4.3 Noting that the current version of the GCOS Space Plan had been prepared on a very short time scale and that the science panels were in the process of reviewing requirements for data from space-borne instruments, the group identified the following actions to be completed as soon as possible in 1996:

- o Seek **confirmation** from the three science panels that their reviews of requirements had not revealed any inconsistencies with the requirements for data from space-borne instruments included in Version 1 .O of the GCOS Plan for Space-based Observations (**AOP, OOPC, and TOP**);
- o Review Version 1 .O of the GCOS Space Plan for any factual errors (**SOP**);
- o Review and comment on the report and approach for prioritising requirements as prepared by Smith System Engineering (**SOP**).

On the basis of these inputs, the working group recommended the following for CEOS:

- o Prepare and submit a summary of GCOS requirements for data from space-borne instruments to the CEOS Task Force on Planning as required (**JPO and SOP Chairman**);

- o Prepare and submit the agreed version of the GCOS Space Plan accompanied by an extract of the report prepared by Smith System Engineering on prioritisation to the JPO in time for the next CEOS plenary (**JPO and SOP Chairman**);

7.4.4 The working group stressed that implementation of space-based observations will require close interaction with space agencies and with CEOS members and affiliates. The group recommended that **JSTC members** contribute their input for the agencies and CEOS through Prof. Harries who will work closely with the Chairman and the JPO. It was felt that some of the CEOS working groups are quite effective (e.g., WG on Calibration/Validation, WG on Information Systems and Services) that it will be important to keep direct contact with these groups and participate actively where possible (**JPO and SOP Chairman and members**).

7.4.5 The working group discussed the value of geostationary satellites, noting the fact that they are critical to the success of GCOS, and should be included in implementation plans for GCOS. Members of the Coordination Group on (geostationary) Meteorological Satellites (CGMS) have been briefed by a member of the SOP and have received the Space Plan for comment.

JSTC recommendations based on the Working Group report

7.4.6 The Chairman thanked Prof. Harries for the report of the working group. He noted that the Space Plan should be circulated to a number of agencies and to key individuals for their comments and feedback (**JPO**). Members agreed that adequate representation of GCOS at various meetings on space-related issues is necessary. They encouraged the **JPO and SOP Chairman** to develop a schedule of key meetings at which representation is required. They took special note of the upcoming Committee on Space Research (COSPAR) in July 1995, and recommended that GCOS participate as a co-sponsor (**JPO**).

7.4.7 During subsequent discussions, Mr Haruyama made two points regarding the relationship of GCOS to CEOS: 1) the **Chairman of the JSTC** should write a letter to the CEOS Chairman regarding the members' review of and response to the **GCOS** Space Plan; and 2) the **Chairman of the SOP** should actively participate in CEOS plenary meetings.

7.4.8 Additionally, with regard to financial support from NASDA, Mr Haruyama noted that he will recommend continuation of the support to SOP activities and to Smith System Engineering to continue their work on behalf of GCOS. Further, he pledged that NASDA will actively participate in pilot projects developed by the **SOP**. The Members expressed their appreciation for the support of NASDA.

7.5 Data Issues

7.5.1 The ad *hoc* working group on data and information issues was chaired by Mr Withee. The working group noted that there are many steps yet to be carried out in implementing the GCOS Data and Information Management Plan, and where appropriate, they identified appropriate agents for action. They stressed the importance of some early next steps, and emphasized that the **DIMP** should:

- o Attempt an inventory of observations and data sets contributing to GCOS objectives;
- o Increase efforts to identify and connect GCOS data centres on the Internet with GCOS users;
- o Develop pilot projects to deliver data and products to, and collect data from, developing countries. These projects should include both mail and Internet data exchange systems;
- o Label GCOS data and GCOS data sets (See following discussion);
- o Locate centres which can take care of the observations from the new upper-air and surface networks sponsored by GCOS.

7.5.2 The working group reviewed the recently adopted WMO policy and practice for the exchange of meteorological and related data and products including guidelines and relationships in commercial meteorological activities. It noted that appropriate technical bodies are being invited to provide impacts on the new policy. The group felt that specific impacts at this time would be difficult to assess, but concern was expressed that the minimum set of essential data and products expressed in the annex to the WMO Congress resolution did not include several of the data sets being considered as part of the GCOS. The working group recommended that the **JSTC** look at the implications of the WMO Congress resolution, and the **JSTC Chairman** take an active role in formulating the observation and data requirements which are being developed and updated by a WMO task team on a regular basis. The JPO should provide timely input to the JSTC on developments in this area to ensure the GCOS needs are being met.

7.5.3 The working group strongly agreed that the **DIMP** should consider end-to-end data and information systems. The emphasis of the GCOS data system should be to foster the collection of climate related observations, the assembly of long-term data sets, and the dissemination of these data sets through convenient access methods to the global user community. It recommended that **the JSTC Members take the** initiative to identify and sponsor the development of specialized GCOS products where possible, or at least convince or facilitate other groups or programmes to produce important products on a continuing basis.

7.5.4 Beyond these operational considerations, the working group noted that the **JSTC and JPO** should make an effort to have important GCOS activities in the news. It felt that a measure of the success of **GCOS** would be the number of other programmes acknowledging the role of GCOS in the preparation of products and delivery of services.

7.5.5 The working group recommended that the **DIMP** explore the concept of a GCOS label further. It suggested that such a label could be applied to GCOS-relevant data sets which met minimal metadata requirements. Along with the label, they suggested that an associated discussion of the quality of the data sets and the merits of the data set for different applications be included. If the concept of GCOS label guidelines is agreed and approved, the working group recommended that appropriate data centres could be invited to

submit their data sets for review and identification (labelling). The concept and procedure should be discussed at the next DIMP meeting.

7.5.6 The working group considered the development of climate indicators. However, it observed that this issue will require considerable care to make the indicators meaningful to the public. Dr Schiffer noted that the **CENR's** Task Force on Observations and Data Management has been working on the development of several indicators and are developing specific criteria for the parameters that must enter indicator calculations. The group concluded that **DIMP** should pursue these ideas with other agencies including WMO, UNEP, CENR, and perhaps the Global Environment Facility. The **DIMP** Chairman should contact such groups to prepare an agenda item for the upcoming DIMP meeting.

JSTC recommendations based on the Working Group report

7.5.7 The Chairman thanked the data working group and its chairman for the comprehensive recommendations. In subsequent discussions, the JSTC agreed that the DIMP should reflect first the needs of the science panels, but must also take into account the requirements of the other observing systems. It recognized that the observing systems will probably require some specialized data management components, but the overall structure should be based on the work by the DIMP to date.

7.5.8 During the plenary discussion, Prof. Norse proposed that the data management activity undertaken by a Working Group of GTOS could be consolidated into the overall plan developed by the DIMP. He suggested that this would obviate the need for a separate GTOS data group in the future. Mr Rebert reported that GOOS is developing a data group since the ocean observations in GOOS will be different than those of climate users.

7.5.9 Mr Withee pointed out that the DIMP is providing an overall concept and structure, data handling and sharing protocols, and standards. He suggested that these could serve GOOS as well as GCOS and GTOS. The DIMP Chairman reminded the participants that all DIMP meetings have had extensive representation from GOOS, GTOS, and operational systems as well as the World Data Centres. Similarly, all GCOS science panels have representatives on the DIMP. With such a forum, Mr Withee felt the principal issues could be discussed authoritatively.

7.5.10 The JSTC recognized that considerable national support **will** be required to carry out the principal activities advanced in the Data and Information Management Plan. It noted that several countries are currently developing national projects which could be very supportive of the plan. Consequently, the JSTC requested the JPO, in concert with the DIMP Chairman, to submit a formal recommendation to the sponsoring organizations to seek support for GCOS data management activities and to assist GCOS obtain support from member states.

7.5.11 The JSTC reiterated its strong support for the overall activities of the DIMP. In particular, it expressed its support of the **DIMP** as it addresses the data and information management projects identified in the Data and Information Management Plan.

7.5.12 The JSTC took note of the statements of the WMO, GTOS and GOOS representatives and agreed that the DIMP had accommodated the disparate views well to date. The JSTC urged the **DIMP** to continue its flexible approach to data and information management so the GCOS plan accommodates other user needs to the degree possible while maintaining an effective strategy for climate user communities.

7.6 General Implementation Issues

7.6.1 The ad *hoc* working group on general implementation issues was chaired by Dr Kennel. The working group attracted a large number of people and addressed many significant topics which had arisen earlier in plenary sessions.

7.6.2 In the context of the earlier presentation by Dr Kennel on an Integrated Global Observing Strategy (**IGOS**) (See section 4.2.2), the working group discussed the strategy for implementing the evolving global observing systems. The group acknowledged that, with respect to climate, GCOS has already initiated several activities which assist in integrating observations, both from space-based and *in situ* instrumentation (e.g., through an effective data and information management strategy). By taking such an integrating viewpoint and including observations from the atmosphere, ocean, and land surface to meet climate objectives, GCOS has shown a willingness and an ability to collaborate effectively with existing and planned systems. Consequently the working group suggested that GCOS work with interested countries and agencies to develop proposals to further co-operation and integration in developing a concerted implementation strategy. Particular opportunities with CEOS, based on the recent CEOS plenary meeting, were suggested.

Increasing national participation

7.6.3 There was considerable discussion regarding the involvement of developing countries in GCOS. One particular issue concerned efforts to increase national involvement with GCOS. The working group agreed that it is essential to continue efforts to create national GCOS committees or, at least, points of contact. Since the earlier approach achieved rather limited success, several additional steps that were outlined earlier in plenary sessions were discussed and agreed. One additional suggestion was that the agencies who would likely be tasked with providing observations in support of GCOS be invited to identify key funding agencies and contacts which could be contacted and informed about the GCOS programme directly. Each GCOS panels was asked to add an agenda item on the subject.

7.6.4 Similarly, the description of the benefits to countries as a result of their participation in the GCOS programme (i.e., what products and data would become available to countries as a result of GCOS efforts) was noted to be of prime importance. In addition, it was recommended that GCOS panels should specifically identify those data products which critically depend on observations from developing countries. With these two points of view in balance, partnerships could be more effectively sought.

