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INTERGOVERNMENTAL
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**REPORT OF THE SEVENTH SESSION OF THE
JOINT SCIENTIFIC AND TECHNICAL COMMITTEE
FOR GCOS**

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SUMMARY OF THE SESSION

The seventh session of the Joint Scientific and Technical Committee (JSTC) of the Global Climate Observing System (GCOS) was held in Veldhoven, the Netherlands, 22 -26 September 1997. The session opened with an informal meeting to review of the activities of the five GCOS co-sponsored panels and was followed by a welcome address by Ms T. van Beek, Deputy Secretary General of the Netherlands Ministry of Transport, Public Works and Water Management. Prof. J. Townshend, Chairman of the JSTC, opened the formal session of the JSTC on the morning of 23 September (for participants and agenda, see Annex I and II).

The Committee received the Chairman's report from Prof. Townshend, reports from the Director of the Joint Planning Office (JPO), from representatives of the sponsoring organizations, from Members on national activities, and from the chairmen of the JSTC sponsored panels. Brief status reports were provided from research programmes and other invited representatives.

Prof. Townshend provided a report to the Committee and related many recent achievements but stressed that much more could have been accomplished if more resources had been available to the programme. He stated that a major goal for the programme is to halt the decline of many *in situ* observation systems and to obtain commitment to implement the needed networks and associated data and information management. GCOS should express concerns with this issue, but in a balanced, objective and constructive manner. He placed high priority on the development of an Integrated Global Observing Strategy (IGOS) and future cooperation with the Committee on Earth Observation Satellites (CEOS). The Chairman conceded the current complexity of the planning and implementation process citing numerous meetings and interactions needed to advance the programme encouraging more active JSTC participation. He acknowledged the help received during the last year and urged nations to increase their participation where feasible.

The Director of the JPO, Dr T. Spence, reviewed activities since the last meeting emphasizing the relationships between GCOS and the United Nations Framework Convention on Climate Change (UN/FCCC), the Intergovernmental Panel on Climate Change (IPCC), the Climate Agenda and various research programmes. He noted that the third UN/FCCC Conference of the Parties (COP-3) invited a report on systematic observations which GCOS would assist to develop. It would be presented to the COP-4 through the Subsidiary Body on Scientific and Technological Advice (SBSTA). It was noted that intergovernmental mechanisms provide effective *fora* to draw attention to the needs and plans of the three global observing systems (G3OS) and to justify commitments. He reviewed recent progress in implement observing networks as components of the Initial Operational System (IOS) noting that the diversity of these elements poses difficult issues in particular for the data and information management activities.

The Chairman of the Atmospheric Observation Panel for Climate (AOPC), Dr M. Manton, reported on the third session of the Panel and the development of the GCOS plan for atmospheric observations. He reviewed the status of the GCOS Upper-Air Network and the GCOS Surface Network and the plans for future work of the panel on atmospheric constituents

and precipitation. Dr D. Whelpdale reported on the recent activities related to atmospheric constituents including chemical species and aerosols. The JSTC recommended that the AOPC should produce a comprehensive plan as a priority and review the 'best practice' advice and provide guidance regarding the development of products based on the networks.

Dr J. Cihlar, Chairman of the Terrestrial Observation Panel for Climate (TOPC), gave an overview of the activities of the Panel since the sixth session of JSTC. The Panel focused on network implementation, demonstration projects and cross-cutting activities undertaken with other GCOS panels. Dr Cihlar identified activities for the next year including the establishment of various networks, implementation of demonstration projects, and updates of the Terrestrial Ecosystem Monitoring Sites (TEMS) database. He cautioned the JSTC that the different stages of evolution between GCOS and the Global Terrestrial Observing System (GTOS) posed barriers to the future TOPC work. The JSTC recommended that the TOPC should continue its development of terrestrial networks for climate-related observations and in particular the GOS-Net, glacier, permafrost, and hydrological networks and continue its major projects already underway.

Dr N. Smith, Chairman of the Ocean Observations Panel for Climate (OOPC), gave a report on its activities. He noted that the Panel should be responsible for a 'baseline sustained observing system' and should cooperate closely with research programmes. The OOPC cosponsored a Time-Series Workshop, established liaison with the Global Sea Level Observing System (GLOSS) and cosponsored a Sea-Level Workshop. The OOPC continues its liaison with implementation groups and provided technical guidance on requirements to guide such groups. Dr Smith reported on the development of the Global Ocean Data Assimilation Experiment (GODAE) which will form a centrepiece for open ocean observations. Issues to be tabled at the next meeting include sea ice, carbon, and new technology. The JSTC recommended that the OOPC review the outcome of the Time-Series Workshop to develop specific recommendations, and continue to work with the implementing agencies to develop a coherent ocean climate observing system. It supported the GODAE efforts.

The Chairman of the Global Observing Systems Space Panel (GOSSP), Mr J. Morgan, reported on the third session of the Panel which shared a few sessions with the World Meteorological Organization (WMO) Commission on Basic Systems (CBS) Working Group on Satellites (WGSAT). The focus of the meeting was on the review of user requirements and capabilities of the various satellite instruments to meet them. He further noted that the Panel was also working toward a new Space Plan which would be primarily 'electronic' to enable frequent updating as a result of changes in requirements and space agency plans. The JSTC recommended that all panels provide timely inputs for the GOSSP so it can accurately maintain requirement databases and portray them to the agencies and to CEOS, and encouraged work to continue on the Space Plan.

The Chairman of the Joint Data and Information Management Panel (JDIMP), Mr T. Karl, reported on recent activities since the sponsorship of the Panel was widened to include the Global Ocean Observing System (GOOS) and GTOS. Since GCOS, GOOS and GTOS are at different stages of evolution and have significant differences in their approach to data and information management, the Panel outlined a number of changes to its Terms of Reference. The role of JDIMP will be to oversee the methods of collection, calibration and quality control, as

well as the procedures for data transfer and distribution and to share responsibility with data centres for the archival of data, information and products. The Panel will continue its leadership on climate extremes, will support the implementation of the G3OS Information Center, and continue its project on metadata.

The JSTC recommended that the JDIMP revise its plan to accommodate its expanded charter, continue the implementation of the Information Center, and continue the development of the metadata project. It recommended the JDIMP proceed with a follow-on meeting on "Extremes" in 1999 and support the data requirements of IPCC regarding its next assessment.

The JSTC reviewed the status on a number of *in situ* observation networks including atmospheric constituents, a variety of ocean networks, ecological sites, and glacier and permafrost networks. It supported the integrated projects (GODAE and Global Observations of Forest Cover (GOFC)) projects.

The Chairman recommended three ad hoc working groups be established to consider key issues raised at the session: (1) data and information management; (2) the Integrated Global Observing Strategy; and (3) government involvement in GCOS.

The first working group discussed the role of the JDIMP and identified key responsibilities and activities for it. The working group proposed a meeting of data centre representatives to focus attention on GCOS data and products. It also considered the functions of the Information Center and proposed a data and product facilitator to resolve problems as they arise on a day-to-day basis. The working group also addressed the implementation of capacity building.

The second working group reviewed the IGOS. A series of plenary presentations by representatives of various space agencies and other organizations provided a foundation for the working group discussions. The working group developed a schematic diagram which identified the various steps that need to be taken and designated responsibilities for their completion. The working group recommended that the G3OS should provide a framework to develop and prioritize national and international needs for observations, and to present them in a consistent fashion to appropriate implementation groups. These needs should reflect the societal issues (e.g., socio-economic benefits, conventions, other political motivations). For those requirements which may be met by space-based instrumentation, the various space data providers should be invited to provide appropriate platforms and instruments. For those which may be met by *in situ* systems, appropriate agencies should be identified to meet them. For those which require a composite approach, an IGOS would be particularly helpful in providing mechanisms to review the comprehensive requirements and present them to appropriate agencies who can then respond in a mutually beneficial manner. Savings will be realized as a result of close collaboration among the various agencies. Duplicate efforts and gaps should be avoided through this process.

The third working group discussed various mechanisms available to develop governmental support for sustained observations. The principal focus was on the UN/FCCC COP-3 in Kyoto for which GCOS was urged to formulate a message and distribute a brochure. In discussing the content, GCOS should stress the need for the integration of all components and common functionalities, give specific examples, and outline the value of data sets, services and

benefits. Future GCOS plans should documented a clear vision of GCOS and should include a chapter on achievements. In the next few years, GCOS should support a series of regional sessions to develop closer ties with national activities in support of climate observations. The working group supported the need for an advisory body to assist the JSTC with regard to financial support. It should include some individuals who are not members of JSTC, but who have close links to the JSTC.

The JSTC was pleased to accept these recommendations. Upon further discussions it adopted a number of specific actions and recommendations (See Annex VII).

Pending final arrangements it was agreed that the eighth session of the JSTC should be held in Geneva, Switzerland (dates to be determined).

The Chairman thanked the members of JSTC, the guests, and the Netherlands hosting organizations for their participation and support. The formal meeting was closed at 4:00 pm, 25 September and was followed by a brief *in camera* session. A public information symposium was held the following day at the same venue.

REPORT OF JSTC-VII

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Meeting

1.1.1 Informal Opening

The seventh session of the Joint Scientific and Technical Committee (JSTC) opened informally on Monday, 22 September at the Koningshof Kongreshotel en Vergadercentrum in Veldhoven, The Netherlands. The informal session included a review of the activities of the five Global Climate Observing System's (GCOS) co-sponsored panels and a brief discussion of the significant achievements and future activities of the panels. A separate annex has been prepared on this informal session (Annex III).

Following the informal panel session, the JSTC was convened for a welcome address by one of the hosting organizations. Ms T. van Beek, Deputy Secretary General of the Netherlands Ministry of Transport, Public Works and Water Management officially welcomed the JSTC and invited guests (Annex IV). She indicated the importance her ministry and the Netherlands government places on climate activities, and in particular the acquisition of comprehensive observations. She praised the work of the JSTC and wished the participants a productive meeting and a pleasant stay in the Netherlands.

The JSTC Chairman, Prof. J. Townshend, thanked Ms van Beek for her supportive remarks, and for the financial assistance provided by her ministry for the meeting. He also acknowledged the generous support of the Royal Netherlands Meteorological Institute, noting in particular the assistance of its Director, Dr H.M. Fijnaut and Dr A. van Lammeren. A reception provided by the host country followed.

1.1.2 Formal Opening of the Session

The Chairman opened the formal session of the JSTC on Tuesday, 23 September 1997. He thanked all the participants for attending the session, and invited all attendees to introduce themselves (Annex I).

1.2 Approval of the Agenda

1.2.1 The Chairman presented the proposed agenda (Annex II). It was suggested that the discussion on the Integrated Global Observing Strategy (IGOS) be held prior to the establishment of *ad hoc* working groups. With this change, the agenda was adopted by the JSTC attendees. The Chairman emphasized that significant agenda items would be addressed during the session, and pointed in particular to important implementation activities underway through the efforts of the various panels. He suggested that the JSTC might wish to consider three *ad hoc* working groups to address: (1) IGOS; (2) strategies to increase governmental support for the various observing networks being established; and (3) data and information cross-cutting activities. The participants were also reminded of the all-day Public Information Symposium to be held on Friday, 26 September 1997 (Annex XIII).

1.3 Conduct of the Meeting

1.3.1 The Chairman proposed a working schedule for the meeting. The first part of the session would be devoted to general reports and updates on JSTC and the Joint Planning Office (JPO) activities, to be followed by substantive reviews of the panels. He noted that the JSTC would meet *in camera* on Thursday to address relevant issues for the Committee.

1.3.2 The Chairman informed the participants that, in keeping with JSTC practices, invited scientific lectures would be given during the session by Drs G. Komen and R. Leemans on issues related to the work of the JSTC.

1.3.3 At the sixth session of the JSTC it was proposed that summary results of the meeting be reported more expeditiously so that JSTC conclusions and actions could be addressed more quickly to relevant organizations and individuals for their attention. Many of the findings and recommendations should be communicated to key individuals, and summary results placed on the GCOS website. An effective method for wider distribution of meeting recommendations should also be pursued. In the present report the actions and recommendations will be displayed in bold type.

1.3.4 The JSTC requested that selected background materials, including the presentation of the JSTC Chairman, and the report of the JPO Director be made accessible on the GCOS website on the Internet'.

2. REPORT OF THE DIRECTOR, JOINT PLANNING OFFICE

2.1 The Director of the JPO, Dr T.W. Spence, reviewed activities since the last meeting (Annex V). He emphasised the relationships between GCOS and the United Nations Framework Convention on Climate Change (UN/FCCC), the Intergovernmental Panel on Climate Change (IPCC), the Climate Agenda and various research programmes.

2.2 He referred in particular to the outcome of the World Climate Research Programme (WCRP) Conference in August 1997 (Geneva, Switzerland), which resulted in a letter addressing global observations to be taken to the UN/FCCC Conference of the Parties (COP) in Kyoto, Japan, in December 1997. He observed that the WCRP recommendation would provide an entree for GCOS to provide documentation to the Convention concerning observations. The Subsidiary Body for Scientific and Technological Advice (SBSTA) for the UN/FCCC was meeting soon, and would receive a brief statement on observational needs and the status of the observing systems from GCOS.

2.3 In the following discussion it was noted that intergovernmental meetings (e.g., the Global Ocean Observing System (GOOS) Agreements Meeting) will provide an effective forum to draw attention to the needs and plans of the three global observing systems (G3OS). The Director noted that government expenditures can be better justified in the light of specific events (e.g., El Niño) and the commitments resulting from the various conventions. He noted that the proposed

The web address for the GCOS presentations is: <http://www.wmo.ch/web/gcos/present.html>

GCOS Participants Meeting should be considered carefully since only verbal support had been obtained to date. He suggested that an *ad hoc* working group should reconsider the options for GCOS to reach particular governments.

2.4 He also mentioned the successful steps recently taken in cooperation with the sponsoring organizations to establish and implement observing networks as components of the Initial Operational System (IOS). These include the GCOS Upper-Air Network (GUAN), the GCOS Surface Network (GSN), and the Global Atmosphere Watch (GAW) for the atmosphere. Close cooperation with the GOOS programme has focused on key elements of the climate module as parts of the GOOS/GCOS ocean network for climate (e.g., the Integrated Global Ocean Services System (IGOSS), the Tropical Atmosphere-Ocean (TAO) Array, the Data Buoy Cooperation Panel (DBCP), the Ship Of Opportunity Programme (SOOP), and the Global Sea Level Observing System (GLOSS)). Similarly, collaboration with the Global Terrestrial Observing System (GTOS) has initiated a GCOS/GTOS Ecosystem Network and Terrestrial Ecosystem Monitoring Sites (TEMS). In addition, the GCOS programme has worked with the World Glacier Monitoring Center to identify a network of glacier sites and with the World Meteorological Organization's (WMO) Hydrology and Water Resources Programme (HWRP) to develop elements of the World Hydrological Cycle Observing System (WHYCOS) hydrological stations as part of a comprehensive hydrology observing component.

2.5 He noted that the diversity of these elements pose difficult issues for the programme, and in particular for the data and information management activities. He suggested that an *ad hoc* working group may be proposed during the session to consider the data issues associated with the delivery of user-driven products.

2.6 Participants expressed some concern about the national perceptions of the measurement programmes. Some governments perceive that the systems are working well, but are apparently unaware of issues with reliability, loss of stations, and inability to document extremes. Some JSTC members noted that only limited climate data have become available through the G3OS to date. The development of networks was cited as an important step in raising the visibility of the climate observing programmes. One participant noted the an apparent disconnect between the plans for the GOOS as they relate to the oceanographic science community (e.g., the Climate Variability and Predictability Programme (CLIVAR)). JSTC attendees noted that the CLIVAR needs, particularly for long-term observations, have not been well established to date. It was noted that there are few mechanisms available which address long-term monitoring, and that GCOS/GOOS will be interested to assist programmes such as CLIVAR. A key ocean link is the joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate (OOPC) which is considering the needs of CLIVAR. A similar collaboration was noted with the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC). The need to continue close collaboration with the WCRP was reemphasized.

2.7 The Director pointed out that the Memorandum of Understanding (MOU) is due for renewal and invited the JSTC members to review it. In addition, a number of vacancies in the JSTC now need to be filled. He proposed that the *in camera* session address this issue. He also informed the JSTC that the JPO has found it difficult to continue the publication and distribution of the GCOS Newsletter. He proposed instead that GCOS should utilize its homepage and publish an Annual Report instead. A first edition could be prepared for June 1998. A draft outline was offered for comment.

3.8 The Chairman thanked the Director for his report, and expressed his gratitude for the support of the JPO during a very active year. He noted that the JPO was facing a serious staffing problem with the departure in January 1998 of Dr H. Kibby, and of the Director in the summer of 1998. He invited the JSTC to consider ways to increase the staff in the office and to reduce the burden of the office. He urged the members to assume more responsibility in achieving the goals of the programme. He also urged them to assist in developing national support for GCOS through appropriate mechanisms.

3. REPORT OF THE CHAIRMAN

3.1 The Chairman, Prof. Townshend, provided a report to the Committee (Annex VI). He related many recent achievements of the programme. However, he stressed that much more could have been accomplished if more resources had been available to the programme. He noted the limited support from the sponsoring organizations, and urged them to consider regular contributions to enable the programme to develop and mature. The major requirement for the programme is to halt the decline of many *in situ* observation systems and obtain commitment to implement the needed networks and associated data and information management. The Chairman acknowledged the considerable help the JPO and the JSTC Chair have received during the last year in support of specific activities. He urged nations to increase their participation where feasible. The Chairman noted with concern that no financial support had been offered for the GCOS Participants Meeting and encouraged the JSTC to develop alternative approaches to obtain needed support.

3.2 He noted that the GCOS programme had been engaged in a variety of important international activities, but he placed high priority on the development of the IGOS. A close cooperation has evolved with the Committee on Earth Observation Satellites (CEOS) in particular. He also welcomed especially the initiative from the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) to work with GCOS in defining climate-relevant products. During the session, an *ad hoc* group may be considered to address the relationships between the GCOS and IGOS.

3.3 Prof. Townshend noted the decline in observing capability, but noted that we should express our concerns with this issue in a balanced and objective manner. A careful diagnosis of the current situation must be made, particularly if the GCOS programme is to provide valuable information to the UN/FCCC.

3.4 The Chairman conceded the current complexity of the planning and implementation process. He cited the numerous meetings and interactions needed to advance the programme and made a plea for fuller participation on the part of the JSTC.

3.5 He notified the JSTC that he wished to step down in favour of a new Chair. He emphasized that the future development of the programme would need leadership from individuals with more 'operationally' oriented experience. The Chairman thanked the JSTC, the JPO and its Director for all their efforts in assisting him with the work of GCOS and pledged to assist in the transition of a new Chair.

3.6 The JSTC expressed its gratitude to Prof. Townshend for his effective leadership of the Committee through three years of very rapid development of the programme. It accepted the challenge to continue the work that was so well initiated by the first two GCOS Chairs.

4. INVITED REPORTS

4.1 Reports from the Sponsoring Organizations

World Meteorological Organization (WMO)

4.1.1 Dr F.E. Delsol, Director of the Atmospheric Research and Environment Programme department of WMO, gave the JSTC a brief report. He noted that the Executive Council (EC-XLIX) appreciated the report on GCOS from the JSTC Chairman. The EC recorded several commendatory statements in its report, and encouraged the JSTC to continue its important work. He noted that the WMO is well aware of the limited resources which constrain the programme and through the EC has asked Members and other cosponsors to increase their support and participation in the programme.

Intergovernmental Oceanographic Commission (IOC)

4.1.2 Dr C. Summerhayes, Director of the GOOS Project Office reported on behalf of the IOC. He noted that Dr A. McEwan briefed the IOC Assembly on GCOS and that the Assembly was very supportive as noted in the excerpt of its report distributed to the participants. The effectiveness of the GOOS/GCOS partnership was recognised and appreciated by the Assembly. However, the lack of resources remains a critical issue for the development of both programmes. It was noted that the IOC Annual Report should cite the IOC co-sponsorship of GCOS.

United Nations Environment Programme (UNEP)

4.1.3 Unfortunately, no representative of UNEP was able to participate. The JSTC expressed its concern with this situation and encouraged representatives of UNEP to attend future sessions.

international Council of Scientific Unions (ICSU)

4.1.4 Dr N. Swanberg reported briefly on behalf of ICSU. He noted that ICSU continues to be supportive of the work of GCOS. It recently commissioned a review of the GCOS programme for the spring meeting of its Executive Board. The review committee, chaired by Dr G. McBean, was provided with extensive documentation about the programme.

Sponsors Group for the Global Observing Systems (SG)

4.1.5 The JPO Director reported on the recent meetings of the SG. It provides a forum for the sponsors to keep abreast of developments in the three global observing programmes. The JPO Director has provided the SG reports on GCOS and obtained the support of the SG with regard to several GCOS issues (e.g., MOU, JSTC membership, common nomenclature). He encouraged the SG to develop a strategy for interacting with CEOS and the International Group of Funding Agencies -for Global Change Research (IGFA) on IGOS. As a result, a strategy for the sponsors

has been prepared. and a future meeting of the SG will involve representatives of CEOS and IGFA in developing a common approach to IGOS. Participants expressed concern that the representatives attending the group be at a sufficiently senior level to make informed decisions and that the roles of the sponsors be better defined, particularly regarding financial support for the programmes. [*Sponsors Group reports are available from the JPO*]

4.2 Reports from G3OS

4.2.1 *Global Climate Observing System (GCOS)*

As a preface to discussion of the G3OS, the JPO Director described the relationship among the various observing systems. He illustrated the cross-cutting nature of GCOS noting that it is working closely with research programmes of WCRP and the International Geosphere-Biosphere Programme (IGBP) as well as operational programmes in meteorology and hydrology. He observed that operational experience in ocean and terrestrial observations is rather more limited. He illustrated the linkage among the G3OS addressing climate observations, and observed that a close cooperation is essential to develop an effective and comprehensive programme. He noted that the GCOS planning framework has involved scientists, operational agencies, and user communities who together are working to improve the collection, analysis, distribution, utilisation, and archiving of observations and information.

