

**G** GLOBAL  
**C** CLIMATE  
**O** OBSERVING  
**S** SYSTEM



WORLD METEOROLOGICAL  
ORGANIZATION

INTERGOVERNMENTAL  
OCEANOGRAPHIC COMMISSION

**REPORT OF THE NINTH SESSION OF THE  
WMO-IOC-UNEP-ICSU STEERING COMMITTEE  
FOR GCOS**

**(Beijing, China, 12 –14 September 2000)**

**November 2000**

**GCOS - 61**

**(WMO/TD No. 1031)**

UNITED NATIONS  
ENVIRONMENT PROGRAMME

INTERNATIONAL COUNCIL FOR  
SCIENCE

© 2000, World Meteorological Organization

NOTE

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

**Editorial Note:** This report has been produced without editorial revision by the WMO Secretariat. It is not an official WMO publication and its distribution in this form does not imply endorsement by the Organization of the ideas expressed.

## TABLE OF CONTENTS

<b>1. OPENING OF THE MEETING</b>	<b>1</b>
1.1 Welcome and Introductions	1
1.2 Approval of Agenda	1
1.3 Conduct of the Meeting	2
1.4 Review of SC-VIII and Matters Arising	2
<b>2. REPORT OF THE CHAIRMAN</b>	<b>2</b>
<b>3. REPORT OF THE DIRECTOR</b>	<b>3</b>
<b>4. UNFCCC AND RELATED ISSUES</b>	<b>5</b>
4.1 Outcome of COP-5	5
4.2 Intergovernmental Mechanisms for GCOS	6
4.3 GCOS National Coordinators' Meeting	8
4.4 Regional Workshops	9
4.5 Preparations for COP-6 and Beyond	10
<b>5. GCOS IMPLEMENTATION STATUS</b>	<b>11</b>
5.1 Atmospheric Observation Panel for Climate (AOPC)	11
5.2 Ocean Observations Panel for Climate (OOPC)	14
5.3 Terrestrial Observation Panel for Climate (TOPC)	16
5.4 Global Observing Systems Space Panel (GOSSP)	19
5.5 Joint Data and Information Management Panel (JDIMP)	20
5.6 National GCOS Programmes	20
<b>6. GCOS IMPLEMENTATION STRATEGY</b>	<b>20</b>
<b>7. FUTURE OF CROSS-CUTTING PANELS AND RELATED ISSUES</b>	<b>20</b>
7.1 Global Observing Systems Information Center (GOSIC)	20
7.2 Data and Information Management (JDIMP)	21
7.3 Space/Satellite Observations (GOSSP)	22
7.4 GCOS Network Acceptance Process	24
<b>8. RELATIONSHIPS WITH OTHER PROGRAMMES</b>	<b>25</b>
<b>9. ACTIONS TO BE UNDERTAKEN BY THE GCOS SECRETARIAT</b>	<b>26</b>
9.1 GCOS Resources (Secretariat)	26
9.2 Priority Activities	27
9.3 Review of Meeting Decisions	28
<b>10. OTHER BUSINESS</b>	<b>28</b>
10.1 Steering Committee Membership	28
10.2 Next Meeting	29
<b>11. CLOSURE</b>	<b>29</b>

## **ANNEXES**

- I. LIST OF PARTICIPANTS
- II. AGENDA
- III. LIST OF DOCUMENTS
- IV. SPONSORS' RESOLUTIONS PERTAINING TO GCOS
- V. GCOS ISSUES DOCUMENT FOR SBSTA-11 AND COP-5
- VI. DECISIONS AND REPORTING GUIDELINES FROM UNFCCC/COP-5
- VII. DRAFT OUTLINE FOR A GCOS SYNTHESIS REPORT AND ADEQUACY ANALYSIS FOR COP THROUGH SBSTA
- VIII. GCOS REGIONAL WORKSHOPS: OVERVIEW DOCUMENT AND SUMMARY OF PACIFIC ISLAND REGIONAL WORKSHOP
- IX. GCOS REPORT TO SBSTA-13/COP-6
- X. REPORTS ON NATIONAL GCOS PROGRAMMES
- XI. GCOS IMPLEMENTATION STRATEGY
- XII. CONSOLIDATED LIST OF DECISIONS, RECOMMENDATIONS AND ACTION ITEMS
- XIII. LIST OF ACRONYMS AND ABBREVIATIONS

# **REPORT OF GCOS SC-IX**

## **1. OPENING OF THE MEETING**

### **1.1 Welcome and Introductions**

The Ninth Session of the Global Climate Observing System (GCOS) Steering Committee (SC) began at 09:00 on Tuesday 12 September 2000 in the conference facilities of the Central Garden Hotel in Beijing, China, kindly hosted by the China Meteorological Administration (CMA). Dr Kirk Dawson, Chairman of the SC, welcomed the participants and expressed his thanks to the CMA for hosting the meeting. He noted that this was his second session as Chairman and commented with satisfaction on the great deal of progress in the GCOS Programme since the previous meeting. Dr Dawson then asked the participants to introduce themselves (see Annex I for list) and introduced Mr Li Huang, Deputy Administrator of the CMA, who welcomed participants on behalf of Mr Wen Kegang, Administrator of the CMA. Mr Li noted the importance of climate issues in both the environment and natural resources dossiers in China and that China had been pleased to have participated on the GCOS SC since its inception in 1992. He pointed out that China had approved the establishment of 37 stations in the GCOS Surface Network (GSN) and was providing data regularly to the GSN archive. China had established a GCOS National Committee in 1997 which was still functioning as the national coordination point for GCOS activities in China. He closed by noting that there still existed difficulties in the full implementation of GCOS and that China was prepared to do its part to help resolve them.

Dr Dawson thanked Mr Li for his kind words and for the contributions of China to GCOS. He then asked Dr Mike Coughlan and Dr Colin Summerhayes to speak on behalf of the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, respectively, as sponsors of GCOS. Dr Coughlan recalled the recent meeting of the Executive Heads of all the GCOS sponsors, which had noted the large number of organizations, programmes, agencies and other structures which were now in place to provide advice and guidance on climate issues, as well as to participate in implementation of global observing systems for climate. This necessitated the active development of solid partnerships among the entities involved, such as had already been established for the various GCOS panels, for example, and he encouraged GCOS to continue and strengthen such partnerships. He also noted the inevitable limitations in the 'hard' money available as direct support from the sponsoring agencies and the need to mobilize the 'soft' resources which might be provided through, for example, the World Bank, the Global Environment Facility (GEF) and foundations such as the UN Turner Foundation. On behalf of the IOC, Dr Summerhayes was pleased to note the continuing support of IOC for GCOS and the strong interaction and partnership between GCOS and the Global Ocean Observing System (GOOS). The IOC was particularly pleased by the role GCOS had been undertaking in representing all the global observing systems in the United Nations Framework Convention on Climate Change (UNFCCC) arena.

### **1.2 Approval of Agenda**

Dr Dawson requested modifications or additions to the Provisional Agenda, pointing out that it had been structured to lead toward the development of a new implementation strategy for GCOS and the establishment of clear priority actions needed to be taken by GCOS and the Secretariat in view of the very limited resources available to them. The proposed Agenda was accepted by the session and is presented as Annex II. The list of documents pertaining to the agenda items is presented as Annex III.

### 1.3 Conduct of the Meeting

Dr Hans Teunissen reviewed the logistical arrangements for the meeting on behalf of the GCOS Secretariat and the CMA.

### 1.4 Review of SC-VIII and Matters Arising

Dr Teunissen reviewed the decisions and action items which had been agreed at the preceding session of the SC. He noted that nearly all the items that had required concrete action had been completed or were in the process of being actioned and would be addressed under the appropriate agenda items during this meeting. The two notable exceptions were the formal updating of the 1995 GCOS Plan, and the establishment of a project or 'implementation' office for the GSN and the GCOS Upper-Air Network (GUAN). The lack of action on these items was a direct result of the unavailability of adequate resources within the GCOS Secretariat and was an issue which needed to be addressed during the session.

The session agreed that excellent progress had been made in advancing the GCOS programme since SC-VIII, particularly in view of the limited resources available, and expressed its appreciation to all who had contributed to this progress.

## **DECISION**

- 1. The SC noted the excellent progress that had been made in carrying out the actions that had been agreed at SC-VIII. It expressed its appreciation in particular to the GCOS Secretariat for its efforts in effecting this progress, as well as to the partners that had provided assistance and the countries and agencies that had contributed resources to carry out the activities of GCOS.**

## **2. REPORT OF THE CHAIRMAN**

Dr Dawson reviewed the progress in the GCOS programme from his perspective as Chairman of the Steering Committee. He noted the substantial progress that had been made since the last SC session in re-establishing the Secretariat, which now once again had a full-time Director and which had been able to pull together a small team of consultants to carry out some of the actions required, thanks to both the Sponsors' support and financial contributions from the UK, Australia, Japan, Eumetsat and the USA. The strategy being followed was to utilize all available resources to carry out as many as possible of the immediate demands rather than to hold back for future years, in order to clearly demonstrate progress to GCOS supporters. Nevertheless, the available resources were clearly inadequate for the tasks at hand and remained a serious problem to be resolved. Dr Dawson also noted the major progress in relation to the UNFCCC process, with strongly supportive decisions regarding systematic observations of climate having been taken at both the Fourth and Fifth Conferences of the Parties (COP) and significant progress having been achieved by GCOS in response to those decisions, as would be reviewed at this meeting. He commented that this progress well-exceeded his most optimistic expectations for the response of the UNFCCC to the GCOS report on adequacy of climate observing systems<sup>1</sup> which had been presented to COP-4 in Buenos Aires, and he was delighted at these developments. On the other hand, he observed that there was little evidence to date that the significant progress in process had resulted in any increase in the number of actual observations being taken and exchanged; indeed, the statistics tended to show a continuing deterioration or at best stability in the observing systems, at least in the atmospheric domain, and he was hopeful that the advances in process would indeed lead to the required advances in reliable observations.

---

<sup>1</sup> Report on the Adequacy of the Global Climate Observing Systems, GCOS-48, October 1998.

Dr Dawson summarized by outlining his view of the major issues before the SC, those being to:

- Provide guidance on the many implementation issues facing GCOS, especially through review of the draft Implementation Strategy for GCOS;
- Consider the priority to be accorded to specific actions to be undertaken by the GCOS Secretariat in light of the severe financial situation that it is facing, that limits severely what it can accomplish and that has continually stretched the capacities of the existing contract staff to the limit;
- Review the actions of the GCOS Secretariat in responding to recent decisions of the UNFCCC-COP and define an effective set of responses for future actions by the Secretariat, especially those related to enhancing the ongoing interaction of the GCOS Secretariat with the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) and with the UNFCCC Secretariat;
- Clarify the procedures for approving 'GCOS' observing systems (or networks) and identify possible implementing actions by the GCOS Secretariat, its partner observing systems and/or research programmes, and its Sponsoring Agencies, for facilitating their implementation by national and international agencies;
- Review the progress of the GCOS science panels and their Terms of Reference. This was very important in light of the efforts being made to increase the level of interaction with the WMO Commissions, IOC bodies, and other Sponsors' activities; and
- Consider the future means of addressing the cross-cutting issues associated with data management and space-based observations in light of recent decisions by the G3OS (GCOS, GOOS, GTOS) Sponsors and the Integrated Global Observing Strategy Partnership (IGOS-P).

During discussion on the above issues, it became clear that the SC as a whole felt that the substantive progress in advancing GCOS was rather greater than implied by the situation for the atmospheric domain alone, especially in the oceanic domain, and that major increases in the data available for use by the climate community in all domains were indeed imminent.

### **3. REPORT OF THE DIRECTOR**

Dr Thomas reviewed the activities of GCOS since the last session of the SC under three broad headings, as follows:

(i) Implementation and further planning of the GCOS Initial Operational System: Dr Thomas briefly reviewed the progress that had been made in implementing GCOS networks under the leadership of the science and cross-cutting panels, noting that details of activities would be presented under the respective agenda items at this meeting. He presented a list of the networks which are currently designated as 'GCOS networks' according to traditional usage, noting that the possible establishment of a more formal mechanism for denoting such networks would be discussed later during this session (see Section 7.4):

#### **ATMOSPHERIC:**

GCOS Surface Network (GSN)  
GCOS Upper-Air Network (GUAN)  
Global Atmosphere Watch (GAW)

## OCEANIC:

TAO/TRITON Array (component of ENSO Observing System)  
GLOSS (Reference Stations - e.g. sea-level)  
Data Buoys (under DBCP)  
Voluntary Observing Ships (VOS)  
SOOP (Ships of Opportunity Programme/XBT)  
Argo (profiling floats)

## TERRESTRIAL:

GTN-G (glacier monitoring network)  
GTN-P (permafrost monitoring network)  
GTN-E (ecosystem network, specifically carbon flux monitoring)  
GTN-H (hydrology network, under development).

Dr Thomas emphasized that these networks are at varying states of implementation but that all are crucial to GCOS. He concurred with comments made by several SC members that GCOS would have to ensure that its requirements from these and other potential GCOS networks were clearly and adequately stated and that the measurements being taken clearly satisfied those requirements.

(ii) Interaction with GCOS Sponsors and the UNFCCC: Since the last session of the SC, the GCOS Secretariat had worked closely with the Secretariats of the International Council for Science (ICSU), IOC/GOOS, and the WMO to bring issues before their governing bodies, especially decisions from COP-4 (Buenos Aires, November 1998) and COP-5 (Bonn, October 1999). This had led to the adoption of strongly supportive resolutions pertaining to GCOS by the Thirteenth WMO Congress in May 1999, the Twenty-sixth General Assembly of ICSU in September 1999, the Fifty-second Executive Council Session of the WMO in May 2000 and the Thirty-third Executive Council Session of the IOC in June 2000 (see Annex IV).

Following the recommendations of SC-VIII, the GCOS Secretariat, on behalf of the global observing systems for climate, had prepared draft guidelines for use by Parties in preparing their national communications to COP on systematic observations. These guidelines had been presented to COP-5 through SBSTA, along with a report on Issues Related to GCOS (Annex V) which had been developed in response to other decisions from COP-4. These inputs had resulted in two significant decisions from COP-5 which would be elaborated under Agenda Item 4.1 along with the GCOS response to those decisions (see Section 4.1 below).

(iii) Future directions and implementation issues: Dr Thomas briefly outlined the efforts that had been made to address the issue of an intergovernmental process for GCOS, primarily through the meeting on the subject that had been held in Toronto in February 2000 (Agenda Item 4.2). This meeting had encouraged the increased use of existing mechanisms of, for example, the GCOS Sponsors, and had added impetus to the development of an Implementation Strategy for GCOS, which would be a main item for discussion and agreement at this meeting (see Section 6 below).

Dr Thomas closed this part of his presentations by emphasizing the redirection that had occurred in GCOS from scientific planning to an emphasis on implementation, within available resources. He reminded the session of the GCOS approach of combining the space-based and *in situ* elements of various observing systems (the so-called GXOS's such as World Weather Watch (WWW), GOOS, Global Terrestrial Observing System (GTOS), GAW and the World Hydrological Cycle Observing System (WHYCOS)) in support of climate applications such as

seasonal-to-interannual forecasting, climate change detection and attribution, extreme climate events, agriculture, health and sustainable development.

#### **4. UNFCCC AND RELATED ISSUES**

##### **4.1 Outcome of COP-5**

As discussed above, GCOS had participated in the Fifth Session of the UNFCCC/COP (COP-5, Bonn, Germany, 25 October - 5 November 1999) on behalf of the global observing systems for climate, and had presented documentation on national reporting guidelines, as well as other responses to COP-4, for consideration by the Parties. As a result, two significant decisions relevant to climate observation had been adopted. Decision 4/CP.5 on national communications by Parties adopted the draft guidance prepared by GCOS as the 'UNFCCC Reporting Guidelines on Global Climate Observing Systems'. These guidelines are to be used by all Parties in providing summary information on their activities in relation to systematic observation of the climate system as part of their National Communications to COP, due by November 2001. Decision 5/CP.5 reaffirmed the adoption of those guidelines and:

- 1) requested Annex I Parties, and Annex II Parties on a voluntary basis, to provide detailed reports on systematic observation in accordance with the UNFCCC guidelines. These reports would be substantially more detailed than the summary reports and would, together with the summary information, form the basis for assessing the status and deficiencies of the global observing systems following a synthesis and analysis of their results based on a process to be defined by the GCOS and UNFCCC Secretariats;
- 2) invited the GCOS Secretariat, in consultation with relevant regional and international bodies, including the Global Environment Facility (GEF), to organize regional workshops to identify the priority capacity-building needs of developing countries related to participation in systematic observation;
- 3) urged Parties to address deficiencies in the climate observing networks and, in consultation with the GCOS Secretariat, to bring forward proposals for this purpose; and
- 4) invited the GCOS Secretariat to continue to investigate the establishment of an intergovernmental process to facilitate the improvement of global observing systems for climate.

The full text of the COP-5 Decisions is presented in Annex VI(a), and the complete 'UNFCCC Reporting Guidelines on Global Climate Observing Systems' are in Annex VI(b).

A number of actions had been taken in response to the above decisions, including a meeting in Toronto to address the issue of an intergovernmental mechanism for GCOS, an informal meeting of GCOS National Coordinators in Melbourne, and the organization of regional workshops to initiate the development of regional action plans to address the deficiencies in observing systems. These are described more fully in the sections below.

On the issue of developing a process to synthesize and analyze the information submitted in accordance with the UNFCCC reporting guidelines, the SC was requested to provide thoughts and advice on possible procedures as guidance for the Secretariat. It was agreed that this was a very important issue since this was the process which would lead directly to the next 'adequacy report' regarding global climate observing systems, and the opportunity to provide this information to the COP must not be missed. It was noted that the current reporting guidelines did not include information on the quality (as opposed to quantity) of the data being taken. Quality information would require the definition of standards and criteria which had not been fully defined as yet, and it was not feasible to modify the existing guidance material to take

this into account. Following discussions on this issue, an outline for the objectives, form and timeline for development of a synthesis report, leading to an adequacy analysis, was developed by Dr Michael Manton to serve as a starting point<sup>2</sup> for guiding this activity (see Annex VII). The SC agreed that this was a good beginning and approved the following decision:

## DECISION

2. **The SC requested the GCOS Secretariat, in consultation with the science panels and individual SC members, to develop, as a matter of urgency, possible methods which could be used to synthesize and analyze the National Communications on systematic observations for climate which are to be submitted to the UNFCCC/COP by November 2001. It approved in principle the process suggested at this meeting and requested that this process be extended to include other information on climate observations in order to develop a second report on the adequacy of global observing systems for climate.**

### 4.2 Intergovernmental Mechanisms for GCOS

Dr Thomas reviewed the objectives and results of the Informal Meeting on Developing an Intergovernmental Mechanism or Process for GCOS, hosted by the Meteorological Service of Canada (MSC) in Toronto, Canada from 7-8 February 2000. That meeting had sought informal advice from interested and informed individuals on how to respond to the UNFCCC decisions at COP-4 and COP-5 related to the initiation of an intergovernmental process to improve global observing systems for climate. The meeting also discussed how the current state of implementation of the Global Climate Observing System could be enhanced. Twenty experts from around the world, including Dr Dawson and Dr Thomas, had participated.

After considering a wide range of possible options, the meeting had concluded that rather than trying to establish a new intergovernmental process specifically for global observations of the climate system, GCOS should continue to be implemented through a more effective use of existing intergovernmental mechanisms. Although the interfaces between GCOS and these mechanisms were extremely complex, it was felt they could be used more effectively. The meeting had urged the GCOS Sponsoring Agencies (WMO, IOC, UNEP, ICSU) to pursue a three-part strategy:

- 1) First, that all of the Sponsoring Agencies make more effective use of their congresses, assemblies, executive councils and other relevant bodies or commissions to develop the links with, and the involvement of, governments in all aspects of GCOS using a consistent and complementary message, perhaps through the mechanism of common resolutions. For this to be more effective it was likely necessary for the sponsorship of GCOS to be augmented with the inclusion of the FAO to ensure that the terrestrial aspects of GCOS were adequately addressed. It was also recommended that the Sponsoring Agencies might wish to look at the nature of the G30S management structure that implicitly implied that GCOS is the entity responsible for the atmospheric domain on a par with the other domain-based systems, GOOS and GTOS, rather than a cross-cutting mechanism for climate;
- 2) Second, that the process of engaging the UNFCCC bodies be actively continued in order that governments were clearly given the opportunity to address deficiencies in the observational system required to meet their needs in the area of climate change. In so doing it was felt that it would make sense to link GCOS more closely with such international research programmes as the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP). In addition, the involvement of the

---

<sup>2</sup> See Annex VII for a modified version completed shortly after the session.