7.6.5 Members of the JSTC **from** developing countries pointed out that similar discussions were held at earlier JSTC meetings, and urged more be done in the near term. It was suggested that the **JPO** be more proactive in contacting developing countries. The Director of JPO pointed out that JSTC-IV recommended hiring a resource specialist to work

with developing countries, but no funding has been identified to do so. The working group agreed that if the **JPO** is to do something in this regard, it will be necessary to find additional resources. **Members of the JSTC** were invited to assist in developing a proposal for such resources.

7.6.6 **Prof. Norse** remarked that the Consultative Group for International Agriculture Research (CGIAR) had been successful in partnerships with developing countries and could provide a potential model for securing their participation in observing systems. He agreed to provide additional information on the Group.

7.6.7 **Dr McEwan** noted that visibility for the programme is very important and suggested that an expanded use be made of Internet. He proposed that the JPO add documents about the benefits and likely products from GCOS be placed in the GCOS Homepage. He urged the inclusion of climate bulletins and other newsworthy climate items be added as well (JPO).

7.6.8 **Ing. Caponi** proposed that a workshop for developing country participation should be planned and suggested a topic such as the “Use of Satellite Data for Global and National Climate Issues”. He noted that such a topic could attract potential participating countries and invited the **SOP** to participate with him in planning. He further suggested that the number of developing country representatives on GCOS panels be increased. **Panel chairmen** will reassess their membership from this perspective.

7.6.9 The working group outlined several activities that should be considered in support of developing country participation in GCOS. They identified those likely to be in concert with related programmes of the sponsoring organizations (**WMO, IOC, UNEP**):

- o Distribute data sets and products to developing countries by suitable methods available to them (**DIMP** and JPO);
- o Provide training in the use of data sets to produce locally needed information and the use of general products (**DIMP, with consultants**);
- o Provide training and help the countries obtain financial assistance needed to institute *in situ* observing activities (**DIMP with consultants**);
- o Work through regional organizations (e.g., ACMAD, IAI, START) to assist in addressing the specific problems countries face (**DIMP and JPO**);
- o Consider developing useful indicators and increase the use of Internet (e.g., with bulletins) to focus attention on GCOS (**DIMP**);
- o Prepare a workshop to attract developing country participation (**Ing. Caponi and SOP members**).

7.6.10 The working group agreed that if relationships are to be fostered between developing countries and GCOS, products that are useful and valuable to the countries must be made available, and the role of GCOS in this distribution should be recognized.

International organizations

7.6.11 The working group considered the links to organizations such as the CEOS, perceived as an organization to provide coherence to space-based observations and management of space-based data. The working group observed the absence of a similar organization with regard to *in situ* observations. It recognized that the observing systems must find effective mechanisms to co-ordinate the surface-based observations to enable nations to understand the requirements and participate in the implementation of necessary observations. Several illustrative diagrams were constructed to indicate the relationship among the various components. Mr Landis noted that the meteorological community had built successful end-to-end operational systems which included both space-based and **surface**-based components. He felt that the *in situ* groups have been identified in meteorology, and could be similarly identified in other regimes as well. The working group agreed that GCOS should play a pivotal role in this area.

7.6.12 The working group did not endorse the concept that a single body should oversee *in situ* observational systems, but did identify a specific and central role for GCOS and the **JSTC** in developing pilot activities which could be used to assist the overall implementation of the global observing systems. In particular, the working group noted that the GCOS programme could take the lead in performing a careful evaluation of all **climate**-related existing systems, both operational and research. Such an evaluation should begin with an inventory and assessment of current capabilities. Separately, GOOS and GTOS have initiated such efforts in their respective areas. The working group recommended that GCOS, initially through the **JPO**, participate actively with them in their evaluations. It was agreed that such an effort would be an important complement to similar evaluations of the **space**-based observations (e.g., by the SOP and by the CEOS Task Force on Planning and Analysis; See section 7.4.2).

7.6.13 The working group reviewed the GCOS report to CEOS at the plenary meeting the preceding week. It recommended the **JSTC Chairman** communicate specifically that:

- o The JSTC is pleased that CEOS members will review and comment on the GCOS Plan for Space-based Observations, Version 1.0;
- o The CEOS Task Force on Planning and Analysis should approach its tasks with participation of GCOS;
- o CEOS review the Initial Operational System (**IOS**) from the perspective of its feasibility and achievability;
- o If CEOS sponsors a workshop addressing an Integrated Global Observing Strategy, the GCOS programme should be invited to play a significant role. A particular suggestion is that, due to its work to date in integrating other

components, GCOS should be viewed as a pilot programme which might reveal many of the issues which will emerge in the formulation of an IGOS.

JSTC recommendations based on the Working Group report

7.6.14 The JSTC appreciated the thoughtful analysis of the *ad hoc* working group and discussed their recommendations for increasing national and international participation in some detail and agreed to the numerous suggestions to stimulate national activity and participation. The Chairman noted that many of the proposed ideas were closely related to the philosophy upon which GCOS was based.

7.6.15 The JSTC particularly appreciated the role that Dr Kennel proposed for GCOS as a central player in the development of a pilot project for an IGOS. A key concept of such a pilot effort, it was agreed, would be the evaluation of the existing *in situ* systems (See section 7.6.12). The JSTC was reminded that such an assessment of existing systems must include an analysis of which are operational programmes and which are research, because it is very likely specific research observations will not meet the long term requirements of GCOS. The JSTC recommended that the **JPO**, in concert with representatives of WWW, GAW, HWRP, GOOS and GTOS develop an approach to inventory existing observations for climate.

7.6.16 The JSTC agreed with the recommendations regarding communications with CEOS, and invited the **JSTC Chairman** to correspond with the CEOS secretariat as noted above (See section 7.6.14).

8. IMPLEMENTATION PLAN

8.1 The Chairman noted that the period since JSTC-IV witnessed the publication of an overall Plan for the GCOS, the Data and Information Management Plan, and the Plan for Space-based Observations. In addition, the OOSDP has released its report on the common module for GOOS and GCOS, and the **GCOS/GTOS** Plan for Terrestrial **Climate**-related Observations is nearing completion. He stated that, taken together these documents (and the supportive information from the sponsoring organizations) constitute a formidable set of important proposals and recommendations to move GCOS forward.

8.2 He noted that the existing GCOS plans and reports in the broadest sense should be viewed as “implementation” plans. The fact that several reports are involved, that only parts of each are directly related to implementation concerns, and the need to integrate data and space issues to each observational component emphasizes the need to produce an integrated implementation plan for GCOS, as a single document.

8.3 When considering the structure (and scope) and mechanisms for preparation of this plan, it requires an examination of the:

- 1) intended audience for the plan;
- 2) resources available for its development;

- 3) level of detail to make the plan useful and practical.

8.4 In discussing the integrated implementation document, it was assumed that the audience would be very broad and include national and international participants. It should be addressed to the governing bodies of the sponsoring organizations, individuals and managers of national centres, agencies and programmes, and high level government officials.

8.5 With respect to (3), the Chairman noted the need to draft a plan which would strike a balance between a global level plan (consuming least resources and time, but of limited use to participants) and a continually updated document giving excessive detail (probably beyond the scope of present staff). The latter was judged unnecessary and impractical in light of its intended audience and a lack of resources. For these reasons a model outline was proposed based on the overall Plan for the GCOS.

8.6 The JSTC agreed to give high priority to the plan over the coming year, and to assist in its development. It was pointed out that such plans create a positive image for the organization. It is necessary to be sure the plan establishes priorities and that it is realistic in terms of what can really be accomplished with limited resources. It needs to focus on priorities for users and key products that can be produced for those users.

9. OTHER BUSINESS

During the final morning of the meeting, a special tribute was paid to the outgoing Chairman of the JSTC, Sir John Houghton. The JPO Director and a number of JSTC Members, including the Chairman-elect and the vice-Chairmen, formally offered their thanks and appreciation for his leadership during the first three years of GCOS.

The incoming Chairman, Prof. Townshend, was welcomed by the Members as he presided over the continuation of the session.

9.1 Socio-economic issues

9.1.1 The JSTC was briefed on the status of the Socioeconomic Working Group by the Director, JPO. The JSTC noted the wish of the Chairman, Dr Briscoe to step down, and reluctantly accepted his resignation. The Chairman invited the JPO Director to express the appreciation of the JSTC for his efforts on behalf of the Working Group and to solicit his council in the future, as appropriate. Although the Working Group met only once, it compiled a literature review of quantitative studies which had ascribed economic value to climate forecasts which was published by the JPO. In it, the Working Group also made specific recommendations concerning those research topics which it felt would contribute to a better understanding of the value of forecasts. Specific topics, regions, and economic sectors were identified. It was also noted that members of the Working Group had presented papers at various meetings based on the findings and recommendations of the group.

9.1.2 The JSTC reiterated its view that there is a need for continuing efforts to better define the benefits of the GCOS programme in specifically socio-economic terms. The JSTC

concluded that, rather than another meeting for 1996, it would be preferable to invite a few experts, as consultants, to consider what is the impact of an improved observing system. The JPO agreed to contact members of the Working Group to identify potential candidates who could do such a study, and to approach potential sponsors. An update on progress was requested for JSTC-VI, at which time the issue would be reconsidered.

9.2 Co-ordination with other programmes

9.2.1 During the discussions of a number of agenda items, members of the JSTC identified programmes which are addressing related issues. Clearly, GCOS must maintain close contact with many of these programmes, and vice versa.

9.2.2 The Director, in his report, identified a large number of contacts that have been instituted by the JPO, and the schedule for the future continues such contacts. During the brief discussion, it became obvious that the JSTC itself provides numerous links with many related programmes. Some members noted the possible links to national academies, to national programmes, to particular industries and economic sectors, and to international bodies (e.g., European Commission, ICSU union members, etc.). Apart from such identification, there were few specific recommendations proffered. The **JPO Director** agreed to continue the policy of broadening the exposure of GCOS to such contacts and invited the **JSTC members** to take advantage of similar opportunities that arise.

9.2.3 The Chairman summarized the issue by noting that other programmes are expressing more interest in the activity of GCOS as they become more widely known. He suggested that the policy of inviting representatives of related programmes to JSTC be continued, and that members of the JSTC attend appropriate functions to reciprocate. If **members of the JSTC** identify additional organizations or activities for action, they should provide specific recommendations to the Chairman, or to the JPO Director.