Global Ocean Observing System (GOOS)

4.2.2 Dr McEwan gave an overview of the main GOOS activities. The Joint Scientific and Technical Committee of GOOS (J-GOOS) and the Strategy Subcommittee of the Intergovernmental GOOS Committee (I-GOOS) have been restructured and combined to form the GOOS Steering Committee (GSC), to be chaired by Prof. W.D. Nowlin. Dr Summerhayes has been appointed Director of the GOOS Project Office (GPO). Dr McEwan noted the GOOS programme is being developed in phases. Phase one consists of "planning, design and technical definition". Documents related to this phase include the GOOS principles (Annex XII) and a strategic plan, as well as an overview document on GOOS being prepared by Dr P. Ryder. Additional components of this phase include the work of the OOPC and the Health of the Oceans (HOTO) module, as well as the modules for coastal, living marine resources, and marine services. Phase two describes the operational demonstrations and pilot experiments (e.g., North East Asian Regional GOOS (NEAR-GOOS) and the European GOOS (Euro-GOOS)). Phase three will incorporate existing and new activities (e.g., the Tropical Atmosphere-Ocean (TAO). SOOP) and develop further relationships with other elements (International Oceanographic Data and Information Exchange (IODE), IGOSS, GLOSS, DBCP, and SOOP).

4.2.3 Dr McEwan noted that a GCOS/GOOS Implementation Meeting is planned for early 1998 in Sydney, Australia, to coordinate these diverse implementation groups for climate observations in the ocean. He noted the important roles for both the Joint Data and Information Management Panel (JDIMP) and the Global Observing Systems Space Panel (GOSSP) in developing GOOS activities.

4.2.4 Dr McEwan informed the JSTC that the GOOS Agreements Meeting is being scheduled during 1998, the Year of the Ocean. The climate module will be a central element of the programme to be presented to senior-level officials. He noted that it will be important for

members of the JSTC to be involved with and be supportive of the Agreements Meeting.

4.2.5 The JSTC was pleased to note that Drs McEwan and Nowlin had accepted leadership positions with I-GOOS and the GOOS Steering Committee, respectively. It encouraged both to continue their active roles with the JSTC, and noted that the two 'vacancies' would permit additional ocean expertise to be added to the JSTC in the future.

Action'

- 1. The JSTC recommended that GCOS requirements be taken into consideration at the Sydney GCOS/GOOS Implementation Meeting.**
- 2. The JSTC agreed to assist GOOS in preparing for the Agreements Meeting.**

Global Terrestrial Observing System (GTOS)

4.2.6 Mr J. Tschirley, acting Director of the GTOS Secretariat, pointed out that GTOS promotes: (1) the integrated biophysical and socio-economic geo-referenced data; (2) the interaction between monitoring networks, research programmes and policy makers; (3) the data exchange and application, quality assurance, and protocols to harmonise measurements; and (4) the provision of guidance in data analysis. The acting Director noted that membership of the Steering Committee (SC) will soon be reviewed. The Chairman of the GTOS Steering Committee will change when the implementation plan is complete&.

4.2.7 The GTOS Working Groups are discussing a number of issues including an implementation plan, coastal issues, socio-economic issues, site criteria, biodiversity, and Earth sciences. He emphasised that the climate issues are being addressed well through GCOS, and in particular through the GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC). As a result, the GTOS SC has put its current priority on land and water issues. The TEMS meta-database⁴ is one of the recent activities of GTOS and GCOS. Further, the Global Observing System Network (GOS-Net), a cornerstone of GTOS, was established at a meeting in June 1997 (Guemica, Spain)⁵. A Networks Panel has been proposed to consider the elements of the ecosystem network. He also mentioned that a proposal to set-up a regional GTOS for South-East Asia has been prepared. Participants expressed concern (also expressed by the SG) that proposals from one of the observing systems be copied to offices of the others to ensure that requests to donors are coordinated.

4.2.8 The acting Director also reported that GTOS has become an affiliate of CEOS, and will participate in future CEOS activities, including the Strategic Implementation Team (SIT) which is developing the IGOS. The Global Observations of Forest Cover (GOFC) is one of the SIT

² Actions and recommendations of JSTC-VII are listed in Annex VII

³ The new Chairman of the GTOS Steering Committee is Dr J. Gosz

⁴ The TEMS database can be found at: <http://www.fao.org/gtos>

⁵ Report of the Meeting of Experts on Ecological Networks (GCOS-38)

projects of particular interest to GTOS.

Action

3. **The JSTC recommended that the Chairman communicate the concerns of the JSTC to the GTOS sponsoring organizations with regard to support for GTOS development.**
4. **The JSTC recommended that broader participation on the part of GTOS be sought from the GTOS SC and the GTOS Secretariat for jointly sponsored meetings and other future joint activities.**
5. **The JSTC recommended that the G3OS Office Directors ensure that all proposals to donors be shared with each other for information.**

4.3 National Activity Updates

National activity reports were received from Australia, China, Germany, Japan, Russian Federation, and Venezuela (Annex VIII).

The JSTC expressed its appreciation for the national reports and recommended that the GCOS website include descriptions of national activities as they become available. [*Several national reports are currently available on the website.*]

4.4 Other Reports

World Climate Research Programme (WCRP)

4.4.1 As noted in §2.2, an international conference, “World Climate Research Programme: Achievements, Benefits and Challenges”, was held in Geneva, Switzerland, 26-28 August 1997. Dr H. Teunissen, representative of WCRP, noted that one of the major outcomes of the conference was the recognition that global observations are essential for future advances in our understanding of climate, and for developing predictive capability. A paper, “Observational Systems: Needs and Prospects” by Drs Spence and Townshend was presented⁶ at the conference. A brief synopsis of the conference was prepared by Dr C.J. Readings and distributed to participants of the JSTC session.

Climate Variability and Predictability Programme (CLIVAR)

4.4.2 Prof. F. Schott informed the Committee that an initial CLIVAR Implementation Plan was presented at the WCRP Conference in August 1997 (Geneva, Switzerland). The first volume provides the overview in its final form, whereas the second volume outlines the details and is presently still under review by the science community. CLIVAR is organized in 11 Principal Research Areas (PRAs) under the three major headings: (1) CLIVAR-GOALS with a focus on seasonal to interannual predictions, in particular the study of the El Niño-Southern Oscillation

⁶ Text and viewgraphs are available at the GCOS website

(ENSO) and monsoons; (2) CLIVAR-DecCen with a focus on decadal and longer time variability and predictability; and (3) CLIVAR-ACC focusing on the prediction, detection and attribution of anthropogenic factors in climate change. While GCOS has embraced some of the core foci of the CLIVAR-GOALS for seasonal to interannual prediction, the DecCen PRAs so far have had less specific impact. Prof. Schott pointed out the potential for predictability for the North-Atlantic Oscillation (NAO).

4.4.3 It is noteworthy that the OOPC has already taken up some of these issues (e.g., Time-series observations¹). Another of the DecCen PRAs, the Thermohaline Circulation, is very much in the research domain but has an important potential for climate change prediction. These are just two examples showing the potential and also the necessity of cooperation in establishing the required observing system. Similar potential for cooperation can be seen in the implementation plan for other PRAs.

Action

6. **The JSTC urged close cooperation among GCOS, GOOS, and WCRP projects be continued.**

International Geosphere-Biosphere Programme (IGBP)

4.4.4 Dr Swanberg, Deputy Executive Director of IGBP, noted that the IGBP recognised many of its projects depend on the GCOS to assist with long-term observations. He noted that the informal relationship among the programmes is working well. The broader remit of IGBP regarding climate change maps well to GCOS interests. He specifically cited interaction with several other programmes, e.g., the AOPC work on atmospheric constituents and the International Global Atmospheric Chemistry (IGAC) programme, and the GCOS/GTOS Terrestrial Observation Panel for Climate and the Large-scale Biosphere-Atmosphere Experiment in Amazonia (LBA).

4.4.5 The JSTC Chairman suggested that IGBP might consider a formal joint sponsorship of the TOPC and that links might be strengthened by having representatives attend appropriate meetings. The JSTC urged close collaborations particularly for the set-up of networks.

Action

7. **The JSTC recommended that a proposal for joint sponsorship of the GCOS/GTOS TOPC be prepared and presented to the next IGBP meeting.**

Climate Information and Prediction Services (CLIPS)

4.4.6 Prof. L.A. Ogallo reported on the CLIPS project of the WMO World Climate Programme. The focus of CLIPS is to: (1) encourage operational climate predictions; (2) provide an international framework for forecasting and demonstrating their value and benefits; and (3) strengthen regional and national centres. The current thrust of CLIPS is therefore on capacity

¹ OOPC Ocean Climate Time-Series Workshop (GCOS-4 I)

building, establishing links to research projects, and the development of useful products. Its primary role is to enhance the capacity of the National Meteorological and Hydrological Services (NMHSs) and to exploit new techniques with regard to prediction and mitigation of, for example, El Niño. CLIPS will need high-quality data for the long-term for climate prediction, and to monitor extreme events. A close cooperation with the International Research Institute for Climate Prediction (IRI) has been initiated.

Action

8. **The JSTC recommended that the CLIPS project work closely with GCOS to ensure that the observational needs to ensure the success of the project are met.**

Committee on Earth Observation Satellites (CEOS)

4.4.7 A brief presentation on CEOS was given by Mr J.-L. Fellous, Chairman of CEOS. He noted the need for a coherent approach to integrate *in situ* and satellite observations has led to CEOS initiatives to develop an IGOS. The strategy calls for a close partnership between the space agencies and the user communities as represented through the CEOS affiliates. The CEOS established a SIT which subsequently selected six projects to aid in the development of the IGOS. He noted that CEOS has so far been interested in energizing the process but wishes to ensure partnerships with the G3OS and their sponsoring organizations. He acknowledged the strong supportive role of GCOS in the development of IGOS.

Action

9. **The JSTC recommended that GCOS work closely with CEOS and appropriate bodies to ensure that an integrated approach to climate-related observations be taken.**

4.4.8 The Chairman thanked the various participants for their reports. He noted the need for the JSTC to be abreast of the activities of these and other similar organizations. He reiterated the need for GCOS to consider how it should participate in the development of the IGOS, and proposed that an *ad hoc* working group be set up during the session to consider the issue.

5. GCOS PANEL ACTIVITIES

5.0 The Chairman reminded participants that the preceding day had been devoted to a discussion concerning the activities of and the interconnections among the GCOS supported panels (Annex III). That discussion led to a number of suggestions for improvements. For the JSTC session, the chairmen of the panels were invited to briefly summarize their reports and provide the JSTC with information to aid in the development of specific recommendations.

5.1 Report of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC)

5.1.1 The Chairman of the AOPC, Dr M. Manton, reported on the third session of the Panel in

July 1997 (Reading, U.K.)⁸. The AOPC-III reviewed current activities and prepared an outline of the GCOS plan for atmospheric climate observations. The plan will be a combination of strategic design and implementation activities. It will build on existing structures, especially the World Weather Watch (WWW) and existing activities such as the GUAN and GSN. The Panel spent some time reviewing its Terms of Reference. The linkages between AOPC and the research and operational communities were considered. Dr Manton noted that while GCOS needs to work closely with the operational agencies, its effectiveness will depend upon its exploitation of alternative sources of support and cooperation. In particular, it will be important for GCOS to complement the activities of the global research programmes of WCRP and IGBP. The Panel considered general principles for the development of requirements for atmospheric observations. It was seen that while AOPC will necessarily be initially focused on the global scale, it must support regional needs of client nations. Specific issues on observation methodology were considered, including the need for low bias techniques and for consistency and homogeneity in measurements.

GCOS Upper-air Network (GUAN)

5.1.2 Dr Manton reviewed the status of the GUAN. The network consists of 133 stations, a subset of the WWW global network. Countries operating these stations have agreed to continue them and to utilize 'best practices' in their operation. He expressed his appreciation for the support of the Commission for Basic Systems (CBS), and in particular for its Working Group on the Global Observing System (GOS) which assisted in the design, implementation, and subsequent monitoring of the GUAN. He noted the threat that 11 stations in the Tropics will be problematic after the closing of the Omega-System in October 1997. While temperature and humidity will continue to be observed, the wind profiles may be unavailable. WMO has found donors for all stations in jeopardy except for a few stations in South America. The European Centre for Middle-Range Weather Forecasts (ECMWF), in Reading, U.K. has agreed to monitoring the performance of the GUAN stations on behalf of GCOS. Dr Manton noted that according to ECMWF, 10-15% of the GUAN stations are reporting less than 50% of the time, indicating the stations are not performing adequately. He also noted that the distribution of stations is still sparse in some key regions and that some stations have problems in reaching heights above 100 hPa. He stressed that the AOPC is aware of these problems, but will need to put its emphases elsewhere (i.e., ocean data array) rather than trying to solve the upgrading problem. He expressed appreciation to ECMWF for its efforts on behalf of the programme, and noted the support from CBS now that its Terms of Reference were broadened to include the climate community.

GCOS Surface Network (GSN)

5.1.3 Dr Manton reported on the second meeting of Experts on GSN in June 1997 (De Bilt, The Netherlands)⁹. The GSN consists of about 1000 stations selected to be a geographically homogeneous sample of long-term, high-quality temperature sites. The stations were selected with the participation of both CBS and the Commission for Climatology (Ccl). The twelfth

⁸ Report of the GCOS/WCRP Atmospheric Observation Panel for Climate (GCOS-40)

⁹ Report of the second Joint CCI/CBS Meeting on the GCOS Surface Network (GCOS-35)

session of the CC! also proposed that the reports from the GSN stations should be monitored by appropriate centres. Germany and Japan have offered to use their climate centres for this monitoring purpose. At the third session of the AOPC it was noted that daily GSN data, in concert with JDIMP, could be helpful to CLIVAR-related projects on extreme climate events. Dr Manton expressed appreciation for the supportive work of the CBS, CC! and the Commission on Atmospheric Sciences (CAS) in establishing GSN. GCOS users should be aware that the actual network design is based on stations of the WMO. It was stressed that the network stations should be recognised as a 'superset' rather than a 'subset' of WWW stations -- they should be viewed as reference stations which provide a baseline and solid foundation for the larger network. Future proceedings will encourage non-governmental organizations (NGOs), e.g., ICSU, to support the funding of the networks. The integration of NGO stations as additional stations in the GSN, has not yet been established.

Atmospheric Constituents

5.1.4 Dr D.M. Whelpdale reported on the recent activities of the revitalised AOPC Working Group on Atmospheric Constituents. He pointed out that the monitoring of constituents is different from monitoring standard meteorological parameters. The measurement of chemical species is more complex, often requiring research-level techniques. The observations are mainly performed on a regional or local scale, although there is a need to better understand the global impact. Links with the research community have been initiated (e.g., the International Global Atmospheric Chemistry Programme (IGAC) and Stratospheric Processes and their Role in Climate (SPARC)). The AOPC recognised that the ozone network needs to be enlarged, in particular to obtain more ozone information from the tropics and the upper troposphere. Aerosols, as a forcing agent for climate, need to be measured to a much greater extent, which requires overcoming the technical limitations of measurements.

Cross Panel Links and other Interactions

5.1.5 The AOPC reviewed the various reanalyses projects at its last session. It recognised the value of reanalyses and agreed to continue to follow the progress of the various research projects. It was stressed that cooperation with the Global Energy and Water Cycle Experiment (GEWEX) Working Group on Numerical Experimentation (WGNE) will also be advantageous. The WGNE will plan to use new resources and old available data sources. Further, the AOPC will strengthen links to space agencies through GOSSP. The Panel will look specifically to two of the six projects of the CEOS SIT (Ozone and Upper-Air Monitoring) as being related to AOPC concerns. The Panel also determined that a closer relationship was needed with JDIMP. Both Panels have a role in the development of an end-to-end system, and a joint session was suggested as a mechanism to explore these links.

Other Issues

5.1.6 While the shorter-term aims will be focused on the IOS, it will be important for GCOS to provide for the evolution of client needs and of technological developments. Therefore, the AOPC discussed the outline of a Plan, comprising six components of the observing systems: a) atmospheric dynamics and thermodynamics. b) atmospheric constituents, c) surface climate. d) air-sea interface. e) air-land interface, and f) air-ice/snow interface. The structure of these components describes products and users, observing systems needs, IOS increments and long-

term increments.

Future Issues

5.1.7 At the upcoming AOPC, it is planned to consider the issue of atmospheric constituents and networks for precipitation (see § 6.2.1).

JSTC Comments

5.1.8 The JSTC expressed its appreciation to Dr Manton for assuming the Chair of the Panel, and for reinvigorating it. The JSTC was gratified to note the number of new experts who attended the most recent session of the Panel and it looked forward to a formal list of members after the next session. It was pleased to see the progress being made by the AOPC, and agreed with the priority to develop a coherent plan for atmospheric observations including atmospheric constituents. It was especially pleased with the progress made in implementing the various GCOS networks, and the close working relationship established with the various research and operational programmes. One participant suggested that the communications to countries concerning participation in the observing networks should also be copied to the 'GCOS Points of Contact' to develop closer ties to the national GCOS activities.

Action

10. The JSTC recommended that the AOPC should:

- a) strive to produce a comprehensive plan as a priority;**
- b) review the 'best practice' advice being prepared for participating countries for the GUAN and GSN, continue to monitor the progress of the networks, and develop recommendations for station replacement in the event of continuing non-performance;**
- c) provide guidance, in collaboration with research and operational agencies, regarding the development of products based on the networks;**
- d) review and make recommendations concerning national offers for archiving network data;**
- e) seek support from non-WMO agencies for the networks;**
- f) endorse, closely monitor and participate in reanalysis activities;**
- g) work closely with the GOSSP, particularly regarding SIT projects, and JDIMP regarding shared responsibilities for products.**

11. The JSTC recommended that the JPO improve its communications with the national GCOS offices and/or points of contact, particularly regarding observing networks.

5.2 Report of the GCOSIGTOS Terrestrial Observation Panel for Climate (TOPC)

5.2.1 Dr J. Cihlar, Chairman of TOPC, gave an overview of the activities of the Panel since the sixth session of JSTC. The Panel work had focused mainly on implementation issues for networks (e.g., GOS-Net, glacier network, permafrost network) and demonstration projects (e.g., regional projects, terrestrial Net Primary Productivity (NPP), GOFC, site coverage, and analysis

of gaps) most of which have been outlined in various TOPC publications”¹⁴.

Cross Panel Links and other Interactions

5.2.2 The TOPC Chairman reported on the various cross-cutting activities undertaken with other GCOS panels (e.g., with AOPC regarding temperature and precipitation, with JDIMP regarding strategies for locating useful data sets for TOPC variables and integrating the TEMS database base). The TOPC has also participated with GOSSP in the development of a consistent set of requirements which can be integrated into the overall space-based observation plans.

Operational Observing System Issues

5.2.3 Dr Cihlar noted that there have been major scientific uncertainties in developing an operational observational system (e.g., derivation of Leaf Area Index (LAI) from satellite) and changes in the observing systems themselves (e.g., changes in satellite data reception plans, changes concerning data access issues) which had to be dealt with.

implementation and Coordination

5.2.4 The Panel established several links to support the implementation of networks and pilot projects (e.g., the IPCC) to the political process (e.g., G7, UN/FCCC COP). It initiated for example the coordination with GTOS, IGOS and long-term space measurements with respect to the evolution of IGOS. The Panel made IGBP and WCRP data sets accessible to G3OSs. Further, it incorporated IGBP sites and databases in long-term observation networks. Flux measurements, the LBA in Amazonia and increasing automation of surface equipment have been recognised as new technological developments.

Future Activities

5.2.5 Dr Cihlar identified several activities proposed for the next year including the establishment of various networks, implementation of demonstration projects, and updates of the TEMS database base. He cautioned the JSTC that the different stages of evolution between GCOS and GTOS posed barriers to the future TOPC work. Mutual support for the work of the Panel has not materialized and has limited the effectiveness of its work programme. He expressed his concern that some important activities are likely to suffer from inadequate resources. Funds are not secure even to hold the next TOPC meeting. He encouraged the JSTC to communicate this concern to the GTOS sponsors.

JSTC Comments

5.2.6 The JSTC expressed its satisfaction with the good progress being made by the TOPC and praised Dr Cihlar for his contributions. It noted in particular the significant progress being made with the various terrestrial networks. The JSTC pointed out that the issue of data exclusivity

¹⁴ GCOS/GTOS Plan for Terrestrial Climate-related Observations, Version 2.0 (GCOS-32); the Global Hierarchical Observing Strategy (GHOST) Brochure (GCOS-33); Report of the Meeting of Experts on Ecological Networks (GCOS-38)

should be discussed since the terrestrial observations are often collected by different agencies and the policies differ substantially. Several examples of important GCOS data sets were cited. Regarding research data sets, the IGBP representative pointed out that this issue was discussed at a recent World Data Centre (WDC) workshop in Boulder, Colorado, USA. It was observed that the research communities differ in the length of time that investigators may retain exclusive use of the data. Additionally, there is the practical problem in getting the proper metadata information. Long-term commitments of people who are assigned to quality assessment and quality control of data should be guaranteed.

Action

12. The JSTC recommended that the TOPC should:

- a) continue its development of terrestrial networks for climate-related observations and in particular the GOS-Net, glacier, permafrost, and hydrological networks;**
- b) pursue projects already underway (NPP, GOFC, regional projects, gaps analysis);**
- c) review the plans for a Network Panel and make its recommendations to JSTC;**
- d) work with the JDIMP in liberalizing restrictive data policies and encouraging data sharing as an essential element of ‘best practice’ for terrestrial observations.**

13. The JSTC recommended that the GTOS Steering Committee be invited to review the work of TOPC as it relates to the objectives of GTOS.