Intergovernmental Panel on Climate Change (IPCC) in the assessment of the adequacy of systematic observations and the needs of governments warranted further consideration;

- 3) Third, that there should be an increase in the number of 'operational' and/or senior governmental representatives on the GCOS SC so that it could more properly perform its managerial or oversight role.

It was suggested by the attendees that another way to improve intra- and intergovernmental coordination could be through a network of 'GCOS National Coordinators' who could be named by each nation participating in GCOS. Periodic meetings of such National Coordinators might be one approach to stimulating improved cooperation and more easily and quickly addressing GCOS problems (e.g. data gaps, continuity issues, etc.).

The meeting participants also recognized that they did not have a shared understanding on how GCOS was being implemented and that this could best be addressed by the GCOS SC and its Secretariat articulating a clear Implementation Strategy, showing how it and its partners proposed to respond to, *inter alia*: the policy needs of the UNFCCC and other conventions (e.g. Biodiversity, Desertification); the research needs to understand seasonal-to-decadal climate variability and change; and the operational needs for predictions, impacts assessment and adaptation.

The meeting was unanimous in its view that the GCOS Secretariat did not have the resources, people or funds to adequately develop and pursue such an Implementation Strategy in an effective manner, and it was clear that further support from the Sponsoring Agencies, as well as individual nations and organizations, was needed in order to move ahead. The Executive Heads of the Sponsoring Agencies were encouraged to consider how they might collectively assist the work of the GCOS Secretariat. It was also urged that the Executive Heads work together and take an active role in encouraging national commitments, soliciting funding support, and building across all agencies the momentum needed to make the GCOS a reality. Many of those present at the meeting indicated a willingness to see how they could mobilize such support at the national level.

Dr Thomas noted that the Secretariat had already responded to many of the recommendations from this meeting, for example by presenting common resolutions to the Executive Bodies of the sponsoring organizations and by adding several operational representatives to the GCOS SC to fill existing vacancies. The continuing engagement of the UNFCCC was obviously being pursued, and a draft Implementation Plan would be considered at this meeting. The Heads of the Sponsoring Agencies had been informed of the recommendations of the Toronto meeting and most had responded in a supportive manner (although no developments had as yet occurred in terms of improved resources).

During the discussion on this issue, it was reiterated that there are a very large number of organizations involved in the implementation of GCOS, both intergovernmental and non-intergovernmental, national and international, etc. The difficulty even at the national level of identifying a single entity to deal with the implementation and/or funding of climate issues was re-emphasized. It was agreed that in proceeding with the use of existing mechanisms, GCOS should focus on a limited set of agencies and entities, including for example the four sponsors, the UNFCCC, and the national space agencies through a body such as CEOS.

## **DECISION**

3. **The SC expressed its appreciation to the Meteorological Service of Canada for hosting the February 2000 Informal Meeting on an Intergovernmental Mechanism for GCOS. It noted the conclusions of that meeting and concurred that GCOS should focus on better use of existing mechanisms rather than the establishment of new**

**ones. It recommended that this effort be targeted toward a limited number of selected mechanisms, both intergovernmental and non-intergovernmental, to communicate and maintain relations with the nations, programmes, agencies and other key partners in implementing GCOS.**

#### 4.3 GCOS National Coordinators' Meeting

Mr Howard Diamond, GCOS National Coordinator for the USA, reported on another meeting which had recently been held in response to several of the recommendations from COP-5, namely the Informal Meeting of National GCOS Coordinators which had been hosted by the Australian Bureau of Meteorology (BOM) in Melbourne from 9-11 August, 2000. This meeting also followed on from the suggestion at the Toronto meeting that a network of GCOS National Coordinators might be useful for facilitating intergovernmental contact for GCOS. The specific objectives of the meeting were to:

- Develop a format for national reports on climate monitoring;
- Progress, and possibly institutionalize, an informal intergovernmental mechanism; and
- Discuss funding mechanisms for on-going developing country participation in GCOS.

GCOS National Coordinators from Australia, Finland, Germany, the Netherlands, New Zealand, Sweden, and the United States participated. Several other national GCOS focal points had been invited but were unable to attend. The agenda for the three-day meeting included:

- Presentations on national reports by the coordinators in attendance and on reporting/monitoring issues by BOM and other experts;
- Development of a draft national reporting framework for GCOS that is more detailed than the UNFCCC guidelines; and
- Discussions on using this forum as a part of the overall intergovernmental process for GCOS.

The meeting participants had agreed that the focus of the national reports should be on monitoring as opposed to research. The reports should indicate whether the GCOS standards for the GSN, GUAN, and GAW are being met and what national activities with regard to satellites are planned, given the increasing importance of satellites in climate monitoring. In addition, it had been decided that data management needed to be included as an element of the reports, including reporting on the length of past records; the homogeneity of these records; instrument continuity; electronic access to the data and metadata; and data rescue efforts. Given the importance of the ten Climate Monitoring Principles<sup>3</sup> as outlined in the UNFCCC Guidelines, some information on the status of adherence to those principles should be given in each report. Finally, it had been stressed that each national report should include as much contact information for GCOS focal points as required to allow for questions on specifics of the report. A supplementary national GCOS reporting template was in preparation. The main categories for supplementary reporting were: surface networks; upper-air networks; atmospheric chemistry; oceanographic; terrestrial; biological (including paleoclimate elements); and satellite monitoring.

This meeting had been the first opportunity to begin a *de facto* intergovernmental process based on GCOS National Coordinators, as had been recommended by the Toronto GCOS meeting. The discussion had considered the issue of having formal national coordinators

---

<sup>3</sup> See Annex VI, p. 10

with the associated need for funding travel, etc., or having an informal, *ad hoc* approach that focused on addressing specific GCOS issues. The consensus was to stimulate others to join (including non-Annex I nations) but to keep the meetings informal and workshop-oriented, at least in the short term.

The USA offered to host a follow-on meeting at the National Climatic Data Center (NCDC) in Asheville, NC, in the May-June 2001 timeframe, possibly the week before the next SBSTA meeting in June 2001. Since national reports were to be finalized around that time, that might be a good opportunity to meet again.

The SC welcomed the progress reported from the Melbourne meeting and thanked the Bureau of Meteorology for hosting it. It was noted that the Thirteenth WMO Congress had also considered the issue of coordination at the national level and that Resolution 3 (Cg-XIII) had urged WMO Members to identify national 'focal points' for GCOS to ensure appropriate action in regard to observing systems for climate, including preparation of comprehensive national GCOS plans and reporting to the UNFCCC. The Melbourne meeting had progressed that activity and demonstrated the potential usefulness of such an approach.

## **DECISION**

- 4. The SC expressed its appreciation to the Australian Bureau of Meteorology for hosting the recent Informal Meeting of GCOS National Coordinators (9-11 August 2000). It welcomed this informal mechanism of interaction between GCOS and participating nations and agreed that it should be continued, noting with appreciation the offer of the USA to host another such meeting in the May/June 2001 time frame. The SC requested the GCOS Secretariat, in conjunction with participating nations, to prepare possible Terms of Reference for GCOS National Coordinators and to pursue the development of this mechanism as a way to implement GCOS within nations and, where appropriate, regionally.**

### 4.4 Regional Workshops

As noted above, one of the recommendations of COP-5 Decision 5/CP.5 was that the GCOS Secretariat, in consultation with relevant regional and international bodies, including GEF, organize regional workshops to identify the priority capacity-building needs of developing countries related to participation in systematic observation. Dr Thomas reviewed the plans and actions that had been taken to date in response to this recommendation. These included:

- Development of an overview document for regional workshops (see Annex VIII(a)), of which the objectives were to: assist developing countries in identifying regional deficiencies in global observing systems for climate; assess priority needs and funding to enable countries to overcome observing system deficiencies and to allow them to collect, exchange, and utilize data on a continuing basis; and initiate the development of regional action plans and proposals to fund improvements in observing systems. This overview document had been distributed at SBSTA-12 in June for the information and comment of participants there;
- Development of a detailed proposal to GEF for participation in the support of a series of up to ten regional workshops of the type described above. These would be held over a period of perhaps five years and should ideally be implemented under the guidance of an informal Advisory Committee established for the purpose; and
- Organization of the first (prototype) workshop in Apia, Samoa from 14-15 August 2000. This 'Pacific Islands Regional Implementation Workshop on Improving Global Climate Observing Systems' had been organized by GCOS with the assistance of the South Pacific Regional

Environment Programme (SPREP) and with additional support from WMO, UNEP, the USA and Australia. It had been considered very successful and had led to a Resolution which included an action to develop, under the leadership of SPREP, a Pacific Regional Action Plan which would form the basis of a proposal for funding improvements in observing systems for climate and related activities in the Pacific region. This action plan was to be completed no later than June 2001 and is to incorporate the priorities raised in reports on national requirements to be developed by SPREP member countries. A copy of the workshop summary and Resolution is presented in Annex VIII(b).

Dr Thomas noted that planning was already well underway for a similar workshop in the Africa region. GCOS would be participating in two coming meetings in Africa (Kampala, Uganda in September and Abuja, Nigeria in October) to publicize the initiative of regional workshops and to solicit additional ideas for their implementation.

SC members were pleased with the major progress that had been achieved in response to the COP-5 decision regarding regional workshops, noting that this activity also responded to several of the SC recommendations from its previous session. They were particularly pleased at the apparent success of the Pacific workshop, but noted that the organization of such workshops is extremely costly in terms of time, money and people, and that the acid test of improvements in regional observing systems over the long term would of course still have to be demonstrated. It was not obvious that a large number of such workshops would be the most efficient way to proceed, nor that this format would be the most appropriate for other regions. The difficulty of drawing together representatives from all domains (atmosphere, oceans, terrestrial) was also noted. It was strongly recommended that this type of activity be closely linked to other planned activities in regions to minimize some of these drawbacks. Some members noted specific meetings and organizations in various regions to which GCOS workshops could potentially be affiliated. It was also recommended that strong efforts be made to link potential meetings of GCOS National Coordinators from a particular region to future workshops which might be held. The general advice of the SC was that the Secretariat should continue along the planned lines for regional workshops, but should do so with appropriate caution and weighing of the real benefits which could potentially be achieved.

## **DECISIONS**

- 5. The SC expressed support for the strategy of holding GCOS Regional Workshops to identify problems and deficiencies in selected regions and to develop Regional Action Plans. It also expressed satisfaction with the results of the recent Pacific Regional Workshop in Samoa. It nevertheless cautioned that workshops are only a means to identifying deficiencies and developing Regional Action Plans and are not an end in themselves.**
- 6. The SC requested the GCOS Secretariat to ensure that the mechanism of Regional Workshops also be used to facilitate the identification of, and interactions among, National Coordinators for GCOS, to the extent possible.**
- 7. The SC requested the GCOS Secretariat and Prof. Laban Ogallo, Co-ordinator of the Drought Monitoring Centre in Nairobi, Kenya, in collaboration with the GOOS Secretariat, to explore the modalities of holding a GCOS Regional Workshop in the Africa region.**

### **4.5 Preparations for COP-6 and Beyond**

Dr Thomas reviewed his participation in the Twelfth Session of SBSTA, which had been held in Bonn from 12-16 June 2000. He had briefed the session on behalf of the global observing systems on GCOS activities and related developments regarding systematic

observations, in response to the decisions and recommendations of COP-5. His report had included most of the developments described in Sections 3 and 4 above and was well received by the session participants. The final report from that session of SBSTA had included the following conclusions:

(a) The SBSTA welcomed the report made by the Director of the GCOS Secretariat, on behalf of the agencies participating in the Climate Agenda, on progress in responding to decision 5/CP.5 and on recent developments in the global observing systems;

(b) The SBSTA noted the efforts already made by the GCOS Secretariat to organize regional workshops in the South Pacific and Africa to identify priority capacity-building needs of developing countries related to their participation in systematic observation. The SBSTA expressed appreciation to those Parties and organizations which provided support to the workshops;

(c) The SBSTA welcomed the information provided by the GCOS Secretariat in response to the invitation contained in decision 5/CP.5, to consider the need for an intergovernmental process for global observing systems. It noted the recommendation that no new intergovernmental mechanism is needed at this time, but that the existing intergovernmental mechanisms, including those available to GCOS and its partners, should be used more efficiently; and

(d) The SBSTA invited the GCOS Secretariat to report periodically on its activities related to decision 5/CP.5, as well as on developments in the global observing systems for climate at its further sessions. It noted the appeal for additional resources by the GCOS Secretariat. The SBSTA urged Parties to contribute financial support to the work of the GCOS Secretariat to enable it to continue its activities, in response to decision 5/CP.5.

As a follow-on to this session, GCOS had prepared, in cooperation with GOOS, GTOS and other partners in the IGOS Partnership, a formal report on these issues (see Annex IX) for input to COP-6 through SBSTA-13, both of which would be held in the Hague, Netherlands from 13-24 November 2000. Dr Thomas would be attending those sessions to speak to the report as necessary, but noted that no formal resolution on observing systems was foreseen at this time due to other pressing issues on the COP-6 agenda.

The SC expressed appreciation for the positive developments at SBSTA-12 and the plans for SBSTA-13 and COP-6. Some members expressed concern, however, that there were no plans for a resolution on these matters at this session of COP, noting that such resolutions were extremely important to many agencies as a mechanism to obtain the national funding needed to support their contributions to the global observing systems.

## **DECISION**

**8. The SC requested the Secretariat to prepare text for a draft decision to SBSTA13/COP-6 (13-24 November 2000 in The Hague) which could be used as necessary in response to the deliberations at those sessions.**

## **5. GCOS IMPLEMENTATION STATUS**

### **5.1 Atmospheric Observation Panel for Climate (AOPC)**

Dr Manton, Chairman of the AOPC, briefed the committee on activities of the Panel since the last meeting of the SC. Two formal meetings had been held, the first (AOPC-V) in Silver Spring, MD, USA from 20-23 April 1999, and the second (AOPC-VI) in Geneva from 10-13 April 2000. Those meetings had focused primarily on the implementation issues involving the

atmospheric and atmosphere-related components of the GCOS Initial Operational System, particularly the GSN, GUAN and GAW networks, as well as the issue of the additional measurements that would be needed in a comprehensive atmospheric observing system for climate. The two GSN Monitoring Centres (at the Deutscher Wetterdienst, Germany for precipitation and the Japan Meteorological Agency, for temperature) had issued two Monitoring Reports on the performance of the GSN in 1999, and a third (for January - June 2000) was expected soon. Unfortunately the observation-reporting performance by GSN stations was consistently at a rather disappointing level (about 55% of expected reports were actually being received, which was about the same proportion as the overall CLIMAT network of about 2500 stations of which the 989 GSN stations are a subset). Slightly better performance (about 74%) was being reported for the GUAN by the Hadley Centre of the UK Met Office, which was the Monitoring Centre for GUAN. On the positive side, the very existence of these Monitoring Centres and the information they were providing were a positive step towards improving the situation, and the GCOS and WMO Secretariats were in the process of taking appropriate action in response to the monitoring reports. One major difficulty in this regard was the lack of staff in those Secretariats to adequately address the problem, and that was an outstanding issue to be resolved.

On the issue of atmospheric composition, Dr Manton noted that it was extremely important that a set of GCOS requirements and measurement criteria be developed for the relevant observations being taken in the GAW network, and the AOPC would work with GAW toward this end. He also reiterated the appreciation that AOPC had expressed to GAW and the WMO for arranging for publication of the very useful Committee on Earth Observation Satellites (CEOS) Pilot Project report on integrated measurement of ozone<sup>4</sup>.

Dr Manton also briefed the SC on the recent US National Research Council report on reconciling satellite, surface and radiosonde measurements of global temperature change. The AOPC strongly supported ongoing work on the improvement of temperature data for the troposphere and stratosphere and on the reconciliation of temperature trends at different levels as obtained from observations and models. It also strongly supported plans for the independent processing of Microwave Sounding Unit (MSU) data and encouraged ongoing efforts to identify and explore strategies to remove inhomogeneities in the radiosonde temperature record. Dr Manton also described some results from the latest workshop<sup>5</sup> on monitoring trends in climate extremes, which had been held under the auspices of the Asia-Pacific Network (APN) for Global Change Research with the support of the AOPC and had been very successful.

Dr Manton completed his presentation by reviewing plans and priorities for the AOPC. He saw AOPC priorities as focusing on consolidation of existing systems, identifying and filling the main gaps in them, and promoting achievements. The approach to networks should follow a dual-stream framework involving 'baseline' observations (long-term, high quality, consistent, homogeneous data from networks such as GSN, GUAN, GAW and others, including appropriate space-based observations) and 'comprehensive' observations (all available data for assimilation). It was intended to complete the current draft GCOS Plan for Atmospheric Climate Observations as soon as possible, and consideration was being given to the possibility of organizing a GCOS 'Atmospheric Observations Conference', along the lines of the recent OceanObs 99 conference (Saint Raphaël, France, October 1999), in the 2002 timeframe. These activities would contribute directly to the priorities that AOPC had defined.

The SC members congratulated the AOPC on the substantial progress made in implementation of the atmospheric networks and encouraged it to continue along the lines it was pursuing. Following discussion of several of the items that had been presented, it approved the decisions listed below.

---

<sup>4</sup> Report on the Integration of Satellite and Ground-based Measurements of Ozone, GAW Tech. Report 140, WMO.

<sup>5</sup> Second APN Workshop on Monitoring Trends in Climate Extremes, 6-10 December 1999, Melbourne, Australia.

## DECISIONS

9. The SC expressed its appreciation to the AOPC for the substantial progress made in implementation of the GSN and GUAN baseline networks. It noted the need to address the measurement of atmospheric trace gases in a similar manner via the GAW network and urged AOPC to begin such action as soon as feasible. The SC also recognized that the monitoring of regional climate will require regional networks beyond GSN and GUAN.
10. The SC noted the publication of the most recent GSN Monitoring Report and reiterated its appreciation to the Deutscher Wetterdienst (DWD) and the Japan Meteorological Agency (JMA) for carrying out this activity in support of the GSN. It also reiterated its appreciation to the World Data Centre-A for Meteorology (NCDC, USA) for its efforts in establishing and maintaining the archive for GSN data.
11. The SC expressed its appreciation for the activities of the ECMWF and the Hadley Centre of the UKMO in monitoring and reporting on the data from the GUAN and requested the Secretariat to formalize recognition of their contributions as soon as possible.
12. The SC urged the WMO Commission for Basic Systems (CBS), through the WMO Secretariat, to instigate appropriate action to address the problems in the reporting of real-time data from the GSN, as identified in the GSN Monitoring Reports. It also urged that the results of the Monitoring Reports be brought to the attention of relevant WMO members as soon as possible, through whatever means are most appropriate. The SC noted with appreciation the activity begun toward this end through the engagement of a consultant and encouraged the continuation of such activity, as well as the establishment of routine liaison between the Monitoring Centres and the operators of the GSN and GUAN stations.
13. The SC reiterated the importance of obtaining historical baseline data from the GSN and GUAN stations. It urged the WMO Commission for Climatology (CCI), through the WMO Secretariat, to address in particular the issue of the submission of historical data from the GSN, as requested in the September 1999 letter to WMO Members, and to explore through the relevant WMO constituent bodies appropriate means to resolve any difficulties with respect to the submission of the daily data that are necessary to establish comprehensive baseline statistics.
14. The SC confirmed the requirement that GCOS baseline data, such as those from the GSN and GUAN, be available for free and open exchange as required by the WMO World Data Centres. It also recognized the importance of full public access to routine performance-monitoring information and thanked the GSN and GUAN Monitoring Centres for facilitating this capability through their respective World Wide Web sites.
15. The SC recognized the importance of assessing the quality of the analyses of global temperatures from surface, radiosonde and satellite data and encouraged the AOPC to pursue the establishment of an international framework for such quality assurance.
16. The SC recognized the importance of maintaining continuity of baseline satellite observations (e.g. MSU radiances) as a component of the GCOS and requested the Secretariat to facilitate appropriate liaison between the AOPC and the relevant satellite agencies toward this end.

17. The SC expressed its appreciation to the WMO and CEOS for supporting completion and publication of the Report on the Integration of Satellite and Ground-based Measurements of Ozone, originally begun as a CEOS Pilot Project. It encouraged the adoption of this activity under the IGOS framework, possibly as part of an Atmospheric Chemistry Theme, leading to eventual implementation of its recommendations.
18. The SC encouraged AOPC to continue working with relevant organizations to promote the analysis and utilization of GCOS data, particularly the production of reliable indicators of extreme events.
19. The SC acknowledged the progress to date in developing the GCOS Plan for Atmospheric Climate Observations and encouraged the AOPC to complete the plan as a high priority activity.
20. The SC encouraged the AOPC to pursue the planning for an international GCOS conference on 'Atmospheric Observations for Climate' which would, *inter alia*, promote the need for, and status of, the atmospheric observations required for climate applications.
21. The SC requested the AOPC to review its Terms of Reference in light of the additional responsibilities assigned to it as a result of the dissolution or modification of the cross-cutting panels, JDIMP and GOSSP, as well as recent developments in GCOS and the new implementation strategy. It requested that revised Terms of Reference be presented to the SC for approval at its next session or sooner.