9.3 Intersessional Activities

9.3.1 Several specific issues concerning intersessional activities were discussed under other agenda items. A few particular points were reviewed under this item.

9.3.2 The Chairman of the AOP felt rather than having a meeting this coming year of the AOP it would be more useful to concentrate on cross cutting issues with other panels and outside groups. He suggested a workshop on atmospheric composition. The chairman of TOP also mentioned some cross cutting issues between the TOP and AOP, in particular on the need for high resolution rainfall and snowfall data. The JSTC agreed that there was no need for an AOP meeting and requested that the AOP chairman pursue these other areas.

9.3.3 There were a number of suggestions of things that could be done to increase the visibility of the programme, and to assist, **members of the JSTC and the JPO** agreed to:

- o Continue to develop the **homepage** so that it is an effective source of information;

- o Comment on and improve the draft “vision statement”. When complete, all sponsoring organizations should be invited to distribute it through their individual country contacts;
- o Develop sessions on climate observations and monitoring at selected professional society meetings. It was agreed that GCOS should consider sponsoring a major meeting in 1997 or 1998;
- o When the IPCC report is officially released, consider a press release describing how GCOS will help solve some of the problems. It was suggested that the WMO public affairs office be invited to help.

9.4 Arrangements for JSTC-VI

9.4.1 It was agreed to explore holding the next meeting in Canada from 28 October to 1 November, 1996.

10. **CLOSURE**

10.1 The Chairman, Prof. Townshend, reiterated the feelings of appreciation from the entire JSTC to the Japanese hosts for all of the hard work they had put in to assure the success of the meeting. He thanked the members for their support and dedication and to the invited speakers for their interesting scientific presentations.

10.2 Several local participants took the opportunity to express their appreciation to the international participants, and complemented the Chairmen for providing an interesting and informative session. They offered their support for GCOS activities in the future.

10.3 The Chairman reminded **all** the participants and guests that the International Symposium on the Global Climate Observing System would be held in Tokyo at the Shiba Park Hotel on Friday, 20 October. This symposium would feature speakers from the JSTC and Japanese scientists (See Annex VI).

10.4 The Chairman closed the JSTC-V session at 4:00 p.m. on 19 October.

ANNEX1

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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 DIRECTOR, JOINT PLANNING OFFICE
3. REPORT OF THE CHAIRMAN
4. INVITED REPORTS
 - 4.1 Reports from sponsoring organizations
 - 4.2 National activity updates
 - 4.3 Report on Climate Information and Prediction Services
5. CO-OPERATION WITH NATIONAL PROGRAMMES
6. GCOS PLANNING
 - 6.1 Report of the GCOS Atmospheric Observation Panel
 - 6.2 Report of the GCOS/GTOS Terrestrial Observation Panel
 - 6.3 Report of the Ocean Observation System Development Panel
 - 6.4 Report of the GCOS Space-based Observation Panel
 - 6.5 Report of the GCOS Data and Information Management Panel
7. GCOS IMPLEMENTATION ISSUES
 - 7.1 Atmospheric implementation issues
 - 7.2 Terrestrial implementation issues
 - 7.3 Oceanographic implementation issues
 - 7.4 Space issues
 - 7.5 Data issues
 - 7.6 General implementation issues
8. DEVELOPMENT OF AN INTEGRATED IMPLEMENTATION PLAN
9. OTHER BUSINESS
 - 9.1 Socio-economic issues
 - 9.2 Coordination with other programmes
 - 9.3 Intersessional activities
 - 9.4 Arrangements for JSTC-VI
10. CLOSURE

ANNEX III

VIEWGRAPHS FROM THE REPORT OF THE JPO DIRECTOR

1. Joint Scientific & Technical Committee (JSTC)

Chairman:

Prof. John TOWNSHEND USA

Vice-chairmen:

Prof. Lennart BENGTSOON Germany
Ing. Claudio CAPONI Venezuela
Mr Robert S. WINOKUR USA

Members:

Sir John HOUGHTON United Kingdom
Prof. Ekundayo E. BALOGUN Nigeria
Dr Daniel CARIOLLE France
Mr Yukio HARUYAMA Japan
Prof. Zdzislaw **KACZMAREK** Poland
Dr Charles KENNEL USA
Dr Angus MCEWAN Australia
Prof. Worth NOWLIN, Jr. USA
Dr Christopher READINGS Netherlands
Prof. Keisuke TAIRA Japan
Dr Alexandr VASILIEV Russian Federation
Dr Douglas M. WHELPDALE Canada
Dr ZHOU Xiuji **China**

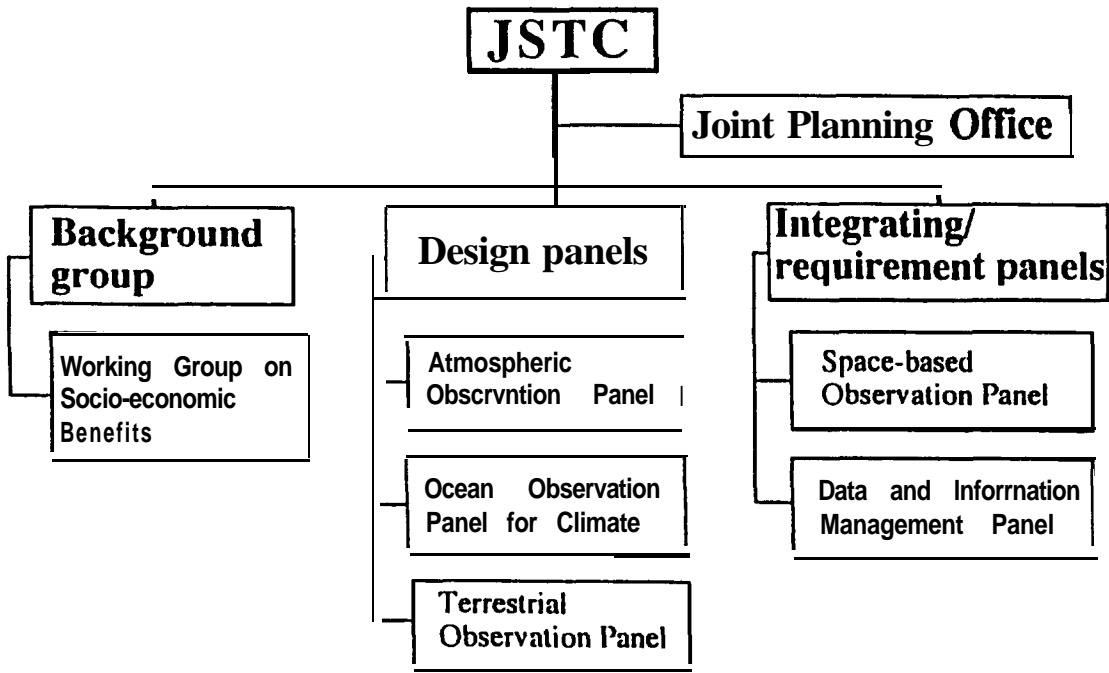
Ex Officio Members:

Dr Melbourne **BRISCOE**⁸ USA
Dr Josef CIHLAR **Canada**
Prof. John HARRIES UK
Mr Gregory WITHEE USA

8 Has submitted his resignation.

2. Structure of the JSTC and Relationship Among the Observing Systems

Structure of the JSTC



Relationship Among the Observing Systems

ATMOSPHERE		LAND		OCEANS
WWW	GAW	GTOS		GOOS
GCOS	CLIMATE	CLIMATE		CLIMATE
Weather	Air Pollution Ozone	Land Degradation Pollution Biodiversity	Sustainability of Managed Systems Anthropogenic Impacts on Natural Systems	Marine Services Coastal Zone Management Ocean Health Living Marine Resources

3. 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.

Chairman: Prof. L. Bengtsson

Last Meeting: 20-23 March 1995 in Tokyo, Japan

Next Meeting: To be determined.

publications:

Report of the GCOS Atmospheric Observation Panel, first session (GCOS-6)

Report of the GCOS Atmospheric Observation Panel, second session (GCOS-17)

GCOS Observation Programme for Atmospheric Constituents (GCOS-20)

4. GCOS/GTOS Terrestrial Observation Panel

Recognizing the need for specific scientific and technical input concerning terrestrial observations, the Joint Scientific and Technical Committee (JSTC) for the Global Climate Observing System (GCOS) and the *ad hoc* Scientific and Technical Planning Group (STPG) for a Global Terrestrial Observing System (GTOS) have jointly established a Terrestrial Observation Panel with the following terms of reference.

4. GCOS/GTOS Terrestrial Observation Panel (continued)

Terms of Refer-end:

- o In accordance with the GCOS Plan, and in co-operation with the GTOS **STPG**, to plan, formulate and design a long-term observing system for those terrestrial properties and attributes which control the physical, biological and chemical processes affecting climate, are affected by climate change or serve as indicators of climate change; and which are essential to provide information concerning the impact of climate and climate change;
- o To review the needs of the user communities for climate related data and to ensure timely provision of data sets at appropriate space and time scales and in suitable forms, paying particular attention to the needs of developing countries;
- o To develop a strategy based on the concept of the Initial Operational System (**IOS**) which includes the assessment of existing operational systems, the determination of deficiencies and the recommendation of necessary enhancements, and a comprehensive data system;
- o To seek review and support for implementation from other relevant research and operational programmes (e.g., WCRP, IGBP, WWW, GAW, WHYCOS, GEMS, GRID, etc.) and to collate, review, publish, and prioritize data requirements and observing system specifications;
- o To co-ordinate activities with other GCOS and GTOS panels and task groups to ensure consistency of requirements with the overall GCOS programme;
- o To recommend actions to address the gaps in present and planned systems;
- o To report regularly to the JSTC of GCOS and the STPG of GTOS.

Chairman: Dr Josef Cihlar

Lust Meeting: 19-21 April 1995, in London, UK

Next Meeting: 19-22 March 1996, in Capetown, South Africa

Publications:

Report of the GCOS/GTOS Terrestrial Observation Panel, **first** session (GCOS-8)

Report of the GCOS/GTOS Terrestrial Observation Panel, second session (GCOS-18)

GCOS/GTOS Plan for Terrestrial Climate-related Observations (GCOS-21)

5. **GCOS/GOOS/WCRP Ocean Observations Panel for Climate**

Recognizing the need for scientific and technical advice and guidance for the common module of the Global Climate Observing System and the Global Ocean Observing System, and the need for liaison and co-ordination between operational observing systems and those of climate research programmes, the GCOS-JSTC, J-GOOS and the JSC for the WCRP hereby establish an Ocean Observation Panel for Climate (OOPC) with the following terms of reference.