5.3 Reort of the GCOS/GOOS/WCRP Ocean Observations Panel for Climate (OOPC)

5.3.1 Dr N. Smith, Chairman of the OOPC, gave a report on its activities since its second meeting in February 1997 (Cape Town, South Africa)¹¹. There, it was stressed that the liaison with research programmes, particularly CLIVAR, is important and significant. The Panel should be responsible for the baseline sustained observing system. The Upper Ocean Panel (UOP) of CLIVAR continues to provide excellent leadership for the sustained (long-term experimental) part. The OOPC has set up a home page¹², but has not made much process in producing the planned end-to-end descriptive brochures. At the Time-Series Workshop, convened by the OOPC in March 1997 (Baltimore, USA), the contributions from ocean time series have been reviewed. The value of laboratory sites was acknowledged, but the scientific productivity based on the observations obtained will be crucial in retaining long-term support. Only “Bravo”, a North Atlantic observing site, seemed to meet all GCOS qualifications. None of the other sites could be identified as a “climate reference station”. The OOPC acknowledged the value of time series data for models and suggested more use of Observing System Experiments (OSEs). Further, an assessment of emerging technology was recommended. The Workshop established

¹¹ Report of the Joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate (GCOS-36)

¹² At: <http://www.bom.gov.au/bmrc/mrlr/nrs/oopc/oopc.htm>

guidelines for the assessment of stations and has provided OOPC and CLIVAR a foundation for implementation.

Cross Panel Links and other Interactions

5.3.2 The Panel has established a liaison with GLOSS and cosponsored, jointly with the National Oceanic and Atmospheric Administration (NOAA) and CLIVAR, the Sea-Level Workshop in June 1997 (Hawaii, USA)¹³. An important aspect of this workshop was to revise the scientific and technical oversight.

Implementation

5.3.3 The OOPC has accepted and acted upon the recommendations regarding implementation as agreed at the last JSTC meeting. The OOPC continues its liaison with implementation groups like GLOSS, the DBCP, and the IGOSS SOOP, and has provided direct input to various meetings of these groups. To meet the various requests for technical guidance, the OOPC has decided to develop a set of specific requirements to guide implementation. As an initiative on behalf of GCOS and GOOS an Implementation Workshop for Ocean (Climate) Observations will be convened in January in Australia. The OOPC will provide the fundamental documentation on requirements, and will engage the operational programmes in the long-term support for the observations needed to meet the requirements. Dr Smith proposed a statement of support be adopted by the JSTC (Annex IX).

Global Ocean Data Assimilation Experiment (GODAE)

5.3.4 Dr Smith reported on the development of GODAE¹⁴. The project was proposed by representatives of GCOS and GOOS at the first CEOS SIT meeting and adopted as one of its six projects. Since then, the project has been widely supported by the two global observing systems, several space agencies, and members of the scientific community. He noted that GODAE will form a centrepiece for open ocean observations. It will also provide a most demanding test since it will attempt to assimilate ocean observations from satellites and *in situ* platforms. The integration of low-end (e.g., drifters) and high-end (e.g., satellite remote sensing) technologies will be a challenge. Dr P. Courtier of the Centre National d'Etudes Spatiales (CNES), is the principal contact for space agencies wishing to be involved. The project received a very strong endorsement from J-GOOS. A draft strategy document was prepared in May 1997 and used as the basis for launching the planning. The first GODAE Workshop was held at the Meteo France Laboratories in Martinique in July 1997, and there will be a follow-up in Melbourne, 20-22 January 1998. There will be continuing interaction with CEOS through its SIT. The fourth session of the J-GOOS reviewed the OOPC progress and resolutions were passed concerning membership of OOPC and GODAE. Dr Smith proposed a similar statement for JSTC endorsement (Annex IX).

¹³ Report of the International Sea-Level Workshop (GCOS-43 in press)

¹⁴ At: <http://www.bom.gov.au/bmrc/mrlr/nrs/oopc/godae/homepage.html>

Data and information Management

5.3.5 The OOPC endorsed a project looking at the value-adding elements of data and information management. in particular the level of quality control that is required for thermal data for various objectives. This project was described at JDIMP-III but has received little attention.

Future Activities

5.3.6 Dr Smith outlined several issues that would be tabled at the next OOPC scheduled for April 1998. In addition to several of the ongoing priority activities above. he proposed the next session would address sea ice, carbon, and new technology.

JSTC Comments

5.3.7 The JSTC expressed its satisfaction with the excellent progress being made by the OOPC and commended Dr Smith. It noted the significant workshops co-sponsored by the Panel, and the leadership shown in the development of GODAE. Although it recognized the need for autonomy in the early phases of the experiment, the JSTC expressed its desire to play an appropriate role in its subsequent development. It was pleased to note the appointment of Mr M.P. Lefebvre as a member of the Panel and recommended that rotation of members be addressed at the next OOPC session.

Action

14. The JSTC recommended that the OOPC:

- a) consider rotation of membership and develop a proposal for the co-sponsors;**
- b) review the outcome of the Time-Series Workshop to develop specific recommendations;**
- c) continue to work with the implementing agencies to develop a coherent ocean climate observing system;**
- d) reconsider the project to assess the value of quality control, and if appropriate, develop a joint activity with JDIMP.**

5.4 Report of the GCOS/GOOS/GTOS Global Observing Systems Space Panel

5.4.1 The Chairman of the GOSSP, Mr J. Morgan, reported on the third session of the Panel held in May 1997 (Paris, France)¹⁵. The session had several shared sessions with the WMO CBS Working Group on Satellites (WGSAT). The Panel has established “virtual task groups” for the intersessional work. The focus of the meeting was on the consolidation of user requirements and the “critical review”. the process whereby the requirements are compared with the capabilities of the various satellite instruments to meet them. The critical review process had been endorsed by GOSSP-II and the WGSAT. The Panel Chairman noted that the review of the requirements is a long and difficult task and needs the full support and strong commitment from the science

¹⁵ Report of the Global Observing Systems Space Panel (GCOS-37)

panels. The process is started through the GOSSP virtual working groups, an activity in parallel to CEOS Analysis Group (AG) activities. The GOSSP Chairman pointed out that GOSSP will not address all of the CEOS SIT project requirements. but will consider most of them. Mr Morgan noted that CEOS needs a process to analyse requirements and he proposed a close partnership between GOSSP and CEOS. He further noted that the Panel was also working toward a new Space Plan which would be primarily ‘electronic’ to enable frequent updating as a result of changes in requirements and space agency plans.

Cross Panel Links and other Interactions

5.4.2 The GOSSP Chairman recognised that close cooperation is essential with G3OS and its panels, as well as with CEOS, WGSAT and other sub-groups. He expressed his concern about the number of meetings noting that coordination and interaction are difficult if too many groups are involved.

JSTC Comments

5.4.3 The JSTC expressed appreciation for the work of the Chairman and of the Panel since the last JSTC session. It noted the important role that the Panel has in representing the needs of the G3OS to the space agencies, and in particular the development of an effective IGOS. With regard to the ‘requirements’ tables, the JSTC suggested that the requirement review process should add “bias” as a criterion. The JSTC welcomed the development of a revised Space Plan, and encouraged the Panel to continue efforts to consolidate the information. *[Mr Morgan tendered his resignation as GOSSP Chairman in December.]*

Action

15. **The JSTC recommended that all panels provide timely inputs for the GOSSP so it can accurately maintain requirement databases and portray them to the agencies and to CEOS, and encouraged work to continue on the Space Plan.**
16. **The JSTC recommended that the various GCOS meeting commitments should be reviewed with a goal to reducing them wherever possible.**

5.5 Report of the GCOS/GOOS/GTOS Joint Data and Information Management Panel

5.5.1 The Chairman of JDIMP. Mr T. Karl. reported on recent activities of JDIMP. Its most recent session, JDIMP-III was held in July 1997 (Tokyo, Japan)¹⁶. This was the first session since the sponsorship was widened to include GOOS and GTOS. Since GCOS, GOOS and GTOS are all at different stages of evolution and have significant differences in their approach to data and information management, the Panel revisited its Terms of Reference and its Data Plan to suggest revisions. The Panel outlined a number of changes to its Terms of Reference that are required to better reflect the interests of the G3OS. Similarly, a new Data Plan was outlined. The Panel Chairman noted as well that the “Environmental Monitoring” principles have been revisited, revised and approved by the JDIMP (Annex XII).

¹⁶ Report of the GCOS/GOOS/GTOS Joint Data and Information Management Panel (GCOS-39)

5.5.2 The JDIMP Chairman used a viewgraph from JDIMP-III (Annex XI) to explain the primary responsibilities of JDIMP. It will be to oversee the methods of collection, calibration and quality control, as well as the procedures for data transfer and distribution. Additionally the Panel will share responsibility with data centres to oversee the archival of data, information and products. The Panel will assist in identifying and specifying variables (e.g., temperature from GSN). In coordination with other panels, it will encourage the processing of observations, including gridding products and analysis. He pointed out that JDIMP will not develop science issues or end-user products. The Panel will continue its leadership in the joint G3OS/CLIVAR/WMO project on climate extremes. It will support the implementation of the G3OS Information Center Pilot project. The Panel will also revise the Data Plan and propose new Terms of Reference.

5.5.3 Mr Karl noted that the Panel recognized the critical role of "champions" who have the capability to marshal resources to carry through on specific projects. There is a need to identify specific champions from the user community and enlist their participation in the production of well-defined products. It was felt in the discussion, that the product definition should result from the GCOS panel work, which will require close cooperation among the panels and members.

Activities

5.5.4 The Chairman reported on a workshop on "Indices and Indicators for Climate Extremes" held in Asheville, NC, USA in June 1997. About 20 of the workshop papers will be published in *Climatic Change*. A number of recommendations concerning data sets resulted from the workshop and will be taken for action by the Panel. He proposed that JSTC consider support for a second workshop sometime in 1999.

5.5.5 He informed the JSTC that the GCOS Information Center has been funded. The Center, located at the University of Delaware, will provide a focus for G3OS data activities. The Center will initially provide a central point for information and assistance for the distributed system of information. For key variables, it will conduct searches for data and organize the resulting information to assist users. It will work with data set holders to expedite user access to needed information. Mr Karl noted that both the GOOS and GTOS office directors wanted to review the Center plans before recommending the respective steering groups endorse the Center.

5.5.6 A pilot project on metadata has been initiated. It will provide a template for metadata requirements, and enable users to quickly determine if a data set is likely to be of value in their particular studies. It will link elements of WMO and IOC/IODE data and information systems.

5.5.7 Several centres have been identified to take responsibility for monitoring the quality and homogeneity of the GUAN and GSN data sets, e.g., ECMWF, NOAA/ National Climatic Data Center (NCDC), and the Deutscher Wetterdienst (DWD). JDIMP will consider the development of products, archives, and improvements to data flow from these networks. The OOPC has considered a number of data issues which may be addressed to JDIMP, but the OOPC-IV meeting will reconsider the ocean situation. Regarding terrestrial requirements, the TOPC has identified 21 variables for consideration by JDIMP. There has also been progress towards the application of high resolution African data for climate extreme indicators and indices projects.

5.5.8 The Panel Chairman noted the links to IPCC. He was concerned that the data needed for the next IPCC assessment may be unavailable. He hoped that JDIMP could provide some assistance to IPCC. Participants encouraged the links to IPCC, citing in particular the importance of the GUAN and GSN for future assessments.

JSTC Comments

5.5.9 The JSTC expressed its appreciation for the JDIMP report and commended the Chairman on the progress made by the Panel. It was pleased to learn of the "Extremes" workshop, and the funding of the Information Center. It agreed that the new charter of the Panel as a joint effort among the G3OS will be very difficult due to the diversity of data and information management issues that could be tabled for Panel action. The JSTC clearly recognized that the Panel requires considerably more resources than are available now. For many of the required projects, voluntary participation is not adequate -- full-time staffing is necessary. It agreed to propose that additional support be obtained from the G3OS, sponsoring organizations, and data-related agencies and centres in light of the importance of the Panel activities. National sources of support should also be aggressively pursued. *[NOAA has generously agreed to contribute funds for the JDIMP-IV meeting scheduled for April 1998.]*

Action

17. **The JSTC recommended that the JDIMP:**
 - a) **revise its data and information management plan to accommodate its expanded charter, but retain the visionary style of Version 1.0;**
 - b) **continue the implementation of the Information Center and consider mechanisms to enhance the support for its important work;**
 - c) **encourage the Center to proceed in a systematic fashion with climate-related variables, and to include GOOS and GTOS non-climate elements at a future date;**
 - d) **continue the development of the metadata project;**
 - e) **proceed with planning for a follow-on meeting on "Extremes" in 1999;**
 - f) **support the data requirements of IPCC regarding its next assessment, and to participate where appropriate with the IPCC;**
 - g) **meet in joint sessions with the AOPC to develop concerted strategies to provide end-to-end continuity with the observing networks through to products.**
18. **The JSTC invited both GOOS and GTOS to consider how the JDIMP could best serve their needs.**
19. **The JSTC invited both GOOS and GTOS to provide guidance on the operation of the Information Center to ensure it supports their requirements.**
20. **The JSTC recommended that additional funding for JDIMP activities be sought from the sponsoring organizations of the G3OS at the next SG meeting, and through national agencies where appropriate.**

6. IMPLEMENTATION ACTIVITIES

6.1 Observing Networks

6.1.1 Space-based Observations

A series of reports was presented by representatives from the European Space Agency (ESA), EUMETSAT, CNES, the National Aeronautics and Space Administration (NASA), and NOAA (Annex X). The Chairman expressed his thanks for the comprehensive reports and documents that were provided to participants. He noted that they provide a good foundation for discussions of IGOS to follow (see §7.1.1 -7.1.2).

6.1.2 *In situ* Observations

The JSTC noted the number of *in situ* observational elements that had been cited in the reports of the panel chairmen. In order to provide an overview of these disparate activities, the JSTC invited the JPO to prepare a status report on the current situation. The JSTC encouraged the GOOS and GTOS offices to contribute to the report which should be updated annually.

Action

21. **The JSTC recommended that an annual status report be prepared on the state of the observing elements of GCOS by the JPO in concert with the offices of GOOS and GTOS.**

6.2 Project and Proposal Development

A number of projects were tabled for the JSTC consideration.

6.2.1 Atmosphere

Dr Whelpdale informed the participants of the GAW Aerosol Scientific Advisory Group (SAG) meeting in San Francisco, 12-13 December, 1997, which he will attend. The SAG will consider the interests of GCOS and WCRP (SPARC), as well as GAW and IGAC. Dr R. Schiffer noted that NASA issued a proposal on aerosols and showed interest to attend the meeting as well. The AOPC Working Group on Atmospheric Constituents has done feasibility studies in cooperation with the research community and has identified a list of about 30 significant species. Cooperation with JDIMP was noted to assist in getting access to ship and aircraft data. The set-up of a volcanic detection event database in the light of the CEOS SIT project on disaster monitoring will also be considered. It should be noted, that volcanic eruptions are monitored routinely for flight safety reasons and therefore corresponding data should be available. Dr Whelpdale also cited the need for inventories and utilization of proxy data.

Action

22. **The JSTC recommended that:**
 - a) **the AOPC should clarify its views with regard to long-term monitoring of**

- atmospheric constituents and formulate a strategy for JSTC consideration;
- b) **the GAW be invited to develop an effective aerosol monitoring effort in support of the GCOS requirements to be specified at the next AOPC.**

6.2.2 Land Surface

Global Observing System Network (GOS-Net)

The GOS-Net meeting in June 1997 (Guernica, Spain) reached a consensus on the need of an overarching international framework for ecological sites and networks and guiding principles for the development of such a system. The GTOS Chairman has sent letters of invitation to the community to participate in this framework. GOS-Net should be administered through GTOS but be positioned to meet the needs for freshwater and land observations for the G3OS. The network should be established by GTOS with participation by GCOS, and including GOOS when appropriate.

Action

23. **The JSTC recommended that:**
- a) **the GTOS be invited to take the lead on GOS-Net since the observations will meet a number of non-climate needs. The JSTC recommended a new title for the network be found;**
- b) **the Network Panel be established at the earliest opportunity, and that GTOS be invited to support it at an effective level.**

Network of Glacier Sites

The World Glacier Monitoring Service (WGMS) sites should be considered in light of the Global Hierarchical Observing Strategy (GHOST) concept, identifying critical gaps and developing guidelines for participation in the network for GCOS and GTOS. The WGMS should be requested to provide an annual report on average change in length and changes in the mass balance of glaciers.

Action

24. **The JSTC, noting the pioneering efforts of the WGMS, endorsed in principle the adoption of an initial glacier network of some 60 sites as a contribution to the GCOS IOS.**
25. **The JSTC recommended that letters on behalf of GCOS be sent to national focal and contact points to determine the observing practices and methods for selecting sites. The letters should also encourage adding sites for climate purposes. Letters should include a statement of ‘best practices’, particularly with regard to observing practices and data sharing.**
26. **The JSTC recommended that the TOPC consider the space-based observational requirements for glacier monitoring in addition to the *in situ* ones and develop an appropriate set of recommendations.**

Permafrost Network

The JSTC approved in principle the formation of a permafrost network to be developed in concert with the International Permafrost Association (IPA). It agreed to consider the possibility of its establishment as a GCOS network upon consideration of adequate documentation.

Action

27. **The JSTC recommended that the TOPC consider the permafrost issue at its next session.**
28. **The JSTC recommended that a joint letter be sent to the IPA inviting its cooperation in the development of a long-term permafrost observing network.**

Demonstration Project • Terrestrial Ecosystem Productivity

The objective of this project is to distribute standard ecosystem productivity products to regional networks for evaluation, and translation into regionally specific crop, range and forest yields maps. The planning of the meeting and resource identification would have to be completed by mid-1998 to enable the sites to be useful for validation of satellite observations.

Action

29. **The JSTC endorsed the “Terrestrial Ecosystem Productivity”* demonstration project, noting that lead responsibility for its development will rest with the GTOS Secretariat.**
30. **The JSTC agreed to work with the GTOS SC to obtain necessary resources and to establish necessary protocols.**

CEOS Pilot Project • Global Observations of Forest Cover (GOFC)

The GOFC was proposed by the CEOS SIT in February 1997. Its objectives are to produce high quality, multi-resolution, multi-temporal data sets and derive products of forest cover and attributes.

Action

31. **The JSTC endorsed the GOFC project in principle (Annex IX).**
32. **The JSTC recommended that:**
 - a) **the TOPC should remain actively involved in the project;**
 - b) **the project leaders of GOFC work with GOSSP and with JDIMP as appropriate.**

6.2.3 Ocean

Implementation Workshop for Ocean (Climate) Observations

A meeting to coordinate the various implementation groups is planned for early 1998. The meeting will consider how the different groups can cooperate in meeting the climate requirements from the ocean. The result could lead to the establishment of the ocean component of the GCOS IOS.

Action

33. **The JSTC supported the Implementation Workshop statement (Annex IX).**
34. **The JSTC invited the OOPC Chairman to represent the climate needs of GCOS on its behalf.**

Global Ocean Data Assimilation Experiment (GODAE)

GODAE is an initiative by the OOPC which plans to develop “patron” and “partner” groups. The latter will form a Steering Committee, which will meet in Melbourne in January 1998. It is intended to remain “aloof” from existing scientific and operational programmes in order to develop independence, provide freedom in development, and to build a GODAE resource. It is hoped that GODAE will attract investment and be self-supporting. Its objectives will cover a broader range than climate, but will be a significant contributor to the objectives of GCOS. The action plan for implementation needs the cooperation with the Upper Ocean Panel, the Commission for Marine Meteorology (CMM), GLOSS, IODE and drifting buoys. There is a workshop planned in early 1998 to identify how these programmes contribute to GCOS/GOOS.

Action

35. **The JSTC endorsed the GODAE statement (Annex IX).**
36. **The JSTC recommended that the OOPC provide information on the plans and activities of the GODAE Steering Group as the experiment proceeds.**

6.2.4 “Implementation Panel” proposal

Mr R.S. Winokur presented information concerning implementation. He noted that GCOS has made great progress towards implementation, but at this stage needs to identify some patrons or supporters who can contribute and commit resources. There is also a need to move towards some integration, e.g., GSN data could be used for terrestrial observations. Therefore, Mr Winokur advocated the establishment of an advisory group to work in concert with the JSTC. The JSTC and the new ‘panel’ would have to initiate activities related to JSTC recommendations.

The JSTC participants expressed concern that another ‘panel’ would be decoupled from the scientific advice of the JSTC. This issue prompted suggestions that the ‘panel’ be composed of senior members of JSTC. The representative from IGFA was concerned that funding agents

could not be expected to sit on the executive bodies of the various international programmes. The JSTC accepted the proposal from the Chair that the issue should be reconsidered later.

6.3 Preparation for "Participants Meeting"

A draft outline of the GCOS National Participants Meeting was presented by the JPO Director. It was proposed that the meeting be two days with about 60 attendees. A tentative agenda would consist of five parts: (1) background, introduction, purpose; (2) current state of development; (3) national perspectives; (4) prioritised needs linked to useful products; and (5) the way forward and conclusions. Several of the sponsors have reviewed this proposal (Inter-agency Committee on the Climate Agenda (IACCA), WMO EC), but currently no indication of support has been received. While the meeting may still be viable, a group should consider if it is feasible at this time to proceed. It may be advisable to develop a set of regional sessions in areas where support is limited to date.

Action

- 37. The JSTC suggested that an ad hoc working group consider the feasibility of a Participants Meeting and/or develop a strategy to use other mechanisms.**

7. INTEGRATED OBSERVING STRATEGY

7.1.1 Mr Fellous gave an overview of the establishment of the IGOS Initiative. He reviewed the six IGOS prototype pilot projects which were selected by the CEOS SIT. He stressed that CEOS will continue the dialogue with user organizations to refine the concept of IGOS and to take steps towards its effective implementation. The feedback and active participation from the science community and the operational agencies are essential. IGFA is also actively supporting this initiative.