## 5.2 Ocean Observations Panel for Climate (OOPC)

Dr Summerhayes reviewed the activities of the OOPC since the previous session of the SC on behalf of the Panel Chairman, Dr Neville Smith, who was unable to attend this meeting. Two sessions of the OOPC had been held (OOPC-IV on 17 May 1999 in Woods Hole, USA and OOPC-V from 20-23 June 2000 in Bergen, Norway). The first was held in conjunction with a planning meeting for the First International Conference for the Ocean Observing System for Climate (OceanObs 99), which was held in Saint Raphaël, France from 18-22 October 1999. That meeting was convened jointly with the WCRP/CLIVAR Upper Ocean Panel (UOP) and constituted the most ambitious undertaking of the OOPC to date. It sought to reach a consensus on the optimum blend of sustained ocean observations to satisfy the collective needs of research and operational applications planned or underway under GOOS, GCOS, WCRP/CLIVAR, the WMO and the IOC. It was considered an unequivocal success in that it did indeed reach consensus on the optimum mix of remotely-sensed and *in situ* measurements needed for ocean observation and the steps needed for their implementation. The draft Conference Statement (<http://www.bom.gov.au/OceanObs99/Papers/Statement.pdf>) contained a complete summary of the meeting's objectives and results and a book would be published based on the invited papers from the conference.

The OOPC attached great importance to the development of the WMO/IOC Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) as the mechanism for implementation of surface marine observations (VOS, drifting buoys, TAO/TRITON array), subsurface observations and sea-level measurements (SOOP, TAO, GLOSS). It looked forward to working in close cooperation with JCOMM in implementation of the ocean observing system for climate. OOPC had also welcomed the establishment of the Partnership for Observation of the Global Oceans (POGO) and noted that POGO had agreed to provide support and leadership for the implementation of an array of fixed-point time series measurements. Good progress had been made with the Global Ocean Data Assimilation Experiment (GODAE) pilot

project, and with its Argo initiative which was on target to achieve global coverage of about 3000 profiling floats by 2004-2005.

The OOPC had initiated a number of working groups and activities which were making good progress, including a sea-surface temperature (SST) working group (in cooperation with AOPC) to intercompare and provide improved knowledge on the quality and reliability of global SST products; a sea-level working group (in collaboration with GLOSS and UOP); collaboration with the WCRP/Commission for Atmospheric Sciences Working Group on Numerical Experimentation (WGNE) on a project to develop a suite of reference surface flux data sets for testing Numerical Weather Prediction (NWP) surface flux products (the 'SURFA' project); a review of the upper ocean thermal network; participation in a planned workshop (11-13 November in Perth, Australia) focused on an ocean observing system for the Indian Ocean; increasing attention to observations in the ice-covered ocean, as well as wind-wave observations; and data and information management issues. OOPC had also cooperated in activities under the IGOS Partnership, notably the Ocean Theme report to which GOSSP had also contributed. It supported the development of a Global Carbon Observation Theme under IGOS and had been attempting to assist where appropriate in this process, noting that leadership in the planning and implementation of an integrated observational approach to this issue should be taken by GCOS in association with IGBP, GTOS, WCRP and GOOS.

Dr Summerhayes highlighted the priority issues for the GCOS agenda, in the view of the OOPC, as:

- Harnessing the power of the UNFCCC to get nations involved in the gathering and utilisation of observing system data;
- Focusing on regional development of GCOS, particularly in relation to climate change issues and El Niño forecasting;
- Fostering cross-disciplinary links in climate issues (e.g. the carbon cycle); and
- Serving as an umbrella for common issues and joint activities such as remote sensing and joint science panel projects (e.g. SST working group).

Finally, Dr Summerhayes noted that the Terms of Reference (ToR) for OOPC had been established in 1995 and had served the Panel well, but that it now had responsibilities that went far beyond those which were originally intended. The Panel had considered some minor changes to the ToR but suggested that more significant modifications should be made. It also felt that the membership should be reviewed.

The SC welcomed the report of the OOPC and congratulated the Panel on the substantial progress it had achieved. Following discussion of the various issues involved, it approved the decisions below:

## **DECISIONS**

- 22. The SC congratulated the OOPC for its contributions to the considerable progress made in implementation of the ocean observing system for climate. It noted in particular the progress made in the GODAE pilot project and its Argo initiative; the review of various components of the system leading, for example, to the revision of the SOOP plan; and the establishment of JCOMM as the formal implementation body for the ocean observing system. The SC also congratulated the OOPC, together with the WCRP/CLIVAR Upper Ocean Panel (UOP), for organizing the highly-successful Conference for the Ocean Observing System for Climate (OceanObs 99, Saint**

Raphaël, France, October 1999) and looked forward to publication of the final proceedings.

23. The SC encouraged the OOPC to continue to work closely with JCOMM to ensure the satisfactory integration of the various elements of the ocean observing system for climate.
24. The SC endorsed the concept of a review of the El Niño/Southern Oscillation (ENSO) Observing System by the OOPC and the CLIVAR UOP with a view to improving its efficiency and strengthening its potential for long-term continuity. It also endorsed the current emphasis being placed on the development of an ocean observing system for the Indian Ocean.
25. The SC noted with appreciation the agreement of POGO to provide support and leadership for the implementation of an array of fixed-point time series ocean measurement stations. It encouraged POGO to ensure that data from such stations, and from similar networks under the auspices of POGO, be made available for free and open exchange in real time.
26. The SC requested that the GCOS and GOOS Secretariats, in consultation with the OOPC, develop a joint paper for GCOS SC-X defining precisely which components of the GOOS Initial Observing System constituted a part of GCOS, and hence which would be described as 'GCOS Networks'.
27. The SC requested that the OOPC, in collaboration with the GOOS and GCOS Secretariats, agree on a set of performance metrics for ocean measurements for climate which could be used to grade the performance of the networks for purposes of, *inter alia*, providing reliable information to COP and SBSTA.
28. The SC recognized that the current responsibilities of the OOPC go well beyond those which were originally defined for the Panel (in effect now including all ocean physics, sea-ice and ocean carbon). Additional responsibilities have also been added as a result of the dissolution or modification of the cross-cutting panels, JDIMP and GOSSP. The SC thus agreed that the OOPC Terms of Reference should be reviewed and updated and requested the Panel to bring forward revised Terms of Reference for approval at the next session of the SC or sooner.

### 5.3 Terrestrial Observation Panel for Climate (TOPC)

Dr Josef Cihlar, Chairman of the TOPC, presented the meeting with a summary of TOPC activities since the previous session of the SC, including the results of the Fifth Session of the TOPC held in Birmingham, UK from 27-30 July 1999. He grouped the activities under four main headings, as follows:

- (i) Development of global observation concepts (TCO, GCO): Following an invitation by GTOS to spearhead the development of a terrestrial carbon observation initiative, the TOPC had produced and widely circulated a prospectus setting out the rationale and possible approach to global terrestrial carbon observations (TCO). This led to a proposal for a TCO initiative to the IGOS Partnership at their meeting in November, 1999. IGOS-P approved the development of a TCO theme under GTOS leadership, and also requested that a proposal for a global carbon theme be developed. The TOPC subsequently organised a synthesis workshop<sup>6</sup> under GTOS and IGBP sponsorship in February 2000, and presented the results at the EC(European

---

<sup>6</sup> Synthesis Workshop on Global Terrestrial Carbon Observation: Requirements, Present Status and Next Steps. 8-11 February 2000, Ottawa Canada.

Community)-IGBP-GTOS meeting<sup>7</sup> in Portugal in May. Following this meeting and the IGOS-P meeting in June 2000, it had been decided to add an ocean component to the terrestrial and atmospheric parts. This had led to a joint effort among IGBP, GTOS, TOPC, WCRP and others for a Global Carbon Observation (GCO) Theme under the IGOS framework, for which a report should be available by mid-2001.

(ii) Status of *in situ* networks: The Global Terrestrial Network for Glaciers (GTN-G) was well-established, with a number of projects underway involving glacier inventories and mass-balance monitoring. Several publications had recently been completed, including a contribution to the IPCC Third Assessment Report. Funding was a problem for much of the work, including ensuring access to the database maintained by the World Glacier Monitoring Service (<http://www.geo.unizh.ch/wgms>), and various strategies were being followed to address this problem. The permafrost network (GTN-P) had been formally established through the recent invitations-to-join which had been distributed by the GCOS Secretariat, and responses were now beginning to arrive. A meeting<sup>8</sup> had been hosted by the Deutscher Wetterdienst in Geisenheim, Germany to pursue the development of a hydrological network for climate (GTN-H), in response to the request from SC-VIII to pursue such an initiative. That meeting agreed to propose the establishment of a GTN-H as well as a Hydrological Observation Panel for Climate (HOPC) which would oversee the development of global observing capabilities, much as TOPC did now for GTN-G and GTN-P. The meeting had recognized the complexity of organizational arrangements in the hydrology domain and had identified the major agencies that would need to be involved in the establishment of these entities. Specific recommendations had been made regarding an implementation process, including the need to take advantage of near-term opportunities to make progress in this area. Development of the global ecological network (GTN-E) was being supported within GTOS by revision of the Terrestrial Ecosystems Monitoring Sites (TEMS) database.

(iii) Demonstration projects: The Global Land Ice Measurements from Space (GLIMS) project aims to employ satellite and supporting ground observations to greatly expand coverage of land-ice observations. It had been endorsed by SC-VIII as an important element of the evolving GTN-G network. The recent successful launch of ASTER on the EOS Terra satellite had paved the way for world-wide glacier mapping using satellite imagery in combination with digital terrain information, and for establishing an important baseline for repeated compilation of statistical information on the distribution and topographic characteristics of glaciers and ice caps. A number of planning and preparation activities had been undertaken by GLIMS, both in terms of readiness for satellite data use and in regional collaborative arrangements (see <http://www.flag.wr.usgs.gov/GLIMS>). Regarding the Global Observation of Forest Cover (GOFC) project, a separate panel had been established under GTOS to continue the initial development activities to which TOPC had contributed. Detailed implementation plans were now being developed in three areas (see <http://www.gofc.org>): land cover characteristics, biomass burning, and forest processes. The Net Primary Productivity (NPP) project, built around the combined use of EOS Terra satellite data and GTN-E *in situ* data, was awaiting the availability of the satellite data in order for full implementation to begin.

(iv) Plans and priorities: Dr Cihlar outlined the following priority activities for TOPC in the near future:

- Complete the development, and pursue the implementation, of global carbon cycle observation capabilities;
- Actively pursue the implementation of a GTN-H and HOPC;

---

<sup>7</sup> EC-IGBP-GTOS Terrestrial Carbon Meeting, 22-26 May 2000, Costa da Caparica, Portugal.

<sup>8</sup> Expert Meeting on the Establishment of a Global Hydrological Network for Climate, 26-30 June 2000, Geisenheim, Germany.

- Strengthen and enhance the existing terrestrial networks (GTN-G, GTN-P, GTN-E); and
- Support the development of a Global Water Cycle Theme under the IGOS framework, under the leadership of the WCRP, as had been endorsed by the preceding (June 2000) meeting of the IGOS Partners.

The SC was pleased to note the progress in the activities described by Dr Cihlar and thanked the TOPC for their efforts. During discussion on the GTN-G, it was pointed out that there were some omissions in the network participants (e.g. some countries with tropical glaciers were not represented) and the Secretariat was requested to work with TOPC to rectify such gaps. Regarding the GTN-H and related hydrology and water cycle issues, it was emphasized that the WCRP, and in particular the Global Energy and Water Cycle Experiment (GEWEX) programme, had many activities underway which were focused directly on these issues, and it was essential that full interaction with these programmes be established and maintained in the future. Following discussions on these and other issues that had been raised by Dr Cihlar, the SC approved the following:

## **DECISIONS**

- 29. The SC expressed its appreciation to the TOPC for the progress achieved in implementation of the GTOS terrestrial networks. It noted in particular the progress made in preparing plans for global observation of terrestrial carbon (TCO) under the IGOS Partnership 'themes' activity. It reiterated the importance of carbon observations as a high priority for GCOS implementation and requested the Secretariat to promote acceptance of the TCO report by the IGOS Partnership and to pursue, in partnership with GTOS, IGBP and other agencies, the implementation of the report's recommendations.**
- 30. The SC noted with appreciation the progress in development of the Global Terrestrial Network for Glaciers (GTN-G), including the support of the World Glacier Monitoring Service at the ETH-Zurich for this initiative. It also noted that the current participants did not necessarily include all nations which might be appropriate, in particular all those countries having tropical glaciers. The SC therefore requested the Secretariat and the TOPC to review the list of participants and arrange for the sending of additional invitations to participate as appropriate. It also recommended that the Secretariat, working with GTN-G and TOPC, seek ways to find additional financial support for the network, and encouraged network participants to acknowledge the interaction between GCOS and GTN-G at all appropriate opportunities.**
- 31. The SC noted with satisfaction the progress in the Global Land-Ice Measurements from Space (GLIMS) project and confirmed its importance to the comprehensive global observation of glaciers being undertaken through the GTN-G. It requested the TOPC to collaborate with GTN-G and GLIMS to ensure that results and techniques from GLIMS are effectively used in GTN-G. The SC also requested that the GCOS Secretariat seek ways to ensure the future continuity of space-based observations needed for this purpose.**
- 32. The SC reaffirmed the need for a global hydrological observation network for climate. It thanked the Deutscher Wetterdienst (DWD) and the Forschungsanstalt Geisenheim for hosting the recent workshop on this topic in Geisenheim, Germany (26-30 June 2000), as well as the efforts of the WMO Hydrology and Water Resources Department (HWR), GTOS and TOPC in organizing that meeting. The SC noted with approval the recommendations of the workshop and requested the GCOS Secretariat to bring them to the attention of the many potential partners who would need to be involved in the implementation of the workshop recommendations.**

33. The SC recognized the critical importance of observations of the global water cycle to understanding the climate system. It requested the GCOS Secretariat and science panels to support the WCRP and other partner agencies and programmes in developing a global water cycle theme for possible adoption by the IGOS Partnership.
34. The SC requested that the TOPC, in collaboration with the GTOS and GCOS Secretariats, agree on a set of performance metrics for terrestrial measurements for climate which could be used to grade the performance of the networks for purposes of, *inter alia*, providing reliable information to COP and SBSTA.
35. The SC requested the TOPC to review its Terms of Reference in light of the additional responsibilities assigned to it as a result of the dissolution or modification of the cross-cutting panels, JDIMP and GOSSP, as well as recent developments in GCOS and its implementation strategy. It requested that revised Terms of Reference be presented to the SC for approval at its next session or sooner.

#### 5.4 Global Observing Systems Space Panel (GOSSP)

Dr Teunissen briefly reviewed the main activities of GOSSP since the last session of the SC on behalf of the Chairman, Prof. Francis Bretherton. He noted that Prof. Bretherton had recently submitted his resignation of the Chairmanship due to changing circumstances, including his pending retirement from the University of Madison. GOSSP activities included a joint meeting with the IGOS-Partnership Ocean Theme Team, held on 5-6 August 1999 in Pasadena, CA, USA. The main objective of that meeting was to advance the development of the Ocean Theme Team report to the IGOS Partners. GOSSP members contributed their expertise, and the viewpoint of the global observing systems, to this process of assessing the needs for, and future availability of, space-based and *in situ* observations for the broad range of ocean applications. The draft report was presented to subsequent meetings of the IGOS Partners, CEOS and the CEOS Strategic Implementation Team (SIT), with a final version due to be discussed at the IGOS and CEOS Plenary meetings in November 2000.

A brief session of GOSSP had been held during the period of the joint meeting to discuss the role of GOSSP in the current activity and in future potential IGOS theme initiatives. The GOSSP role in the ocean theme was clear (participation in this meeting, needs-and-capabilities analysis activities carried out by the Chairman, review of the eventual report), but it was noted that much of this activity had placed a very large load on the Chairman and it was not apparent that such involvement would be feasible for other potential themes, certainly not if they were to be implemented simultaneously. A mechanism for distributing the overall responsibilities more widely among GOSSP members and experts was needed. Members had agreed to consider possible modifications to the GOSSP Terms of Reference and *modus operandi* prior to the next full session of the Panel.

Essentially all other activities of GOSSP had been carried out by the Chairman, who had participated in a very large number of meetings on behalf of the Panel over the previous eighteen months. Most of this activity focused on the needs-definition and gap-analysis activities for various theme or application areas under the auspices of IGOS and CEOS, bringing the views of the global observing systems and the cross-cutting perspective of GOSSP to the generally domain-based activities of the current themes.

The issue of modifications to the structure and operation of GOSSP was of course an item to be discussed at this SC session (see Section 7.3), and discussion of GOSSP was deferred to that item.

## 5.5 Joint Data and Information Management Panel (JDIMP)

No formal meetings of JDIMP had occurred since the last session of the SC, although one publication had been completed, that being the GCOS/GOOS/GTOS Joint Data and Information Management Plan (GCOS-60, May 2000). The future of JDIMP was an item to be addressed at this meeting and is discussed in Section 7.2.

## 5.6 National GCOS Programmes

It was agreed during the session that the review of national programmes for GCOS in various countries would be done in the form of written reports in an effort to make most efficient use of the time available. Reports were received from Australia, Canada, China, Germany, Japan, Russia, the UK, and the USA and are presented in Annex X.

## 6. **GCOS IMPLEMENTATION STRATEGY**

Dr Dawson introduced the draft GCOS Implementation Strategy for consideration and discussion by the session. This strategy had been drafted by the SC Chairman and the GCOS Secretariat with input from the Chairmen of the science panels, as well as comments from several members of the SC and representatives of various user constituencies and other partners of GCOS. It had been developed in light of the many changes that had occurred since the establishment of GCOS, and in response to the request of the Eighth Session of the SC and other relevant meetings (e.g. the Toronto meeting on Intergovernmental Mechanisms, Section 4.2) for an updated strategy showing how GCOS and its partners would meet the goals and expectations of GCOS.

The SC members generally agreed with the strategic approach presented in the draft document, while offering a number of comments and suggestions for modifications in a revised version<sup>9</sup>. Several members felt that the urgency of the requirements for implementing GCOS should be emphasized, and others suggested that longer-term priorities for GCOS should be given more attention. Following lengthy discussion of the document and its overall objectives and content, the SC agreed on the following decision:

### **DECISION**

**36. The SC accepted in principle the strategic approach contained in the GCOS Implementation Strategy but requested that several additions be made to the current draft. In particular, the SC requested that the GCOS Secretariat stress the urgency of implementing GCOS and add a new section that outlines the longer-range actions and priorities for implementation. It also requested that more emphasis be placed on the outreach and communication aspects of the document, to enhance its usefulness as a marketing tool for the GCOS programme.**

## 7. **FUTURE OF CROSS-CUTTING PANELS AND RELATED ISSUES**

### 7.1 Global Observing Systems Information Center (GOSIC)

Prof. Ferris Webster, Director of the Global Observing Systems Information Center (GOSIC) at the University of Delaware, USA, presented the SC with an overview and current status of GOSIC. GOSIC is a central entry point for users of the G3OS data and information systems. It provides basic user services including a description of the systems and their data as well as a search capability which facilitates access to a worldwide set of observations and

---

<sup>9</sup> A revised version (Draft #2) of the GCOS Implementation Strategy, produced in response to discussions at this meeting, is presented as Annex XI to this report.

derived products. GOSIC is a pilot activity currently in its third year of development, with support from the US National Oceanic and Atmospheric Administration and the US National Aeronautics and Space Administration. Prof. Webster provided a demonstration of some of the capabilities of GOSIC using material that is accessible through its Web site (<http://www.gos.udel.edu>), which is the main point of entry and where all details of GOSIC can be found.

Prof. Webster pointed out that although a university environment is a good one for trying out new ideas, GOSIC must ultimately evolve from a developmental experiment into a rigorous, fully operational activity in support of an international system. This is normally beyond the scope of a university environment, and it was therefore planned to transition GOSIC to an operational entity which could take on this responsibility. He felt a further period of about five years would be needed before such a transfer could be completed. In the interim, funding was being sought for an additional three-year period of development (2001-2003). During a follow-on two-year period, the plan was to work with an agency or institution that would eventually take over the GOSIC operation. Prof. Webster outlined the steps that would be required during this two-year transitional period, noting the need for detailed plans and close cooperation with the many existing national and international organizations dealing with global data collection, analysis and exchange.

Development of GOSIC had to date been overseen on behalf of the global observing systems by JDIMP. The issue for the SC to consider was how this needed oversight should be provided in future, in view of current discussions on the future of JDIMP and its potential dissolution. The GOOS SC had already considered options for such oversight, several of which could be satisfactory, in Prof. Webster's opinion.