- (i) To evaluate, modify and update, as necessary, the design of the observing system for the common module of GOOS and GCOS whose goals are:
 - to monitor, describe and understand the physical and biogeochemical processes that determine ocean circulation and the effects of the ocean on seasonal to multi-decadal climate change, and
 - to provide the information needed for climate prediction.
- (ii) To provide a procedural plan and prioritization for an integrated set of requirements consistent with the observing system design criteria, thereby also drawing from findings of WOCE and TOGA, and in a form that enables timely and effective implementation.
- (iii) To liaise and provide advice, assessment and feedback to other panels and task groups of GCOS, GOOS and WCRP as requested concerning ocean observations for climate in order to ensure that the designs and implementation schedules are consistent and mutually supportive.
- (iv) To establish the necessary links with scientific and technical groups to ensure that they are cognizant of, and can take advantage of the recommended system, and that, in turn, the Panel can benefit from research and technical advances.
- (v) To carry out agreed assignments from and to report regularly to the JSTC, J-GOOS and the JSC for the WCRP.

Chairman: Dr Neville Smith

First Meeting: 25-27 March 1996, in Miami, FL, USA

Publications of OOSDP:

Scientific Design for the Common Module of the Global Ocean Observing System and the Global Climate Observing System: An Ocean Observing System for Climate. Department of Oceanography, Texas A&M University, College Station, Texas, 265pp.

6. Space-based Observation Panel

Recognizing the need for a comprehensive approach to the various space-based observational activities for the Global Climate Observing System, the JSTC established a **Space-based Observation Panel**. The Panel has the following terms of reference.

Terms of Reference:

Based on guidance in the GCOS plans, the primary tasks of the Panel are:

- o To maintain and further develop the plan for the space-based observation components of GCOS, considering the GCOS requirements from the science panels;
- o To develop, integrate, 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;
- o To identify and evaluate problems, and advocate solutions;
- o To report regularly to the JSTC and planning groups for **GCOS**.

The Space-based Observation Panel will be the focus for exploiting space systems in meeting the objectives of GCOS. The Panel must continually refine, update, and interpret the implications of the requirements of the user communities carrying out climate studies, and provide related advice in terms of space instruments and satellite payloads flown by the data providing agencies.

Chairman: Prof. John Harries

Last Meeting: 19-21 April 1995, in Washington, DC, USA

Next Meeting: To be determined

Publications:

GCOS Plan for Space-based Observations, Version 1.0 (GCOS-15)

7. Data and Information Management Panel

Recognizing the need for a comprehensive approach to formulate, implement, and oversee the GCOS data and information management system, the JSTC established a Data and Information Management Panel.

As the GCOS data and information system should be developed to be a common system that accommodates data and products from the climate modules of GOOS, GTOS, and the **WWW**, the DIMP must include representatives of these programmes. Furthermore, the DIMP should be

7. Data and Information Management Panel (continued)

constituted of a core group of members (6-8) representing the different GCOS communities, and a number of representatives from related backgrounds and disciplines. The DIMP should possess a broad range of expertise including research scientists who use and understand GCOS data sets, and data management experts responsible for significant components of the overall GCOS information management system. The DIMP should be a highly focused “problem solving” group, concentrating on resolving crucial issues affecting the quality of GCOS data sets, and access to them. Individual agenda items could require additional participants as well.

Terms of Reference:

- o In concert with the GCOS science panel requirements and the GCOS user community, formulate and develop the GCOS Data and Information Management Plan;
- o Monitor the overall implementation of the GCOS Data and Information Plan;
- o Make reports and present recommendations, as required, to the JSTC on information management issues.

The DIMP has the following specific responsibilities:

- o Based on requirements from the GCOS science panels and the climate community, to solicit data sets relevant in meeting GCOS objectives;
- o To identify gaps in available GCOS data sets and co-ordinate efforts to redress data deficiencies;
- o To consider and develop a process whereby data sets be identified and included as GCOS Data Sets. The process should include an assessment addressing, ***inter alia:***
 - that the data quality meets standards acceptable to peers of the submitting scientists using that type data,
 - that the data contain documentation (metadata) of a standard acceptable to peers using similar data;
- o To review and provide oversight of the GCOS information management system to ensure:
 - that deficiencies in data sets are addressed,
 - that access to data and products is provided as required,
 - that archiving activities are adequate.

7. Data and Information Management Panel (continued)

Chairman: Mr G Withee

Last Meeting: 7-10 February 1995, Washington, DC, USA

Next Meeting: 22-24 May 1996, in Tokyo, Japan

Publications:

Report of the GCOS Data and Information Management Panel (GCOS-11)

GCOS Data and Information Management Plan (GCOS-13)

Report of the GCOS Data Centre Implementation/Co-ordination Meeting (GCOS-19)

8. Working Group on Socio-Economic Benefits

All the nations of the world should derive socio-economic 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 established a Working Group on Socio-Economic Benefits” with the following terms of reference.

Term 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 socio-economic 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 the understanding of the socio-economic 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 socio-economic 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 socio-economic benefits of a GCOS, whenever designated;

¹⁰ Socio-economic 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.

8. Working Group on Socio-Economic Benefits (continued)

- o To report progress and recommendations to the JSTC.

Chairman: To be designated (Dr Briscoe has resigned as chairman)

Last Meeting: 1-3 August, 1994 in Washington, DC, USA

Next Meeting: To be determined

Publications:

Report of the Working Group on **Socio-economic** Benefits (GCOS-9)

The Socio-economic Benefits of Climate Forecasts: Literature Review and Recommendations (GCOS-12)

9. Other Activities

Special Meeting:

“Long-term Climate Monitoring of the Global Climate Observing System”

An international meeting was held in Asheville, NC, USA from 9-11 January 1995. The meeting, organized by Dr T. Karl (**NCDC/NOAA**) attracted nearly 100 attendees to discuss the observational requirements for long-term monitoring, and to prepare recommendations to improve current observing systems.

A selection of papers is being published in ***Climatic Change***, and limited copies will be available from the JPO. For a brief report on the meeting, see: **GCOS** Newsletter # 3, or the March 1995 edition of ***Earth System Monitor***.

10. Publications

For a current list of GCOS publications, note the last page of this report or visit the GCOS **Homepage** (<http://www.wmo.ch/web/gcos/gcoshome.html>).

In addition to the list noted above, several brochures and Newsletters **1,2,3**, and 4 are available from JPO.

11. Activities of JPO

Attendance at numerous meeting of the sponsoring organizations, seminars, workshops, and various meetings. For a calendar of activities, see this Annex III, page 13 ff.

12. Selected Implementation Highlights

GCOS Upper-Air Network:	Accepted by WMO Members for implementation
GCOS Surface Network:	Station selection underway
TAO Implementation Panel:	4th Meeting (GCOS co-sponsorship)
Data Buoy Co-operation Panel:	Participation in South Atlantic and Indian Ocean buoy programmes
GCOS/GTOS Site Selection:	Invitations to participate accepted by several hundred sites
Data Centre Participation:	Many data centres have agreed to participate

13. National Committees

Several countries have designated points of contact for GCOS, and many have established committees to provide national focus for GCOS. Efforts continue to broaden national participation.

14. Support Considerations

Sponsors:

WMO:	Staff (2) and funding for activities Participation from all Technical Departments Co-operation with Technical Commissions Co-operation with Regional Associations
UNEP:	Funding for staff and for activities Programme co-ordination with GTOS Co-operation with EARTHWATCH, GEMS, GRID
IOC:	Program co-ordination with GOOS Co-operation with DBCP, GLOSS, IODE , IGOSS
ISCU:	Funding for activities Co-operation with ICSU constituent groups

14. Support Considerations (continued)

Staff:

Director: Dr Tom **Spence**
Senior Scientist: Dr Hal Kibby
Administrative Assistant: Mrs Sylvie Kalombratsos
Secretary: Mrs Carol **Saynor** (part-time)

“Extended staff” : Mr N. Matsuura (NASDA)
Mr K. Shida (JMA)
Mr D. **McGuirk** (WMO/WWW)
Mr L. Sager (NOAA)

Consultants: Dr D. Croom (UK)
Dr P. Julian (USA)
Mr R. Vet (Canada)
Mr M. Malone (Canada)

15. The "New Phase"

With the publication of the **GCOS/GTOS** Plan for Terrestrial Climate-related Observations, Version 1.0 of a suite of GCOS plans is complete (GCOS 10, 13, 14, 15, 21; and OOSDP Final Report). As a result, the focus for the next phase will be on the implementation of the Initial Operational System (**IOS**).

Documents have been and continue to be distributed to the community for its review, and comment. While revisions will occur periodically to reflect these updates, the principal thrust now will be to act on the plans to implement key elements in co-operation with existing programmes and systems.

The new phase will require contact with nations through a variety of mechanisms. Two principal mechanisms identified to date are:

“Packaged” approach	Through the “Climate Agenda”, e.g.
Sponsor invitations	Through direct sponsor contacts with constituents
Programme contacts	Through contact with nations and appropriate agencies

Hopeful signs:

Strong verbal support at international meetings (e.g., sponsoring organizations)
Response from international programmes and committees (e.g., EC, CEOS)
Offers for participation and mutual programme development (e.g., START, **IAI**).