7.1.2 The G3OS have an essential partnership role to play in IGOS in close association with CEOS and IGFA. CEOS wishes to work closely with GCOS in the development of the plans for the climate observing system. Full integration of satellite-based data, as provided by CEOS agencies with ground-based and *in situ* data, will maximise the value of this system. The IGOS partnership was discussed at several meetings during 1997 and will be the central topic of the SIT meeting following directly the JSTC-VII, in October 1997 (Oxford, U.K.). The meeting objectives will be to review of the IGOS prototype projects status and the lessons learned, as well as a review of the Analysis Group. The relevance and impact of IGOS in the context of international conventions will be considered, and common issues across IGOS projects will be addressed. The meeting will discuss the future of SIT, as well as a future framework for development of the IGOS. Further, it will identify initial commitments of support from CEOS agencies for IGOS projects, The JSTC noted the endorsement of the projects by the WMO EC in June 1997.

7.1.3 Dr J. Marks of IGFA presented the objectives and role of this international group. IGFA supports programmes and facilities to exchange information on national global change research programmes. It discusses approaches to the integration and phasing of global change research

in the light of available resources. and promotes the coordination of access to and deployment of specialised research facilities. IGFA aims to optimise the allocation of national contributions to global change research. The role of IGFA is to provide a forum for communication among national funding organizations and international programmes (e.g.. IGBP. International Human Dimensions Programme (IHDP)). IGFA addresses specific issues as funding for capacity building and the interaction between science and policy. IGFA has set up four working groups on: “Resource Issues”, “Human Dimensions of Global Change”. “Data and Observations” and “Interactions with Aid Agencies”. The Data and Observations Working Group aims to get access to dispersed national data sets, to work on national data management policies. and to work with CEOS and G3OS sponsors on an integrated global observing strategy. The next steps are to develop a strategic partnership of senior representatives of G3OS sponsors, CEOS. IGFA and others to develop cooperation at the national level of agencies and ministries with responsibilities. IGFA will facilitate the planning of funding agency support for integrated space and *in situ* observations. It will help to develop support for G3OS through concerted funding.

8. AD HOC WORKING GROUPS

8.1 Establishment of Working Groups

The Chairman proposed that three *ad hoc* working groups be established to consider key issues raised at the session. He proposed:

1. Data and Information Management -- What is the role of the various groups in developing a coherent and consistent end-to-end data flow from observations to products?
2. Integrated Global Observing Strategy -- What is the strategy behind the concept of IGOS and what does it mean for GCOS?
3. Government Involvement in GCOS -- How can we more effectively engage governments in the work of GCOS? Is a Participants Meeting feasible? How can we raise the political visibility of the programme?

8.2 Data and Information Management

The discussion of the working group, led by Mr Karl, can be summarised as follows:

- o The group discussed the “Template to Guide JDIMP” (Annex XI, Figure 1).

The template will be modified to separate the “data collection” module into two components to include “measurements”, which are associated with the instruments required to collect data, agencies sponsoring the collection, oversight for initial quality control and observing procedures. and data transfer mechanisms from the field to a collection centre. and secondly a “data assembly” module which includes data archaeology, data preparation, and the collection of data at the node or collection centre. The latter component is fully within JDIMP tasks. indicated by boxes 3, 4 and 6 in the template. and the former component is primarily outside JDIMP tasks. boxes 1 and 2 .

Three types of products were identified and JDIMP's responsibility in each varies from primary responsibility to little or no responsibility. These products are defined as: (a) products that are well established and are routinely processed (JDIMP to take the lead); (b) products that are being developed through new algorithms and processing systems, e.g.. new forest cover product. GODAE. reanalysis by national meteorological centres (JDIMP supportive, but does not take the lead); (c) products for which the methodology and algorithms are well developed, but still require processing of past data (JDIMP could take lead depending on the desires of the science panels).

Each data set has a variety of institutions and idiosyncrasies that present unique issues in order to adequately address the end-to-end data and product flow. This is quite dependent on the initial expectation of the users of the data type. Each data type normally has many different applications which can often lead to parts of the data and product flow to be quite adequate, while other parts remain inadequate. Recognition of these differences is critical for an adequately functioning G3OS programme.

Finding'

1. The JSTC should recognise JDIMP responsibilities and invite the COOS and GTOS Steering Groups to provide comments.

- o The activities of G3OS centres need to be coordinated.

Some G3OS centres may be completely end-to-end while others may focus on a single component of the JDIMP template. An "Affiliated G3OS Centres" meeting would focus attention on the data and products. It is envisioned that each centre takes responsibility for its activity. The purpose of the meeting would be to evaluate how the G3OS guidelines and principles are working and to resolve any technical problems related to the end-to-end data. information and product generation, archive and access. It is suggested that the meeting would be held prior to the G3OS panel meetings and culminate in a one- or two-day JSTC session.

Finding

2. An Affiliated G3OS Centres Workshop should be held.

- o It is necessary to ensure that the end-to-end process from data collection to product generation and archiving function effectively. A number of elements are required:
 1. A pilot "Information Center" that will help to identify deficiencies in the access to data and information as well as their quality;
 2. Regular attention given by the panels to the overall end-to-end G3OS data and product flow;
 3. Scientific assessments carried out routinely, but infrequently;

¹⁷ The findings of the Ad Hoc Working Groups are listed in Annex VII

3. An international (and national) data and product facilitator that resolves problems as they arise on a day-to-day basis. This latter function is required to fill the time gap related to the attention provided to the system by the panels, assessments and the application of the Information Center by users.

Finding

3. An International Data and Product Facilitator for each of the G3OS Offices should be established.

The responsibilities of such positions include:

- I) Identifying problems related to the end-to-end JDIMP template for the GCOS/GTOS/GOOS data and products suitable to address users and climate needs.
 - ii) Resolving problems identified through agreement with affiliated G3OS data and operational centres.
 - iii) Reporting on the status and problems related to the JDIMP end-to-end template to the G3OS secretariats and panels on a routine basis (e.g., semi-annually).
 - iv) Coordinating activities of National Data and Products Facilitators related to specific problems and solutions of national affiliated G3OS centres.
 - v) It is desirable that the International Facilitators reside in a national centre that has international data and/or product related responsibilities for collection, processing, access, archive, and/or product generation. This centre should be an affiliated data centre.
- o The working group discussed the implementation of capacity building.

The manner in which such capacity building will be implemented will rely on existing programmes as appropriate, e.g., The System for Analysis, Research and Training (START).

Finding

4. Utilize existing programmes to develop capacity related to G3OS.

8.3 Integrated Global Observing Strategy

The working group, led by Dr D. Williams, discussed the IGOS concept. The working group developed a schematic diagram relating the various steps that need to be taken, and determined who had responsibilities for the completion of these steps.

- o The outcome of the discussion was illustrated with a flow chart (Annex XI).

The G3OS should provide a framework to develop and prioritize national and

international needs for observations, and to present them in a consistent fashion to appropriate implementation groups. These needs should reflect the societal issues (e.g., socio-economic benefits, conventions, other political motivations). For those requirements which may be met by space-based instrumentation, the various space data providers should be invited to provide appropriate platforms and instruments. For those which may be met by *in situ* systems, appropriate agencies should be identified to meet them. For those which require a composite approach, an IGOS may be particularly helpful. It provides a mechanism to review the comprehensive requirements and present them to appropriate agencies who can then respond in a mutually beneficial manner. Savings will be realized as a result of close collaboration among the various agencies. Duplicate efforts and gaps should be avoided through this process.

Where the needs are not adequately being met, there should be a process to revisit the observing requirements and the instrumentation identified to meet them. The iteration of requirements and provisions should continue until both the user and supplier communities are satisfied their interests are satisfied. The value added by the IGOS would be to provide a rational process for selecting the priority observations to be taken, and enabling agencies to coordinate their responses to eliminate duplication and avoid gaps in the continuity of data provided.

Finding

5. Continue to develop appropriate strategy for GCOS to interact with IGOS.

8.4 Government Involvement in GCOS

The working group, led by Mr S. Mildner, included support for panels, groups and committees. The result of the discussion can be summarised as follows:

- o An opportunity to promote GCOS will occur at COP-3 in Kyoto. GCOS needs to formulate a message for COP-3.

GCOS will not have a specific agenda item and will be addressed by national references. Therefore, national support should be organized through national contacts. It was noted, that the IPCC Chair will address GCOS at the Kyoto Conference as decided at the WCRP Conference in August 1997 (Geneva, Switzerland).

It was mentioned that observations for extreme events are available (e.g., water vapour trends, extreme weather and ozone, etc.) and could serve to promote GCOS "Issues". The idea to promote GCOS by producing a public relations brochure as a handout at the meeting was rated as necessary.

Finding

6. Select a group to develop the GCOS statement for governments.

7. Prepare a brochure for COP-3.

8. Inform national contacts to support systematic observations.

- o There is a need in formulating an overarching GCOS concept.

The GCOS concept should stress the need for the integration of all components and common functionalities (e.g., Data and Information Management Plan). It should give specific examples and outline the use of data sets, services and benefits. A five-year “road map” for implementation should be developed. The required list of contributions, funding requirements, priorities, costs and benefits have to be identified. The new GCOS plan should be documented and describe a clear vision of GCOS. Also, it should include one chapter of “Achievements*“.

Finding

- 9. **Establish a task group to develop appropriate materials for presentation to governments about GCOS.**

- 10. **Consult agency heads and decision-makers on content.**

- 11. **Develop a strategy for a series of regional meetings to address GCOS plans.**

- o The GCOS should avail itself of opportunities provided by other meetings (e.g., GOOS Agreements Meeting).

- 12. **The JSTC should assist in presenting the GCOS message through national contacts with sponsoring organization representatives.**

- o An advisory body should be constituted to assist the JSTC with regard to financial support. It is advisable that the body should include some individuals who are not members of JSTC, but who have close links to the JSTC. Typical members should include representatives of governmental agencies, industry or other benefactors.

Finding

- 13. **The JSTC should establish an advisory body to address resources.**

9. OTHER BUSINESS

9.1 Intersessional Activities

9.1.1 The principles of GCOS, GOOS and draft of principles governing the selection of GCOS atmospheric constituents observations should be reviewed by JSTC members. In addition, the prepared JSTC statements for GOFC and GODAE were presented and discussed. The Chairman recommended that the AOPC should draft principles for the SIT ozone project as well. These various statements of principles are summarized in Annex XII.

9.1.2 The inventory of existing networks should be taken on by the G3OS offices.

9.2 Arrangements for JSTC-VIII

9.2.1 After reviewing potential dates and venues, the JSTC agreed to meet in Geneva, Switzerland (dates to be determined).

10. CLOSURE

10.1 The Chairman thanked the members of JSTC and the guests for their participation in the meeting. He particularly thanked Dr van Lammeren and his team for the excellent organization and the various agencies that contributed to and supported the meeting. He expressed appreciation for the interesting scientific presentations by Drs Komen and Leemans during the session. The JSTC members were invited to remain to meet *in camera* held immediately following the closure. The Chairman closed the meeting at 16 00 hrs on 25 September, 1997.

ANNEX I

LIST OF PARTICIPANTS

Members of the JSTC

Prof. John TOWNSHEND (**Chairman**)
Department of Geography
University of Maryland
1113 Lefrak Hall
COLLEGE PARK, MD 20742-8225, U.S.A.

Tel: +1 301 405 4558
Fax: +1 301 314 9299
Email: jt59@umail.umd.edu

Ing. Claudio CAPONI
DGIASV, Ministerio del Ambiente y de
los Recursos Naturales Renovables
Esq. y Edf. Camejo, Mezanina Este
Centro Simon Bolivar, El Silencio
CARACAS 10 10, Venezuela

Tel: +58 2 283 2584
Fax: +58 2 542 0607
Telex: 28475 MARN VC
Email: ccaponi@reacciun.ve

Mailing address: Proyecto Ven 92/007, CCS-2150, P.O. Box 02-8537
MIAMI, FLA 33 102-8537, U.S.A.

Mr Yukio HARUYAMA
Earth Observation Planning Department
Office of Earth Observation Systems
National Space Development Agency of Japan
2-4- 1, Hamamatsu-cho, Minato-ku
TOKYO 105-8060, Japan

Tel: +81 3 34386331
Fax: +81 3 54018702
Email: haruyama@rd.tksc.nasda.go.jp

Prof. Zdzislaw KACZMAREK
Institute of Geophysics
ul. Ks. Janusza 64
01 452 WARSAW, Poland

Tel: +48 2237 7858
Fax: +48 2237 0522
Email: kaczmar@igf.edu.pl

Dr Angus MCEWAN
Bureau of Meteorology
P.O. Box 7276
HOBART, Tasmania 700 1, Australia

Tel: +61 3 62212090
Fax: +61 3 62212089
Email: a.mcewan@bom.gov.au

Prof. Worth D. NOWLIN, Jr.
Department of Oceanography
Texas A & M University
COLLEGE STATION, TX 77843-3 146, U.S.A.

Tel: +1 409 84.5 3900
Fax: +1 409 847 8879
Email: wnowlin@latexsun.tamu.edu

Dr Christopher J. READINGS
Earth Sciences Division
Directorate of Observation of the Earth
and its Environment, ESTEC
Postbus 299
2200 AG NOORDWIJK, Netherlands

Tel: +31 7156 55673
Fax: +31 7156 55675
Email: creading@estec.esa.nl

Dr Douglas M. WHELPDALE
Climate Research Branch
Atmospheric Environment Service
4905 Dufferin Street
DOWNSVIEW. Ontario M3H 5T4, Canada

Tel: +1 416 739 4869
Fax: -14167395700
Email: douglas.whelpdale@ec.gc.ca

Mr Robert S. WINOKUR
Satellite and Information Services
NESDIS/NOAA
Federal Building 4. Room 2069
4700 Silver Hill Road - Stop 9909
WASHINGTON. D.C. 20233-9909, U.S.A.

Tel: +1 301 457 5115
Fax: +1 301 457 5276
Email: rwinokur@nesdis.noaa.gov

Dr ZHOU Xiuju
Chinese Academy of Meteorological Sciences
China Meteorological Administration
Baishiqiaolu No. 46, Western Suburb
BEIJING 10008 1. China

Tel: +86 106217 5931
Fax: +86 10 6217 5931
Email: cams@public.bta.net.cn

Ex officio Members of the JSTC

Dr Josef CIHLAR
Environmental Monitoring Section
Applications Division
Canada Centre for Remote Sensing
588 Booth Street
OTTAWA, Ontario K1A 0Y7, Canada

Tel: +1 613 947 1265
Fax: +1 613 947 1406
Email: josef.cihlar@geocan.nrcan.gc.ca

Mr Thomas R. KARL
National Climatic Data Center
NOAA
15 1 Patton Avenue, Room 5 16E
ASHEVILLE, NC 28801-5001, U.S.A.

Tel: +1 704 271 4319
Fax: +1 704 271 4328
Email: tkarl@ncdc.noaa.gov

Dr Michael MANTON
Bureau of Meteorology Research Centre
13th Floor, 150 Lonsdale Street
MELBOURNE. Vic. 3000, Australia

Tel: +61 3 9669 4444
Fax: +61 3 9669 4660
Email: m.manton@bom.gov.au

Mr John MORGAN
Fields End Farm
Chessel Lane
Charlton Adam
SOMERTON TA 11 7BJ. U.K.

Tel: +44 1458 223505
Fax: +44 1458 224212
Email: john@quensha.demon.co.uk

Dr Neville SMITH
Bureau of Meteorology Research Center
GPO Box 1289K
MELBOURNE, Vic. 3001, Australia

Tel: +61 3 96694434
Fax: +61 3 96694660
Email: n.smith@bom.gov.au

Representatives of Sponsoring Organizations

WMO

Dr Frederic DELSOL
Atmospheric Research and Environment
Department
World Meteorological Organization
P.O. Box 2300
12 11 GENEVA 2, Switzerland

Tel: +41 22 7308212
Fax: +41 22 7400984
Email: Delsol_F@gateway.wmo.ch

IOC/GOOS

Dr Colin SUMMERHAYES
GOOS Project Office
IOC/UNESCO
1, rue Miollis
F-75732 PARIS CEDEX 15, France

Tel: +33 145684042
Fax: +33 145684812
Email: c.summerhayes@unesco.org

ICSU/IGBP

Dr Neil SWANBERG
IGBP Secretariat
Royal Swedish Academy of Sciences
Box 50005
S- 10405 STOCKHOLM, Sweden

Tel: +46 8 166448
Fax: +46 8 166405
Email: neil@igbp.kva.se

FAO/GTOS

Mr Jeff TSCHIRLEY
GTOS Office, SDNR
FAO
Viale delle Terme di Caracalla
I-00100 ROME, Italy

Tel: +39 6 5705 3450
Fax: +39 6 5705 3369
Email: jeff.tschirley@fao.org

Other Invitees

Dr David CARSON
Hadley Centre for Climate Prediction
and Research, Room 3 18
Meteorological Office, London Road
BRACKNELL RG12 2SZ. U.K.

Tel: +44 1344 854606
Fax: +44 1344856909
Email: djcarson@meto.govt.uk

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Dr Philippe COURTIER
Centre National d'Etudes Spatiales
2, Place Maurice Quentin
F-75039 PARIS cedex 01. France

Tel: +33 144767401
Fax: +33 144767950
Email: courtier@cst.cnes.fr

Dr Craig DORMAN
Technical Director
Office of Naval Research, Europe
223 Old Marlyebone Road
LONDON NW1 5TH. U.K.

Tel: +44 171 514 4516
Fax: +44 171 5144924
Email: cdorman@onreur.navy.mil

Mr Jean-Louis FELLOUS
Director
MEDIAS-CNES
18, avenue Edouard Belin
B.P. 4057
F-3 1055 TOULOUSE cedex. France

Tel: +33 561282209
Fax: +33 561282905
Email: fellous@medias.cst.cnes.fr

Dr Michael GWYNNE
P.O. Box 24529
NAIROBI, Kenya

Tel: +254 2 88 2370
Fax: +254 2 88 2370
Email: -

Dr John MARKS
Division of Natural Sciences, Technology
and Environment
Ministry of Education, Culture and Science
P.O. Box 25000
2700 LZ ZOETERMEER, Netherlands

Tel: +31 79 323 2294
Fax: +31 79 323 4816
Email: j.marks@minocw.nl

Dr Valentin MELESHKO
Voeikov Main Geophysical Observatory
7, Karbyshev Street
19402 1 ST PETERSBURG, Russian Federation

Tel: +7 812 247 4390
Fax: +7 812 247 8661
Email: meleshko@main.mgo.rssi.ru

Mr Stefan MILDNER
Deutscher Wetterdienst
P.O. Box 100465
D-63004 OFFENBACH, Germany

Tel: +49 69 8062 2846
Fax: +49 69 800 4201
Email: smildner@dwd.d400.de

Mrs Linda V. MOODIE
Office of International and Interagency Affairs
National Environmental Satellite, Data,
and Information Services, NOAA
13 15 East-West Highway
SILVER SPRING. MD 20910-3282, U.S.A.

Tel: +1 301 713 2024 x. 111
Fax: +1 301 713 2032
Email: lmoodie@nesdis.noaa.gov

Dr George NEEDLER
Physical and Chemical Sciences
Bedford Institute of Oceanography
P.O. Box 1006
DARTMOUTH, Nova Scotia B2Y 4A2, Canada

Tel: +1 902 426 3145
Fax: +1 902 426 7827
Email: g_needler@bionet.bio.dfo.ca

Prof. Laban A. OGALLO
Department of Meteorology
University of Nairobi
P.O. Box 30197
NAIROBI, Kenya

Tel: +254 2 56 7864
Fax: +254 2 56 7888
● Email: logallo@lion.meteo.go.ke

Dr Peter RYDER
8. Sherring Close
BRACKNELL RG42 2LD. U.K.

Tel: +44 1344 42 3380
Fax: +44 1344 42 3380 (call first)
Email: peteryder@classic.msn.com

Dr Robert A. SCHIFFER
NASA Headquarters, Code YS
300 E Street S.W.
WASHINGTON, DC 20546, U.S.A.