The SC agreed that GOSIC provided a valuable and necessary service and expressed its thanks to Prof. Webster and his team for their efforts on behalf of the global observing systems, deferring additional discussion to the issue of the future of JDIMP (see Section 7.2 below).

## **DECISION**

**37. The SC noted the considerable effort that had been expended in establishing the Global Observing Systems Information Center (GOSIC) and the significant progress made, and expressed its thanks to Prof. Webster and his team for leading this effort in support of the global observing systems.**

### **7.2 Data and Information Management (JDIMP)**

Dr Dawson introduced the issue of the status of JDIMP and its potential future. JDIMP had not met since mid-1998, and the Chairman had reluctantly resigned since that time due to the demands of other issues. The GCOS/GOOS/GTOS Joint Data and Information Management Plan prepared by JDIMP had been completed and published in May 2000 (GCOS-60). The question now was whether the functions required of a JDIMP should be carried out by a continuing panel with the same structure, or if there was a more appropriate way in which these could be discharged. This question had been put to the GOOS SC in April 2000 through a discussion paper which had outlined several options for meeting the needs of the global observing systems in the area of data and information management (DIM), including oversight of GOSIC. Those options and the recommendations of the GOOS SC had been presented to GCOS SC members through the documentation for this meeting. Essentially, the GOOS SC had recommended a two-part strategy:

(a) To replace JDIMP by a small DIM expert group for each of the three observing systems, with infrequent coordination meetings between them and frequent contacts (not necessarily

meetings) between them and GOSIC. This would allow each of the observing systems to deal with a highly-distributed structure with many 'owners'; and

(b) To establish a very small steering committee for GOSIC, recognizing that the interface between data providers and GOSIC would be better at each of the project offices or in a data centre, rather than in a centralized committee.

The SC noted the recommendations of the GOOS SC regarding JDIMP and GOSIC and was in general agreement with them. It was clear that GOSIC required the oversight it was seeking and that a small, appropriately-selected group to perform this task should be adequate. From the point of view of GCOS, the SC noted that GOSIC is concerned with all environmental data of interest to the global observing systems, not only that for climate applications. They also noted that the current structure of GOSIC associated data sets with the individual observing systems (GCOS, GOOS, GTOS) rather than the domain from which the data were obtained (atmosphere, ocean, terrestrial), and strongly recommended that this be reversed. It was also observed that the non-climate components of atmospheric observations seemed not to be adequately represented in the current structure, and that this should be rectified. Following further discussion, the SC approved the following :

## **DECISIONS**

- 38. The SC agreed that most of the functions originally defined for the JDIMP were now being, or could be, carried out through alternative mechanisms. In particular, it agreed that most DIM activities for the three observing systems could be handled by a small expert group for each system, as had been agreed by the GOOS SC, and recommended that at least one expert from each of these three groups should be a member of the relevant GCOS science panel. The SC therefore agreed to the dissolution of the JDIMP in its current form and expressed its thanks to the former panel members and Chairmen for their valuable contributions and services.**
- 39. The SC endorsed the concept of a small 'GOSIC Advisory Committee' to provide guidance and oversight for GOSIC. This committee would consist of six members, two representing each of the atmospheric, oceanic and terrestrial domains. One of each of the two domain advisors would represent the interests of the climate observing systems and be selected from, respectively, the AOPC, OOPC and TOPC. The other would represent the non-climate observation interests in each domain. Establishment of this committee and development of its Terms of Reference would be led by GOOS, to whom the SC agreed to provide names of potential participants representing the atmospheric domain.**
- 40. The SC agreed to invite the WMO to identify a DIM expert to serve on the GOSIC Advisory Committee.**

### **7.3 Space/Satellite Observations (GOSSP)**

Dr Teunissen introduced the issue of the future of GOSSP, recalling the discussion at the August 1999 session of GOSSP (Section 5.4) and referring to the discussion document that had been prepared for this meeting. He briefly reviewed the history of the Panel from its origins in 1993 as the *ad hoc* GCOS Space-based Observations Task Group, through the GCOS Space-based Observation Panel to the current GOSSP. The Terms of Reference for the Panel had not varied all that widely during this period, although the manner in which it had carried out its mission had indeed evolved. The fact that there was currently a perception that GOSSP was not functioning effectively or efficiently, and the excessive load placed on the Chairman in its current *modus operandi*, had stimulated the need for a review of its status. Such a review was all the more timely in view of the recent resignation of the current Chairman.

From the GCOS perspective, the GOSSP-type functions needing to be fulfilled were:

- 1) Performing needs-and-capability assessments for GCOS application areas: climate monitoring, climate change detection and attribution (CCD/A), seasonal-to-interannual climate prediction (SIP), and impacts assessment. This involved ensuring that GCOS (and by extension the climate components of GOOS and GTOS) needs for space-based observations are appropriately defined by the science panels; that the space-based observations purported to be available or planned are appropriately represented by the space agencies from the users' perspective; comparing the requirements with the observations which will be available to identify gaps and overlaps; and presenting the results of the above to the space agencies with a view to their taking the actions needed to eliminate any such gaps and overlaps;
- 2) Maintaining close liaison with the space agencies, especially through CEOS;
- 3) Representing GCOS interests in the IGOS Theme process, to ensure that any Theme Team recommendations and potential responses to them have taken full account of the needs of GCOS which might be affected by such actions; and
- 4) Providing a cross-cutting (i.e. across all domains) perspective and advice to the G3OS Steering Committees with respect to space-based observations, which might be overlooked by the individual domain-based science panels.

Dr Teunissen pointed out that there are currently other groups carrying out at least some of these functions for applications of interest to them, notably the WMO/CBS OPAG (Open Programme Area Group) for the Integrated Observing System (IOS) Expert Team on Observational Data Requirements and Redesign of the Global Observing System (known by the acronym 'ET-RR'), and the IGOS Theme Teams. The ET-RR was currently investigating the SIP application, and had tentatively agreed to add the other climate applications to its agenda. Under the IGOS framework, only one theme (Oceans) had been addressed to date, but another had been accepted (Global Carbon Cycle) and three others had been proposed for future consideration (Global Water Cycle, Coastal Zones and Coral Reefs, and Atmospheric Chemistry). For any accepted theme, a Theme Team would be established which would perform functions 1) above. It was possible that a Climate Change or Climate Monitoring Theme could be proposed to represent GCOS application areas. It was also possible that the CCI/Clivar Working Group on Climate Change Detection might have a role to play here. This group was established in 1997 and had among its Terms of Reference "To assess, in collaboration with GCOS and other groups, the capabilities of surface and upper-air networks and other climate monitoring systems to provide adequate data for studies on climate change detection and, as required, develop proposals for new networks." Dr Teunissen noted that these groups addressed both space-based and *in situ* observations in an integrated sense, rather than focusing only on space-based observations as was the case for GOSSP.

The issue of the future of GOSSP had been considered by the recent third session of the GOOS SC, where the former GOSSP Chairman had led the discussion. That meeting had decided not to recommend any changes to the current structure and mandate, while acknowledging that further thought needed to be given to the issue of needs-and-capability assessments for climate issues and the role to be played by WMO/CBS. The issue had also been raised for discussion at the June, 2000 meeting of the 'G3OS Sponsors' group, at which both GOOS and GTOS were represented. It was suggested at that meeting that GOSSP be restructured as an *ad hoc* group, meeting as and when required to address specific issues. Two members would be named by each of GCOS, GOOS and GTOS (as was the case now), with the intention that one of each of those pairs of members would represent climate issues and, for GOOS and GTOS, the other could represent the non-climate issues of concern. The climate-

oriented members from each observing system would also be members of the relevant GCOS science panel and would be charged with representing the space perspective there. An additional member could be named as Chair to ensure that the cross-cutting perspective be included, and could also be responsible for ensuring that the SC received appropriate advice in this regard.

During discussion of this issue, it was agreed that GOSSP had served a valuable role, but that its current functioning was perhaps not ideal. It was also agreed that the integration of space-based and *in situ* observations in performing needs-and-capability assessments was the appropriate approach to be following. Such integration, as well as increased liaison with the needs-definition component of this work, could be aided by ensuring that members of a future GOSSP-type panel also sit on the various domain-based panels. Some members suggested that GCOS partners, especially CEOS and IGOS, be consulted before taking any final decisions on modifications to GOSSP. After discussion of various options, the session agreed on the following:

## **DECISION**

**41. The SC noted the report on the activities of the GOSSP since SC-VIII and the options presented for possible alternative ways of carrying out the responsibilities of this Panel in the future. It suggested that these responsibilities could be better served by adoption of the following:**

- **Membership of each of the three GCOS science panels should include at least two experts on space-based observations in the relevant domain;**
- **The science panels should be fully responsible for identification of the requirements for space-based observations in their domains;**
- **The identified requirements should be incorporated as appropriate in relevant IGOS theme activities (through participation of appropriate members on the IGOS Theme Teams), and/or the WMO/CBS OPAG ET-RR (through membership on that ET) for incorporation into the WMO Statements of Guidance for the satellite operators; and**
- **The Chairman of the GCOS SC may convene the appropriate experts of each panel, as necessary, to provide cross-domain advice and perspectives on space-based observations to the SC and to prepare an integrated GCOS perspective on space-based observation matters for use in various fora.**

**The SC requested that this proposed process be discussed with the other sponsors of GOSSP, and with its space-agency and other partners in the IGOS Partnership, to obtain their views prior to final adoption of this or an alternative structure.**

**42. The SC expressed its thanks to the members and Chairman of GOSSP for their valuable contributions and services to the global observing systems.**

### **7.4 GCOS Network Acceptance Process**

Dr Thomas introduced the issue of the designation of specific observing systems or networks as 'GCOS Networks', in the sense that they would be formally identified by both GCOS and the network operator as a component of GCOS. Since the establishment of GCOS in 1992, a number of different lists of 'GCOS Networks' had been presented in documentation describing GCOS and/or the GCOS Initial Operational System (IOS). There appeared to be no

formal record of the manner in which many of these networks had come to be designated or approved as GCOS Networks, either by GCOS itself or by the network operator. Based on the various lists in use, a tentative up-to-date list of 'GCOS Networks' had been established by the Secretariat and had been used by Dr Thomas in his Director's Report to the SC (Section 3). Even for this list, there was evidence of formal agreement regarding their status as GCOS Networks for only a few of these, including GSN and GUAN; the remaining networks seemed to have been added through informal consensus.

It was generally agreed that it would be beneficial to have a more rigorous process for designating a network as a GCOS Network. For example, this could be used to ensure that only those networks meeting standards defined by the GCOS domain panels were included. It would also give a clearer picture of what components were actually included in GCOS and help to clarify what components were still missing. It was also noted that this issue applied not only to observing networks or components thereof, but also to the GCOS Monitoring Centres, to potential data analysis centres and to similar entities. Dr Thomas proposed a procedure along the following lines:

- 1) The domain panels would identify a network (or other entity) or component thereof that would contribute to meeting the needs of GCOS. This network might already exist, or might need to be created. Standards for its operation would be set by the appropriate science panel. Panel representatives would discuss informally with the network operator the feasibility and desirability of having the network designated as a GCOS Network;
- 2) Following informal agreement between the panel and the network, the panel would make a proposal to the GCOS SC for inclusion of the network in GCOS. Acceptance by the SC would serve as the official basis (from the GCOS side) of the designation; and
- 3) The GCOS SC would then formally invite the network to become part of GCOS. Positive response to such an invitation would finalize the approval process.

It was agreed during discussion that it would be undesirable to exclude networks that had been traditionally considered as GCOS Networks only because there had been no formal process to date to designate them as such. The SC therefore approved the following:

## **DECISION**

**43. The SC agreed that formalization of a process for designating a network, centre, database or other entity as a 'GCOS' entity should be pursued, using an approach of the type discussed. It requested that the Secretariat work with the science panels to develop appropriate criteria for such designation and prepare a revised proposal for consideration and approval by the SC as soon as feasible. In the interim, it agreed that entities that have traditionally been identified as GCOS entities should retain that designation.**

## **8. RELATIONSHIPS WITH OTHER PROGRAMMES**

Dr Dawson introduced the broad issue of the status of GCOS relationships with its many partners, including: the major domain-based observing systems (WMO/WWW, GOOS and GTOS); its sponsors (WMO, UNEP, ICSU and IOC); the international climate research and assessment programmes (WCRP, IGBP and IPCC); the UNFCCC (including SBSTA and the Subsidiary Body for Implementation, SBI); the IGOS Partnership; and CEOS. He was pleased to note that from his perspective, the GCOS relationship and interaction with nearly all of these partners was very good. Nevertheless, some improvement was always possible and in some cases necessary.

It was noted in particular that the GCOS relationship with UNEP, both as a sponsor and as a partner in implementation, was somewhat sporadic. Although interaction had increased recently as a result of cooperative efforts in supporting the Pacific Islands Regional Workshop, it was agreed that a strengthening of the connections between GCOS and UNEP was desirable. Efforts to enhance cooperation with IGBP had also been initiated, for example by inviting IGBP to become a co-sponsor of TOPC, although this arrangement had not yet been completed. Increased interaction in this area was anticipated through the activities underway to develop a Global Carbon Observation theme under the IGOS framework. This should also lead to enhanced cooperation with GTOS. Finally, it was noted by some members that although GCOS interacts with CEOS both as an Associate Member of CEOS and as a partner in IGOS, a strengthening of this interaction, and perhaps an increase in its visibility, would be appropriate and beneficial for both GCOS and CEOS.

It was also noted during these discussions that the term 'G3OS' had in the past been misleading, in that it had tended to imply that GCOS represented the atmospheric counterpart to GOOS (for ocean observations) and GTOS (for terrestrial observations). This confusion had also been raised by participants at the Toronto meeting on intergovernmental mechanisms for GCOS (see Section 4.2 above). GCOS was of course not restricted to the atmosphere but represented a cross-cutting framework for climate observations across all domains, and it was agreed that this should be made clear to the so-called 'G3OS Sponsors' and to all other parties at every opportunity in the future.

## **DECISIONS**

- 44. The SC agreed that there was a particular need to strengthen the interaction between GCOS and UNEP. It requested that the SC Chairman formally participate in appropriate sessions of the UNEP executive bodies, as authorized by the terms of the GCOS Memorandum of Understanding.**
- 45. The SC requested that GCOS enhance its participation and visibility in the CEOS arena, for example by increasing direct contacts between the SC Chairman and the CEOS Chairman and increasing interaction between the GCOS and CEOS Secretariats.**
- 46. The SC felt strongly that the terminology 'G3OS' is misleading in that, *inter alia*, it implies that GCOS speaks for the full range of atmospheric observing systems. It recommended that this difficulty be brought to the attention of the GCOS, GTOS and GOOS sponsors at their next meeting for consideration of potential alternatives. The SC further recommended that the Global Observing System (GOS) of the WMO World Weather Watch be formally invited to participate in the semi-annual meetings of the sponsors of the global observing systems as the representative of the broad atmospheric observation systems.**

## **9. ACTIONS TO BE UNDERTAKEN BY THE GCOS SECRETARIAT**

### **9.1 GCOS Resources (Secretariat)**

Dr Thomas presented the session with an overview of the current and expected state of available resources for the functioning of the GCOS Secretariat. There were only two full-time dedicated positions in the Secretariat (Director and Administrative Assistant), both of which were fully supported by WMO. The annual contributions of the sponsors totalled roughly \$200,000 US per year, with some 70% of this being provided by the WMO. Special contributions from individual countries in the last two years had averaged approximately \$150-200,000 US per year, generally tied to specific activities such as regional workshops. This total was barely adequate to cover the costs of basic operation of the Secretariat (support for panel meetings,

travel, infrastructure costs, etc., about \$100,000), salaries for consultants and part-time staff (typically \$200,000) and the holding of a regional workshop (typical cost about \$100,000), and it was obviously critically dependent on the continuing support of individual special contributions. The most serious shortfall at present was in the area of implementation of the GSN and GUAN networks, as had been pointed out earlier (Sections 1.4, 5.1), where there simply were no resources to adequately support the activities which needed to be carried out at the Secretariat level. A number of other items (e.g. updating the GCOS plan; producing regular summaries of the GCOS networks and their status; etc.) were also essentially on hold due to the absence of the needed resources. In addition, it was clear that the organizing of future workshops could be done only if incremental resources were identified specifically for the purpose. Dr Thomas closed by reiterating the strategy that had been agreed by the Secretariat and the SC Chairman, namely that GCOS would continue to expend all available resources on pressing activities, without holdback of contingency funds for future activities, on the assumption that it was essential to deliver the maximum possible output from GCOS as a tangible demonstration of the benefits of ongoing and additional support for the programme.

The SC took note of the resource situation and acknowledged the tenuous nature of the basic level of support. It concurred with the strategy of maximizing the tangible outputs while continuing the effort to identify resources to sustain the programme on a longer-term basis. Some members emphasized the substantial costs of holding regional workshops and reiterated the need to associate them with other regional activities as a priority strategy to minimize costs. The SC also noted that the decisions to devolve the data management and space-based observation responsibilities from JDIMP and GOSSP to the science panels would have cost implications for those panels, and urged the Secretariat to make every effort to ensure that appropriate support was made available.

## 9.2 Priority Activities

Dr Dawson and Dr Thomas summarized their interpretation of the priority activities to be taken by the GCOS Secretariat in the immediate future, based on the discussions at this session and with reference to the Implementation Strategy as discussed in Section 6. The SC had identified a broad range of actions that should be undertaken to implement GCOS based upon this strategy; these would be incorporated into the next version of the strategy (see Annex XI). However, given the severe resource limitations facing GCOS, it was agreed to focus the activities of the GCOS Secretariat over the next inter-sessional period on the following:

- Complete the GCOS Implementation Strategy and develop an implementation timeline; seek interagency and national commitments to the strategy; develop a calendar of significant events;
- Provide oversight, advice on integration and cross-linkages, and generally facilitate the work of the three domain-based science panels so that they can continue to move forward with the development and implementation of specific components of GCOS;
- Continue to monitor developments in the international research programmes and satellite observing systems to identify opportunities for enhanced effectiveness;
- Articulate the requirements of GCOS and, as appropriate, those of its partners (WWW, GOOS, GTOS, etc.) at intergovernmental meetings, including the various WMO Technical Commissions, and at regional and international fora;
- Report to the governing bodies of the GCOS Sponsors on the implementation of GCOS and seek the support of their Members for implementation;

- Engage the Subsidiary Bodies of the UNFCCC/COP in building support for the implementation of global observing systems for climate on behalf of GCOS partners;
- Present the climate-related themes of the IGOS Partners in reports and statements to SBSTA and the UNFCCC;
- Build a network of national GCOS focal/contact points to facilitate communication, develop national reports, and encourage the correction of deficiencies in current systems;
- Develop, in collaboration with the UNFCCC Secretariat, a synthesis/analysis process for the national reports on systematic observations due in November 2000, and use the analysis as the basis for updating the GCOS "Adequacy Report" (GCOS-48) for presentation to COP-8;
- Complete the Pilot Project of the GCOS Regional Workshop Programme over the next year and develop a plan and proposal to GEF for the remaining regional (or sub-regional) workshops over the next 4 to 5 years. (This activity will build on current activities of the GCOS partners and current national and regional initiatives but will be conditional on obtaining additional resources.); and
- Assist in the development of proposals to address regional deficiencies and submit for funding to bilateral activities and international financial mechanisms, such as the GEF, as a follow-on to the Regional Workshop Pilot Project.

These specific actions for the Secretariat were also incorporated into the GCOS Implementation Strategy (as presented in Annex XI).

### 9.3 Review of Meeting Decisions

The GCOS Secretariat presented a draft list of decisions, recommendations and action items that had been tentatively agreed during the session. This list was reviewed and approved by the session following appropriate revisions and additions. The final versions appear throughout this report and have been presented in consolidated form in Annex XII.

## 10. OTHER BUSINESS

### 10.1 Steering Committee Membership

Dr Dawson reminded the session that four vacancies on the SC had recently been filled, with the formalities of finalizing their appointment nearing completion. That left three vacancies (of the total membership of sixteen) remaining to be filled at this time, with expertise in the areas of hydrology, oceanography and the cryosphere being particularly desirable. The Secretariat was in the process of consulting with the Sponsors, the other global observing systems and additional partners to identify suitable candidates for these positions. In view of the fact that there were no other substantive issues requiring an *in camera* session of the SC, it was agreed to postpone such a meeting until the next full SC session, with any issues that might arise in the interim being handled by electronic correspondence as was the normal process.