16. “Reality Check”

Resources:

WMO funding for GCOS approved for 1996-1999
Uncertain funding situation at UNEP
Uncertain funding situation at IOC
Reliable, but modest support from ICSU
USA Environmental Protection Agency project concluding
National contributions to the climate fund reduced

National support:

Several countries have contributed funds and personnel
Others should be invited to participate

GCOS “Message”:

GCOS concept and programme not well understood by many countries
JSTC should state clearly and publicize the GCOS mission and its vision
Support needed for planning GCOS should be made explicit
Support needed for implementation should be articulated

End-to-end Blueprint:

An “operational” **mindset/approach** is needed
Mechanisms to ensure commitments are needed

17. GCOS Activity Calendar

Participants: LB L. Bengtsson DC D. Croom
 JH J. Houghton PJ P. Julian
HK H. Kibby NM N. Matsuura
 AM A. **McEwan** WN W. Nowlin
 TS T. **Spence** JT J. Townshend
 RV R. Vet DW D. Whelpdale

Month/Year	Event	Participant
Oct 1994	OOSDP-10, USA Coord. Comm. on WCP, Switz TOGA TAO Implementation Panel, South Korea Visits to Japanese agencies Consultant @ JPO ESA Earth Obs User Consultn. Mtg, Netherlands	WN TS TS TS RV DC
Nov 1994	WMO RA-I, Botswana CEOS WG on Data, China DBCP-X, USA Interprogramme Data Management, Switz W/T Surface Velocity Programme, USA GCOS/GTOS TOP Hydrology subgroup, Switz	TS, Balogun DM DM, TS TS, JT
Dec 1994	CEOS WG on Cal/Val , Australia CEOS Task Force on Longterm Plan, France	DC
Jan 1995	Long-term Monitoring of Clim. Chg., USA GCOS STPG-II, Morocco Isotopes in Hydrology, Switz GCOS AOP subgroup & CC1 WG, Switz EC visit & presentation on GCOS, Belgium	TS, others HK, TS, JT Co-sponsorship PJ, TS, others TS
Feb 1995	GCOS DIMP-I, USA CBS WG on Data Management, USA I-GOOS Strategy Panel, Switz	DM DM AM, WN, TS
Mar 1995	GCOS AOP-II, Japan 2nd Intl Symposium on Asian Climate, Japan Assimilation of Obs in Atm & Ocean, Japan COP-I for UNFCCC, Germany (Brochure) CEOS Task Force on Longterm Plan, France IGBP-BAHC-GCTE-IGAC CO₂/H₂O Fluxes, Italy	LB, TS, others LB, TS DC HK

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Apr 1995	GCOS/GTOS TOP-II, UK Intl. TOGA Conference, Australia (paper) WMO EC Panel on Atm. Chem. J-GOOS-II, France	HK ,JT PJ DW AM, TS
May 1995	GCOS SOP-I, USA WMO Congress-XII, Switz UNEP Governing Council, Kenya (document)	DC, TS, others JH, TS
Jun 1995	IOC Assembly, France IOC/WMO/UNEP I-GOOS , France Symposium on Seas of SE Asia, Indonesia	TS TS TS
Jull1995	UNEP GTOS Planning Meeting, Switz CEOS Task Force on Long-term Planning, France	HK DC
Aug 1995	Meeting with IOC on GCOS, France	TS
Sep 1995	4th TAO Implementation Panel, Brazil UNEP Mtg. on GCOS Terrestrial Plan, Kenya COP SBSTA, Switzerland	TS HK TS
Oct 1995	JSTC-V, Japan WMO-IGAC Conf on Atm Comp Chg., China CEOS Plenary, Canada Agency meetings on GCOS Aspects, USA ICSU Forum on Earth System Res., China IGBP SAC, China IGFA Meeting, Japan DBCP, South Africa (document)	All DW TS TS TS TS TS
Nov 1995	CIMO WG Upper-air Measurement, Switz WMO/IOC IGOSS-VII, France (document)	TS TS
Dec 1995	GCOS-IAI Clim Chg Mon & Det in S Amer, Chile CBS WG on Data Processing, Switz WMO/NOAA Mtg on GAW Data, USA CIMO WG on Surface Measurements, Switz Training seminar on Clim Chg Issues, Spain	TS, DW DM RV Trenberth

Jan 1996	GCOS/CCI WG on Clim Chg Detection, Switz IODE, Greece	TS, PJ TS
Feb 1996	CLIVAR-NEG- 1, Jamaica 1st Prep Mtg for Intl Buoy Pgm in I. O., India	Smith
Mar 1996	TOP-III, South Africa OOPC-I, USA CBS/CCI/GCOS Sfc Ref Network Mtg., UK CEOS-GCOS Integration Workshop, USA WCRP JSC-17, France Oceanology International 96, UK	Cihlar, HK Smith, TS PJ TS, JT
Apr 1996	SOP-II, TBD J-GOOS-III , France CGMS-XXIV, Switz CMM subgrp on Marine Climatology, Switz	Harries, TS TS
May 1996	DIMP-II, Japan CEOS WGISS, Japan I-GOOS Priorities Meeting, USA [Postponed] I-GOOS Planning Meeting-II, USA European Geophysical Society	Withee, DM Withee, DM TS
Jun 1996	WMO-EC-XLVIII, Switz CLIVAR SSG, Japan CBS Advisory WG, Switz Ocean Soc on Mar Env & Global Chg, NL GEWEX 2nd International Conference, USA	TS
Jul 1996	COSPAR, UK	co-sponsor
Aug 1996		
Sep 1996		
Oct 1996		
Nov 1996		
Dec 1996		

ANNEX IV

NATIONAL ACTIVITY UPDATES

1. China

A written statement was received from Prof. Chen on activities in China. China has been developing the following activities related to GCOS since the last JSTC session.

- i) To formulate the organizing plan of China GCOS National Committee for approval.
 - The national committee consists of approximately 14 governmental departments (such as the China Meteorological Administration, Chinese Academy of Sciences, National Education Commission, National Water Resources Department, State Oceanic Administration, State Civilian Navigation Administration, State Environmental Protection Administration, and National Agricultural Department).
 - To establish a Joint Coordination **Office** in charge of routine GCOS business, planning, publicity, newsletters, brochures, and foreign affairs.
 - To establish the joint expert working group in charge of the general scientific and technical plan, implementation guidance, etc. Group members will be seconded by each unit.
- ii) To lay down a regulation for the work of National GCOS committee which includes the following:
 - (a) Scientific Objectives:
 - To improve a nation-wide climate observing system based on the existing weather network;
 - To coordinate with the international GCOS programme;
 - To implement climate observation data collection, processing, analysis and research projects;
 - To improve the operational work of climate monitoring and climate variation prediction.
 - (b) Main emphases:
 - To update the national GCOS development and implementation plans;
 - To improve the existing weather network including observation items, techniques, data transmission;
 - To establish a climate data base;
 - To implement a climate research **programme** and promote the academic exchange both in domestic and international basis.

- iii) Establish a National Climate Center under the China Meteorological Administration. The center's primary task focuses on operational activity and the improvement of short term climate predictions. It is also involved with national and international research projects such as Asian monsoon studies. Since May of 1995 the Center has distributed a number of products including monitoring reports, climate assessments and climate predictions.
- iv) Two monsoon field programmes, the Japan-China Asian monsoon experiment and Chinese-American South China Monsoon experiment have been implemented.
- v) The national field and research programme -- the Tibetan Plateau Field Experiment (TIPEX) -- has been implemented since 1994. The scientific objectives of TIPEX are:
 - To reveal the physical processes of land-atmosphere interaction, energy/water cycle, planetary boundary layer/troposphere structure, cloud/radiation processes, etc. over the Tibetan plateau and to develop parameterization schemes for them;
 - To improve the understanding of the impact of physical processes over the Tibetan plateau on global and regional climate change and the formation and development of disastrous weather in eastern Asia;
 - To improve the numerical forecasting models of simulation of climate change and the forecasting of disastrous weather with new parameterization scheme for the Tibetan Plateau.

2. **Germany**

The following written report from Germany was made available to members of the JSTC.

i) Organizational matters

The German Remote Sensing Data Centre (Deutsches Fernerkundungsdatenzentrum, DFD) of the German Aerospace Research Establishment (DARA) is prepared to contribute as a GCOS Support Centre.

The International CLIVAR Project Office (**ICPO**) now has its full start-up complement of staff and is therefore open for business. The new Director of ICPO is Dr Coughlan, a meteorologist with the Australian Bureau of Meteorology. Dr Coughlan will be ably supported by Dr Martin Rieland and a third member of the team by Ms Anne **Stephan**, the ICPO Administrator. The contact details are:

International CLIVAR Project Office
Troplowitzstrasse 7
D-22529 Hamburg, Germany
Tel: **+49 40 56 1017**
Fax: **+49 40 56 3990**
Email: **clivar@clivar.dkrz.d400.de**

ii) Present activities

The German GCOS-Office hosted an experts meeting (GCOS Data Centre Implementation/Co-ordination Meeting) in June 1995 in Offenbach. As main results, e.g., the establishment of a GCOS Data Support Network and a GCOS Data and Information System Technical Advisory Group have been proposed. The report of the meeting is available from JPO (GCOS-19).

The German GOOS-Secretariat (at Bundesamt für Seeschifffahrt and Hydrographie) is drafting a national status report which will reflect already existing programmes and potential additional activities which may possibly become part of a German participation in GOOS. The report will serve as a discussion platform for decision concerning the extent to which Germany will commit itself to participate in GOOS.

The first issue of an Annual Climate Bulletin in WMO Region VI (Europe) sponsored by the European Climate Support Network (ECSN), WMO, and the Deutscher Wetterdienst (DWD) has been published. The bulletin is a summary of the information contributed by the national weather services in 25 RA VI countries and is co-ordinated by the DWD.

Current status of the Global Precipitation Climatology Centre (GPCC) analyses of monthly precipitation for the Earth land surfaces (gridded data, **gridsize** 2.5 x 2.5 degree latitude/longitude):

- (a) The data are produced in the framework of the WCRP Global Precipitation Climatology Project (GPCP);
- (b) Up to now gridded **datasets** are available for 84 months (1986 - 1992) based on raingauge observations from 6,700 stations worldwide. The data processing is permanently going on. Access to these products will be possible by ftp;
- (c) In 1996, the GPCC is planning to start an operational **monthly** near real-time product based on Global Telecommunication System (GTS) data (ca. 4,500 stations) and to produce a validation **dataset** based on 40,000 stations.

The German GAW global station **Zugspitze/Hohenpeissenberg** is being established in co-operation between the DWD and the German Federal Environmental Agency. Instruments for monitoring trace gases and aerosol in the air have been installed and tested at Hohenpeissenberg and precipitation analyses for ions and trace elements were started on a routine basis. The regional station, Schauinsland, of the Federal Environment Agency has been operational under the GAW programme since 1994.

DWD is planning to establish a World Wide Web server by the end of 1995. A Climate Information System (**Klimainformationssystem**) will be run on the server.