Tel: +1 202 358 1876
Fax: +1 202 358 2770
Email: rschiffer@hq.nasa.gov

Prof. Friedrich SCHOTT
Abteilung Regionale Ozeanographie
Institut für Meereskunde an der
Universität Kiel
Düsternbrooker Weg 20
D-24 105 KIEL, Germany

Tel: +49 431 597 3820
Fax: +49 431 597 3821
Email: fschott@ifm.uni-kiel.de

Dr Hans TEUNISSEN
World Climate Research Programme
World Meteorological Organization
P.O. Box 2300
12 11 GENEVA 2. Switzerland

Tel: +41 22 730 8225
Fax: +41 22 734 0357
Email: Teunissen_H@gateway.wmo.ch

Dr David WILLIAMS
EUMETSAT
Am Kavalleriesand 3 1
D-64295 DARMSTADT, Germany

Tel: +49 6151 807603
Fax: +49 6151 807830
Email: dwilliams@eumetsat.de

GCOS Secretariat

Dr Thomas W. SPENCE
Joint Planning Office
Global Climate Observing System
c/o World Meteorological Organization
P.O. Box 2300
12 11 GENEVA 2, Switzerland

Tel: +41 22 7308401
Fax: +41 227401439
Email: gcosjpo@gateway.wmo.ch

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Dr (Ms) Carolin RICHTER
Joint Planning Office
Global Climate Observing System
c/o World Meteorological Organization
P.O. Box 2300
12 11 GENEVA 2, Switzerland

Tel: +41 22 7308272
Fax: +41 22 7401439
Email: Richter-C@gateway.wmo.ch

Local Participants

Dr Gerbrand KOMEN
Royal Netherlands Meteorological Institute
P.O. Box 201
3730 AE DE BILT, The Netherlands

Tel: +31 302206676
Fax: +31 30 2210407
Email: komen@knmi.nl

Ms Marleen KALTOFEN
Royal Netherlands Meteorological Institute
As above

Tel: +31 30 2206589
Fax: +31 30 2210407
Email: kaltofen@knmi.nl

Ms Marieke LAAGLAND
Royal Netherlands Meteorological Institute
As above

Tel: +31 30 2206575
Fax: +31 30 2210407
Email: laagland@knmi.nl

Dr Rik LEEMANS
Department of Global Environmental Assessment
National Institute of Public Health &
Environmental Protection
P.O. Box 1
3720 BA BILTHOVEN, The Netherlands

Tel: +31 30 2743377
Fax: +31 30 2744435
Email: rik.leemans@rivm.nl

Dr Andre VAN LAMMEREN
Royal Netherlands Meteorological Institute
As above

Tel: +31 30 2206385
Fax: +31 30 2210407
Email: lammeren@knmi.nl

ANNEX II

AGENDA

WELCOMING ACTIVITIES

1. ORGANIZATION OF THE SESSION
2. REPORT OF THE DIRECTOR. JOINT PLANNING OFFICE
3. REPORT OF THE CHAIRMAN
4. INVITED REPORTS
 - 4.1 Reports from sponsoring organizations
 - 4.2 Reports from the **G3OS**
 - 4.3 National activity updates
 - 4.4 Other reports
5. GCOS PANEL ACTIVITIES
 - 5.1 Report of the **GCOS/WCRP** AOPC
 - 5.2 Report of the GCOS/GTOS TOPC
 - 5.3 Report of the **GCOS/GOOS/WCRP** OOPC
 - 5.4 Report of the **GCOS/GOOS/GTOS** GOSSP
 - 5.5 Report of the **GCOS/GOOS/GTOS** JDIMP
6. IMPLEMENTATION ACTIVITIES
 - 6.1 Observing networks
 - 6.2 Project and proposal development
 - 6.3 Preparation for “Participants Meeting”
7. INTEGRATED OBSERVING STRATEGY
8. **AD HOC** WORKING GROUPS
 - 8.1 Establishment of Working Groups
 - 8.2 Data and Information Management
 - 8.3 Integrated Global Observing Strategy
 - 8.4 Government Involvement in GCOS
9. OTHER BUSINESS
 - 9.1 Intersessional activities
 - 9.2 Arrangements for JSTC-VIII
10. CLOSURE

IN CAMERA SESSION OF JSTC

PUBLIC INFORMATION SYMPOSIUM ON THE GLOBAL CLIMATE OBSERVING SYSTEM

ANNEX III

GCOS PANEL REVIEW SESSION

1. ORGANIZATION OF THE SESSION

1.1 On behalf of host organizations, Dr van Lammeren from the Royal Netherlands Meteorological Institute (KNMI) welcomed the attendees of the GCOS Panel review session (Appendix 1) at the Koningshof Kongreshotel.

2. OPENING REMARKS BY THE JSTC CHAIRMAN AND THE DIRECTOR, JOINT PLANNING OFFICE

2.1 The Chairman of the JSTC, Prof. Townshend, opened the review session and presented the agenda (Appendix 2). The Chairman remarked that this session was considered 'experimental', and was proposed to provide an opportunity for the panel chairmen to review their activities and discuss coordination among themselves. The session addressed many of the detailed panel issues and problems while specific projects and proposals of future activities were scheduled for discussion at the regular JSTC session. The Director of the JPO, Dr Spence, gave an overview of the GCOS structure, future work and sponsorship and reminded participants that the purpose of this session was to harmonise the work of the panels.

3. PRESENTATION BY THE CHAIRMEN OF THE PANELS

3.1 GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC)

3.1.1 The Chairman of the AOPC, Dr Manton, reported on the work of the Panel. He remarked that the joint sponsorship of the AOPC with the World Climate Research Programme (WCRP) was regarded as an important link to the climate research community and will provide pilot studies and pilot products as well as assistance in the design of networks. He briefly described the GCOS Upper-Air Network (GUAN) and the GCOS Surface Network (GSN). He gave a status report with respect to the GUAN, noting problems which may follow the shutdown of the Omega sounding system. He was concerned about the lack of commitment of WMO Members to the GSN. The role of GCOS in GUAN and GSN needs to be clearly identified. Dr Manton referred to the revitalised atmospheric constituents element noting that the Global Atmosphere Watch (GAW) formally contributes to GCOS objectives.

3.1.2 Dr Manton cited the draft of an AOPC Plan, a result from the third session of the AOPC. The plan will recommend that the AOPC should move beyond its advisory role and take more control of the end-to-end process. This in turn will call for formal membership on the Panel and the identification of panel responsibilities. The AOPC Chairman felt that it may be necessary to directly contact operators to guarantee responses to climate needs. He intends to call for the Panel to identify products that should result from the GCOS networks, and to develop a strategy to have them provided to the users.

3.1.3 The AOPC is considering elements relevant to three different interfaces: air-sea, air-land and air-snow/ice. Thus, it must interact closely with the other two GCOS science panels. The AOPC must also work with the JDIMP on GUAN and GSN data quality and transfer issues. Additionally, it must work with GOSSP with regard to space-based observations. He noted that several candidate AOPC products will combine *in situ* and space observations. The Committee on Earth Observation Satellites (CEOS) Strategic Implementation Team (SIT) projects on ozone and upper-air observations provide other opportunities for cooperation.

3.1.4 The JSTC Chairman expressed the need to discuss the identification of applications with regard to the WMO/CEOS database.

3.2 GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC)

3.2.1 The Chairman of the Terrestrial Observation Panel for Climate (TOPC), Dr Cihlar, presented as main issues: (1) establishment of networks; (2) initiation of demonstration projects (e.g., gaps analysis); and (3) the need for corresponding resources and support. The TOPC will work together with AOPC on the extension of data sets for temperature and precipitation. With JDIMP, TOPC is identifying candidate data sets and with the GOSSP, the requirements for selected priority applications. Dr Cihlar noted that cooperation is difficult with GTOS due to its stage of evolution, and due to the lack of supporting resources for the joint efforts (e.g., initial implementation of GOS-Net and other demonstration projects). Proposed emphasis for next year is on partnerships to: develop the glacier network, initiate the global system of ecological sites (GOS-Net), develop a permafrost network, and continue development of a hydrology network. Further, the Panel will consider present site coverage and analyse gaps similar to the way the AOPC has approached the GSN. The TOPC will assist in the implementation of the Ecosystem Productivity Project as one of the demonstration projects. The Panel also planned to ensure that GCOS/GTOS climate-related interests are represented in the Global Observation Forest Cover (GOFC), a CEOS SIT project.

3.3 GCOS/GOOS/WCRP Ocean Observations Panel for Climate (OOPC)

3.3.1 The Chairman of the Ocean Observations Panel for Climate (OOPC), Dr Smith, reported on the busy schedule of the OOPC. He stressed that the Panel places a high priority on the identification of products from ocean observations. The Panel has close liaison with research programmes (e.g., Climate Variability and Predictability Programme (CLIVAR)) and recognised their importance. He reported on the Time-Series Workshop and noted that the research community would prefer to maintain a number of the stations, but he noted that the effectiveness of the stations for climate applications must be identified. He also noted the role played by the Global Sea Level Observing System (GLOSS) in obtaining climate-related observations.

3.3.2 An implementation workshop for ocean observations involving GCOS, GOOS, and a number of bodies associated with observations is being scheduled early in 1998. The outcome of this workshop should lead to some cross-cutting activities with the AOPC. The Chairman reported that the GOSSP database structure would be welcomed by the OOPC. The OOPC is in charge of the SIT Global Ocean Data Assimilation Experiment (GODAE), a critical experiment for the success of the ocean component of GCOS. However, the OOPC Chairman explained that GODAE should be kept separate from GCOS/GOOS for 2-3 years to develop

community participation and secure resources. GODAE will remain an OOPC project and will report back through the Panel.

3.4 GCOS/GOOS/GTOS Global Observing Systems Space Panel (GOSSP)

3.4.1 The Chairman of the Global Observing Systems Space Panel (GOSSP), Mr Morgan, pointed out that the parallel activities of the Panel and CEOS need to be carefully orchestrated and coordinated. He noted that the Integrated Global Observing Strategy (IGOS) intended to have the G3OS as the drivers of the SIT pilot project requirements. Mr Morgan expressed his concern about the relationship among the G3OS and the CEOS projects, noting some ambiguity in the Panel with regard to the non-climate projects. The Chairman raised an issue about the number of meetings which he felt makes it difficult to interact efficiently.

3.5 GCOS/GOOS/GTOS Joint Data and Information Management Panel (JDIMP)

3.5.1 The Chairman of the Joint Data and Information Management Panel (JDIMP), Mr Karl, reviewed the status of the Panel. He pointed out that in future users or customers should be explicitly identified, and in agreement with the other panel chairs, that there should be well-defined products as outcome.

3.5.2 Mr Karl suggested that JDIMP would act on a programme-to-programme basis, and would be constructive in its interactions with other panels. He noted that the GCOS science panels were intended to take the “end-to-end” responsibility from observations to products. The JDIMP has primary interest in aspects of data collection (e.g., quality control, metadata), data transmission and sharing, product development, and delivery. It is also working with data centres on archiving and future data availability. He noted the need for specific projects to exercise the overall GCOS framework and exemplified the role of JDIMP using the GSN. During the discussion, GOOS **recognised** the need for a similar approach towards data and information management. There are other GOOS panels than OOPC, but they all need a central perspective in form of a Data Information Management Service (DIMS).

4. DISCUSSION OF ISSUES

4.1.1 The session attendees agreed that the Terms of Reference (TOR) should reflect the implementation roles. The TOR of the three design panels should not differ from each other too distinctively. Proposals for the TORs and memberships for JDIMP and GOSSP in respect of joint sponsorships were welcomed.

4.1.2 For illustration, it was noted that there are three levels of programme activity associated with GCOS. First, there are the GCOS programme elements funded directly through GCOS. Second, there are GCOS activities funded from outside sources, but subject to GCOS operational and reporting roles, and finally there are programmes which contribute to GCOS (e.g., national, regional or global activity. independently organized and funded) and help achieve the goals of GCOS. The final level should meet the technical standards of GCOS but they will likely remain independent of the programme.

4.1.3 In discussion, it was determined that the panels should be responsive to the JSTC recommendations, but may act relatively independently to develop and pursue efficient strategies to achieve their objectives. The JSTC remains the guiding body, sharing responsibility with the other sponsors. The JPO and other offices must however be fully informed of panel activities.

4.1.4 The role of JDIMP is central to the success of GCOS. Its function may be described as giving advice and guidance and addressing critical deficiencies with regard to information management. The panels should cooperate with it to promote effective implementation. It was agreed that the activities which support implementation in practical cases need to be clarified among the panels. The JSTC should continue to review the work of JDIMP.

5. PREPARATION OF MATERIALS FOR JSTC-VII SESSION

5.1 The reports presented to the JSTC should be limited to that material which can be profitably addressed. The material should be seeking for strategic advice and should be targeted.

5.2 In the materials, it should be considered how the JSTC can be made more useful to the panels and work of GCOS concerning composition, frequency and type of meetings. It is not intended to redefine the role of the JSTC, but only to revisit the different levels (i.e., panels, etc.).

6. ADJOURN

6.1 The review session was adjourned at 17 00 hrs.

APPENDIX 1

LIST OF PARTICIPANTS

(Addresses in Annex I)

Members of the JSTC

Prof. J. TOWNSHEND (**Chairman**)

Dr A. **McEwan**

Dr C. Readings

Dr D. Whelpdale

Ex officio Members of the JSTC

Dr J. Cihlar

Mr T. Karl

Dr M. **Manton**

Mr J. Morgan

Dr N. Smith

Other **Participants**

Dr C. Summerhayes

Dr M. Gwynne

Dr V. Meleshko

Ms L. **Moodie**

Dr G. Needler

Dr R. Schiffer

Dr H. Teunissen

Dr A. van Lammeren

GCOS Secretariat

Dr T. **Spence**

Dr (Ms) C. Richter

APPENDIX 2

AGENDA

1. Organization of the Session
2. Opening Remarks by JSTC Chairman and JPO Director
3. Presentations by the Chairmen of the Panels
 - 3.1 AOPC
 - 3.2 TOPC
 - 3.3 OOPC
 - 3.4 GOSSP
 - 3.5 JDIMP
4. Discussion of issues
5. Preparation of materials for JSTC-VII session
6. Adjourn

ANNEX IV

ADDRESS OF MS TANJA VAN BEEK DEPUTY SECRETARY GENERAL MINISTRY OF TRANSPORT, PUBLIC WORKS AND WATER MANAGEMENT

Mr Chairman, Members of the Joint Scientific and Technical Committee of the Global Climate Observing System, ladies and gentlemen:

First of all, I would like to welcome you to the Netherlands. We feel honoured that you have chosen the Netherlands to convene the 7th meeting of the Joint Scientific and Technical Committee of the Global Climate Observing System (GCOS). It is an opportunity for us to show our strong support for GCOS and for you to experience the hospitality of this part of our country.

Climate variability and climate change are important topics in the Dutch society and politics. This is clearly illustrated by the commitment of our government to conclude an effective protocol at the Kyoto conference later this year. Furthermore our country boasts a relatively large research effort on many aspects of the climate problem. My own ministry supports the research programme on climate and climate change at KNMI, your host for this meeting. Finally we play an active role in IPCC, which incidentally has its own plenary meeting at this moment in the Maldives. Regretfully, this prevents some of our Dutch representatives from attending this GCOS meeting.

To illustrate the importance of the climate issue for our country. I want to recall the special hearings of the Dutch parliament. Politicians felt the need to be informed as thoroughly as possible on all aspects of the problem. So, a unique step in the Dutch parliamentary history was taken last year. An official "climate hearing" was organized. Scientists from many disciplines were heard together with representatives from social and environmental organizations, trade unions and industry. From this, parliament concluded that the climate problem is a real problem with a direct impact on our social and economic system. The precautionary principle was accepted as a basis for Dutch climate policy.

Why is the climate issue so important for this country? Let me give you two examples to illustrate this. Sea level rise threatens our coastal defense system. The western half of the Netherlands is below sea level. So, if the sea level is rising my ministry wants to know this as accurately and early as possible. This gives us time to take measures, so catastrophes may be avoided.

The second example is the recent floods of rivers Meuse and Rhine in the winters of 1994 and 1995. During the last floods, over 100,000 people had to be evacuated from their homes. The social, emotional and economical damage was large. Again, information on climate variability and change is important to estimate the risk and to take the measures needed.

I need not tell you that observations of the climate on a global basis are crucial for all aspects of the climate problem. We need observations for understanding the system, validate our models, predict important climate fluctuations, such as the present El Niño. The recent meeting of the World Climate Research Programme in Geneva has emphasised this time and again. Your meeting is important because you can show the scientific and climate impact and prediction

communities that you can live up to their expectations. The Global Upper-Air Network and the Global Surface Network are excellent initiatives. It is your task to make sure that these data are accessible to the users.

As I understand from the information I receive, GCOS is organized in panels. It pleases me personally to see that the satellite observations have their own separate panel. Satellite observations have come a long way. From the more or less qualitative observations of the early days, the instruments have evolved to generate good quantitative measurements of many aspects of the climate system.



Europe contributes substantially to the world-wide network of earth observing satellites. The ERS satellites are extremely successful. In the near future the Meteorological Operational Satellite (METOP) and the European Space Agency Environmental Satellite (ENVISAT) satellites will be launched. Somewhat further ahead, we are all working hard in planning the Earth Explorer and Earth Watch Missions of the European Space Agency. The Dutch scientific community and Dutch industry play a prominent role. The Global Ozone Monitoring Experiment (GOME) instrument on the European Remote Sensing Satellite (ERS-2) is a good example. Accurate measurements of ozone and other trace gases are now produced routinely. We are all looking forward with excitement to the launch and first results of the Scanning Imaging Absorption Spectrometer for Atmospheric Chartography (SCIAMACHY). But let us not forget that reliable ground-based observations are and always will be needed for retrieval, quality control and validation of the satellite observations.

I would like to conclude with wishing you a good and successful meeting here in Veldhoven. I hope the discussions will be vivid and challenging. I also hope that the interactions with the representatives of the Dutch research community, ministries and others at the public information symposium on Friday will be interesting for all parties. Above all I hope that your meeting succeeds in convincing governments that GCOS is worth their support.

With this, I officially open the seventh meeting of the Joint Scientific and Technical Committee of the Global Climate Observing System.

Thank you.

ANNEX V

REPORT OF THE DIRECTOR, JOINT PLANNING OFFICE

Introduction

This document has been prepared for the seventh session of the Joint Scientific and Technical Committee for GCOS. It is intended to update the JSTC on activities and progress since JSTC-VI, and to provide some specific input related to the agenda for the JSTC-VII. The document consists of a brief report of recent progress in planning and implementing GCOS. For further details on the programme, readers are invited to refer to the various GCOS publications or to the GCOS homepage. *[Tabs in the original are not included in this version.]*

Progress Toward a Global Climate Observing System

Since JSTC-VI considerable progress has been made, particularly regarding implementation and cooperation with other agencies. This may be best discussed in the context of the structure of the programme: the JSTC, the JPO, and the panels.

The Joint Scientific and Technical Committee (JSTC)

The JSTC-VII agenda includes a special session devoted to the work of the various panels and a public symposium featuring speakers from GCOS and the Dutch government agencies and science community. The focus of the principal JSTC-VII session is on implementation through the work of the panels and cooperative organizations, activities, and programmes. As usual, participants representing a wide range of viewpoints have been invited.

An *in camera* session will address several administrative and political issues including the MOU and new members. The MOU is due for renewal, and a draft version is available for review. The membership of the JSTC is under continual review. During the past year, six members have concluded their terms. A slate of nominees is being prepared on the basis of inputs from the sponsors, other organizations, and individuals. The MOU calls for the Executive Heads to concur with the final selection. Suggestions from participants would be in order.

Joint Planning Office (JPO)

The JPO is currently staffed by a director, a senior scientist, an administrative assistant, two junior professional officers (seconded from Japan and Germany), and a part-time secretary. Funding for the senior scientist position ends this year and for the part-time secretary early in 1998 unless additional funds are obtained. Even with current staff, the resources are inadequate to conduct the range of activities recommended by the JSTC and the subsidiary bodies. It is estimated that two additional staff and approximately an additional US\$ 150,000 per year is required to provide adequate support for GCOS activities for the next biennium. Proposals to assist with particular activities will continue to be prepared, but baseline support needs to be increased. In particular, the international sponsoring organizations will be invited to review their contributions to the programme. A budget for the GCOS programme has been provided. Detailed budgetary issues will be discussed *in camera*.

Panel Activities

The comprehensive panel structure of GCOS was instituted at JSTC-III, and has served the development of GCOS well. Currently, all the panels have some level of joint sponsorship, so they are also serving other organizations as well. All the three 'discipline-oriented' panels are now co-sponsored by the appropriate G3OS partners, and WCRP, as appropriate. The two 'cross-cutting' panels have full G3OS sponsorship. The level of participation in these joint activities is not uniform, but as they progress and develop, we anticipate that they will become more balanced. All of the panels, except the Terrestrial Observation Panel for Climate (TOPC), have met since JSTC-VI and GCOS has provided the major share of the financial support needed for their operation with the exception of OOPC which has been supported by the GOOS Project Office. With the exception of OOPC-II, all panel reports have been published and distributed. This year, GOOS has assumed from GCOS the administrative responsibility for the Tropical Atmosphere-Ocean Implementation Panel (TIP). It next meets in November in the U.K.

A comprehensive report from each of the panel chairmen will be included in the JSTC-VII agenda. In addition many implementation projects undertaken by the panels will be noted under other agenda items. Consequently only brief summary comments are provided in this report.

GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC)

The AOPC, now co-sponsored by WCRP, met in August in the U.K. under its new Chairman, Dr M. Manton (Australia). The Panel discussed the upper-air and surface reference networks which have now been adopted by WMO Members, and refined the requirements for atmospheric composition measurements in concert with IGBP IGAC and WCRP SPARC programmes. In addition, several specialized meetings were held with regard to the atmospheric networks (GUAN and GSN), as well as atmospheric constituents.

GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC)

Under the leadership of the Chairman, Dr J. Cihlar (Canada), TOPC completed and published the second version of the GCOS/GTOS Plan for Terrestrial Climate-related Observations, and a brochure on its measurement strategy (GHOST). The TOPC organized an important meeting of ecosystem network representatives in Spain. As a result of the meeting, sponsored by GCOS, GTOS, and IGBP, 12 networks have agreed to join together in a consortium for ecosystem measurement. The TOPC is also working closely with CEOS on the development of an IGOS project for Global Observations of Forest Cover. This project fills the need for systematic and routine collection and analysis of forest data from optical and microwave satellites. A 'beta' model demonstration of the Terrestrial Ecosystem Monitoring Sites (TEMS) database, developed with GTOS, is available.

GCOS/GOOS/WCRP Ocean Observations Panel for Climate

The OOPC chaired by Dr N. Smith (Australia) met in South Africa in February to continue the development of its strategy to implement key ocean climate elements. It also co-sponsored a meeting to consider long-time series stations in the ocean. The OOPC proposed an ocean assimilation experiment which has been accepted by CEOS as one of the pilot projects of

the IGOS. The intention of this project is to develop an operational system to characterize the physical state of the oceans on a continuing basis, an important scientific and practical advance.

The members are currently preparing a suite of brochures describing how ocean observations lead directly to economic benefits, through, for example, the characterization and prediction of El Niño. The OOPC has participated with a variety of specific implementation groups (e.g., IGOSS, DBCP, SOOP) and now supports the coordination of these activities through WMO and IOC. Administration of this panel is handled by the GOOS Project Office.