Dr Dawson also took this opportunity to inform the group that he would be stepping down as Chairman following this session. This was in line with the current expiry of his two-year appointment to the position and was to a large extent driven by the complexities of carrying out the demands of the position in his fully-retired capacity. He emphasized that he would continue to fulfil the role of Chairman for the coming six months or so, thereby allowing ample time for a new Chairperson to be found with minimal impact to the smooth functioning of the GCOS Programme and the SC. Dr Dawson expressed his pleasure at having had the opportunity to

serve as SC Chairman and was gratified by the support he had received and the substantial progress that had been achieved in implementing the programme during his tenure. At this time, Dr Christopher Readings also announced that he would be stepping down from the SC in view of his pending retirement. He was pleased to have been able to serve on the SC during the past six years and wished the programme every success in its continuing implementation. Participants at the session expressed their gratitude to both Dr Dawson and Dr Readings for their contributions to the programme.

#### 10.2 Next Meeting

It was agreed that the Tenth Session of the SC should be held in the early-2002 timeframe, this following the next two sessions of the UNFCCC COP and the many related activities that GCOS would be carrying out during the interim period. The location would be identified and transmitted to the members in due course.

### 11. **CLOSURE**

The Chairman thanked the members of the SC and the other participants in the session for their input and advice. He also expressed his sincere appreciation, and that of all participants, to the China Meteorological Administration for their kind hospitality in hosting the meeting. He formally adjourned the Ninth Session of the GCOS SC at 18:00 on Thursday 14 September 2000.

### **DECISION**

**47. The SC expressed its sincere appreciation to the China Meteorological Administration and Mr Wen Kegang and his staff for the excellent facilities and gracious hospitality provided for the session.**



## **ANNEXES**



## ANNEX I

### LIST OF PARTICIPANTS

#### Members of the GCOS Steering Committee

Dr Kirk DAWSON (**Chairman**)

RR No. 1, S84A C1  
OKANAGAN FALLS  
B.C. V0H 1R0  
Canada

Tel: +1 250 497 8621  
Fax: : +1 250 497 8621  
E-mail: kirkdawson@home.com

*Mr Koh Kee CHOW (unable to attend)*  
*Malaysian Meteorological Service*  
*Jalan Sultan,*  
*46667 PETALING JAYA*  
*Malaysia*

Tel: +603 765 9422/758 7422  
Fax: +603 755 0964  
E-mail: chow@kjc.gov.my

*Dr Philippe COURTIER (unable to attend)*  
*Météo-France*  
*1 Quai Branly*  
*F – 75340 PARIS Cedex 07*  
*France*

Tel: +33 1 4556 7006  
Fax: +33 1 4556 7005  
E-mail: philippe.courtier@meteo.fr

*Mr Barry GREER (unable to attend)*  
*Atmospheric Monitoring & Water Survey*  
*Meteorological Service of Canada*  
*Environment Canada*  
*4905 Dufferin St.*  
*DOWNSVIEW, Ontario*  
*Canada M3H 5T4*

Tel: +41 6 739 4965  
Fax: +41 6 739 4621  
E-mail: barry.greer@ec.gc.ca

Mr Yukio HARUYAMA  
Remote Sensing Technology Center of  
Japan (RESTEC)  
Roppongi First Bldg  
1-9-9 Roppongi, Minatoku-ku  
TOKYO, 106-0032  
Japan

Tel: +81 3 5561 8892  
Fax: +81 3 5561 9541  
E-mail: haruyama@restec.or.jp

Prof. Paul J. MASON  
Meteorological Office  
London Road  
BRACKNELL RG12 2SZ  
UK

Tel: +44 1344 854 604  
Fax: +44 1344 856 909  
E-mail: pmason@meto.gov.uk

Dr Valentin MELESHKO  
Voeikov Main Geophysical Observatory  
7, Karbyshev Str.  
194021 ST PETERSBURG  
Russian Federation

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

Mr S. MILDNER  
Technical Department  
Deutscher Wetterdienst  
Postfach 100465  
D – 63004 OFFENBACH  
Germany

Tel: +49 69 8062 2846  
Fax: +49 69 800 3829  
E-mail: stefan.mildner@dwd.de

*Mr Koikchi NAGASAKA (unable to attend)*  
*Planning Division*  
*Japan Meteorological Agency*  
*1-3-4 Otemachi, Chiyoda-ku*  
*TOKYO 100-81-22*  
*Japan*

Tel: +81 3 3211 4966  
Fax: +81 3 3211 2032  
E-mail: inad-jma@hq.kishou.go.jp

Prof. Yunqi NI  
Chinese Academy of Meteorological  
Sciences (CAMS)  
46, Baishiqiao Road, Haidian District  
BEIJING 100081  
P.R.China

Tel: +86 10 6840 6956  
Fax: +86 10 6217 5931  
E-mail: cams@public.bta.net.cn

Prof. Laban A. OGALLO  
Drought Monitoring Centre Nairobi  
P.O. Box 30259  
NAIROBI - Kenya

Tel: +254 2 567 864  
Fax: +254 2 567 888 or 567 889 or 577 373  
E-mail: logallo@lion.meteo.go.ke

Dr Christopher READINGS  
Earth Sciences Division  
Directorate of Application Programmes  
ESTEC  
Postbus 299  
2200 AG NOORDWIJK  
The Netherlands

Tel: +31 71 565 5673/5674  
Fax: +31 71 565 5675  
E-mail: creading@estec.esa.nl

*Dr David WILLIAMS (unable to attend)*  
*EUMETSAT*  
*Am Kavalleriesand 31*  
*D-64295 DARMSTADT*  
*Germany*

Tel.: +49 6151 807 603/633  
Fax: +49 6151 807 830  
E-mail: dwilliams.@eumetsat.de

*Mr Gregory WITHEE (unable to attend)*  
*NOAA/Satellite & Information Services*  
*1335 East-West Highway, SSMC1/8338*  
*SILVER SPRING, MD 20910*  
*USA*

Tel.: +1 301  
Fax: +1 301  
E-mail: greg.withee@noaa.gov

### Ex-officio Members of GCOS SC

*Dr Francis BRETHERTON (GOSSP)*  
*(unable to attend)*  
*University of Wisconsin-Madison*  
*Space Science & Engineering Center*  
*1225 West Dayton Str.*  
*MADISON, WI 53706*  
*USA*

Tel.: +1 608 262 7497  
Fax: +1 608 262 5974  
E-mail: francis@ssec.wisc.edu

*Dr Josef CIHLAR (TOPC)*  
*Canada Centre for Remote Sensing*  
*588 Booth Street*  
*OTTAWA, Ontario K1A 0Y7*  
*Canada*

Tel.: +1 613 947 1265  
Fax: +1 613 947 1383  
E-mail: josef.cihlar@ccrs.nrcan.gc.ca

*Dr Michael MANTON (AOPC; WCRP)*  
*Bureau of Meteorology Research Centre*  
*GPO Box 1289K*  
*MELBOURNE, Vic. 3001*  
*Australia*

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

*Dr Neville SMITH (OOPC) (unable to attend)*  
*Bureau of Meteorology Research Centre*  
*GPO Box 1289K*  
*MELBOURNE, Vic. 3001*  
*Australia*

Tel.: +61 3 9669 4434  
Fax: +61 3 9669 4660  
E-mail: n.smith@bom.gov.au

### Representatives of Sponsoring Organizations

#### **ICSU**

*Mr Larry KOHLER (unable to attend)*  
*International Council for Science*  
*51, Boulevard de Montmorency*  
*F-75016 PARIS*  
*France*

Tel.: +33 1 4525 0329  
Fax: +33 1 4288 9431  
E-mail: larry@icsu.org

#### **IOC (GOOS)**

*Dr Colin SUMMERHAYES*  
*GOOS Project Office*  
*Intergovernmental Oceanographic*  
*Commission (IOC) – UNESCO*  
*1, Rue Mollis*  
*F-75732 PARIS CEDEX 15*  
*France*

Tel: +33 1 4568 4042  
Fax: +33 1 4568 5813  
E-mail: c.summerhayes@unesco.org

#### **UNEP**

*Dr Arthur L. DAHL (unable to attend)*  
*Division of Environmental Information,*  
*Assessment & Early Warning*  
*UNEP GEC, 11-13 Ch. des Anémones*  
*1219 CHATELAINE/GENEVA*  
*Switzerland*

Tel.: +41 22 917 8207  
Fax: +41 22 797 3471  
E-mail: arthur.dahl@unep.ch

**WMO**

Dr Mike COUGHLAN  
World Meteorological Organization  
P.O. Box 2300  
1211 GENEVA 2  
Switzerland

Tel.: +41 22 730 8269  
Fax: +41 22 730 8042  
E-mail: coughlan\_m@gateway.wmo.ch

**Representatives from Other Organizations**

**GTOS**

*Mr Jeff TSCHIRLEY (unable to attend)*  
GTOS Secretariat  
c/o Food & Agriculture Organization (FAO)  
SDRN, Viale delle Terme di Carcalla  
I-ROME 00100  
Italy

Tel.: +39 6 5705 3450  
Fax: +39 6 5705 3369  
E-mail: jeff.tschirley@fao.org

**GOOS**

*Prof. Worth NOWLIN, Jr. (unable to attend)*  
Department of Oceanography  
Texas A&M University  
COLLEGE Station, TX 77843-3146  
USA

Tel.: +1 409 845 3900  
Fax: +1 409 847 8879  
E-mail: wnowlin@tamu.edu

**IGBP**

*Dr Will STEFFEN (unable to attend)*  
IGBP Sweden  
Royal Swedish Academy of Sciences  
Box 50005  
S-104 05 STOCKHOLM  
Sweden

Tel.: +46 8 166 448  
Fax: +46 8 166 405  
E-mail: will@igbp.kva.se

**NOAA/NESDIS**

Mr Howard J. DIAMOND  
US GCOS Program Manager  
Environmental Information Services Program  
Office, NOAA/NESDIS (E/EIS)  
1335 East-West Highway, Room 7222  
SILVER SPRING, MD 20910  
USA

Tel.: +1 301 713 1283  
Fax: +1 301 713 0819  
E-mail: howard.diamond@noaa.gov

Ms Linda MOODIE  
Senior Int'l Relations Specialist  
NOAA /NESDIS,  
1335 East-West Highway, Rm 7311  
SILVER SPRING, MD 20910  
USA

Tel: +1 301 713 2024  
Fax: + 1 301 713 2032  
E-mail: Linda.Moodie@noaa.gov

**UNFCCC**

*Mr Dennis TIRPAK (unable to attend)*  
UNFCCC Secretariat  
P.O. Box 260 124  
D-53153 BONN - Germany

Tel.: +49 228 815 1424  
Fax: +49 228 815 1999  
E-mail: dtirpak@unfccc.de

**WCRP**

*Dr David CARSON (unable to attend)*  
World Meteorological Organization  
P.O. Box 2300  
1211 GENEVA 2  
Switzerland

Tel.: +41 22 730 8247  
Fax: +41 22 734 0357  
E-mail: carson\_d@gateway.wmo.ch

**Other Attendees**

*Mr Johannes GUDDAL (unable to attend)*  
Co-chair JCOMM  
Det Norske Meteorologiske Institutt (DNMI)  
Vervarslinga paa Vestlandet, Allég. 70  
N-5007 BERGEN  
Norway

Tel.: + 47 5523 6600  
Fax: + 47 5523 6703  
E-mail: j.guddal@dnmi.no

Mr Naomasa MURAKOSHI  
NASDA  
World Trade Centre Building  
2-4-1 Hamamatsu-cho, Minato-ku  
TOKYO 105-8060  
Japan

Tel.: +81 3 3438 6032  
Fax: +81 3 5402 6512  
E-mail: murakoshi.naomasa@nasda.go.jp

Dr Nobuo SATO (*for Mr. Nagasaka*)  
Numerical Prediction Division  
Forecast Department  
Japan Meteorological Agency  
1-3-4 Otemachi, Chiyoda-ku  
TOKYO 100-8122  
Japan

Tel: +81 3 3211 8408  
Fax: +81 3 3211 8407  
E-mail: nsato@met.kishou.go.jp

Ing. Ciro L. ROCHA  
Hydrology and Water Resources Specialist  
Federal University of Santa Catarina  
Rua Rui Barbosa, No. 343-242  
88025-300 FLORIANOPOLIS – SC  
Brasil

Tel.: +55.48.3331.7708  
Fax: +55.48.228.2688  
E-mail: clrocha@intergate.com.br

Mr Volker VENT-SCHMIDT  
Head, German GCOS Office  
Deutscher Wetterdienst  
Department Climate & Environment  
Postfach 100465  
D-63004 OFFENBACH  
Germany

Tel.: +49 69 8062 2758  
Fax: +49 69 8062 3759  
E-mail: Volker.Vent-Schmidt@dwd.de

Prof. Ferris WEBSTER  
College of Marine Studies  
University of Delaware  
LEWES, DE 19958  
USA

Tel.: +1 302 645 4266  
Fax: +1 302 645 4007  
E-mail: ferris@udel.edu

**GCOS Secretariat**

Dr Alan R. THOMAS  
Director, GCOS Secretariat  
c/o World Meteorological Organization  
P.O. Box 2300  
1211 GENEVA 2  
Switzerland

Tel.: + 41 22 730 8275  
Fax: + 41 22 730 8052  
E-mail: [thomas\\_a@gateway.wmo.ch](mailto:thomas_a@gateway.wmo.ch)

Dr Hans TEUNISSEN  
GCOS Secretariat  
c/o World Meteorological Organization  
P.O. Box 2300  
1211 GENEVA 2  
Switzerland

Tel.: + 41 22 730 8086  
Fax: + 41 22 730 8052  
E-mail: [teunissen\\_h@gateway.wmo.ch](mailto:teunissen_h@gateway.wmo.ch)

## **ANNEX II**

# **AGENDA**

### **TUESDAY, 12 SEPTEMBER**

#### **08:30 Registration**

#### **09:00 – 12:30**

1. Opening of the Session
  - 1.1 Welcome and Introductions (CMA, Dawson)
  - 1.2 Approval of Agenda (Dawson)
  - 1.3 Conduct of the Meeting (Teunissen)
  - 1.4 Review of Report of SC-VIII and Matters Arising (Teunissen)
2. Report of the Chairman, GCOS Steering Committee (Dawson)
3. Report of the Director, GCOS Secretariat (Thomas)
4. UNFCCC and Related Issues (Dawson/Thomas)
  - 4.1 Outcome of COP-5 and GCOS Response
  - 4.2 Intergovernmental Mechanisms for GCOS (Toronto Meeting)
  - 4.3 Outcome of SBSTA-12
  - 4.4 COP-6 and beyond
  - 4.5 Regional Workshops

#### **12:30 – 14:00            **LUNCH****

#### **14:00 – 17:30**

5. GCOS Implementation Status
  - 5.1 Overview (Thomas)
  - 5.2 Report of the GCOS/WCRP Atmospheric Observation Panel for Climate (Manton/Vent-Schmidt)
  - 5.3 Report of the GCOS/GOOS Ocean Observations Panel for Climate (Smith/Summerhayes)
  - 5.4 Report of the GCOS/GTOS Terrestrial Observation Panel for Climate (Cihlar)

### **WEDNESDAY 13 SEPTEMBER**

#### **09:00 - 12:30**

5. GCOS Implementation Status (continued....)
  - 5.5 Report on the GCOS/GOOS/GTOS Global Observing Systems Space Panel (Teunissen)
  - 5.6 Report on the GCOS/GOOS/GTOS Global Observing Systems Joint Data and Information Management Panel (Thomas)
  - 5.7 Reports on National GCOS Programmes (Australia, Canada, China, Germany, UK, USA,.....)
6. Results from Other Meetings (Thomas et al.)
  - 6.1 WMO Executive Council (Thomas)
  - 6.2 IOC Executive Council (Thomas)
  - 6.3 G3OS Sponsors (Teunissen)
  - 6.4 IGOS Partners (Teunissen)
  - 6.5 Pacific Island Regional Implementation Workshop (Thomas)
  - 6.6 GCOS National Coordinators (Diamond)
  - 6.7 Global Hydrological Network (Cihlar)

12:30 - 14:00            **LUNCH**

14:00 - 17:30

7. GCOS Implementation Strategy
  - 7.1 Strategic Approach (Dawson/Thomas)
  - 7.2 Atmospheric Programme Priorities (Manton)
  - 7.3 Oceans Programme Priorities (Smith/Summerhayes)
  - 7.4 Terrestrial Programme Priorities (Cihlar)
  - 7.5 Relative Programme Priorities (Dawson/Thomas)

#### **THURSDAY 14 SEPTEMBER**

09:00 - 12:30

8. Future of Cross-Cutting Panels/Issues
  - 8.1 Global Observing Systems Information Centre (GOSIC) (Webster)
  - 8.2 Data and Information Management (Dawson)
  - 8.3 Space/Satellite Observations (Teunissen)
  - 8.4 GCOS Network Acceptance Process (Thomas/Dawson)
9. Coordination/Review of Relationships with Other Programmes
  - 9.1 GOOS and GTOS
  - 9.2 WMO, UNEP, ICSU and IOC
  - 9.3 WCRP, IGBP and IPCC
  - 9.4 UNFCCC and SBSTA/SBI

12:30 - 14:00            **LUNCH**

14:00 - 17:00

10. Actions to be undertaken by the GCOS Secretariat
  - 10.1 Availability of Resources (Thomas)
  - 10.2 Priority Activities (Dawson)
  - 10.3 Review of Meeting Decisions (Thomas/Teunissen)
11. Other Business
  - 11.1 Arrangements for SC-X
  - 11.2 Steering Committee Membership (In Camera, Thursday PM)
12. Close of the Session

(Intentionally Blank)

### ANNEX III

## LIST OF DOCUMENTS

Document No.	Agenda Item	Title
1	1.2	Provisional Agenda
2	1.2	Explanatory Memorandum
3	1.4	Decisions and Action Items from GCOS SC-VIII
4	2	Report of the Chairman, GCOS Steering Committee
5	3	Report of the Director, GCOS Secretariat
6	4.1	Outcome of COP-5 and GCOS Response
7	4.2	Intergovernmental Mechanisms for GCOS (Results from Toronto Meeting)
8	4.3, 4.4	SBSTA-12 and COP-6
9	4.5	GCOS Regional Workshops
10	5.2.	Report on the GCOS/WCRP Atmospheric Observation Panel for Climate
11	5.3, 7.3	Report of the Chairman, Ocean Observations Panel for Climate (OOPC)
12	5.4, 7.4	Report of the Chairman, Terrestrial Observation Panel for Climate (TOPC)
13	5.5, 8.3	Report on GOSSP
14	6.1	Results from WMO Executive Council
15	6.2	Results from IOC Executive Council XXX-III
16	6.3	Report of G3OS Sponsors, Fifth Session
17	6.4	Report of IGOS Partnership, Fifth Session
18	6.5	Summary Report from Pacific Island Regional Implementation Workshop
19	6.6	Informal Meeting of National GCOS Coordinators
20	6.7	Report from Expert Meeting on a Global Hydrological Network
21	7.1	GCOS Implementation Strategy: Implementing GCOS in The New Millennium
22	8.1	Global Observing Systems Information Center (GOSIC)
23	8.2	Future of JDIMP
24	8.3	Future of GOSSP

<b>Document No.</b>	<b>Agenda Item</b>	<b>Title</b>
25	8.4	GCOS Network Acceptance Process
26	5.2	GCOS Surface Network Monitoring Report No. 2
27	4.5, 6.5	Discussion Paper for Pacific Regional Workshop

### **LIST OF INFORMATION DOCUMENTS**

INF. 1	List of Participants
INF. 2	Results from WMO Congress XIII
INF. 3	GSN Letter to WMO Members
INF. 4	GCOS Memorandum of Understanding
INF. 5	GCOS Report to IACCA and IACCA Response
INF. 6	Letter of Invitation to Join GTN-P

## ANNEX IV

### **SPONSORS' RESOLUTIONS PERTAINING TO GCOS**

#### **(a) WMO Congress Resolution 7 (Cg-XIII) (May 1999) - GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)**

##### **THE CONGRESS,**

##### **NOTING:**

- (1) Resolution 3.2.5/1 (Cg-XII) - Global Climate Observing System ;
- (2) The renewed Memorandum of Understanding by WMO, IOC of UNESCO, UNEP, and ICSU concerning the Global Climate Observing System ;
- (3) Agenda 21: Programme of Action for Sustainable Development;
- (4) The UN Framework Convention on Climate Change (UNFCCC);
- (5) The Report on the Adequacy of the Global Climate Observing Systems prepared by the GCOS Secretariat for the UNFCCC;
- (6) UN General Assembly Resolution 52/200 and the Declaration of Guayaquil adopted at the First Intergovernmental Meeting of Experts on El Niño;
- (7) Decisions 2/CP.4 and 14/CP.4 of the Fourth Session of the Conference of the Parties to the UNFCCC;