3. Nigeria

The following written statement was provided by Nigeria on GCOS related activities.

There has been a greater awareness of GCOS in Nigeria. It is hoped that a national committee can be put in place after the November Conference on Climate Change being held in Lagos, Nigeria. Many participants from many parts of the world have expressed the desire to attend the conference, thanks to the publicity given by the Director of the JPO. The conference is being sponsored by the Nigerian Department of Meteorological Services and the Nigerian Meteorological Society with some financial support from WMO and the International Centre for Theoretical Physics in Trieste, Italy.

The goals of GCOS are not at present properly understood by many African Governments. In fact, GCOS is viewed with suspicion by some of these countries. Many African scientists think that GCOS may be another data gathering exercise of very little importance to them as individuals or as a group. Some of them note with dismay that many research projects do not acknowledge the African scientists contributions in publications or when the data are used. It is necessary to remove these misconceptions to get support for the GCOS from African governments and scientists.

At the November Climate Conference in Lagos an effort will be made to stress the benefits that will accrue to the African countries if they invest in GCOS. The documents which are now available from the JPO will go a long way to improving the level of understanding of GCOS not only among the African Countries, but also in many other countries throughout the world.

4. Russian Federation

The following document was provided to the JSTC reporting on recent activities in the Russian Federation.

In the Russian Federation, much current activity is aimed at resolving global ecological problems, including prevention of anthropogenic climate change, and is one of the main objectives of the national strategy in the Russian Federation in the field of conservation of the environment.

The Russian Federation ratified the UN Framework Convention on Climate Change. The ratification documents were deposited with the Convention **officials** 28 December 1994.

The Russian Federation has many years of experience in fundamental research in the field of environmental protection. The modern scientific activities, practical measures, and work are based on the results of this experience. In particular, these results were obtained in the framework of the State scientific and technical programme "Global Change in Environment and in Climate". Also contributing were other federal and regional programmes, among them the departmental scientific programmes of the Russian Federal Service for Hydrometeorology and Environmental Monitoring, "Estimations and Forecasts of Climate Change and Its Consequences", headed by Academician Izrael, Director of the Institute of Global Climate and Ecology and by Academician Budyko, initiator of Russian national climate change studies.

In addition, a number of other federal and departmental scientific and technical programmes, covering various aspects of national activities, are implemented in the Russian Federation. These programmes reflect the purposes and problems of the country in its commitments under the convention.

Among these programmes the following should be mentioned:

- High-speed Environmentally Sound Transport;
- Environmentally Sound Energy;
- Energy and Resources Conservation and Ecological Safety Processes in Mining and Metallurgy;
- Ecological Safety Processes in Chemistry and Chemical Technologies;
- Russian Forestry;
- Complex Utilisation and Reprocessing of Raw Wood;
- Modern Methods of Bioengineering;
- Future Technologies, Machines and Production;
- Perspective Processes in Agricultural Production and Perspective Processes in Use of Agricultural Production;
- Progressive Technologies in Complex Assimilation of Fuel and Energy Resources in Russia;
- Safety of Population and of Economical Objectives in Conjunction with the Risk of Environmental and Technological Catastrophes;
- Complex Investigations of Oceans and Seas, Arctic and Antarctic;
- Ecological Safety of Russia.

At the same time, for consolidation of national efforts in **organisation** and implementation of investigations and work on climate change problems, the development of the special federal programme "Prevention of Dangerous Climate Change and Its Negative Consequences" is, at present, near completion in the Russian Federation. The programme might be a pivotal factor for national scientific investigations and practical activities concerning global climate change and implementation of GCOS.

In 1994, a special State coordinating mechanism for national investigation and practical activities under the Climate Convention was created in the Russian Federation. The government established the Interagency Commission of the Russian Federation on Climate Change Problems to be chaired by Mr **Bedritsky**, the Head of the Russian Federal Service for Hydrometeorology and Environmental Monitoring.

The main tasks of the Interagency Commission are:

- Coordination of activities of the ministries and agencies of the Russian Federation in the field of mitigation of negative influence of economic activities on climate and of prevention of negative consequences of climate change for the economy of the country and for the environment;

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- Coordination of activities of the ministries, agencies and **organisations** of the Russian Federation on maintenance and fulfilment of the obligations of the Russian Federation under the UN Convention on Climate Change. This effort is directed to the stabilisation of greenhouse gas concentrations in the atmosphere at such a level, which do not admit dangerous anthropogenic effects on climate system;
- Organisation and coordination of activities on participation of the Russian Federation in official bodies of the Convention as well as in international cooperation on climate change problems.

Responsible representatives of about 30 state planning, industrial, agricultural and environmental ministries and agencies, as well as scientists, are members of the Interagency Commission. The Interagency Commission is going to establish a special working group whose responsibility will be to ensure effective interdisciplinary and programme coordination of the activity with regard to GCOS.

ANNEX V

THE GCOS BASELINE UPPER-AIR NETWORK (GUAN)

The purpose of the GCOS Baseline Upper-Air Network is to ensure a relatively homogenous distribution of upper-air stations to meet requirements of GCOS. The key issue is to establish a network of stations with reliable prior records, and which could be relied upon to continue in the future. The criteria used by the Atmospheric Observation Panel to select presently-operating World Weather Watch Global Observing System (GOS) stations to be included in the Network are, in order of importance: (1) the remoteness of the station, which determines its relative contribution to as homogeneous a distribution as possible (given the global land/ocean distribution); (2) the performance of a site in producing high quality observations; and (3) the existence of a reasonable length of historical record. The selection process considered performance records of existing GOS stations and station quality information from the Lead Centre quality monitoring programme of the WMO Commission for Basic Systems (CBS).

It has been noted that the present GOS has experienced and continues to experience problems in the number, availability and quality of its upper-air network in some areas of the world. Although a number of geographically isolated, and therefore important, sites have been closed for logistic and economic reasons, the density and performance of stations is generally adequate for the GCOS Initial Operational System (**IOS**) objectives over the major land areas of the Northern Hemisphere. The situation is not as bright for much of the tropics and the Southern Hemisphere. The current performance of the GOS upper-air network, compared with the performance ten years ago, can be judged by the fact that in 1985 approximately 1500 soundings per day were produced by the GOS while in early 1994 that number was reduced to about 1050 per day. Moreover, it now appears likely that key stations, in particular island sites, will not continue in the future unless action is taken to reverse the decline of the GOS.

The network has been reviewed by the CBS Working Group on Observations. It has been presented to Members of WMO responsible for its operation. Members have provided their comments on the proposed stations which in nearly all cases have been accepted by the AOP. The Members have consequently agreed to provide data from these stations as a contribution to **GCOS**.

At the second session of the AOP (GCOS-17), a set of guidelines were developed. The concept of "best practice" was proposed whereby the operators of the stations should consider, inter *alia*, **the** following elements:

- o long-term continuity;
- o provision of detailed metadata;
- o use of high altitude soundings (to reach 5 **hectoPascal**, if possible);
- o rigorous quality control;
- o back-up release in case of **failure** or major data loss;
- o co-location with atmospheric constituent measurements where possible.

The stations in the network and candidate stations for inclusion are listed below.

GCOS Baseline Upper-air Network

Northern Hemisphere

Station Index	Name	Latitude	Longitude
01001	Jan Mayen	70 56N	008 40W
02836	Sondankyla	67 22N	026 39E
03005	Lerwick	60 08N	001 11W
03808	Cambome	50 13N	005 19W
03953	Valentia Observatory	51 56N	010 15w
04018	Keflavik	63 58N	022 36W
04270	Narsarsuaq	61 09N	045 26W
08495	Gibraltar	36 09N	005 2ow
08508	Lajes/Santa Rita (Azores)	38 44N	027 04W
10739	Stuttgart/Schnarrenberg	48 50N	009 12E
16245	Pratica di Mare	41 39N	012 26E
17130	Ankara/Central	39 57N	032 53E
20674	Ostrov Dikson	73 30N	080 24E
21982	Ostrov Vrangelja	70 59N	178 29W
22271	Sojna	67 53N	044 08E
23472	Turuhansk	65 47N	087 57E
24266	Verhojansk	67 33N	112 26E
28698	Omsk	54 56N	074 23E
30230	Kirensk	57 46N	108 07E
32540	Petropavlovsk-Kamchatskij	52 58N	158 45E
33345	Kiev	50 24N	030 27E
3473 1	Rostov-na-Donu	47 15N	039 49E
35121	Orenburg	51 45N	055 06E
38880	Ashgabat	37 58N	058 20E
41217	Abu Dhabi	24 26N	054 39E
45004	King's Park	22 19N	114 10E
47412	Sapporo	43 03N	141 20E
47646	Tateno	36 03N	140 08E
47827	Kagoshima/Yoshino	31 38N	130 36E
47936	Naha	26 12N	127 41E
47971	Chichijima	27 05N	142 11E
47991	Minamitorishima	24 18N	153 58E
50527	Hailar	49 13N	119 45E
51709	Kashi	39 28N	075 59E
52681	Minqin	38 38N	103 05E
53068	Erenhot	43 39N	112 00E
55299	Naqu	31 29N	092 04E
56778	Kunming	25 01N	102 41E

Northern Hemisphere (continued)

Station Index Name	Latitude	Longitude
57461 Yichang	30 42N	111 18E
60020 Santa Cruz de Tenerife	28 27N	016 15W
60680 Tamanrasset	22 47N	005 31E
62414 Asswan	23 58N	032 47E
70026 Barrow/W. Post W Rogers	71 18N	156 47W
70308 St. Paul	57 09N	170 13w
70398 Annette Island	55 02N	131 34w
71072 Mould Bay, UA, N.W.T.	76 15N	119 21w
71082 Alert, UA, N.W.T.	82 30E	062 20W
71816 Goose Bay, UA, NFLD	53 18N	060 22W
71836 Moosonee, ONT	51 17N	080 36W
71934 Fort Smith, UA, N.W.T.	60 02N	111 56W
72201 Key West/INT., FL	24 33N	081 45W
72261 Del Rio/INT., TX	29 22N	100 55W
72293 San Diego/MIRAMAR, NAS,CA	32 51N	117 07W
72403 Sterling, UA	38 59N	077 28W
72597 Medford, OR	42 22N	122 52W
72764 Bismarck/MUN., ND	46 46N	100 45w
78016 Bermuda Naval air station Kindley	32 22N	064 41W
91245 Wake Island	19 17N	166 39E
FIXED SHIP STATION Cumulus (Former LIMA)	57 00N	020 00W