GCOS/GOOS/GTOS Joint Data and Information Management Panel (JDIMP)

The Panel, now with G3OS sponsorship, had its third session in Japan in July under its new Chairman, Mr T. Karl (U.S.A.). During the intersessional period considerable progress had been made on several projects. Proposals for cooperation among data centres, and for a GCOS Information Centre were developed and submitted; the latter will receive funding. A major meeting, supported in part by the reinsurance industry, was held to consider the data required for indices and indicators of severe storms. The papers presented at the meeting will appear in *Climatic Change* and will be compiled into a book. At the third session of the Panel several new projects were advanced to address metadata, expand the information centre to serve G3OS, and to develop version 2.0 of the Data and Information Management Plan which will now include GOOS and GTOS aspects.

Global Observing Systems Space Panel (GOSSP)

The GOSSP, successor to the GCOS Space Panel, met in the fall of 1996 under its Chairman, Mr J. Morgan (U.K.), to consider its broader remit in support of GOOS and GTOS. At that time, it developed an approach to include the non-climate elements of the two programmes, and to develop a second version of the comprehensive plan for space-based observations which is now being prepared. The Panel also established a method of analysis of requirements and space instrument capabilities which is to enable the G3OS to give detailed guidance to CEOS, and to individual space agencies as required. Due to the rapidly evolving IGOS concept, the GOSSP met again in May in France. There, GOSSP compiled and analysed requirements for those variables needed by the CEOS pilot projects proposed as elements of IGOS. This information was provided to CEOS groups through the formal participation of the JSTC Chairman, the GOSSP Chairman, and other members of G3OS panels. The Panel also recommended action based on the current plan, for example, a letter supporting continuity of EUMETSAT missions was dispatched through WMO on behalf of the Panel. A close cooperation with CEOS working groups (WGISS; WGC/V) has been established to ensure the space-based observing needs of the G3OS are well addressed.

Tropical Atmosphere-Ocean Implementation Panel (TIP)

The GCOS programme administered the TIP from 1993 to 1996. During that time, the Panel met in various tropical sites to assess where TAO array expansion might be desirable and feasible. In 1995, the meeting in Brazil led to the development of the Pilot Research Moored Array in the Tropical Atlantic (PIRATA) research experiment to monitor tropical Atlantic ocean conditions. In 1996, TIP met in India and the Panel is considering the deployment of moorings in the eastern Indian Ocean. Starting with the upcoming meeting in the U.K. in 1997, the GOOS

Project Office will assume responsibility for the administration of the Panel

Meetings and Publications

As an integral part of its meetings in Tokyo, Japan (I 995) and Victoria, Canada (1996), the JSTC has conducted public symposia to expose the national academic communities and agencies to GCOS and also to permit local experts to discuss national responses to the programme. A similar one-day symposium will be hosted by KNMI during the upcoming JSTC meeting. The agenda for the symposium has been made available. All are invited to attend.

In addition to the regular meetings of the panels, several expert workshops have been held since JSTC-VI to address specific issues. Examples include: the GCOS Surface Network (GSN) (2 meetings), atmospheric chemistry, long-time series observations in the ocean, ecosystem networks (which led to GOS-Net), and indicators and indices noted earlier. In addition, the GCOS programme participated in organizing the American Meteorological Society's (AMS's) First Symposium on Integrated Global Observations. These will continue annually, and will provide opportunities to showcase the G3OS activities in this community. The JPO Director convened a session at the International Association of Meteorological and Atmospheric Sciences/International Association for the Physical Sciences of the Ocean (IAMAS/IAPSO) Symposium in Australia, "Toward a Global Observing System". Representatives of GOOS and GTOS participated both on the organizing committee and by giving presentations. The programme was also active in the organization of the World Climate Research Programme Conference and presented a paper on GCOS. As a result of the discussions about GCOS, a special letter was drafted for the UN/FCCC Conference of the Parties in Kyoto, Japan this December.

As noted at JSTC-VI, the GCOS programme has sponsored or co-sponsored international symposia in a broader context. Examples include: (1) "Long-Term Climate Monitoring by the Global Climate Observing System", (2) "In situ Observations for the Global Observing Systems", and (3) "Monitoring for Climate Change Detection in the Americas". Similar meetings should be developed for the future, but resources severely limit GCOS activities in this area. The JSTC may wish to recommend mechanisms to solicit support for a more active participation of the programme in climate-related activities. It is felt that many opportunities to advance the agenda of the G3OS are also likely being missed as well.

To provide information on the GCOS, the JSTC has developed an overall publication strategy which encourages publication of plans, reports, studies, brochures, articles, and newsletters. Since JSTC-VI, GCOS has added approximately 14 new publications to its list (GCOS-28 to GCOS-41), many related to the work of the panels noted above. However, distribution of these publications is still not optimal. The JSTC will be invited to assist in providing more effective distribution of materials. Note that all but one publication since GCOS-5 are available through the GCOS website and in hard copy.

Unfortunately, two scheduled issues of the GCOS Newsletter (November 96, May 97) have not been published. It is planned to resume publication this fall with the November issue, but additional resources and assistance are needed to prepare articles, complete the layout, print copies, and distribute them. *[Plans to publish newsletters are on hold pending resources.]* The

JSTC may wish to know that total circulation of the Newsletters (5 issues) reached over 25,000 people, and that the mailing list increased from a few hundred at the outset to over 3,500. Additional compilation of names and maintenance of this list occupies a large fraction of staff time. Assistance from the JSTC would be most welcome.

As an alternative to the costly publication and distribution of a newsletter, significant efforts have been devoted to improving the content and appearance of the GCOS homepages. After the satellite images, they are the second most frequently visited pages of the numerous websites in WMO. To increase the utility and value of the homepages, JSTC members are encouraged to provide constructive input, suggest additional features, and propose appropriate links that can be made from or to the website.

Implementation

The central issue facing all global observing systems is the implementation. However, as originally conceived, GCOS was not intended to be an 'implementing organization', but was expected to work cooperatively with other implementing organizations (e.g., sponsoring organizations, international and national agencies) to ensure that climate-related needs were being met. To do this, GCOS developed the concept of an Initial Operational System (IOS) which would entrain specific elements of ongoing observing programmes under the GCOS 'umbrella'. Thus the JSTC, JPO, and panels actively worked with the user communities to identify requirements, and with the operational and research organizations to acquire the essential observations. In addition, the GCOS programme proposed specific improvements and enhancements to the observing systems so they would better meet climate-related needs. Examples include atmospheric networks (e.g., GUAN, GSN, GAW); ocean networks (e.g., DBCP, GLOSS, IGOSS, SOOP, and TAO); and land surface networks (e.g., Flow Regimes from International Experiments and Network Data (FRIEND), TEMS, WHYCOS). In addition, close cooperation with GOOS and GTOS was fostered.

Space-based observations are being addressed through the plans of the GOSSP, in concert with the sponsoring organizations and through CEOS and the Coordination Group for Meteorological Satellites (CGMS). The data and information issues are being pursued through the JDIMP in concert with the various data centre activities of the sponsoring organizations and numerous national data centres.

However, when existing organizations do not have the capability to support the required observations for GCOS, it will be necessary for GCOS to encourage development of effective mechanisms to obtain the required observations. This will require additional programme resources and the active participation and support of the sponsoring organizations if the GCOS are to succeed.

Particular note should be taken of the recent progress with the implementation of elements of GOOS. While many of the elements do not relate specifically to climate needs, the evolution of regional programmes (e.g., EuroGOOS, NEARGOOS) signal a more active participation of countries in this key partnership between GOOS and GCOS.

Principal Areas of Concern

The key areas of concern to GCOS that should be the focus of the JSTC meeting include: (1) enhancement of the role of the international sponsoring organizations in support of GCOS; (2) assistance in ensuring that scientifically sound and practical plans are developed and promulgated; (3) acquisition of adequate resources and staff to effectively develop the programmes; and (4) establishment of mechanisms to effectively present the plans to governments for adoption and implementation.

Sponsoring Organizations

The GCOS sponsors acknowledge their limited capability to support the programme at the level required. Each of them is under financial pressures, and frankly, the climate issue is not their primary concern. The creation of the Sponsors Group for the Global Observing Systems (SG) is an important step in obtaining a better understanding of the issues facing the G3OS, and it may be able to provide some measure of coordination among the G3OS and the sponsors. However, it is not realistic to expect adequate resources from these organizations.

Apart from the financial issues, the sponsors must be encouraged to take a more proactive stance toward the G3OS. At meetings of governing bodies and through informal contacts the sponsors have many opportunities to showcase the observing systems with governments. To date, this has not been done effectively. The JSTC should consider ways to have the G3OS assume a more prominent role in the sponsoring organizations.

Status of GCOS Plans

Although comprehensive plans have been prepared, reviewed, and published by the GCOS JPO on behalf of the sponsoring organizations, there has been very limited feedback from the several of the sponsors, from governmental agencies, and from user groups. Now that a couple of years have passed, it is time to reassess this approach, and to develop an appropriate strategy for the future. While the panels should continue to develop the technical plans needed for their effective progress, the overall representation of the programme plans should be considered carefully.

The JSTC needs to consider what documentation (and what distribution of it) is appropriate at this time in the maturity of the programme. It is planned to revisit the overall GCOS plan. Two versions have been visualized -- one for the policy- or decision-makers, and one for scientific and technical audiences. The JSTC should indicate their views about the nature and substance of these documents, agree to participate actively in their preparation, and in addition, consider mechanisms to obtain effective endorsement of the plans so they could be taken to governments for action.

Some earlier JSTC discussions favoured an 'implementation plan', but by default, this is becoming a compilation of those elements that are components of the GCOS effort, and an electronic compilation is a long-term goal being pursued incrementally. With the active partnerships with WWW, GAW, GOOS, and GTOS, a good compilation should eventually result. Advice and help is sought with this procedure.

Finally, a brochure is being planned for the G3OS. At the SG-II meeting, the directors of the G3OS agreed to develop brochures with a similar appearance so a 'set' of materials could be mixed and matched as the occasion requires. Assistance with the GCOS version would be welcome.

Status of Implementation

The strategic approach taken by the JSTC toward implementation of GCOS was noted above. The JSTC provides overall guidance to the science and cross-cutting panels to enable them to develop working relationships with the appropriate implementing bodies. Examples of these include the WWW, GAW, and HWR programmes of WMO; IGOSS and DBCP of WMO and IOC; GLOSS of IOC; and similar programmes of the other sponsoring organizations. In addition, GCOS depends on the implementation activities of GOOS and GTOS for ocean and land-surface observations. During the past year, considerable progress has been made through these channels.

The development of requirements themselves has proven to be a difficult matter for GCOS (and even more difficult for GOOS and GTOS). For several years, the GCOS programme has been trying to establish unambiguous requirements based on the overall science issues, the particular applications for which the observations are required, and the technical specifications of observing instrumentation. More active participation of user communities, particularly those engaged in developing products, must be sought.

Fortunately, relational databases have now been developed that permit searches by variable, application, and programme. (For this capability, we acknowledge the particular efforts of the WWW satellite office.) GCOS can now accurately portray its detailed requirements and make specific requests to implementing organizations. This **capability** can be demonstrated to the members, if desired.

Once the requirements are established, there remains the challenge of translating these into a design for an 'optimal system' to obtain the observations to meet the requirements. In many cases, this is still an open science question, and we turn often to WCRP and IGBP projects to provide guidance. The science panels are thus continuously reviewing the requirements in concert with the science and user communities, and making specific proposals to implementing agencies to meet these requirements in a progressively more effective manner.

Resources

As noted above, the primary source of funding, our international sponsors, is not sufficient to undertake the programme. Additional national and international resources must be sought. To date, the JPO has prepared focused proposals aimed at staffing the office at at least a minimal level. We have combined project proposals and secondments for our current year. However, there are major difficulties for the next few years in sustaining even that level, let alone increasing to the appropriate level of staffing.

The JSTC should consider mechanisms to assist with the staffing of the office, or the development of alternate off-site solutions. These are urgently needed at this particularly critical

time in which we are taking our case to governments.

For the major national investments in the operational systems envisioned, we require a continuing dialogue. To date, this has **occured** informally, and efforts to provide a formal framework have not progressed well. The JSTC should provide guidance in this critical area.

National Support

It is essential that the GCOS programme enjoys wide national support and participation. Several measures have been taken to increase national involvement, but progress has been rather slow, although new countries continue to inform us of their participation, or at least provide a point of contact or national committee to discuss the programme.

At JSTC-V and VI, a possible 'participants meeting' was discussed. At JSTC-VI, specific recommendations were made for such a meeting. During the intersessional period, the Chairman of JSTC and the Director of JPO have continued to explore the possibility of such a meeting. The original concept was that it would be done in the context of the "Climate Agenda" (a brochure was distributed). The Climate Agenda has been developed by a group of international organizations to provide a comprehensive coordinated response to the climate needs from research through to impacts. Climate observations are the fourth thrust of the Climate Agenda.

Recently an Inter-agency Committee on the Climate Agenda (IACCA) was formed to advance the programme. At its first meeting, it gave strong support for GCOS to develop a 'participants meeting'. Subsequently a special one-day meeting of IACCA with national representatives who were attending the WCRP Conference discussed such a meeting in the first half of 1998, and in the draft summary report¹ concluded that

"... the timing for such an event was appropriate and would allow useful interactions between those responsible for implementing the international GCOS and national participants. The programme of the meeting would need careful construction..."

The meeting was endorsed by the WMO Executive Council, but no explicit funding was provided in the budget for it. At the SG-II meeting, the issue of support for the meeting was raised. Representatives of the sponsoring organizations present were not encouraging. The JSTC should consider the 'participants meeting'.

The SG-II was informed that the IOC Assembly gave approval for a GOOS meeting with senior level government representatives. While some details are unclear, the GCOS programme and appropriate expertise was offered to support this meeting to the extent possible. Climate issues will be prominently featured.

¹ Available as a Working Paper for JSTC until approved for distribution

Other Issues

Participation in the Development of an Integrated Global Observing Strategy

As noted at JSTC-V and VI, the development of an IGOS has been taken seriously. In fact, the GCOS programme has already addressed the integration of observations from the atmosphere, ocean, land surface, utilizing both *in situ* and space-based systems. Some of the GCOS partners, for example the WWW, already utilizes integrated observations from space and *in situ* platforms through assimilating models to provide products. Such an approach has been visualized as essential for GCOS through a climate data assimilation system.

At the 1996 meeting of the Committee for Earth Observation Satellites (CEOS), a set of steps to advance the concept was agreed. These involve various meetings among the space agencies and the affiliates of CEOS, and the preparation of complex databases for analysis of requirements. During 1997, GCOS participated in several meetings of various CEOS working groups to develop the suite of pilot projects now being advanced under the IGOS. It is also active with the Sponsors Group for the Global Observing Systems.

Issues arising from these groups need to be addressed including:

1. The role of the international sponsoring organizations (individually and collectively) in the process of evaluating and possibly supporting the IGOS concept;
2. The technical role to be played by GCOS and its panels;
3. The resource (funds, personnel) needed for GCOS (and other affiliates) to effectively participate in the IGOS.

Coordination with International Bodies and Programmes

The level of effort expended by the GCOS programme in this area continues very high. For the period from September 1996 to the present meeting, the JPO identified 15 activities for which GCOS was a sponsor or a major participant, 32 significant activities or meetings to which it sent representatives, and probably a similar number to which it sent or commissioned documents. Levels of activity for next year are likely to be similar or higher. Many other important opportunities must be declined due to the shortage of funds and personnel.

The challenge to adequately coordinate the global observing systems with the appropriate international bodies and programmes is a daunting one. The JSTC-VII agenda provided a good example. Additional assistance from the members to meet the growing level of activity is essential. Individual members are requested to identify those areas in which active assistance may be expected.

Summary

As this report and other JSTC documents attest, it has been a rather productive year for the developments of GCOS. While we have reached a moderate level of development and recognition, the major tasks lie ahead. The JSTC will need to help us marshal resources and government support for the programme to proceed toward its objectives.



ANNEX VI

REPORT OF THE CHAIRMAN

This has been an exceedingly busy year for everyone associated with the Global Climate Observing System. We have many successes to report, but continue to achieve less than we believe is necessary for a variety of reasons. During the year, implementation of the system's existing networks has been continuing and new networks are being defined.

This year has seen very active participation of the GCOS in international activities. Both the Director and I attended the IACCA and WMO Executive Council meetings in Geneva in April and June respectively. We have taken advantage of several scientific meetings to inform the broader community of the work of GCOS. I presented papers at the AMS meeting in Long Beach, CA, U.S.A., and at IAMAS in Melbourne, Australia on the work of GCOS. The Director and I attended the JSC of the WCRP, and the Director made a presentation on our behalf at the WCRP Conference in Geneva in August.

GCOS has participated actively with the Strategic Implementation Team (SIT) and AG of the Committee on Earth Observation Satellites (CEOS) associated with the Integrated Global Observing Strategy (IGOS). I served on the organizing committee of SIT, attended its first meeting in Irvine, CA, U.S.A., and will be attending its second meeting in Oxford, U.K., immediately after this meeting. The very full consideration of the needs of GCOS by these various CEOS activities has been gratifying and I believe that GCOS must continue to work closely with CEOS to assist in our implementation. Although the final form of an Integrated Global Observations Strategy has still to be finalised, I remain convinced that it is of the highest priority and the many international and national bodies concerned with observations must redouble their efforts to establish it.

All of our panels have been very active. We have continued in our efforts to collaborate with other bodies to reduce the proliferation of committees and panels. The Global Observing Systems Space Panel (GOSSP) now serves all three observing systems and the Joint Data and Information Management Panel (JDIMP) plays a similarly cross-cutting role. I attended a jointly sponsored meeting between GCOS, the Global Terrestrial Observing System (GTOS) and the International Geosphere-Biosphere Programme (IGBP) in Guemica, Spain in June of this year. There, the first steps in defining and coordinating a global system of ecological sites (GOS-Net) occurred. The revivification of the Atmospheric Observation Panel for Climate under the chairmanship of Dr M. **Manton**, and now jointly sponsored by the World Climate Research Programme (WCRP), is especially welcome.

Despite the many positive aspects of the work of GCOS, it has to be **recognised** that there are major hurdles to overcome before we can hope to achieve a satisfactory global observing system. Throughout the world many in situ observations are being reduced due to financial, technical and other issues. GCOS as an organization has received many words of encouragement this year, but unfortunately, they have often not been supported by tangible help. It was especially disappointing that at the Executive Council of WMO our proposal for a GCOS Participants Meeting was warmly welcomed by many, but no additional funds could be found to support it. We will be looking for advice on how we can strengthen our interactions with nations at this meeting and subsequently during the year.

The Joint Planning Office has received considerable help from individual countries, notably Germany, Japan and the U.S.A., in supplementing the resources made available through the WMO (and other sponsors). However, currently it seems likely that there will be substantially fewer resources available next year and this must inevitably limit the range of our activities. In receiving advice from the JSTC on our plans for next year, we will also look forward to advice on how these plans are to be **resourced**.

Looking to our work over the next year and the goals of the seventh session of the JSTC, we must continue to seek and receive the highest quality advice on our plans, their implementation and how we can sensibly prioritize. We must also continue to find improved ways in which we interact with international and national entities, looking wherever possible for simplification of current structures and more direct ways to active implementation. I believe that we have to emphasize the end products that are created through the work of GCOS. In doing this we must take advantage of observational assets whose priorities are not chiefly climate: for this reason I welcome the initiative from EUMETSAT to work with GCOS in defining **climate-relevant** products from METEOSAT Second Generation (MSG) and I would welcome similar initiatives from other space agencies.

The membership of the JSTC is of great importance for the success of GCOS and we must continue to seek an appropriate balance between scientific and operational expertise. As GCOS matures, it is clear that while continuing to include the highest possible level of scientific guidance, greater emphasis should be placed on long-term implementation. For this reason I have indicated that a new Chairperson should be sought for the JSTC to reflect this changing emphasis.

Many people contribute to the work of GCOS, but as you all know, no one is more devoted than the Director of the Joint Planning **Office**, Dr Tom **Spence**, who is so ably supported by his small team in Geneva. Their incredible efforts under Tom Spence's leadership underpin all of the achievements of GCOS.

I would also personally like to acknowledge the support I have received from NASA and NOAA as Chairman of the JSTC during the last two and a half years.

ANNEX VII

SUMMARY OF ACTIONS AND RECOMMENDATIONS

During the session, the JSTC agreed to a number of actions which are summarized in this annex.

1. The JSTC recommended that GCOS requirements be taken into consideration at the Sydney GCOS/GOOS Implementation Meeting.
2. The JSTC agreed to assist GOOS in preparing for the Agreements Meeting.
3. The JSTC recommended that the Chairman communicate the concerns of the JSTC to the GTOS sponsoring organizations with regard to support for GTOS development.
4. The JSTC recommended that broader participation on the part of GTOS be sought from the GTOS SC and the GTOS Secretariat for jointly sponsored meetings and other future joint activities.
5. The JSTC recommended that the G3OS Office Directors ensure that all proposals to donors be shared with each other for information.
6. The JSTC urged the close cooperation among GCOS, GOOS, and WCRP projects be continued.
7. The JSTC recommended that a proposal for joint sponsorship of the GCOS/GTOS/ TOPC be prepared and presented to the next IGBP meeting.
8. The JSTC recommended that the CLIPS project work closely with GCOS to ensure that the observational needs to ensure the success of the project are met.
9. The JSTC recommended that GCOS work closely with CEOS and appropriate bodies to ensure that an integrated approach to climate-related observations be taken.
10. The JSTC recommended that the AOPC should:
 - a) strive to produce a comprehensive plan as a priority;
 - b) review the 'best practice' advice being prepared for participating countries for the GUAN and GSN, continue to monitor the progress of the networks, and develop recommendations for station replacement in the event of continuing non-performance;
 - c) provide guidance, in collaboration with research and operational agencies, regarding the development of products based on the networks;
 - d) review and make recommendations concerning national offers for archiving network data;
 - e) seek support from non-WMO agencies for the networks;
 - f) endorse, closely monitor and participate in reanalysis activities;
 - g) work closely with the GOSSP, particularly regarding SIT projects, and JDIMP regarding shared responsibilities for products.