##### **CONSIDERING:**

- (1) The continuing importance and urgency to acquire comprehensive information on the properties and evolution of the Earth's climate system for detecting climate change, for supporting climatological applications for economic development, and for developing climate science and predictions;
- (2) The specific observational needs expressed by the IPCC, the WCRP and the IGBP; the global observations for sustainable development noted in Agenda 21; and the requirements for comprehensive observations in support of the UN Framework Convention on Climate Change;
- (3) The close cooperation needed among the climate research activities of the WCRP and the IGBP, the data management, application, and impacts components of the WCP, and the various operational activities of the WMO scientific and technical programmes, to develop a comprehensive global observing system for climate;
- (4) The deficiencies, and in many parts of the world the decline, in the number and availability of systematic observations for climate;

##### **RECOGNIZING:**

- (1) The urgent need for on-going coordination of global observing systems for climate to meet the needs of a range of different clients and the important role being played by the Steering Committee and Secretariat of the GCOS;
- (2) The active and supportive roles taken by the sponsoring organizations of GCOS, namely the WMO, the IOC of UNESCO, UNEP and ICSU;

- (3) The interdisciplinary nature of the activities being undertaken to develop and implement a comprehensive approach to climate system observations ;
- (4) The decision of Congress (Resolution 3.4.4/1 (Cg-XIII)) to establish a Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) and the enhanced potential that this offers for implementation of the ocean component of the GCOS; [*to be confirmed during Cg-XIII*]
- (5) The need for operational oceanography to be implemented following the same principles as used for meteorology;
- (6) The need to integrate both surface and space-based observations into an integrated global observing system;

**RECOGNIZING WITH APPRECIATION:**

- (1) The support and guidance of the Executive Council in the planning and early implementation phases of the GCOS;
- (2) The efforts of the Secretary-General to provide WMO leadership and to encourage support for the GCOS;
- (3) The support and active participation by the constituent bodies of the WMO in GCOS planning activities;
- (4) The excellent inter-agency cooperation in the process of planning, development and initial implementation of the Global Climate Observing System and, in particular, the close partnership between GCOS, GOOS, and GTOS;

**REAFFIRMS** that the WMO should continue its leadership role in the further planning, development and implementation of the Global Climate Observing System;

**DECIDES that:**

- (1) The Global Climate Observing System should be continued as an essential activity in support of the Climate Agenda, the WCP, the UNFCCC and other climate-related intergovernmental activities;
- (2) The inter-agency arrangements for coordination should be further strengthened in view of the increasing interest and involvement of governments and, *inter alia*, the need for integrating both surface and space-based observations ;

**URGES Members:**

- (1) To prepare national plans for undertaking programmes of systematic observation of the meteorological and hydrological components of the climate system based on the information developed by the Global Climate Observing System and its partner programmes, and to increase assistance to developing countries in their preparation of such plans and programmes to the extent possible;
- (2) To ensure that information on plans and programmes relating to their participation in global observing systems for climate are incorporated as an element of national communications to the UNFCCC in the context of reporting on research and systematic observation;
- (3) To continue to support their national meteorological and atmospheric observing systems, including measurement of greenhouse gases, in order to ensure that the stations identified as elements of the Global Climate Observing System networks,

based on the World Weather Watch and Global Atmosphere Watch and underpinning the needs of the UNFCCC, are fully operational and use best practices, and to take action to reverse the decline in such systems in some countries;

- (4) To consider enhancements to the GCOS Initial Operational System for atmospheric and hydrological observations through augmentation of existing systems and addition of new elements as feasible;
- (5) To actively support the capacity building in developing countries to enable them to participate fully in GCOS including, inter alia, to collect, exchange and utilize data to meet local, regional and international needs;
- (6) To strengthen international and intergovernmental programmes assisting countries to acquire and use climate information through the provision of resources and the contribution of facilities to undertake quality control and archiving activities;
- (7) To consider the urgent request of the GCOS-SC for additional project resources to carry forward the task of implementing the Global Climate Observing System and responding to the needs of its clients, including the UNFCCC and other environmentally-related conventions;
- (8) To ensure that their delegations to sessions of the UNFCCC-COP and its subsidiary bodies are properly informed of the key role played by NMHSs in implementing and maintaining observing systems necessary to meet national obligations under the Convention;

**REQUESTS the Executive Council:**

- (1) To keep under regular review developments within GCOS and to provide constructive guidance as it moves forward with implementation;
- (2) To take steps to further develop support among Members, sponsoring bodies, and international organizations for the implementation of global observing systems for climate;

**REQUESTS GCOS and the WMO technical commissions** to continue their interaction and cooperation in the development and implementation of GCOS;

**REQUESTS the Secretary-General**, using whatever flexibility might exist within the regular budget:

- (1) To take urgent action in support of the planning, development and implementation of GCOS, including the development of responses to the UNFCCC-COP, particularly in the investigation of a process for securing enhanced support of Members and possibly through the support of regional meetings or workshops to assist Members in preparing and reporting on national plans and programmes for their participation in GCOS;
- (2) To continue to urge ongoing and new participation by sponsoring organizations in GCOS;
- (3) To articulate, at all appropriate fora, including the UNFCCC-COP/SBSTA, that significant new funds are required by both Members and international agencies in order to be able to fully implement GCOS.

**(b) International Council for Science, 26<sup>th</sup> General Assembly (Sep. 1999) - Resolution 7, Global Climate Observing System**

The 26<sup>th</sup> General Assembly of ICSU

*Endorses* ICSU's continuing efforts in support of the strengthening of global observation systems, especially the Global Climate Observing System;

*Urges* all ICSU Members to become involved in the national planning of global observing systems and to participate in the preparation of future national reports on activities in connection with the UNFCCC (UN Framework Convention on Climate Change).

**(c) WMO Executive Council, Resolution 3 (EC-LII) (May 2000) - GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)**

**THE EXECUTIVE COUNCIL,**

**NOTING:**

- (1) Resolution 7 (Cg-XIII) - Global Climate Observing System ;
- (2) Decisions 2/CP.4 and 14/CP.4 of the Fourth Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC-COP);
- (3) Decisions 4/CP.5 and 5/CP.5 of the Fifth Session of the UNFCCC-COP;
- (4) The conclusions of the recent Informal Meeting on Developing an Intergovernmental Mechanism or Process for GCOS;

**RECOGNIZING:**

- (1) That there are in existence a number of intergovernmental and international agencies and processes involved in systematic observations for climate that should be more fully engaged in the implementation of GCOS;
- (2) That the UNFCCC-COP provides an important mechanism whereby Members can address deficiencies in the observing systems required to meet their commitments to the Convention;
- (3) That, in view of the November 2001 deadline for reporting to the UNFCCC-COP, Members need to start now to prepare reports on their activities in relation to systematic observation for inclusion in the next national communications to the UNFCCC-COP;
- (4) That, as GCOS moves forward with its implementation, there will be a need for senior operational and governmental advice as well as scientific and technical expertise;
- (5) That there is a need for full coordination also at the national level to ensure balanced development of national observing systems for climate;

**URGES MEMBERS TO:**

- (1) Ensure that their delegations to sessions of the UNFCCC-COP and its subsidiary bodies are properly informed of the key role played by NMHSs in implementing and operating observing systems necessary to meet national obligations under the Convention; and take steps to provide appropriate scientific advice to national delegations through the inclusion therein of representatives of NMHSs;
- (2) Cooperate in the development of regionally-based action plans that address deficiencies in observing systems for climate and in the presentation of these plans to potential funding agencies, and the GEF, for their consideration;
- (3) Support regional workshops to assist developing country Members in improving their observing systems for climate;
- (4) Ensure that NMHSs actively participate in the preparation of their detailed reports and national communications to the UNFCCC due in November 2001, in particular in reporting on their actions with regard to global climate observing systems, development of observational networks, and, as appropriate, support for capacity-building in

developing countries related to collection, exchange and utilization of data to meet local, regional and international needs;

- (5) Coordinate as necessary among the national counterparts of the GCOS international sponsoring agencies, in order to identify a national focal point for GCOS to ensure appropriate action in regard to observing systems for climate change and variability, in particular, in regard to preparation of comprehensive national GCOS plans and reporting to the UNFCCC in relation to research and systematic observation;
- (6) Enhance their support to the GCOS Secretariat to the extent possible, for example in the form of secondment of experts or through contributions to the Climate Observing System Fund;

**REQUESTS THE GCOS SECRETARIAT TO:**

- (1) Develop an implementation strategy for GCOS and report on it to the next session of the Executive Council and, as appropriate, to the other sponsoring bodies;
- (2) Organize, in consultation with relevant international and regional bodies, regional workshops on improving observing systems for climate;
- (3) Assist Members, especially developing countries, in the preparation of implementation plans to improve their observing systems for climate;

**REQUESTS THE PRESIDENTS OF TECHNICAL COMMISSIONS**, in particular CAS, CBS, CCI and JCOMM, to strengthen the cooperation between GCOS and their respective technical commissions;

**REQUESTS THE SECRETARY-GENERAL TO:**

- (1) Consult with the other GCOS sponsoring agencies to develop effective strategies to implement GCOS, including common resolutions, and to strengthen senior operational and governmental involvement in GCOS;
  - (2) Inform Members of the urgent need to commence preparation of material for inclusion in national reports and communications to the COP on their contribution to systematic observation;
  - (3) Advise developing country Members about the potential availability of funding from the Global Environment Facility to assist them in preparing their reports to UNFCCC-COP;
  - (4) Give high priority to GCOS, using whatever flexibility might exist within the regular budget;
  - (5) Keep Members informed on other recent important developments in regard to GCOS.
-

**(d) IOC Resolution EC-XXXIII.10 (June 2000) - Global Climate Observing System**

The Executive Council,

**Noting:**

- (i) recent Decisions (4/CP.5 and 5/CP.5) of the 5<sup>th</sup> Session of the Conference of Parties to the UN Framework Convention on the Climate Change (Bonn, 1999), and
- (ii) conclusions of the recent Informal Meeting on Developing an Intergovernmental Process for GCOS (Toronto, Canada, February 2000),

**Recognizing:**

- (i) the close and productive linkage between the Global Ocean Observing System and the Global Climate Observing System, demonstrated in particular by the fact that the ocean component of GCOS and the climate component of GOOS are one and the same,
- (ii) that the UNFCCC Conference of the Parties (COP) provides an important mechanism through which Member States can address deficiencies in the observing systems required to meet their commitments to the Convention,
- (iii) that, in view of the November 2001 deadline for reporting to the UNFCCC-COP, Member States need to start now to prepare reports on their activities in relation to systematic observation for inclusion in the next national communications to the UNFCCC-COP,
- (iv) that there is a need for full co-ordination also at the national level to ensure balanced development of national observing systems for climate,

**Decides** that the inter-agency arrangements for coordination of systematic observations of the climate system should be further strengthened in view of the increasing interest and involvement of governments and, *inter alia*, the need for integrating both surface and space-based observation,

**Urges Member States to:**

- (i) ensure that their delegations to sessions of the UNFCCC-COP and its subsidiary bodies are properly informed of the key role played by oceanographic agencies in implementing and operating observing systems necessary to meet national obligations under the Convention; and to take steps to provide appropriate scientific advice to national delegations through the inclusion therein of representatives of such agencies;
- (ii) co-operate, where ever possible, in the development of regionally-based action plans that address deficiencies in observing systems for climate and in the presentation of these plans to potential funding agencies, including the GEF, for their consideration;
- (iii) ensure that oceanographic communities in Member States actively participate in the preparation of their detailed reports and national communications to the UNFCCC due in November 2001;
- (iv) actively support implementation of national oceanographic observing systems as elements of the Global Climate Observing System and Global Ocean Observing System networks and to support, to the extent possible, an increase in the number of ocean observations, particularly in remote locations; and the establishment and maintenance of reference stations, within the context of GCOS and GOOS plans;

- (v) actively support the building of capacity in developing countries to enable them to collect, exchange and utilize data to meet local, regional and international needs;
- (vi) consider how they might provide additional project resources for the implementation of the global ocean observing system for climate and the need for resources in the GCOS and GOOS Secretariats to co-ordinate these implementations;

**Instructs the Executive Secretary IOC to:**

- (i) consult with the other GCOS sponsoring agencies to develop effective strategies to implement GCOS, including common resolutions, and to strengthen senior operational and governmental involvement in GCOS;
- (ii) inform Member States of the urgent need to commence preparation of material for inclusion in national reports and communications to the COP on their contribution to systematic observation;
- (iii) advise developing country Members about the potential availability of funding from the Global Environment Facility to assist them in preparing their reports to UNFCCC-COP;
- (iv) and, within available budgetary resources, continue to support the planning, development and implementation of GCOS through financial support to the operation of the GOOS and GCOS Secretariats;

---

Financial implications: US\$20,000 per year from extra-budgetary sources

## ANNEX V

# GCOS ISSUES DOCUMENT FOR SBSTA-11 AND COP-5

Distr.  
GENERAL  
FCCC/SBSTA/1999/10  
3 September 1999  
Original: ENGLISH

---

SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE  
Eleventh session  
Bonn, 25 October - 5 November 1999  
Item 12 of the provisional agenda

### RESEARCH AND SYSTEMATIC OBSERVATION

#### Issues related to the Global Climate Observing System

##### Note by the secretariat

#### CONTENTS

	<u>Paragraphs</u>	<u>Page*</u>
I. INTRODUCTION.....	1 - 7	2
A. Mandate.....	1 - 5	2
B. Scope of the note.....	6	2
C. Possible action by the SBSTA.....	7	3
II. INFORMATION RELEVANT TO THE MANDATES .....	8 - 21	3
A. Developments regarding observational networks, including difficulties encountered and options for financial support.....	8 - 15	3
B. Intergovernmental processes for addressing the priorities for action .....	16 - 19	5
C. Options for synthesizing national plans and programmes for systematic observation of the climate system .....	20 - 21	7

#### Annex

Information on research and systematic observation contained in second national communications of Annex I Parties

GE.99-

---

\* As they appear in this Annex

† Not included here. Available at the UNFCCC web site as Annex to:  
<http://www.unfccc.de/resource/docs/1999/sbsta/10.htm>

## I. INTRODUCTION

### A. Mandate

1. The Conference of the Parties (COP), by its decision 14/CP.4, requested Parties to submit information on national plans and programmes in relation to their participation in global observing systems for climate, in the context of reporting on research and systematic observation, as an element of national communications from Parties included in Annex I to the Convention (Annex I Parties) and, as appropriate, from Parties not included in Annex I to the Convention (non-Annex I Parties) (FCCC/CP/1998/16/Add.1).

2. The COP requested the Subsidiary Body for Scientific and Technological Advice (SBSTA), in consultation with the agencies participating in the Climate Agenda, drawing *inter alia* on the information provided in the second national communications from Annex I Parties and, as appropriate, in the initial national communications from non-Annex I Parties, to inform the Conference of the Parties at its fifth session of developments regarding observational networks, difficulties encountered, *inter alia*, with respect to the needs of developing countries and options for financial support to reverse the decline in observational networks.

3. It also invited the agencies participating in the Climate Agenda, through the Global Climate Observing System (GCOS) secretariat, to initiate an intergovernmental process for addressing the priorities for action to improve global observing systems for climate in relation to the needs of the Convention and, in consultation with the Convention secretariat and other relevant organizations, for identifying immediate, medium-term and long-term options for financial support; and it requested the secretariat to report results to the Subsidiary Body for Scientific and Technological Advice at its tenth session.

4. The SBSTA, at its ninth session, invited the agencies participating in the Climate Agenda, in consultation with the Convention secretariat, to assess options for synthesizing national plans and programmes for systematic observation of the climate system, for example by drawing on the expertise of GCOS and/or using the roster of experts, and to report to the SBSTA at its eleventh session (FCCC/SBSTA/1998/9, para. 26 (c)).

5. The SBSTA, at its tenth session, invited the agencies participating in the Climate Agenda, through the GCOS secretariat, to report to the SBSTA at its eleventh session on their actions and plans, in accordance with decision 14/CP.4, including proposals to hold workshops and, in preparing to do so, to consult widely, including, *inter alia*, with the Convention secretariat, the Chairman of the Intergovernmental Panel on Climate Change (IPCC) and the Global Environment Facility (GEF). The SBSTA also recalled paragraphs 1 (c) and 5 of decision 2/CP.4 requesting the GEF to report to the COP on its activities with regard to providing funding to developing countries to build capacity for participation in systematic observational networks (FCCC/SBSTA/1999/6, para. 75 (c) and (e)).

### B. Scope of the note

6. This note provides preliminary information in response to the above mandates. It contains information on observational networks as provided by Annex I Parties in their second national communications, including, in some cases, information on support for capacity-building in developing countries. Information on the status of observational networks as provided by Parties not included in Annex I to the Convention is provided in document FCCC/SBI/1999/11. The GCOS secretariat also provided information, particularly with respect to the operation of surface and upper air networks and ocean observation networks in different regions. The information represents an initial step in understanding the current status of support for

observational networks and is suggestive of broad areas needing improvements. Given the preliminary nature of the information, specific options for funding are not included in the note.

### **C. Possible action by the SBSTA**

7. The SBSTA may wish to consider the information in this note and the need for any further activities. For example, it may wish to consider a process, in cooperation with the GCOS, for identifying the specific needs and resource requirements of developing countries, perhaps through a series of regional implementation meetings. It may also wish to provide additional guidance to the secretariat on this issue.

## **II. INFORMATION RELEVANT TO THE MANDATES**

### **A. Developments regarding observational networks, including difficulties encountered and options for financial support**

#### *Information from national communications*

8. Twenty-five Parties included in Annex I to the Convention have reported on research and systematic observation within their second national communications<sup>(1)\*</sup> (see the annex<sup>(2)</sup> to this document). The scope, coverage and level of detail vary considerably, making comparisons difficult. Of these, 23 Parties have reported at varying levels of coverage on data monitoring, collection and archives. Some of these national programmes feed directly into the international programmes discussed later. Regarding the international research activities, Parties indicated involvement in the International Geosphere-Biosphere Programme (IGBP), the World Climate Research Programme (WCRP) and the International Human Dimensions of Global Environmental Change Programme (IHDP). Parties also mentioned their involvement in other relevant international programmes including the World Weather Watch (WWW), the Global Atmosphere Watch (GAW), the Global Climate Observing System (GCOS), the Global Terrestrial Observing System (GTOS) and the Global Ocean Observing System (GOOS).

9. Activities aimed at promoting regional cooperation in systematic observations were reported by a large number of Parties.<sup>(3)</sup> Two Parties reported on capacity-building activities directly within their region,<sup>(4)</sup> whereas others reported participation in regional groupings or regional projects such as the Association of South East Asian Nations (ASEAN), the Pacific Meteorological Services Project, and the South Pacific Regional Environment Programme (SPREP). One Party reported assistance to developing countries via participation in the Valdivia Climate Change Working Group. In addition, other capacity-building assistance to developing countries was identified by some Parties.<sup>(5)</sup> The assistance included projects for systems of atmospheric soundings, support of meteorological departments and assistance to national meteorological and hydrological services (NMHSs) and national meteorological services (NMSs). The development of the Pacific Climate Assistance Programme (PCAP), approved for funding by the Global Environment Facility, was one such activity.

10. Eight Parties not included in Annex I to the Convention have provided information on observational networks in their first national communications (FCCC/SBI/1999/11).<sup>(6)</sup> Parties have reported on national meteorological, climate and hydrological networks and monitoring of greenhouse gases and sinks. Three tables are provided in the document referenced above with information on: (a) the types and number of observation stations, national databanks, archiving activities and equipment and institutional arrangements; (b) examples of regional and international cooperation; and (c) activities requiring financial and technical assistance.

#### *Information from the World Meteorological Organization and the GCOS secretariat*

---

\* Footnotes in this Annex appear on its page 7

11. Another source of information regarding the status of observational networks is the monitoring data collected under the World Weather Watch (WWW) of the WMO for surface observations, by the European Centre for Medium-range Weather Forecasts (ECMWF) for upper-air observations and by Météo France for ocean observations. These data sets provide some indication of the performance of critical parts of the meteorological and oceanographic networks.<sup>(2)</sup> The data provided in tables 1 and 2, representative of recent performance, lend substance to the reports of degradation of observing systems, especially in developing countries. The data represent one piece of information needed to set funding priorities. Additional information from these centres may be available at the eleventh session of the SBSTA.

12. Table 1 provides preliminary information on the status of the GCOS Surface Network (GSN) and GCOS Upper Air Network (GUAN). It shows, by WMO region and globally: in the first column the percentage of "good" stations (i.e. those providing at least 90 per cent of required observations); in the second column, the percentage of "unsatisfactory" stations (i.e. those providing some observations but less than 50 per cent of requirement); and, in the third column, the percentage of "silent" stations (i.e. those providing no data). The table indicates that the worst situation regarding the implementation of the GSN exists in South America and Africa where only 20 and 30 per cent of GSN stations, respectively, provide 90 per cent or more of required observations. About 15 per cent of GSN stations in each of these regions and in the South-West Pacific are considered as "silent".