Tropics

Station Index	Name	Latitude	Longitude
41114	Khamis Mushait	18 18N	042 48E
48455	Bangkok	13 44N	100 34E
48698	Singapore/Changi Airport	01 22N	103 59E
61052	Niamey-Aero	13 29N	002 10E
61641	Dakar/Yoff	14 44N	017 30w
61901	St. Helena Island	15 56S	005 40w
61902	Wide Awake Field (Ascension Is)	07 58S	014 24W
61976	Serge Frolow (Ile Tromelin)	15 53s	054 31E
63450	Addis Ababa	08 59N	038 48E
63741	Nairobi/Dagoretti	01 18S	036 45E
63985	Seychelles Inter Airport - (Rawinsonde Station)	04 41S	055 32E
64910	Douala R.S.	04 01N	009 42E
65578	Abidjan	05 15N	003 56W
67774	Harare	17 50s	031 01E
76654	Manzanillo, COL.	19 03N	104 20w
78397	Kingston/Norman Manley	17 56N	076 47W
78526	San Juan/Int. , Puerto Rico	18 26N	066 00w
78583	Belize/Phillip Goldstron Inter. Airport	17 32N	088 18W
78762	Juan Santamaría	10 00N	084 13w
78954	Grantley Adams	13 04N	059 29w
80222	Bogota/Eldorado	04 43N	074 09W
81405	Cayenne - Rochambeau	04 50N	052 22W
82193	Belem (Aeroporto)	01 23S	048 29W
82332	Manaus (Aeroporto)	03 09s	059 59w
82397	Fortaleza	03 46S	038 36W
83378	Brasilia (Aeroporto)	15 52S	047 56W
84008	San Cristóbal (Galapagos)	00 54s	089 36W
84628	Lii-Callao/Aerop.Int. Jorge Chavez	12 00s	077 07W
91217	WSMO Agana, Guam Mariana Is.	13 33N	144 50E
91285	Hilo/Gen Lyman, Hawaii	19 43N	155 04W
91334	Truk, Caroline Is.	07 28N	151 51E
91376	Majuro/Marshall Is. Intl.	07 05N	171 23E
91408	Koror, Palau Is.	07 20N	134 29E

Tropics (continued)

Station Index Name	Latitude	Longitude
91517 Honiara	09 25S	159 58E
91557 Bauerfield (Efate)	17 42S	168 18E
91610 <i>Tarawa</i>	01 21N	<i>172 55E</i>
91643 Funafuti	08 31S	179 13E
91765 Pago Pago/Int. Airport	14 20s	170 43w
91801 Penrhyn	09 00S	158 03W
91925 Atuona	09 48S	139 02W
91938 Tahiti Faaa	17 33s	149 37W
94035 Port Moresby M.O	09 26S	147 13E
94120 Darwin Airport	12 24S	130 52E
94203 Broome Airport	17 57s	122 13E
94294 Townsville AMO	19 15s	146 45E
96315 Brunei Airport	04 56N	114 56E
96935 Surabaya/Juanda	07 22s	112 46E
96996 Cocos Island Airport	12 11s	096 49E
98223 Laoag	18 11N	120 32E

Southern Hemisphere

Station	Index	Name	Latitude	Longitude
61995		Vacoas (Mauritius)	20 18S	057 30E
61996		Martin de Vivies (Ile N Amsterdam)	37 48S	077 32E
61998		Port aux Français (Ile Kerguelen)	49 21s	070 15E
67197		Fort-Dauphin	25 02S	046 57E
68110		Windhoek	22 34s	017 06E
68588		Durban Int. Airport	29 58S	030 57E
68816		Cape Town Int. Airport	33 59s	018 36E
68906		Cough Island	40 21s	009 53w
68994		Marion Island	46 53S	037 52E
83780		Sao Paulo (Aeroporto)	23 37S	046 39W
85442		Antofagasta	23 26S	070 26W
85469		Isla de Pascuu	27 09s	109 25W
85543		Quintero Santiago	32 47S	071 31w
85799		Puerto Montt	41 25S	073 05W
85934		Punta Arenas	53 00S	070 51 w
87155		Resistencia Aero	27 27S	059 03W
87860		Comodoro Rivadavia Aero	45 47s	067 30W
88889		Mount Pleasant Airport	51 49s	058 27W
89002		Neumayer	70 40s	008 15 W
89009		Amundsen-Scott	90 00S	
89022		Halley	75 30s	026 39W
89050		Bellingshausen	62 12S	058 56W
89512		Novolazarevskaja	70 46s	011 50E
89532		Syowa	69 00S	039 35E
89564		Mawson	67 36S	062 52E
89611		Casey	66 17s	110 31E
89642		Dumont d'Urville	66 40s	140 01E
89664		McMurdo	77 51s	166 40E
91592		Noumea (Nlle Caledonie)	22 16S	166 27E
91958		Rapa	27 37S	144 2ow
93417		Paraparaumu Aerodrome	40 54s	174 59E
93844		Invercargill Aerodrome	46 42S	168 33E
93986		Chatham Island	43 57s	176 34W
93997		Raoul Island Kermadec Isl	29 15s	177 55W
94302		Learmonth Airport	22 14s	114 05E
94461		Giles	25 02S	128 17E
945 10		Charleville Airport	26 24S	146 16E
94610		Belmont (Perth Airport)	31 56S	115 57E
94659		Woomera Airport	31 08S	136 49E
94975		Hobart Airport	42 50S	147 29E

Southern Hemisphere (continued)

Station Index Name	Latitude	Longitude
94995 Lord Howe Island	31 32S	159 04E
94996 Norfolk Island Airport	29 02s	167 56E
94998 Macquarie Island	54 29s	158 57E

Stan&by List**Network Enhancements**

43599 Gan	00 41s	073 09E
68992 Bouvet Island	54 26S	003 24E
85585 Isla Juan Femandez	33 40s	078 59W
91530 Nauru Airport	00 32S	166 55E
91701 Kanton Island	02 46S	171 43w

Network Upgrades (operating sites)

61995 Vacoas (Radiosonde)	20 18S	057 30E
78016 Bermuda Naval Air Station Kindley	32 22N	064 41w
85469 Isla de Pascua	27 09S	109 25W
91610 Tarawa	01 21N	172 55E

Further Monitoring for Qualification

42182 New Delhi/Safdarjung	28 35N	077 12E
42809 Calcutta/Dum Dum	22 39N	088 27E
43003 Bombay/Santa Cruz	19 07N	072 51E
43279 Madras/Minambakkam	13 00N	080 11E
62414 Asswan	23 58N	032 47E
64650 Bangui	04 24N	018 31E

ANNEXVI

INTERNATIONAL SYMPOSIUM ON THE
GLOBAL CLIMATE OBSERVING SYSTEM

20 October, 1995

Shiba Park Hotel, Tokyo, Japan
STA, JMA, NASDA

1000-1020 OPENING ADDRESS

Director-General, Japan Meteorological Agency
**Director-General, Research and Development Bureau, Science and
Technology Agency of Japan**
Executive Director, National Space Development Agency of Japan

1020-1215 MORNING PRESENTATIONS -- *Chairman, Dr Thomas Spence*

The Climate Issue Sir John HOUGHTON
The GCOS Strategy and Approach. Prof. John TOWNSHEND
Climate Perspective in Japan Prof. Taro MATSUNO
Design of the Ocean Component of GCOS Prof. Worth NOWLIN

1215-1400 Lunch

1400-1510 AFTERNOON PRESENTATIONS -- *Chairman, Mr Yukio Haruyama*

Terrestrial Observations for Climate Ing. Claudio CAPONI
Monitoring of Atmospheric Greenhouse Gases . . . Dr.Takayo MATSUO
Satellite Observations for Climate Monitoring Mr Junkichi OHTAO
Information Management Concepts Mr Gregory WITHEE

1510-1530 Coffee Break

1530-1700 PANEL DISCUSSION -- *Moderator, Dr Thomas Spence*

*Relationships between GCOS and Research/Operational Programmes in
Japan*

Comments on Requirements of Research/Operational Programmes for GCOS
The Current Status of GEWEX Asian Monsoon Experiment (GAME)
. Prof. Tetsuzo YASUNARI
Climate Prediction Dr Tatsushi TOKIOKA
Research Projects on Terrestrial Biosphere Dr Kuninori OTSUBO

Discussion and Concluding Comments on the Observing Systems
- Sir John HOUGHTON, Prof. Keisuke TAIRA, and Dr David NORTH

1700 CLOSURE OF **THE SYMPOSIUM**

1800 Reception

ANNEX VII

ACRONYMS AND ABBREVIATIONS

ACMAD	African Centre of Meteorological Applications for Development (Niger)
ADEOS	Advanced Earth Observation Satellite (Japan)
ALACE	Autonomous Lagrangian Circulation Explorer
AOP	Atmospheric Observation Panel (GCOS)
BAHC	Biological Aspects of the Hydrological Cycle (IGBP)
BALTEX	Baltic Sea Experiment (GEWEX)
CAS	Commission for Atmospheric Sciences (WMO)
CBS	Commission for Basic Systems (WMO)
cc1	Commission for Climatology (WMO)
CD-ROM	Compact Disc-Read Only Memory
CENR	Committee on Environment and Natural Resources (USA)
CEOS	Committee on Earth Observation Satellites
CGIAR	Consultative Group for International Agriculture Research
CGMS	Co-ordination Group for Meteorological Satellites
CIMO	Commission for Instruments and Methods of Observation (WMO)
CLIPS	Climate Information and Predictions Services (WMO)
CLIVAR	Study of Climate Variability and Predictability (WCRP)
CMA	China Meteorological Administration
COP	Conference of the Parties (UN/FCCC)
DBCP	Data Buoy Co-operation Panel (IOC, WMO)
DDB	Distributed Database
DIMP	Data and Information Management Panel (GCOS)
DWD	Deutscher Wetterdienst (Germany)
EC	European Commission
ECSN	European Climate Support Network
ENSO	El Niño-Southern Oscillation
EPA	Environmental Protection Agency (USA)
ESA	European Space Agency
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EUROGOOS	European Regional Oceanographic GOOS Programme
FAO	Food and Agriculture Organization (UN)
FRIEND	Flow Regimes from International Experiments and Network Data
GAIM	Global Analysis, Interpretation and Modelling (IGBP)
GAME	GEWEX Asian Monsoon Experiment
GAW	Global Atmosphere Watch (WMO)
Gcos	Global Climate Observing System (ICSU, IOC, UNEP, WMO)
GCTE	Global Change and Terrestrial Ecosystem (IGBP)
GEF	Global Environment Facility
GEMS	Global Environmental Monitoring System (UNEP)
GEWEX	Global Energy and Water Cycle Experiment (WCRP)
GLOSS	Global Sea Level Observing System (IOC)
GOOS	Global Ocean Observing System (ICSU, IOC, UNEP, WMO)
GOS	Global Observing System (WMO/WWW)
GPCC	Global Precipitation Climatology Centre
GPCP	Global Precipitation Climatology Project (WCRP)