11. The JSTC recommended that the JPO improve its communications with the national GCOS offices and/or points of contact, particularly regarding observing networks.
12. The JSTC recommended that the TOPC should:
 - a) continue its development of terrestrial networks for climate-related observations and in particular the GOS-Net, glacier, permafrost, and hydrological networks;
 - b) pursue underway projects (**NPP**, GOFC, regional projects, gaps analysis);
 - c) review the plans for a Network Panel and make its recommendations to JSTC;
 - d) work with the JDIMP in liberalizing restrictive data policies and encouraging data sharing as an essential element of 'best practice' for terrestrial observations.
13. The JSTC recommended that the GTOS Steering Committee be invited to review the work of TOPC as it relates to the objectives of GTOS.
14. The JSTC recommended that the OOPC:
 - a) consider rotation of membership and develop a proposal for the cosponsors;
 - b) review the outcome of the Time-Series Workshop to develop specific recommendations;
 - c) continue to work with the implementing agencies to develop a coherent ocean climate observing system;
 - d) reconsider the project to assess the value of quality control, and if appropriate, develop a joint activity with JDIMP.
15. The JSTC recommended that all panels provide timely inputs for the GOSSP so it can **accurately** maintain requirement databases and portray them to the agencies and to CEOS, and encouraged work to continue on the Space Plan.
16. The JSTC recommended that the various GCOS meeting commitments should be reviewed with a goal to reducing them wherever possible.
17. The JSTC recommended that the JDIMP:
 - a) revise its data and information management plan to accommodate its expanded charter, but retain the visionary style of Version 1 .O;
 - b) continue the implementation of the Information Center and consider mechanisms to enhance the support for its important work;
 - c) encourage the Center to proceed in a systematic fashion with climate-related **variables**, and to include GOOS and GTOS non-climate elements at a future date;
 - d) continue the development of the metadata project;
 - e) proceed with **planning** for a follow-on meeting on "Extremes" in 1999;
 - f) support the data requirements of IPCC regarding its next assessment, and to participate where appropriate with the IPCC;
 - g) meet in joint sessions with the AOPC to develop concerted strategies to provide end-to-end continuity with the observing networks through to products.
18. The JSTC invited both GOOS and GTOS to consider how the JDIMP could best serve their needs.

19. The JSTC invited both GOOS and GTOS to provide guidance on the operation of the Information Center to ensure it supports their requirements.
20. The JSTC recommended that additional funding for JDIMP activities be sought from the sponsoring organizations of the G3OS at the next SG meeting, and through national agencies where appropriate.
21. The JSTC recommended that an annual status report be prepared on the state of the observing elements of GCOS by the JPO in concert with the offices of GOOS and GTOS.
22. The JSTC recommended that:
 - a) the AOPC should clarify its views with regard to long-term monitoring of atmospheric constituents and formulate a strategy for JSTC consideration;
 - b) the GAW be invited to develop an effective aerosol monitoring effort in support of the GCOS requirements to be specified at the next AOPC.
23. The JSTC recommended that:
 - a) the GTOS be invited to take the lead on GOS-Net since the observations will meet a number of non-climate needs. The JSTC recommended a new title for the network be found;
 - b) the Network Panel be established at the earliest opportunity, and that GTOS be invited to support it at an effective level.
24. The JSTC, noting the pioneering efforts of WGMS, endorsed in principle the adoption of an initial glacier network of some 60 sites as a contribution to the GCOS IOS.
25. The JSTC recommended that letters on behalf of GCOS be sent to national focal and contact points to determine the observing practices and methods for selecting sites. The letters should also encourage adding sites for climate purposes. Letters should include a statement of 'best practices', particularly with regard to observing practices and data sharing.
26. The JSTC recommended that the TOPC consider the space-based observational requirements for glacier monitoring in addition to the *in situ* ones and develop an appropriate set of recommendations.
27. The JSTC recommended that the TOPC consider the permafrost issue at its next session.
28. The JSTC recommended that a joint letter be sent to the International Permafrost Association inviting its cooperation in the development of a long-term permafrost observing network.
29. The JSTC endorsed the "Terrestrial Ecosystem Productivity" demonstration project, noting that lead responsibility for its development will rest with the GTOS Secretariat.

30. The JSTC agreed to work with the GTOS SC to obtain necessary resources and to establish necessary protocols.
31. The JSTC endorsed the GOF C project in principle (Annex IX).
32. The JSTC recommended that:
 - a) the TOPC remain actively involved in the project;
 - b) the project leaders of GOF C work with GOSSP and with JDIMP as appropriate.
33. The JSTC supported the Implementation Workshop statement (Annex IX).
34. The JSTC invited the OOPC Chairman to represent the climate needs of GCOS on its behalf.
35. The JSTC endorsed the GODAE statement (Annex IX).
36. The JSTC recommended that the OOPC provide information on the plans and activities of the GODAE Steering Group as the experiment proceeds.
37. The JSTC suggested that an *ad hoc* working group consider the feasibility of a Participants Meeting and/or develop a strategy to use other mechanisms.

FINDINGS OF THE AD *HOC* WORKING GROUPS

1. The JSTC should **recognise** JDIMP responsibilities and invite the GOOS and GTOS Steering Groups to provide comments.
2. An Affiliated **G3OS** Centres Workshop should be held.
3. An International Data and Product **Facilitator** for each of the **G3OS Offices** should be established.
4. Utilize existing programmes to develop capacity related to **G3OS**.
5. Continue to **develop** appropriate strategy for GCOS to interact with IGOS.
6. Select a group to **develop** the GCOS statement for governments.
7. Prepare a brochure for COP-3.
8. Inform national contacts to support systematic observations.
9. Establish a task group to **develop** appropriate materials for presentation to governments about GCOS.
10. Consult agency heads and decision-makers on content.

11. Develop a strategy for a series of regional meetings to address GCOS plans.
12. The JSTC should assist in presenting the GCOS message through national contacts with sponsoring organization representatives.
13. The JSTC should establish an advisory body to address resources.

ANNEX VIII

NATIONAL ACTIVITY REPORTS

Australia

In 1996, a GCOS/GOOS Secretariat was established as a focal point for *GCOS* activities in Australia. There are joint activities planned with the marine community through the GCOS/GOOS Joint Working Group (JWG), which will report to a Steering Committee, The GCOS Expert Sub-group, chaired by Dr Manton, has produced a draft plan "The Australian Climate Observing System". This plan aims to review the current state of the Australian observing systems and to give recommendations to specify a contribution to the Initial Operational System (IOS). The GOOS Expert Sub-group provides support to a marine Science and Technology Plan, outlining elements of an Australian Ocean Observing System. Significant steps have been made by Australia to commit itself to GUAN and GSN stations and ensuring the operation of the Ship of Opportunity Programme (SOOP). The low-density expendable bathythermograph (XBT) lines have been transferred to an operational system run by the Bureau of Meteorology.

China

China has established a China Commission for GCOS (CCGCOS), whose main tasks are to maintain links and cooperative activities to GCOS. The executive branch of the commission is set up at the China Meteorological Agency, Department of Meteorological Services and Climate. The expert group of the commission is responsible for drafting the development and implementation plans of the national climate observing system. It will provide the commission with scientific and technical guidance. Furthermore, the geostationary meteorological satellite programme of China (FY-2) will be in operational state from the middle of October 1997 on and will deliver cloud track wind data.

Germany

Germany proposed new members for the JSTC, AOPC, GOSSP and TOPC and has participated in the last year at the GCOS/CLIVAR workshop on climate extremes, at a GOOS workshop and at the third session of JDIMP. Germany, together with Japan, has offered to monitor the GSN data. The German GAW global station "Zugspitze/Hohenpeissenberg" and the regional station "Schauinsland" continued its operation, whereas a second regional station "Neuglobsow" has just started contributing. Germany is cooperating with mountain stations in Austria and Switzerland to monitor a common data set for chemical species. The Global Precipitation Climatology Centre (GPCC) products comprise data sets of gridded monthly area-mean precipitation for the global land surface from January 1986 to June 1997. The Global Run-off Data Centre (GRDC) consists of about 3600 stations, which now include stations in Latin America and the Caribbean. Furthermore, GRDC fostered the links to various international programmes (e.g., WHYCOS or the Arctic River Data Base). Information about the German Global Collecting Centre (GCC) is now available on the Internet. Germany also contributes to the Environmental and Natural Resource Management Project (G7-ENRM). A detailed proposal concerning the Satellite Application Facility (SAF) on Climate Monitoring will be submitted to the next Council Session of EUMETSAT.

Japan

The surface meteorological and upper-air observations including GSN and GUAN stations are being recorded on an operational basis. The Geostationary Meteorological Satellite (GMS) series have contributed to various climatic programmes such as the International Satellite Cloud Climatology Project (ISCCP) and the Global Precipitation Climatology Project (GPCP). Further, the Advanced Earth Observation Satellite (ADEOS) and the Tropical Rainfall Measuring Mission (TRMM) contribute as well to climate observing programmes. The observations of greenhouse gases and ozone have been carried out in the framework of the GAW. The World Data Centre for Greenhouse Gases (WDCGG) operated by the Japan Meteorological Agency (JMA) collects greenhouse gases data, checks data quality, archives data in a database, and provides it to users on request. Japan is promoting the Global Energy and Water Cycle Experiment (GEWEX) Asian Monsoon Experiment (GAME). As a contribution to the terrestrial component of GCOS, JMA is planning to operate a database of total snow depth within the WMO distributed databases in Tokyo. Japan intends to promote the application of precipitation data along the river and of run-off data in climate studies. For this purpose, it is considered important to establish close connections with the currently planned programme of Flow Regimes from International Experiments Network Data in Southeast Asia and the Pacific (Asian FRIEND), which aims at the establishment of a river run-off data archive in the Asian Pacific region.

Russian Federation

The Russian stations which are transmitting CLIMAT and CLIMAT TEMP messages continue to work operationally. The daily reports and monthly summaries of 143 stations are published in the Meteorological Bulletin. The baseline network for carbon dioxide monitoring consists of three stations, of which two have not been operating for more than 3 years. The WMO World Radiation Data Centre (WRDC) in St Petersburg is publishing regularly the "Solar Radiation and Radiation Balance Data". The data of the world network, which includes 1170 sites, are available from the period 1964 to 1993 and will be accessible in future via the Internet.

Venezuela

After two years of intense lobbying, Congress has finally given the approval to a project for the modernisation of the hydrometeorological forecasting system in the country, called "VEHNEMET". It will be financed through a US line of credit, will have a 5 year duration, starting from January 1998, and an approximate cost of 63M US\$. The project includes the installation of approximately 400 Data Collection Platforms for surface meteorology and hydrological measurements, five upper air stations, a meteorological radar network, and an enhanced national and international communications system. The project concerns all the government agencies with operational responsibilities, and the National Meteorology and Hydrology Commission (which also acts as the National GCOS Committee) will be its Advisory Board.

ANNEX IX

STATEMENTS OF THE JSTC

Statement Regarding the Global Observation of Forest Cover (GOFC) Project

At its seventh session, the GCOS Joint Scientific and Technical Committee considered the Global Observations of Forest Cover (GOFC) project. The discussion was based on the current proposal developed at the Ottawa Workshop, and on presentations by representatives of the Global Terrestrial Observing System (GTOS) and the Terrestrial Observation Panel for Climate (TOPC).

The JSTC wishes to express its appreciation to the Committee on Earth Observation Satellites for the initial support of the concept of GOFC and their leadership in the initial planning effort.

The JSTC acknowledges the rapid progress that has taken place, while **recognising** that much remains to be done before the execution can begin.

The JSTC wishes to ensure that the global climate-related forest issues continue to receive high priority by the project planning team. In particular, the role of forests in global biogeochemical cycling and the impact on forests are critical issues from the GCOS perspective.

The JSTC charged the TOPC with responsibility for representing GCOS requirements in the project and for reporting on its progress.

Statement on the Ocean Climate Observation Implementation Workshop

At its seventh session, the GCOS Joint Scientific and Technical Committee was briefed on an initiative of WMO and GOOS, in collaboration with the OOPC, to hold a Workshop focusing on the implementation of the Ocean Climate Observing System (OCOS).

The JSTC recalled the statement of JSTC-VI which noted that the mechanisms for implementation of the OCOS were only partially effective, and which recommended actions to remedy the situation.

JSTC-VII welcomed the initiative to hold an implementation workshop, concluding it was an appropriate and imaginative response to the previously expressed concerns. JSTC welcomed in particular the focus on the strengths and weaknesses of existing mechanisms and capabilities, and the aim to seek specific actions, and assign direct responsibility, to various groups in respect of the implementation and maintenance of the OCOS. JSTC-VII also noted that an effective, managed evolution of the implementation infrastructure was extremely important.

In endorsing this initiative, the JSTC asked the convenors of the Workshop to maintain a strong focus on the development of a workable and effective operational mechanism, noting that it was the perceived inadequacies in this area that motivated the resolution of JSTC-VI. The

JSTC suggested that the Workshop should take care to limit its considerations to those measurement streams recommended by OOSDP/OOPC, and those other physical measurements for which there are well defined, scientifically justified requirements. Moreover, in the case of climate, the convenors are asked to ensure that the recommendations of the Workshop are consonant with observing elements, specific measurements, and products that are considered in the OCOS plan.

Statement Regarding the Global Ocean Data Assimilation Experiment (GODAE)

At its seventh session, the GCOS Joint Scientific and Technical Committee considered the Global Ocean Data Assimilation Experiment (GODAE) and a report from the Chair of the OOPC. GODAE is a project of the OOPC and aims to provide a practical demonstration of the utility and feasibility of real-time, global ocean observing, modelling and data assimilation systems.

The JSTC commended the OOPC on its initiative and noted the strong support from many sections of the scientific and operational community including CEOS and GOOS. GODAE would provide a powerful test and demonstration of strategies for integrated global observing, a key element of the GCOS approach. The JSTC further noted the key role GODAE would play in the realisation of a global ocean observing system and the statement made by J-GOOS commending the initiative.

The JSTC noted that climate applications were a major part of the multi-purpose GODAE approach. Recalling the several enhancements to, and future developments of, the ocean climate observing system recommended in the OOSDP Report, JSTC noted that GODAE would provide an important impetus for the incremental implementation and evolution of these components.

JSTC noted and endorsed the strong emphasis on integration of direct and remote observing systems and endorsed and encouraged the close interactions with groups like CEOS and its working groups. GODAE would provide a capability for integrated ocean analysis and would have as one of its products a reanalysis of past ocean data, a product which is critical for the development of climate applications.

The JSTC welcomed the strong emphasis of GODAE on attracting intellectual and material investment in the development and support of ocean observing and processing systems. The JSTC also noted the initial emphasis on self-determination and the intention that GODAE would in general be generating its own resources.

JSTC requested the OOPC to continue to advance the plans for GODAE, in consultation with the GOOS and GCOS Project Offices, and asked the JSTC to be kept fully informed of progress. It was noted that as GODAE outcomes and “products” become better defined there would be an important parallel role for the JSTC, together with the GOOS Committee, to promote the value of the products, not only within the scientific community, but also to the vast global community of potential “users” (managerial, environmental and strategic).

The JSTC encouraged the OOPC to develop a draft plan for GODAE and asked that it pay particular attention to the development of the climate aspects, and in a way that is consistent with the development of the other components of GCOS.

ANNEX X

SPACE AGENCY REPORTS

Centre National d'Etudes Spatiales (CNES)

A memorandum of agreement for cooperation on the Jason programme has been signed by CNES and NASA. The programme's main objective is to continue taking the highly accurate altimetry measurements currently being taken by the Ocean Surface Topography Experiment (TOPEX/POSEIDON) mission. These allow ocean circulation and its variations to be studied on a global scale. A further objective is to provide a near real-time data service to forecast the state of seas and ocean circulation. The first satellite, Jason-1, will be placed in orbit by a US launcher in late 1999. It will consist of a PROTEUS platform provided by CNES and a payload jointly produced by France and the United States. The payload will comprise an altimetry radar and DORIS receiving unit for orbit computation purposes, provided by CNES, and a laser retro reflector and Global Positioning System (GPS) receiving unit, provided by NASA. The Jason-1 satellite has been designed to operate for three years.

European Space Agency (ESA)

The current elements of the ESA Earth Observation Programme consist of METEOSAT and METEOSAT Second Generation (MSG) in joint co-operation with EUMETSAT, as well as the Meteorological Operational Satellite (METOP). Further elements are the European Research Satellites ERS-1 and ERS-2, ENVISAT and the Earth Explorer and Earth Watch Missions. The future ESA strategy for Earth Observation beyond current missions and those being developed being elaborated in consultation with the user community and delegations. For the post-2000 era two general classes of missions have been proposed. The first one is the Earth Explorer, describing research and development missions focusing on specific topics and techniques. Nine missions are identified: Gravity Field and Steady-State Ocean Circulation, Earth Radiation, Land-Surface Processes and Interactions, Atmospheric Dynamics, Atmospheric Chemistry, Magnetometry, Precipitation, Atmospheric Profiling, Topography. The second identified class is Earth Watch, describing thematic pre-operational missions focusing on specific Earth Observation application areas (i.e., Coastal Zones, Ice Monitoring, Land Surface, Atmospheric Chemistry, Open Oceans and Hazard Monitoring).

European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)

METEOSAT-7 was launched recently and will provide data until the year 2002. METEOSAT-5 will be transferred over the Indian Ocean for the next two years for the Indoex Experiment. This satellite will be focused on the needs of the research community. With respect to the climate focus, EUMETSAT has agreed on the following tactics: improve awareness, identify requirements, develop new products and manage new programmes. In a planning state, at present, are the satellites Ozone-Sat, Ocean-Ice-Sat, and Climate-Sat which are supposed to deliver routine products. There are also plans for a "land processing" satellite to produce land surface requirements.

Short-term issues are concerned with the Metadata Archive Retrieval Facility (MARF), archive calibration and product validation. Further, there is METEOSAT Second Generation (MSG) calibration and validation as well as Data Connection Platform (DCP) usage and the data transfer system.

National Aeronautics and Space Administration (NASA)

Current events of the Mission to Planet Earth (MTPE) are the selection of the Earth System Science Pathfinder missions, Vegetation Canopy Lidar (VCL), to be launched in the year 2000, and the Gravity Recovery and Climate Experiment (GRACE), to be launched in the year 2001. A third ESSP mission is the Chemistry and Circulation Spectroscopy Mission (CCOSM). NASA is expecting the results from LightSAR (a proposed low-cost, Earth-orbiting imaging radar satellite) studies in November 1997. Further, the space agency has proposed a Science Data Purchase study. The EO-1 Phase B has been finished and the EO-2 mission will be selected shortly. The OrbView-2 (former SeaStar), Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere (CRISTA), Measurements of Air Pollution from Satellites (MAPS) and the TWR/Lewis satellite are all flying. The Tropical Rainfall Measuring Mission (TRMM) will be launched in November 1997.

Preliminary results from the MTPE biennial review process are: (1) The mission AM- 1, PM-1 and CHEM-1 will be left as they are; but future missions should be re-examined; (2) The Earth Observation System Data Information System (EOSDIS) is charged with new paradigms involving federation data centres. NASA will be responsible for calibration and validation, whereas principle investigators will be responsible for value-added product generation; (3) The programme balance will be shifted within MTPE to increase the current resources; (4) Technology Infusion Strategy will be based on science needs. The funding will support more efficient and cost-effective instrument implementation and shorten mission development cycle; (5) the post-2002 era will implement the live MTPE science themes (i.e., Land-Cover and Land-Use Change Research, Seasonal-to-Interannual Climate Variability and Prediction, Natural Hazards Research and Applications, Long-Term Climate: Natural Variability and Change Research and Atmospheric Ozone Research) with respect to the lessons learnt from the first series of missions including new partnerships in international, interagency and commercial areas. Future challenges include long-term observation tasks with NOAA, Department of Defense and Foreign Agencies (e.g., through IGOS) and understanding and modelling of cloud-aerosol radiation feedback processes or air-sea interactions.

National Oceanic and Atmospheric Administration (NOAA)

NOAA has launched the Geostationary Operational Environmental Satellite GOES- 10. Further highlights were ensuring the geostationary and polar continuity, with a planned launch of NOAA-K in February 1998. Additionally, on-line access was being provided to Defense Meteorological Satellite Programme (DMSP) data. Information retrieved by DMSP will have input in the CEOS SIT project proposal for "Disaster Monitoring". NOAA has been working together with EUMETSAT, ESA and NASA on Meteorological Operational Satellite (METOP) for polar morning continuity. Climate parameters have been included in the development of the National Polar Orbiting Environmental Satellite System (NPOESS) (e.g., calibrated radiometry for sea surface temperature, ozone continuity and better profiles and altimeter). Several activities have taken place on data issues, as for example the Workshop on Indices and Indicator for Climate Extremes. The work on the development of the GSN algorithm has been published and NOAA will accept GUAN and GSN data for quality control, archival and distribution. NOAA established a Council on long-term Climate Monitoring to consider needs of GCOS. This council will focus on observing systems operated by NOAA and will include experts from universities and private sectors. It will be chaired by Mr Tom Karl.