**Table 1. Preliminary information on the status of meteorological networks, by WMO region**

WMO region	% of stations providing at least 90 per cent of observations	% of stations providing less than 50 per cent of observations	% of "silent" stations
GSN (WWW monitoring, 1-15 October 1998)			
I - Africa	30	18	16
II - Asia	70	7	5
III - South America	20	18	13
IV - North & Central America	77	2	8
V - South-West Pacific	75	1	14
VI - Europe	86	0	3
Antarctica	80	5	0
GUAN (ECMWF monitoring, March-April 1999)			
I - Africa	65	9	0
II - Asia	65	8	4
III - South America	40	12	12
IV - North & Central America	75	0	5
V - South-West Pacific	62	3	5
VI - Europe	93	0	0
Antarctica	67	8	0
Global	69	6	4

13. The worst implementation of the GUAN is in South America, where only 40 per cent of stations provide sufficient observations, while about a quarter are completely "silent" or have low implementation (i.e. establishment and continuing operation) levels. The situation is only a little better in Africa, Asia and the South-West Pacific. The reasons for low or non-availability of observational data from these areas include obsolete equipment, lack of qualified staff, and lack

of consumables and spare parts due to economic constraints experienced by developing countries in these regions.

14. The situation with regard to basic atmospheric/ocean surface variables, by major ocean basin, is indicated in table 2. The data represent the range of daily average percentages of the World Weather Watch (WWW) requirements met for each variable for a recent period; for these data, GCOS requirements are not likely to be much different. Since most of the observations are derived from voluntary observing ships (VOS) and drifting or moored buoys, there is considerable variation even within each ocean basin, and the table reflects this. From an analysis of these and similar results, it is clear that the availability of data from the oceans is far from satisfactory at the present time, though it is relatively stable.<sup>(8)</sup>

**Table 2. Preliminary information on the status of oceanographic data collected, by ocean basin**

<b>Ocean basin</b>	<b>Surface air pressure</b> (per cent WWW requirements)	<b>Sea surface temperature</b> (per cent WWW requirements)	<b>Surface air temperature</b> (per cent WWW requirements)	<b>Surface wind</b> (per cent WWW requirements)
North Atlantic	50 - 200	50 - 150	20 - 90	20 - 100
South Atlantic	25 - 90	20 - 70	0 - 30	0 - 50
North Pacific	5 - 90	40 - 100	5 - 40	5 - 60
South Pacific	< 10 (except in limited areas)	20 - 70	0 - 20	0 - 15
Indian	5 - 60	10 - 50	0 - 30	0 - 20
Southern	< 10	0 - 70	< 5	0 - 20

15. The experience of the agencies participating in the GCOS suggests that non-Annex I Parties have three needs: training and development of their human resources, observing equipment that is consistent with their level of infrastructure, and ongoing funding for supplies and maintenance. The first two of these requirements may be tractable using existing mechanisms such as the Global Environment Facility (GEF) and bilateral aid programmes, but long-term, ongoing operational funding is not ensured by any of the existing financial mechanisms. Funding for such activities has been within the domain of national governments. Given the data presented above on the status of the networks, meeting these needs is clearly still a major problem for the global networks.

### **B. Intergovernmental processes for addressing the priorities for action**

16. The invitation of the COP to consider an intergovernmental process was explored with the relevant agencies at the third session of the Inter-Agency Committee on the Climate Agenda (IACCA) earlier this year. It was determined that existing coordination mechanisms do not focus on all aspects of the climate agenda, while a one-time intergovernmental meeting on systematic observations would only be of limited benefit. Due to the breadth of the climate agenda, no current intergovernmental organization or mechanism encompasses all aspects of a global observing system for climate. Various proposals are being discussed on an appropriate mechanism to establish the priorities for implementing a global observing system for climate and its international coordination. As was noted in the GCOS report to SBSTA 10, they range from a one-time intergovernmental meeting on systematic observations to an intergovernmental board. The former could have only limited impact while the latter requires extensive planning, coordination and development before it could be accepted internationally. Due to the wide range

of views on this matter, the GCOS secretariat is working with representatives from a number of interested nations and other organizations to better document a possible process. The next step being considered is a meeting of these representatives in late September 1999 so that a report on a possible process could be presented to the Conference of the Parties at its fifth session.

17. Although meeting the needs of the UNFCCC for systematic observations requires global networks, the experience of the relevant agencies suggests that regional or other sub-global approaches will also be needed to make significant progress towards implementation. Given adequate funding, the GCOS secretariat proposes to hold a series of regional implementation meetings that would identify the specific needs of the Parties or groups of Parties in a given region to address network deficiencies. These needs could be assembled into specific projects and taken to funding agencies such as the GEF. In addition, the meetings would be used to inform Parties about the process of national planning for systematic observations for climate and the requirements for specific regional observations. Building on the experience of the few Parties that have commenced preparation of national climate plans, the meetings would explore the guidance prepared for systematic observations and assist the development of national communications by participating Parties.

18. The Thirteenth World Meteorological Congress (May 1999) noted that the GCOS had now reached "a critical point in its existence due to the serious lack of resources for its implementation. This critical situation had been exacerbated by the need for GCOS to respond to the many urgent requests emanating from ... the Fourth Session of the ... COP ... and the large additional load this had placed on the GCOS secretariat. Congress agreed that the COP Subsidiary Body for Scientific and Technological Advice (SBSTA) should be informed that significant new funds are required both for the Secretariat to discharge this load and for Members to be able to implement the atmospheric and hydrological components of the GCOS plan, and that a similar situation existed within the oceanographic and terrestrial domains."

19. It is anticipated that further developments relating to intergovernmental processes will be reported by the GCOS secretariat to the eleventh session of the SBSTA.

### **C. Options for synthesizing national plans and programmes for systematic observation of the climate system**

20. Parties that have provided information on observational systems do so using many different formats. The information is generally very diverse, but limited in scope (see the annex to this document). The communications do not include national plans, but sometimes provide summaries of national programmes. Improved guidance for reporting on plans and programmes is needed to encourage Parties included in Annex I to the Convention to provide more uniform and comprehensive information in their national communications. This would subsequently enable more comprehensive syntheses to be undertaken.

21. The GCOS secretariat has provided such draft reporting guidance. It may be found in document FCCC/SBSTA/1999/13/Add.2. If this guidance or a subsequent version is accepted by the Parties, and if Parties use it as a basis for reporting third national communications, it will be possible to develop options for synthesizing information on national plans and programmes in the future. Moreover, if similar reporting guidance were also to be accepted by Parties not included in Annex I to the Convention, it might provide a better basis for ascertaining the technical and financial needs of those Parties.

## Annex

**Information on research and systematic observation contained in second national communications of Annex I Parties.** (available at the UNFCCC web site as Annex to: <http://www.unfccc.de/resource/docs/1999/sbsta/10.htm>)

---

### Notes:

1. The Parties that have provided information include: Australia, Austria, Canada, the Czech Republic, Denmark, the European Economic Community, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Latvia, the Netherlands, New Zealand, Norway, Portugal, Romania, the Russian Federation, Sweden, Switzerland, the United Kingdom of Great Britain and Northern Ireland, and the United States of America.
2. The annex represents a synthesis of information contained in the second national communications of Annex I Parties, but does not provide an exhaustive description. It contains some mention of developments in the observational networks over time and is a status report on the institutions responsible for coordination, number of various types of stations, and other aspects. There is little information on the limitation of these networks, such as lack of complete coverage, or partial automation.
3. The Parties that have reported information related to regional cooperation include: Australia, Austria, Bulgaria, Canada, Denmark, European Economic Community, Germany, Greece, Italy, Japan, the Netherlands, New Zealand, Portugal, Sweden and the United States of America.
4. Australia and New Zealand.
5. Parties reporting information on capacity-building include: Australia, Finland, New Zealand, Norway and the United States of America. It should be noted that reporting on capacity-building activities was not an explicit requirement of the guidelines for reporting on second national communications of Parties included in Annex I to the Convention.
6. The Parties that have reported information include: Argentina, Armenia, Kazakhstan, the Republic of Korea, Mauritius, Mexico, Uruguay and Zimbabwe.
7. Centres have been established by Germany (Deutscher Wetterdienst) and Japan (Meteorological Agency) to monitor the performance of the GSN; by the European Centre for Medium-range Weather Forecasts to monitor the performance of the GUAN; and by the USA (National Climatic Data Centre) to archive the data from these networks.
8. The Ocean Observation Panel for Climate is organizing jointly with the Upper Ocean Panel of CLIVAR, OCEANOBS 99, a major international Conference on the Ocean Observing System for Climate in October 1999, with the purpose of defining the optimum mix of measurements needed to meet the goals of climate programmes. It will be hosted by the Government of France with the support of over 20 sponsors. The outcome should be available in time for the eleventh session of the SBSTA.

(Intentionally Blank)

## ANNEX VI

# **DECISIONS AND REPORTING GUIDELINES FROM UNFCCC/COP-5**

### **(a) DECISIONS:**

#### **Decision 4/CP.5**

##### **Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications**

*The Conference of the Parties,*

*Recalling* the relevant provisions of the United Nations Framework Convention on Climate Change, in particular Articles 4, 6, 7.2, 9.2(b), 10.2, and 12 thereof,

*Recalling* its decisions 9/CP.2 and 11/CP.4 on national communications from Parties included in Annex I to the Convention,

*Having considered* the relevant recommendations of the Subsidiary Body for Scientific and Technological Advice and of the Subsidiary Body for Implementation,

*Noting* that the revised guidelines for the preparation of national communications by Parties included in Annex I to the Convention annexed to decision 9/CP.2 need to be updated to improve the transparency, consistency, comparability, completeness and accuracy of the information reported,

1. *Adopts* the guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications;<sup>1</sup>

2. *Decides* that Parties included in Annex I to the Convention (Annex I Parties) should use Part II of the UNFCCC reporting guidelines for the preparation of their third national communications due by 30 November 2001, in accordance with decision 11/CP.4;

3. *Requests* Annex I Parties to provide a detailed report on their activities in relation to systematic observation, in accordance with the UNFCCC reporting guidelines on global climate observing systems adopted by decision 5/CP.5, in conjunction with their national communications;

4. *Urges* those Annex I Parties that have not submitted their first or second national communications, including those that were included in Annex I by decision 4/CP.3, to do so as soon as possible;

5. *Urges* Parties included in Annex II to the Convention to assist Annex I Parties with economies in transition, through appropriate bilateral or multilateral channels, with technical aspects of the preparation of national communications.

*9th plenary meeting  
4 November 1999*

---

<sup>1</sup> See FCCC/CP/1999/7.

**Decision 5/CP.5**

**Research and systematic observation**

*The Conference of the Parties,*

*Recalling* Articles 4.1(g), 4.1(h) and 5 of the United Nations Framework Convention on Climate Change,

*Recalling also* its decisions 8/CP.3, 2/CP.4, and 14/CP.4,

1. *Recognizes* the need to identify the priority capacity-building needs related to participation in systematic observation;

2. *Invites* the secretariat of the Global Climate Observing System, in consultation with relevant regional and international bodies, including the Global Environment Facility, to organize regional workshops on this issue;

3. *Urges* Parties to actively support and participate in these regional workshops;

4. *Invites* the secretariat of the Global Climate Observing System to continue to assist and facilitate the establishment of an appropriate intergovernmental process to identify the priorities for action to improve global observing systems for climate and options for their financial support;

5. *Requests* the secretariat of the Global Climate Observing System to report on this matter to the Subsidiary Body for Scientific and Technological Advice at its twelfth session;

6. *Urges* Parties to address deficiencies in the climate observing networks and invites them, in consultation with the secretariat of the Global Climate Observing System, to bring forward specific proposals for that purpose and to identify the capacity-building needs and funding required in developing countries to enable them to collect, exchange and utilize data on a continuing basis in pursuance of the Convention;

7. *Adopts* the UNFCCC reporting guidelines on global climate observing systems;<sup>2</sup>

8. *Invites* all Parties to provide detailed reports on systematic observation in accordance with these guidelines, for Parties included in Annex I to the Convention in conjunction with their national communications, pursuant to decision 4/CP.5, and on a voluntary basis for Parties not included in Annex I;

9. *Invites* the Convention secretariat, in conjunction with the secretariat of the Global Climate Observing System, to develop a process for synthesizing and analysing the information submitted in accordance with the UNFCCC reporting guidelines on global climate observing systems.

*9th plenary meeting  
4 November 1999*

---

<sup>2</sup> See FCCC/CP/1999/7.

**(b) REPORTING GUIDELINES**

Distr.  
GENERAL  
FCCC/CP/1999/7  
16 February 2000  
Original: ENGLISH

CONFERENCE OF THE PARTIES  
Fifth session  
Bonn, 25 October - 5 November 1999  
Agenda items 4 (a) and 4 (h)

**REVIEW OF THE IMPLEMENTATION OF COMMITMENTS  
AND OF OTHER PROVISIONS OF THE CONVENTION**

**UNFCCC guidelines on reporting and review**

CONTENTS

	Page*
II. Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications: IX. RESEARCH AND SYSTEMATIC OBSERVATION.....	2
III. UNFCCC reporting guidelines on global climate change <sup>1</sup> observing systems.....	3

---

\* As they appear in this Annex

<sup>1</sup> The relevant COP-5 Decisions do *not* include the word "change"

## **II. GUIDELINES FOR THE PREPARATION OF NATIONAL COMMUNICATIONS BY PARTIES INCLUDED IN ANNEX I TO THE CONVENTION**

### **PART II: UNFCCC REPORTING GUIDELINES ON NATIONAL COMMUNICATIONS**

#### **IX. RESEARCH AND SYSTEMATIC OBSERVATION**

57. Pursuant to Articles 4.1(g) and (h), 5 and 12.1(b), Annex I Parties shall communicate information on their actions relating to research and systematic observation.

58. The national communication shall address both domestic and international activities (for example, the World Climate Programme, the International Geosphere-Biosphere Programme, the Global Climate Observing System, and the IPCC). They shall also reflect action taken to support related capacity-building in developing countries.

59. Parties shall provide summary information on global climate observing system activities in accordance with paragraph 64 below. To guide reporting under section IX, parts A and C, Parties should refer to the detailed guidance provided in the UNFCCC reporting guidelines on global climate observing systems (contained herein, see pages 101-108).

60. The national communication should report, in summary form, on action taken. For example, the results of research studies or model runs or data analysis should not be included in this section.

#### **A. General policy on and funding of research and systematic observation**

61. Parties should provide information about general policy on and funding of research and systematic observation.

62. Parties should identify the opportunities for and barriers to free and open international exchange of data and information and report on action taken to overcome barriers.

#### **B. Research**

63. Parties should provide, *inter alia*, information on highlights, innovations and significant efforts made with regard to:

- (a) Climate process and climate system studies, including paleoclimate studies;
- (b) Modelling and prediction, including general circulation models;
- (c) Research on the impacts of climate change;
- (d) Socio-economic analysis, including analysis of both the impacts of climate change and response options;
- (e) Research and development on mitigation and adaptation technologies.

#### **C. Systematic observation**

64. Parties should provide summary information on the current status of national plans, programmes and support for ground- and space-based climate observing systems, including long-term continuity of data, data quality control and availability, and exchange and archiving of data in the following areas:

- (a) Atmospheric climate observing systems, including those measuring atmospheric constituents;
- (b) Ocean climate observing systems;
- (c) Terrestrial climate observing systems;
- (d) Support for developing countries to establish and maintain observing systems, and related data and monitoring systems.

### **III. UNFCCC REPORTING GUIDELINES ON GLOBAL CLIMATE CHANGE\* OBSERVING SYSTEMS**

#### **I. INTRODUCTION**

##### **A. Objective**

1. The purpose of these guidelines for reporting on global climate observing systems for Annex I and, as appropriate, non-Annex I Parties to the Convention, is to assist Parties in reporting their actions with regard to global climate observing systems, development of observational networks and, as appropriate, support for non-Annex I Parties to the Convention, as defined in Articles 4.1(g) and (h), 5 and 12.1(b) of the Convention.

##### **B. Structure**

2. The information identified in these guidelines shall be communicated by the Party in a single document and submitted to the Conference of the Parties through the secretariat, and shall be in one of the official languages of the United Nations. Parties may include a reference to a national focal point and/or web site where additional copies may be obtained. The length of the report may be decided by the submitting Party but every effort shall be made to avoid over-lengthy reports. Parties also should provide an electronic version of their reports to the secretariat

#### **II. REPORTING**

##### **A. General approach to systematic observation**

3. Parties shall describe the status of their national programme for systematic observation to meet the needs for meteorological, atmospheric, oceanographic and terrestrial observations of the climate system as identified by the Global Climate Observing System (GCOS)<sup>1</sup> and its partner programmes in line with Article 5 of the Convention. A list of the technical acronyms used in these guidelines is given in appendix 1.

4. In describing their national programme, Parties should, where relevant, report on the following:

(a) Existing national plans and their availability, the time frame for their implementation and specific commitments to address GCOS requirements,<sup>2</sup> Parties should also list and describe the responsibilities of the ministries and agencies, including space agencies, responsible for implementing the plans;

---

\* The relevant COP-5 Decisions do *not* include the word "change"

<sup>1</sup> As agreed by the responsible agencies (World Meteorological Organization (WMO), Intergovernmental Oceanographic Commission (IOC) of UNESCO, United Nations Environment Programme (UNEP) and International Council for Science (ICSU)), the GCOS is made up of the climate observing components of the World Weather Watch (WWW), Global Atmosphere Watch (GAW), World Hydrological Cycle Observing System (WHYCOS), Global Ocean Observing System (GOOS), Global Terrestrial Observing System (GTOS), and relevant observation systems established under the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP).

<sup>2</sup> Plan for the Global Climate Observing System (GCOS), Version 1.0, May 1995 GCOS-14 (WMO/TD-No. 681).

(b) Parties may, if they so wish, provide additional information to that sought in the guidelines, including maps of networks and participation in other relevant programmes, such as the Integrated Global Observing Strategy (IGOS).

5. Parties should describe the extent to which national data on systematic observations are exchanged with other Parties and provided to international data centres. Parties should describe any barriers to the exchange of data or provision of data to international data centres. Parties should, as necessary, describe any national policy or guidance relevant to the exchange of data relevant to meeting the needs of the UNFCCC.

6. Parties should describe actual and/or planned activities for capacity-building in developing countries related to collection, exchange and/or utilization of data to meet local, regional and international needs.

7. Parties should describe actual and/or planned actions since the publication of the previous national communication to strengthen international and intergovernmental programmes related to global climate observing systems.

8. Where information required in these guidelines cannot be provided, Parties should report on any difficulties encountered, needs that should be met to facilitate improved reporting, and steps taken to improve availability of information.

## **B. Meteorological and atmospheric observation**

9. Parties shall, to the extent possible, describe their participation in GCOS, through their provision of meteorological and atmospheric observations including: the GCOS Surface Network (GSN),<sup>3</sup> GCOS Upper Air Network (GUAN)<sup>4</sup> and Global Atmosphere Watch (GAW).<sup>5</sup> Parties should describe to what extent the observations correspond to the GCOS/GOOS/GTOS climate monitoring principles (appendix 2) and relevant best practices.<sup>6</sup>

10. In describing their national programmes, Parties should, where relevant, report on the following: international data exchange; the provision of metadata to the World Data Centres; and participation in, and support for, international quality control and archiving programmes.

11. Parties should, in order to facilitate integration of national reports, complete table 1.

---

<sup>3</sup> Initial selection of a GCOS Surface Network, February 1997. GCOS-34 (WMO/TD No. 799). See also <http://www.wmo.ch/web/gcos/gcoshome.html> for details of GSN and GUAN requirements.

<sup>4</sup> Report of the GCOS Atmospheric Observation Panel, second session. Tokyo, 1995. GCOS-17 (WMO/TD No. 696) See also <http://www.wmo.ch/web/gcos/gcoshome.html> for details of GSN and GUAN documents.

<sup>5</sup> GAW requirements are specified by the WMO Executive Council Panel of Experts on Environmental Pollution and Atmospheric Chemistry and its best practices are guided by GAW Quality Assurance/Science Activity Centres and calibration centres. See also [http://www.wmo.ch/web/arep/gaw\\_home.html](http://www.wmo.ch/web/arep/gaw_home.html).

<sup>6</sup> GSN and GUAN best practices are given in the WMO Manual on the Global Observing System, sections 2.10.3.17 and 2.10.4.9 respectively.

**Table 1. Participation in the global atmospheric observing systems**

	GSN	GUAN	GAW	Other*
How many stations are the responsibility of the Party?				
How many of those are operating now?				
How many of those are operating to GCOS standards now?				
How many are expected to be operating in 2005?				
How many are providing data to international data centres now?				

Note: \* Provide brief details

### **C. Oceanographic observations**

12. Parties shall, where relevant and to the extent possible, describe their participation in GCOS and GOOS through their provision of oceanographic observations<sup>7</sup> including, for example, sea surface temperature, sea level, temperature and salinity profiles, energy and carbon flux data. Parties should describe to what extent the observations correspond to the GCOS/GOOS/GTOS climate monitoring principles (appendix 2) and other relevant best practices.