GRDC	Global Runoff Data Centre
GRID	Global Reference Information Directory (UNEP)
GSO	GOOS Support Office
GTOS	Global Terrestrial Observing System (FAO, ICSU, UNEP, UNESCO, WMO)
GTS	Global Telecommunications System (WMO/WWW)
GUAN	GCOS Upper-air Network
HDP	Human Dimensions Programme (ICSU, ISSC)
HWRP	Hydrology and Water Resources Programme (WMO)
IAI	Inter-American Institute
ICSU	International Council of Scientific Unions
ICTP	International Centre for Theoretical Physics
IGAC	International Global Atmospheric Chemistry Project (IGBP)
IGBP	International Geosphere-Biosphere Programme (ICSU)
IGBP-DIS	IGBP Data and Information System
I-GOOS	International Committee for GOOS
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System (IOC, WMO)
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IODE	International Ocean Data Exchange (IOC)
10s	Initial Operational System (GCOS)
IPCC	Intergovernmental Panel on Climate Change (UNEP, WMO)
ISAPB	International South Atlantic Buoy Programme (DBCP)
ISSC	International Social Sciences Council
JAMSTEC	Japan Marine Science and Technology Center (STA)
J-GOOS	Joint Scientific and Steering Committee for GOOS
JMA	Japan Meteorological Agency
JPO	Joint Planning Office (GCOS)
JSTC	Joint Scientific and Technical Committee (GCOS)
LUCC	Land Use and Land Cover Change (HDP, IGBP)
NASA	National Aeronautics and Space Administration (USA)
NASDA	National Space Development Agency of Japan (STA)
NCDC	National Climatic Data Center (NOAA)
NDSC	Network for Detection of Stratospheric Change
NEARGOOS	NorthEast Asia Region GOOS Programme
NOAA	National Oceanic and Atmospheric Administration (USA)
OECD	Organization for Economic Co-operation and Development
OOPC	Ocean Observation Panel for Climate (GCOS, GOOS, WCRP)
OOSDP	Ocean Observation System Development Panel
PALACE	Profiling Autonomous Lagrangian Circulation Explorer
RA	Regional Association (WMO)
RESTEC	Remote Sensing Technology Center of Japan
SBSTA	Subsidiary Body for Science and Technological Advice (UN/FCCC)
SOOP	IGOSS Ship of Opportunity Programme
SOP	Space-based Observation Panel (GCOS)
SSG	Science Steering Group
STA	Science and Technology Agency (Japan)

START	System for Analysis, Research, and Training (IGBP, WCRP)
STPG	Scientific and Technical Planning Group (GTOS)
TAO	Tropical Atmosphere-Ocean (TOGA)
TIP	TAO Implementation Panel (CLIVAR, GCOS, GOOS)
TIPEX	Tibetan Plateau Field Experiment
TOGA	Tropical Ocean-Global Atmosphere Programme (WCRP)
TOP	GCOS/GTOS Terrestrial Observation Panel
TRMM	Tropical Rainfall Measurement Mission (Japan)
UN	United Nations
UNEP	United Nations Environment Programme
UN/FCCC	United Nations Framework Convention on Climate Change
UOP	Upper Ocean Panel (CLIVAR)
v o s	Volunteer Observing Ship
WCP	World Climate Programme (WMO)
WCRP	World Climate Research Programme (ICSU, IOC, WMO)
WDC	World Data Centres (ICSU)
WG	Working Group
WGO	Working Group on Observations (CBS/WMO)
WHYCOS	World Hydrological Cycle Observing System (WMO)
WMO	World Meteorological Organization
WMO EC	WMO Executive Council
WOCE	World Ocean Circulation Experiment (WCRP)
WWW	World Weather Watch (WMO)
XBT	Expendable Bathythermograph

LIST OF GCOS PUBLICATIONS

- GCOS-1
(WMO/TD-No. 493) Report of the first session of the Joint Scientific and Technical Committee for GCOS (Geneva, Switzerland, April 13-15, 1992)
- GCOS-2
(WMO/TD-No. 55 1) Report of the second session of the Joint Scientific and Technical Committee for GCOS (Washington DC, USA, January 11-14, 1993)
- GCOS-3
(WMO/TD-No. 590) Report of the third session of the Joint Scientific and Technical Committee for GCOS (Abingdon, UK, November 1-3, 1993)
[ftp://www.wmo.ch/Documents/gcos/jstc-3.txt]
- GCOS-4**
(WMO/TD-No. 637) Report of the fourth session of the Joint Scientific and Technical Committee for GCOS (Hamburg, Germany, September 19-22, 1994)
[ftp://www.wmo.ch/Documents/gcos/jstc-4.txt or /jstc-4.wp5]
- GCOS-5
(WMO/TD-No. 639) Report of the GCOS Data System Task Group (Offenbach, Germany, March 22-25, 1994)
[ftp://www.wmo.ch/Documents/gcos/dstg.txt or /dstg.wp5]
- GCOS-6
(WMO/TD-No. 640) Report of the GCOS Atmospheric Observation Panel, first session (Hamburg, Germany, April 25-28, 1994)
[ftp://www.wmo.ch/Documents/gcos/aop-1.txt or /aop-1.wp5]
- GCOS-7
(WMO/TD No. 641) Report of the GCOS Space-based Observation Task Group (Darmstadt, Germany, May 3-6, 1994)
[ftp://www.wmo.ch/Documents/gcos/sotg.txt or /sotg.wp5]
- GCOS-8**
(WMO/TD No. 642)
(UNEP/EAP.MR/94-9) Report of the **GCOS/GTOS** Terrestrial Observation Panel, first session (Arlington, VA, USA, June 28-30, 1994)
[ftp://www.wmo.ch/Documents/gcos/top-1.txt or /top-1.wp5]
- Gcos-9
(WMO/TD-No. 643) Report of the GCOS Working Group on **Socio-economic** Benefits, first session (Washington DC, USA, August 1-3, 1994)
[ftp://www.wmo.ch/Documents/gcos/wgsb-1.txt or /wgsb-1.wp5]
- GCOS-10**
(WMO/TD-No. 666) Summary of the GCOS Plan, Version 1.0, April 1995
[ftp://www.wmo.ch/Documents/gcos/gps-ver1.txt or /gps-ver1.wp5]
- GCOS-11
(WMO/TD-No. 673) Report of the GCOS Data and Information Management Panel, first session (Washington DC, USA, February 7-10, 1995)
[ftp://www.wmo.ch/Documents/gcos/dimp-1.txt or /dimp-1.wp5]
- GCOS-12**
(WMO/TD-No. 674) **The Socio-economic** Benefits of Climate Forecasts: Literature Review and Recommendations (Report prepared by the GCOS Working Group on Socioeconomic Benefits), April 1995
[ftp://www.wmo.ch/Documents/gcos/wgsb-1rr.txt or /wgsb-1rr.wp5]

- GCOS-13**
(WMO/TD-No. 677) GCOS Data and Information Management Plan, Version 1.0, April 1995
[ftp://www.wmo.ch/Documents/gcos/dp-ver1.txt or /dp-ver1.wp5]
- GCOS-14**
(WMO/TD-No. 68 1) Plan for the Global Climate Observing System (GCOS), Version 1.0, May 1995
[ftp://www.wmo.ch/Documents/gcos/gp-ver1.txt or /gp-ver1.wp5]
- GCOS-15**
(WMO/TD-No. 684) GCOS Plan for Space-based Observations, Version 1.0, June 1995
[ftp://www.wmo.ch/Documents/gcos/sp-ver1.wp5]
(wp version only)
- GCOS-16**
(WMO/TD-No. 685) GCOS Guide to Satellite Instruments for Climate, June 1995
(will not be on **FTP** Server)
- GCOS-17**
(WMO/TD-No. 696) Report of the GCOS Atmospheric Observation Panel, second session (Tokyo, Japan, March 20-23, 1995)
[ftp://www.wmo.ch/Documents/gcos/aop-2.txt or /aop-2.wp5]
- GCOS-18**
(WMO/TD-No. 697)
(UNEP/EAP.MR/95-10) Report of the GCOS/GTOS Terrestrial Observation Panel, second session (London, UK, April 19-21, 1995)
[ftp://www.wmo.ch/Documents/gcos/top-2.txt or /top-2.wp5]
- GCOS-19**
(WMO/TD-No. 709) Report of the GCOS Data Centre Implementation/Co-ordination Meeting (Offenbach, Germany, June 27-29, 1995)
[ftp://www.wmo.ch/Documents/gcos/dcc-1.txt or /dcc-1.wp5]
- GCOS-20**
(WMO/TD-No. 720) GCOS Observation Programme for Atmospheric Constituents: Background, Status and Action Plan, September 1995
[ftp://www.wmo.ch/Documents/gcos/atmcons.txt or /atmcons.wp5]
- Gcos-21**
(WMO/TD-No. 721)
(UNEP/EAP.TR/95-07) **GCOS/GTOS** Plan for **Terrestrial** Climate-related Observations, version 1.0, November 1995
[ftp://www.wmo.ch/Documents/gcos/top-ver1.wp5]
- GCOS-22**
(WMO/TD-No. 722) Report of the fifth session of the Joint Scientific and Technical Committee for GCOS (**Hakone**, Japan, October 16-19, 1995)
[ftp://www.wmo.ch/Documents/gcos/jstc-5.wp5]