A template to guide JDIMP

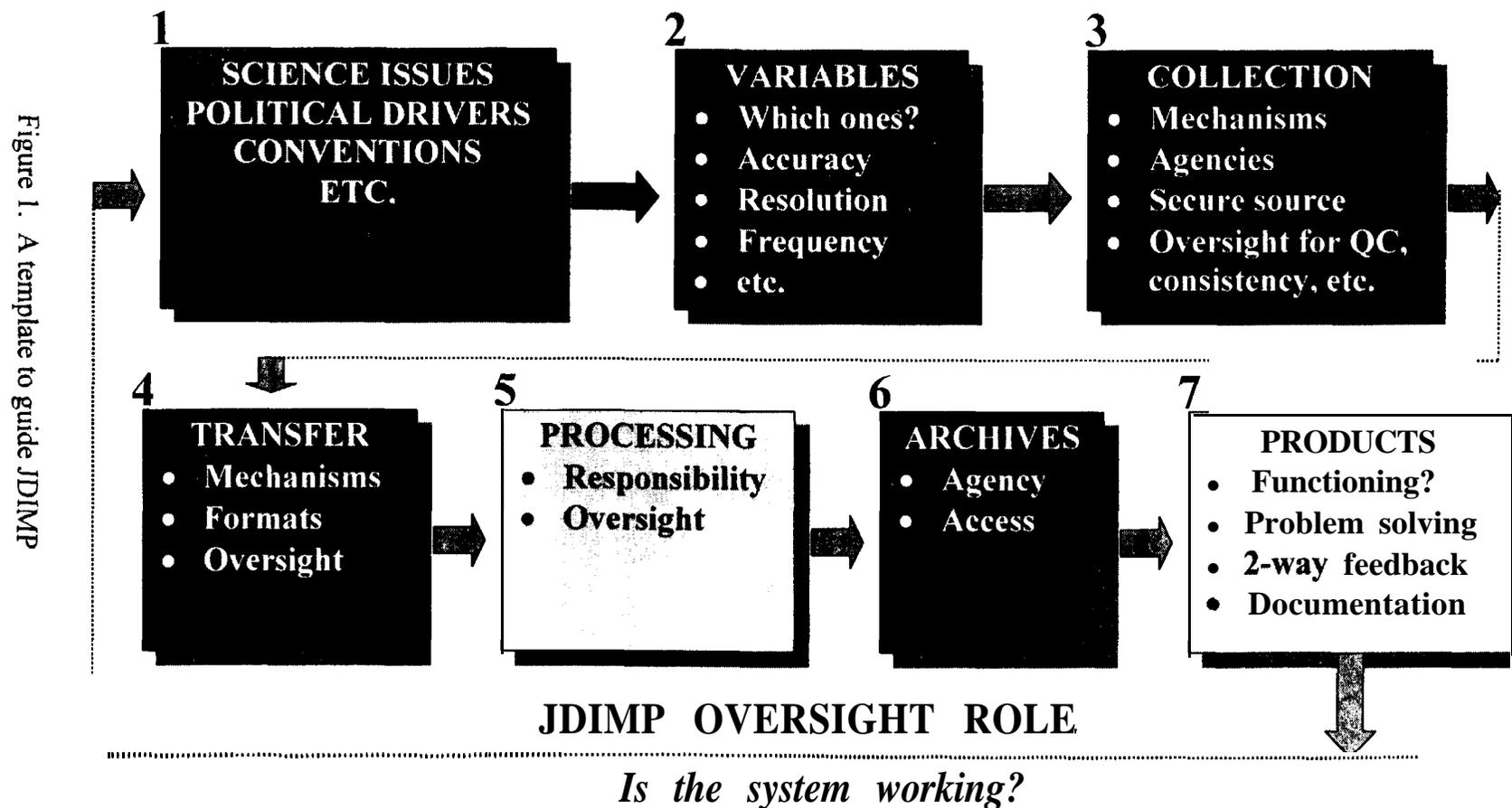


Figure 1. A template to guide JDIMP

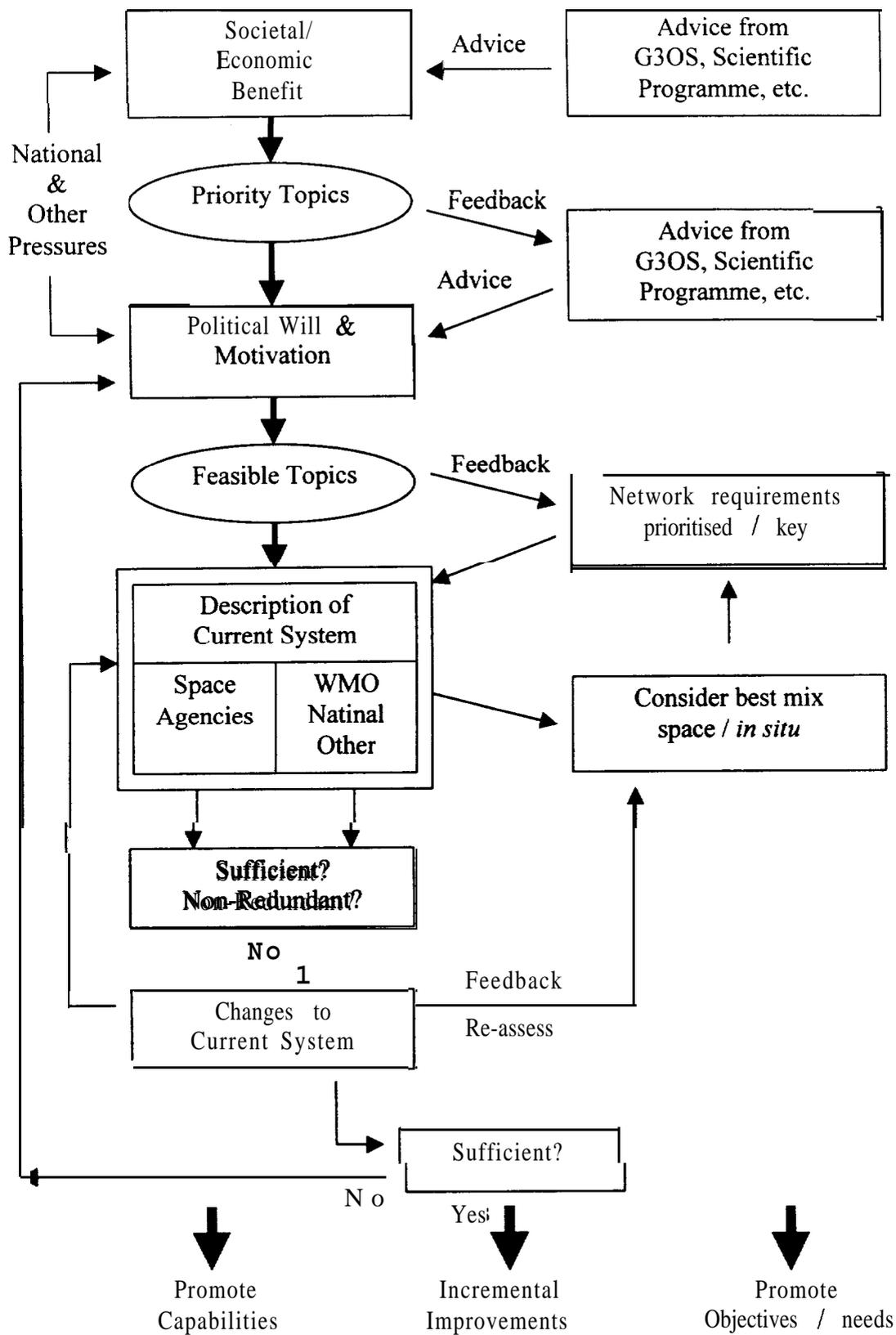


Figure 2 Framework for IGOS

ANNEX XII

PRINCIPLES

During the JSTC session, several references were made to 'principles'. For reference purposes, several sets of principles are provided in this annex. The first are the Guiding Principles for GCOS developed for the GCOS Plan, Version 1.0 as published in 1995, and the second was developed at JSTC-VII to guide the selection of atmospheric constituents and related variables.

Two sets of principles have been developed by the GOOS programme. The first are principles guiding the design of the programme, and the second guiding participation in the programme.

Finally, a set of principles has been developed to guide environmental measurement. These were based on discussions at several workshops.

Guiding Principles for GCOS':

GCOS must be:

- o Based on a scientifically sound foundation with broad interdisciplinary community participation;
- o Technically feasible, cost-effective, and affordable;
- o Developed in a phased approach based, to the degree possible, upon existing systems;
- o A fully open system with equal access to all participants;
- o A user-driven system to support requirements;
- o Internationally coordinated in support of national programmes and activities;
- o A source of guidance for the collection, distribution? and archiving of data and information of the highest quality in a timely fashion;
- o Helpful to participating nations in obtaining resources to upgrade existing systems and establish new systems as required;
- o Proactive in capacity building to assist countries in obtaining maximum benefits from the global climate observing system.

Principles Governing the Selection of GCOS Atmospheric Constituent Observations:

- o The constituent must be a primary constituent or indicator for describing and quantifying radiative forcing, constituent budgets, or the state, changes and variability of the atmospheric portion of the climate system;
- o An identifiable and active client community, beyond the research community, must exist for the application of the constituent data and products, for climate purposes;
- o A reliable capability must exist to provide consistent measurements of the constituent on a long-term basis;

GOOS Design Principles:

- (i) GOOS is based on a plan designed to meet defined objectives on the basis of user needs.
- (ii) The design assumes that contributions to GOOS are long-term and systematic.
- (iii) The design will be reviewed regularly.
- (iv) The design allows for flexibility of technique.
- (v) GOOS is directed towards global problems and/or those ubiquitous problems benefiting from global observing systems.
- (vi) The design covers the range from data capture to end products and services.
- (vii) The management, processing and distribution of data will follow a specified data policy.
- (viii) The design takes into account the existence of systems outside GOOS that can contribute to and/or benefit from GOOS.
- (ix) The plan takes into account quality assurance procedures.

GOOS Principles of Involvement:

- (x) Contributions to GOOS will be compliant with plans developed and agreed on the basis of the above design principles.
- (xi) Contributions will be compliant with a defined GOOS data policy.
- (xii) Contributions should reflect an intent for sustained observations.
- (xiii) Standards of quality will apply to GOOS contributions.
- (xiv) Implementation will be effected using exiting national and international systems and organizations where appropriate.
- (xv) Implementation will be incremental and progressive, whilst bearing in mind the long-term goals.
- (xvi) Participation in GOOS implies an undertaking to help less-developed countries to participate and benefit.
- (xvii) Participants will have full autonomy in the management of their contributions to GOOS.
- (xviii) Contributing nations and organizations will reserve the right to determine and limit their contributions to GOOS.
- (xix) Use the GOOS “labels” implies conformity with the relevant principles of GOOS.

Environmental Monitoring Principles

1. **Those responsible for observations need to ensure sufficient long-term records of key variables.**
 - o Global observing systems should define the criteria to specify essential baseline networks.
 - o The global observing systems must work with implementors to identify candidate sites for *in situ* observations or sensing systems for space observations.
 - o Implementors need to respond to these requirements and commit themselves long term (at least at a “best effort” level).
 - o Calibration procedures should be implemented so that observations can be related to objective external standards.
 - o Every effort should be made to build on existing mechanisms, plans and systems.

2. **Information must be collected and analysed so that the veracity of the record can be understood.**
 - o Routine and permanent mechanisms need to be put in place to evaluate and monitor observing system performance including calibration and metadata.
 - o Periodic information on monitoring of data quality including assessment of random errors and long-term systematic biases must be assembled.
 - o Information should be objectively assessed by the wider community (e.g., IPCC and other assessments by global observing systems etc.).

3. **Where there are potential disturbances to the record (e.g., due to changing technology) there must be a commitment to ensure that the internal consistency of the record is maintained.**
 - o Studies must be carried out to assess the impact of new technology as they affect the climate record (prior to and during implementation).
 - o Sensitivity of objectives, applications and products should be determined.
 - o Observations should be collected so the long-term record can be maintained. e.g. through collection overlapping observations of the older and newer systems and/or use of calibration procedures.
 - o The studies should involve the wider user community.

4. **There should be distribution of information to allow the consistency of long-term records to be assessed.**
 - o Wide distribution of all information and analyses carried out to enable assessment of the long-term record.
 - o This includes periodic information regarding calibration and validation, metadata and procedures used to process the data.
 - o The global observing systems should report on the success of the procedures implemented to maintain the long-term record.

ANNEX XIII

PUBLIC INFORMATION SYMPOSIUM ON THE GLOBAL CLIMATE OBSERVING SYSTEM

Sponsored by the
Royal Netherlands Meteorological Institute
The Netherlands Ministry of Transport, Public Works and Water Management
National Research Programme on Global Air Pollution and Climate Change

Koningshof Kongreshotel en Vergadercentrum
Veldhoven, The Netherlands

Friday, 26 September 1997

OPENING AND WELCOMING REMARKS

Dr T. Spence

Presentations on the Global Climate Observing System (GCOS)

- | | | |
|---|--|--------------------|
| o | Overview of GCOS | Prof. J. Townshend |
| o | Principles governing climate observations | Mr T. Karl |
| o | Integrated Global Observing Strategy | Dr R. Schiffer |
| o | Extending weather observations for climate purpose | Dr M. Manton |
| o | Terrestrial networking | Dr J. Cihlar |
| o | Global Ocean Data Assimilation Experiment (GODAE) | Prof W. Nowlin |

LUNCHEON

Featured Speaker: Mr G. Wolters

Title: On the International Climate Policy of the Dutch Government'

Presentations from Scientists from the Netherlands

- | | | |
|---|---------------------------------------|--------------------|
| o | Remote sensing and climate monitoring | Dr N. Bunnik |
| o | EuroGOOS | Dr J. Stel |
| o | Integration of cloud observations | Dr A. van Lammeren |
| o | Observations of the biosphere | Dr M. Menenti |

DISCUSSION

CONCLUDING REMARKS

Dr T. Spence

ANNEX XIV

LIST OF ACRONYMS AND ABBREVIATIONS

ADEOS	Advanced Earth Observation Satellite
A G	Analysis Group (CEOS)
AOPC	Atmospheric Observation Panel for Climate (GCOS)
CAS	Commission on Atmospheric Sciences (WMO)
CBS	Commission on Basic Systems (WMO)
CCGCOS	China Commission for GCOS
cc1	Commission for Climatology (WMO)
CCOSM	Chemistry and Circulation Spectroscopy Mission
CEOS	Committee on Earth Observation Satellites
CGMS	Coordination Group for Meteorological Satellites
CLIPS	Climate Information and Prediction Services (WMO)
CLIVAR	Climate Variability and Predictability (WCRP)
CMM	Commission for Marine Meteorology (WMO)
CNES	Centre National d'Etudes Spatiales
COP	Conference of the Parties
CRISTA	Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere
DBCP	Drifting Buoy Co-ordination Panel
DCP	Data Connection Platform
DIMS	Data Information Management System
DMSP	Defense Meteorological Satellite Program
DORIS	Doppler Orbitography and Radiopositioning Integrated by Satellite
DWD	Deutscher Wetterdienst
EC	Executive Council (WMO)
ECMWF	European Centre for Middle-Range Weather Forecasts
ENRM	Environmental and Natural Resource Management
ENSO	El Nino-Southern Oscillation
ENVISAT	Environmental Satellite
EOSDIS	Earth Observing System Data and Information System of NASA
ERS	European Remote-sensing Satellite
ESA	European Space Agency
ESSP	Earth System Science Pathfinders
EUMETSAT	European Organization for Meteorological Satellites
FAO	Food and Agriculture Organization
FRIEND	Flow Regimes from International Experimental Network Data
FY	Feng Yun Satellite
G3OS	GCOS, GOOS and GTOS
GAME	GEWEX Asian Monsoon Experiment
GAW	Global Atmosphere Watch
GCC	Global Collecting Centre
GCOS	Global Climate Observing System
GEWEX	Global Energy and Water Cycle Experiment
GHOST	Global Hierarchical Observing Strategy
GLOSS	Global Sea Level Observing System
GMS	Geostationary Meteorological Satellite

GODAE	Global Ocean Data Assimilation Experiment
GOES	Geostationary Operational Environmental Satellites (NOAA)
GOFC	Global Observations of Forest Cover
GOOS	Global Ocean Observing System
GOS	Global Observation System
GOSSP	Global Observing Systems Space Panel
GPCC	Global Precipitation Climatology Centre
GPCP	Global Precipitation Climatology Program
GPO	GOOS Programme Office
GPS	Global Positioning System
GRACE	Gravity Recovery and Climate Experiment
GRDC	Global Run-off Data Centre
GSC	GOOS Steering Committee
GSN	GCOS Surface Network
GTOS	Global Terrestrial Observing System
GUAN	GCOS Upper-Air Network
HOTO	Health of the Ocean (GOOS)
HWRP	Hydrology and Water Resources Programme
IACCA	Inter-agency Committee on the Climate Agenda
ICSU	International Council of Scientific Unions
IGAC	International Global Atmospheric Chemistry
IGBP	International Geosphere Biosphere Programme
IGFA	International Group of Funding Agencies for Global Change Research
I-GOOS	Intergovernmental GOOS Committee
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System
IHDP	International Human Dimensions Programmes
IOC	Intergovernmental Oceanographic Commission
IODE	International Ocean Data Exchange (IOC)
IOS	Initial Operational System
IPCC	Intergovernmental Panel on Climate Change
IRI	International Research Institute for Climate Prediction
ISCCP	International Satellite Cloud Climatology Project
J-GOOS	Joint Scientific and Technical Committee of GOOS
JDIMP	Joint Data and Information Management Panel
JMA	Japan Meteorological Agency
JPO	Joint Planning Office (GCOS)
JSTC	Joint Scientific and Technical Committee (GCOS)
JWG	GCOS/GOOS Joint Working Group
LAI	Leaf Area Index
LBA	Large Scale Biosphere-Atmosphere Experiment in Amazonia
MAPS	Measurement of Air Pollution from Satellite
MARF	Metadata Archive Retrieval Facility
METEOSAT	Meteorological Satellite
METOP	Meteorological Operational Weather Satellite
MOU	Memorandum of Understanding

MSG	Meteosat Second Generation
MTPE	Mission to Planet Earth (NASA)
NAO	North Atlantic Oscillation
NASA	National Aeronautics and Space Administration (U.S.A.)
NCDC	National Climatic Data Center
NEAR	Near East Asian Region
NGO	Non-governmental Organizations
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanographic and Atmospheric Administration (U.S.A.)
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	Net Primary Productivity
OOPC	Ocean Observations Panel for Climate (GCOS)
OSE	Observing System Experiment
PIRATA	Pilot Research Array in the Tropical Atlantic
PRAs	Principle Research Areas (CLIVAR)
SAF	Satellite Application Facility
SAG	Scientific Advisory Group (GAW)
SBSTA	Subsidiary Body for Scientific and Technological Advice
SC	Steering Committee
SG	Sponsors Group for the Global Observing Systems
SIT	Strategy Implementation Team (CEOS)
SOOP	Ship of Opportunity Programme
SPARC	Stratospheric Processes And their Role in Climate
START	System for Analysis, Research and Training
TAO	Tropical Atmosphere-Ocean Array
TEMS	Terrestrial Ecosystem Monitoring Site (UNEP)
TIP	Tropical Atmosphere-Ocean Implementation Panel
TOPC	Terrestrial Observation Panel for Climate (GCOS)
TOPEX	The Ocean Topography Experiment
TOR	Terms of Reference
TRMM	Tropical Rainfall Measuring Mission
UNEP	United Nations Environment Programme
UN/FCCC	United Nations Framework Convention on Climate Change
UOP	Upper Ocean Panel
VCL	Vegetation Canopy Lidar
WCRP	World Climate Research Programme
WDC	World Data Centre
WDCGG	World Data Center for Greenhouse Gases
WGMS	World Glacier Monitoring Service
WGNE	Working Group on Numerical Experimentation (GEWEX)
WGSAT	Working Group on Satellites (WWW/WMO)
WHYCOS	World Hydrological Observing System
WMO	World Meteorological Organization
WRDC	World Radiation Data Centre
w w w	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)
- GCOS3**
(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 .O, 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 Socio-economic 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-ver 1 .txt or /dp-ver 1 .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-ver 1. txt or /gp-ver 1.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-ver 1. 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) Report of the GCOS/GTOS Terrestrial Observation Panel, second session (London, UK, April 19-21, 1995)
(UNEP/EAP.MR/95-10) [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) GCOS/GTOS Plan for Terrestrial Climate-related Observations, version 1 .0, November 1995
(UNEP/EAP.TR/95-07) [ftp://www.wmo.ch/Documents/gcos/top-ver 1.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]
- GCOS-23**
(WMO/TD-No. 754) Report of the GCOS/GTOS Terrestrial Observation Panel for Climate, third session (Cape Town, South Africa, March 19-22, 1996)
(UNEP/DEIA/MR.96-6) [ftp://www.wmo.ch/Documents/gcos/top-3.wp5]
(FAO GTOS- 1)

- GCOS-24**
(WMO/TD-No. 768)
(UNESCO/IOC) Report of the Joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate, first session (Miami, Florida, USA, March 25-27, 1996)
[ftp://www.wmo.ch/Documents/gcos/oopc-1.wp5]
- GCOS-25**
(WMO/TD-No. 765)
(UNEP/DEIA/MR.96-5) Report of the GCOS Data and Information Management Panel, second session (Ottawa, Ontario, Canada, May 14-17, 1996)
[ftp://www.wmo.ch/Documents/gcos/dimp-2.wp5]
- GCOS-26**
(WMO/TD-No. 766) Report of the Joint CCI/CBS Expert Meeting on the GCOS Surface Network (Norwich, UK, March 25-27, 1996)
[ftp://www.wmo.ch/Documents/gcos/cbs-1.wp5]
- GCOS-27**
(WMO/TD-No. 772)
(UNEP/DEIA/MR.96-7) Report of the Expert Meeting on Hydrological Data for Global Observing Systems (Geneva, Switzerland, April 29-May 1, 1996)
[ftp://www.wmo.ch/Documents/gcos/hwr-1.wp5]
- GCOS-28**
(WMO/TD-No. 793)
(UNEP/DEIA/MR.97-3) *In Situ* Observations for the Global Observing Systems (Geneva, Switzerland, September 10-13, 1996)
[ftp://www.wmo.ch/Documents/gcos/insitu.wp5]
- GCOS-29**
(WMO/TD-No. 794)
(UNEP/DEIA/MR.97-4) Report of the Global Observing Systems Space Panel, second session (Geneva, Switzerland, October 16-18, 1996)
[ftp://www.wmo.ch/Documents/gcos/gossp-2.wp5]
- GCOS30**
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