13. In describing their national programmes, Parties should, where relevant, report on the following: international data exchange; and their participation in, and support for, international quality control and archiving programmes.

14. Parties should, in order to facilitate integration of national reports, complete table 2.

**Table 2. Participation in the global oceanographic observing systems**

	VOS	SOOP	TIDE GAUGES	SFC DRIFTERS	SUB-SFC FLOATS	MOORED BUOYS	ASAP
For how many platforms is the Party responsible?							
How many are providing data to international data centres?							
How many are expected to be operating in 2005?							

Note: See appendix 1 for explanation of acronyms

### **D. Terrestrial observations**

15. Parties should describe their participation in GCOS and GTOS programmes for terrestrial observations<sup>8</sup> including the Global Terrestrial Network - Glaciers (GTN-G),<sup>9</sup> Global

<sup>7</sup> The GOOS 1998. *IOC1998, IOC, Paris*. See also [http://ioc.unesco.org/goos/act\\_pl.htm](http://ioc.unesco.org/goos/act_pl.htm) for details of ocean observation requirements and for guidance on best practices.

<sup>8</sup> GCOS/GTOS Plan for Terrestrial Climate-related Observations, version 2.0, June 1997. GWS-32 (WMO/TD. No 796). See also [http://www.wmo.ch/web/gcos/pub/topv2\\_1.html#](http://www.wmo.ch/web/gcos/pub/topv2_1.html#) contents for a general outline of terrestrial observations requirements.

Terrestrial Network - Permafrost (GTN-P),<sup>10</sup> and the Global Terrestrial Network - Carbon (FLUXNET),<sup>11</sup> and other networks monitoring land-use, land cover, land-use change and forestry, fire distribution, CO<sub>2</sub> flux, and snow and ice extent. Additionally, a general description of programmes for hydrological systems should be given. Parties should describe to what extent the observations correspond to the GCOS/GOOS/GTOS climate monitoring principles (appendix 2) and relevant best practices.

16. In describing their national programmes, Parties should, where relevant, report on the following: international data exchange; the provision of metadata for these networks; and participation in international quality control and archiving programmes, including hosting international archiving and/or quality assurance and quality control centres.

17. Parties should, in order to facilitate integration of national reports, complete table 3.

**Table 3. Participation in the global terrestrial observing systems**

	GTN-P	GTN-G	FLUXNET	Other
How many sites are the responsibility of the Party?				
How many of those are operating now?				
How many are providing data to international data centres now?				
How many are expected to be operating in 2005?				

### **E. Space-based observing programmes**<sup>12</sup>

18. Parties should, where relevant, provide information on their participation in national and international space-based observing programmes or programmes using satellite data to derive climate-related information.

19. Parties should include the following information: summary description of space series, missions, and/or instruments; mechanisms for access to data and products by international programmes in relation to climate change; mechanisms for archiving, quality assurance and quality control; major domains of applications (atmosphere, ocean, terrestrial); and prospects for long-term continuity, including expected overall lifetime of observational programme. Parties should describe to what extent the observations correspond to the GCOS/GOOS/GTOS climate monitoring principles (appendix 2) and relevant best practices.

20. Where space activities are undertaken jointly with other Parties or multinational bodies, Parties should either list participating Parties or should refer to the report of another Party in which the information can be found.

21. Parties should include in their reports information on climate-related space activities in which the private sector is partly or wholly involved.

<sup>9</sup> Report of GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC). Birmingham, July 1999. See <http://www.geo.unizh.ch/wgms/> for guidance on GTN-G requirements and best practices.

<sup>10</sup> See <http://www.geography.uc.edu/~kenhinke/CALM/> for guidance on GTN-P requirements and best practices.

<sup>11</sup> Report of GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC). Birmingham, July 1999. See <http://www-eosdis.ornl.gov/FLUXNET/fluxnet.html> for guidance on FLUXNET requirements and best practices.

<sup>12</sup> Refer to GCOS-15 (WMO/TD No 685). The GCOS Plan for Space-based Observations, Version 1.0, June 1995 (GCOS-15) is available at <http://www.wmo.ch/web/gcos/publist2.html#plan> while GCOS space-based observations requirements can be found by specifying GCOS as the user in [http://sat.wmo.ch/stations/\\_asp\\_htx\\_idc/Requirementsearch.asp](http://sat.wmo.ch/stations/_asp_htx_idc/Requirementsearch.asp)

**Appendix I**

**DEFINITION OF ACRONYMS USED IN THE GUIDELINES**

ASAP Automated Shipboard Aerological Programme  
FLUXNET Global Terrestrial Network - Carbon  
GAW Global Atmosphere Watch of WMO  
GCOS Global Climate Observing System  
GOOS Global Ocean Observing System  
GSN GCOS Surface Network  
GTN-G Global Terrestrial Network - Glaciers  
GTN-P Global Terrestrial Network - Permafrost  
GTOS Global Terrestrial Observation System  
GUAN GCOS Upper Air Network  
ICSU International Council for Science  
IGBP International Geosphere-Biosphere Programme  
IGOS Integrated Global Observing Strategy  
IOC Intergovernmental Oceanographic Commission of UNESCO  
SFC Drifters Surface Drifters  
SOOP Ship of Opportunity Programme  
Sub-SFC Sub-surface  
UNEP United Nations Environment Programme  
UNESCO United Nations Educational, Scientific and Cultural Organization  
VOS Volunteer Observing Ship  
WCRP World Climate Research Programme  
WHYCOS World Hydrological Cycle Observing System  
WMO World Meteorological Organization  
WWW World Weather Watch of WMO

## **Appendix 2**

### **GCOS/GOOS/GTOS CLIMATE MONITORING PRINCIPLES**

Effective monitoring systems for climate should adhere as closely as possible to the following principles:

1. The impact of new systems or changes to existing systems should be assessed prior to implementation.
2. A suitable period of overlap of new and old observing systems should be required.
3. The results of calibration, validation and data homogeneity assessments and assessments of algorithm changes should be treated with the same care as data.
4. A capability to routinely assess the quality and homogeneity of data on extreme events, including high-resolution data and related descriptive information, should be ensured.
5. Consideration of environmental climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.
6. Uninterrupted station operations and observing systems should be maintained.
7. A high priority should be given to additional observations in data-poor regions and regions sensitive to change.
8. Long-term requirements should be specified to network designers, operators and instrument engineers at the outset of new system design and implementation.
9. The carefully planned conversion of research observing systems to long-term operations should be promoted.
10. Data management systems that facilitate access, use and interpretation should be included as essential elements of climate monitoring systems.

## ANNEX VII

### **DRAFT OUTLINE FOR A GCOS SYNTHESIS REPORT AND ADEQUACY ANALYSIS FOR COP THROUGH SBSTA**

Decision 5/CP.5 adopts the UNFCCC reporting guidelines on global climate observing systems and invites all Parties to provide detailed reports on systematic observation in accordance with these guidelines, for Annex I Parties in conjunction with their national communications, pursuant to Decision 4/CP.5, and on a voluntary basis for Parties not included in Annex I to the Convention. The Decision also invites the Convention secretariat, in conjunction with the Global Climate Observing System secretariat, to develop a process for synthesizing and analyzing the information submitted in accordance with the UNFCCC reporting guidelines on global climate observing systems.

At its ninth session in September 2000, the GCOS Steering Committee (SC) requested the GCOS Secretariat, in consultation with the science panels and individual SC members, to develop, as a matter of urgency, possible methods which could be used to synthesize and analyze the information on systematic observations which are to be submitted to the UNFCCC/COP by 30 November 2001. It also requested that this process be extended to include other information on climate observations in order to prepare a second report on the adequacy of global observing systems for climate.

This document outlines a process for responding to Decision 5/CP.5 discussed at the GCOS SC meeting. This process includes the preparation of a second report on the adequacy of global observing systems for climate, which is consistent with the request of COP-4, Decision 14/CP.4. It would involve international experts in analyzing the adequacy of the current global observing systems for climate in light of the national reports<sup>1</sup> and any additional data and information on observing systems that is available from operational agencies and the research community.

The following is an outline of a suggested process that the GCOS Secretariat could undertake on the requisite process to meet the requirements of Decisions 5/CP.5 and 14/CP.4, subject to agreement by the UNFCCC Secretariat and review/comment by individuals who are involved with systematic observations.

#### **A. Synthesis Report**

- Based on information submitted by Parties, using GCOS/UNFCCC Guidelines (i.e. 'national reports')
- Collate and aggregate basic data in national reports
- Use to highlight successes, on the assumption that many countries will highlight positive aspects
- Use to identify deficiencies where possible
- Provide an analysis of support by the Parties for systematic observation using the national reports.

---

<sup>1</sup> The term 'national reports' includes both the summary information on systematic observation provided by Annex I Parties in accordance with the UNFCCC guidelines and the detailed reports on systematic observation that were invited from all Parties.

## **B. Adequacy Analysis**

- Complement synthesis report
- Present either as attachment to synthesis report or as a subsequent analysis document
- Utilize additional data on systematic observation, not available in the national reports, which themselves will:
  - Not cover all countries, i.e. not global, since these reports are voluntary for non-Annex I Parties
  - Not have detailed monitoring and QC information
  - Not cover climate products
  - Generally be based on raw inputs rather than outputs and outcomes
- Will be more comprehensive than synthesis report
- Will be based on responsibility assigned to GCOS by COP (14/CP.4 Par. 9 for Adequacy Report, 5/CP.5 Par.9 for Synthesis Report).

### **Aim: To provide**

- Scientific specification of the observing systems needed to meet UNFCCC objectives
- Scientific analysis of the adequacy of the current global observing system against the specification
- Analysis of full end-to-end systems based on the two points above.

### **Form**

- Scientific document, with political credibility
- Succinct, with supporting documents, e.g. GCOS plans
- Relatively short document, ca. 50 pages with 5-page executive summary.

### **Process**

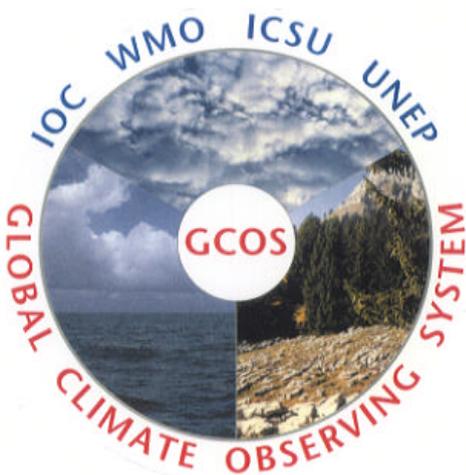
- Preparation by science team covering GCOS spectrum (ca. 10-20 people)
- Review by international workshop of scientists from Parties
- Leadership by internationally-known scientists (e.g., from WCRP or GCOS Panels)
- Team endorsed by GCOS sponsors
- Framework endorsed by SBSTA/COP.

### **Schedule**

Nov 2000	Consultation with UNFCCC Secretariat
Dec 2000	Proposal and working team to sponsors
Mar 2001	Team drafts outline of report
Jun 2001	Report outline and process to SBSTA
Nov 2001	National reports to COP
Mar 2002	Team commences assessment
Aug 2002	Complete Synthesis Report
Oct 2002	International science workshop to review information in national reports and to consider other available information on systematic observations
Nov 2002	Report to COP-8 (re Synthesis Report)
Jun 2003	Preliminary findings to SBSTA
Aug 2003	Complete Adequacy Analysis Report
Nov 2003	Report to COP-9 (re Adequacy Analysis)

## ANNEX VIII

### (a) GCOS REGIONAL WORKSHOPS ON IMPROVING GLOBAL CLIMATE OBSERVING SYSTEMS



#### BACKGROUND

The Parties to the United Nations Framework Convention on Climate Change (UNFCCC) have recognized the importance of high quality data for climate-related purposes and have noted that in many instances either the geographic coverage, quantity, or quality of the data produced by current global and regional observing systems are inadequate. Most of the problems occur in developing countries, where lack of funds for modern equipment and infrastructure, adequate training of staff, and continuing operational expenses is often a major constraint.

Decision 14 at the 4<sup>th</sup> Conference of the Parties to the UNFCCC in 1998 urged Parties to actively support meteorological, atmospheric, terrestrial, and oceanographic observing systems. It also urged Parties to actively support the building of capacity in developing countries in order to enable them to collect, exchange, and utilize data to meet local, regional, and international needs. Decision 5 at the 5<sup>th</sup> Conference of the

Parties in 1999 reinforced the earlier decision by urging the Parties to address deficiencies in climate observing networks and by inviting them, in consultation with the Global Climate Observing System Secretariat, to identify the capacity-building needs and funding required in developing countries to enable them to collect, exchange, and utilize data on a continuing basis in pursuance of the Convention. Specifically, Decision 5:

- *Recognizes* the need to identify the priority capacity-building needs related to participation in systematic observation;
- *Invites* the Secretariat of the Global Climate Observing System, in consultation with relevant regional and international bodies, including the Global Environment Facility, to organize regional workshops on this issue; and
- *Urges* Parties to actively support and participate in these regional workshops.

#### THE GCOS STRATEGY FOR INITIATING IMPROVEMENTS IN OBSERVING SYSTEMS

Regional workshops are a fundamental element of GCOS's four-part strategy for improving observing systems for climate. For each region, the *first* part of our strategy is to acquire a basic understanding of the particular observing system deficiencies of the region and to identify a regional partner with whom to work. As a small secretariat, GCOS must rely on collaboration with regional

organizations. Such organizations will enable us both to utilize existing regional expertise and to develop relationships with those most capable of carrying out the priority actions identified at workshops. The *second* part of our strategy is the regional workshop itself. Workshops will serve both to build consensus on what needs to be done and to lay the groundwork for the development of an action plan in the *third* phase of the strategy. Action plans will provide a detailed strategy for addressing the priority observing system needs identified in regional workshops. The development of detailed action plans and proposals will normally be undertaken by regional entities; however, GCOS can continue to play an active, though reduced, role in this phase. Action plans might address needs for training, analysis, continuing operations, infrastructure, and/or hardware procurement. The *fourth* phase of the strategy is implementation and involves, first, obtaining the necessary resources and, second, using them to make the needed improvements. We recognize that there is no source of funds for continuing operations and thus that the countries involved will need to be responsible for maintaining their observing systems. We also recognize that no single source of funding exists for all of the needs countries are likely to have. Hence, a proposal may need to be directed toward a consortium of funding organizations and donor countries, such that each member of the consortium would be requested to fund that portion that best relates to its mandate or interest.

## **REGIONAL WORKSHOP GOALS**

GCOS launched its regional workshop program in response to the UNFCCC invitation in January 2000. The first GCOS Regional Implementation Workshop is scheduled to take place in the South Pacific region in August 2000. Our long-term objective is to organize 1 to 2 workshops per year in different developing regions of the world during the next five years. The fundamental aim of the program is to initiate processes that will

lead to real and substantial improvements in global climate observing systems.

The central goals of GCOS's regional workshops are:

- To assist developing countries in identifying regional deficiencies in global observing systems for climate;
- To assess priority observing system needs and funding required to enable countries to overcome deficiencies in observing systems and to allow them to collect, exchange, and utilize data on a continuing basis in pursuance of the UNFCCC;
- To initiate development of action plans and proposals to fund improvements in observing systems.

## **WHY ARE IMPROVED OBSERVATIONS IMPORTANT?**

At the global level, improved observing systems for climate will enhance the ability of scientists to understand, detect, and predict climate change. Better knowledge of climate change will in turn enable improvements in strategies to mitigate and, as necessary, adapt to its potential harmful effects. Accurate observational data are also important for a broad range of sustainable development needs. At the regional level, both developing and developed countries need observational data to improve impact analyses, seasonal-to-interannual climate predictions, and monitoring of sea level rise and of such extreme events as hurricanes and drought. There is a confluence of interests between the need to improve the climate observing system globally and the need for improved observations at national and regional levels. In supporting improved observations, the Parties to the UNFCCC have understood the importance of accurate, long-term data for developing sound climate change policies.

**(b) Summary of the**  
**Pacific Islands Regional Implementation Workshop**  
**On Improving Global Climate Observing Systems**

**August 14-15, 2000**

**Apia, Samoa**

The Pacific Islands Regional Implementation Workshop, held in Apia, Samoa August 14-15, 2000, was the first in what GCOS expects to be approximately 10 workshops in various developing regions of the world. The principal motivation for organizing this and subsequent regional workshops is Decision 5/CP.5 of the 5<sup>th</sup> Conference of the Parties to the Framework Convention on Climate Change. This decision recognizes the need to identify the priority capacity-building needs of developing countries related to participation in systematic observation and invites the secretariat of the Global Climate Observing System, in consultation with relevant regional and international bodies, to organize regional workshops on this issue.

The South Pacific Regional Environment Programme (SPREP) assisted GCOS in the organization of the workshop, and SPREP, as the principal regional entity concerned with climate variability and change, will take the lead in co-ordinating and implementing the actions specified in the workshop resolution (see Annex 1). Significant support for the workshop was provided by the World Meteorological Organization, the United Nations Environment Programme, the United States of America, and Australia. The participants of the workshop included the meteorological service directors from some 20 Pacific Island countries and a number of climate change co-ordinators from these countries.

The principal goals of the workshop were to assist participants in identifying regional deficiencies in climate observing systems, to assess priority observing system needs in the region, and to initiate the development of regional action plans and proposals to fund improvements in observing systems.

Day 1 of the 2-day workshop consisted principally of two sets of presentations (see the workshop agenda in Annex 2). The first was designed to familiarize participants with GCOS, help them understand the linkages between GCOS and the UN Framework Convention on Climate Change, and inform them about the possibilities, especially through the Global Environment Facility, for funding improvements in observing systems. The second set of presentations reviewed the status and needs of observing systems in the region, addressing in turn the question of why improved observations are important for the region and the globe and the deficiencies and needs of key meteorological, oceanographic, and terrestrial observing systems. A key talk was given on the climate observing elements of a recently completed study, titled *Pacific Meteorological Services: Meeting the Challenges*. This report, commonly known as the "Needs Analysis," gives the countries of the Pacific region an important head start in identifying climate observing system needs and in developing a regional action plan to address these needs.

Day 2 of the workshop began with a presentation by Dr. John Zillman, who introduced a discussion paper specially prepared for the workshop on "Developing an Action Plan for Improved Climate Monitoring in the Pacific." The remainder of the day was devoted to group discussion of regional priorities and to consideration of next steps to take in realizing the ultimate GCOS objective of making real and significant improvements in climate observing systems in the region. The principal outcome of this discussion was the decision to prepare a workshop resolution reflecting the consensus of participants. A draft "Resolution Concerning the Improvement of Global Climate Observing Systems in the

Pacific Region” was prepared after the close of the meeting and subsequently considered, revised, and approved two days later by the same participants at the 7<sup>th</sup> Regional Meteorological Service Directors Meeting.

The Resolution approved by the workshop participants was a significant achievement of the workshop. In it, the participants encouraged the countries of the region to support their NMHSs in the preparation of national reports on activities related to systematic observation (as invited by the Parties to the UNFCCC) and urged the preparation of a regional Action Plan that would form the basis for the development of proposals for funding improvements for observing systems for climate in the region. Significantly, a series of actions was specified in the resolution, that if taken by SPREP and the Pacific Island countries, would result in completion of the Action Plan by June 2001. The complete Resolution is attached to this report.

Given that the Pacific Island Regional Implementation Workshop was the first of up to 10 regional workshops that GCOS expects to organize in the next 5 years, it was, in large part, a pilot workshop and, hence, an opportunity to learn lessons that may be applicable in organizing future workshops. Overall, GCOS considers this first regional workshop to have been a success. Some lessons learned that may help us in the future include the following:

- The workshop emphasized the importance of having a strong regional partner. Developing a regional plan will depend on the efforts of our partner (in this case SPREP) to follow through on the outcome of the workshop;
- GCOS needs to spend more time ensuring that participants understand what GCOS is, how it is related to other entities, and what it can do for them. Having a summary in laymen’s language, based on the GCOS implementation strategy, might be helpful;
- There should be a more extensive discussion at the workshop of the importance and preparation of national reports. This might include a mini-tutorial on what information should be included in the national reports and on the UNFCCC guidelines and their application;
- Having national Climate Change Coordinators at the workshops is important in order to facilitate the discussion on how to include systematic observation within a Party’s national communications and reports to the UNFCCC;
- The importance of observational people, e.g., directors of NMHSs, in the development of national strategies and plans needs to be emphasized;
- An explicit listing of GSN and GUAN stations within the region or sub-region and the current status of these stations should be provided to each participant. If possible, it would be desirable to have as much analysis as possible of the known deficiencies and problems within the region;
- A short presentation on the opportunities and process of funding through the Global Environment Facility should be included in each workshop;
- It is not clear how best to incorporate the needs of oceanographic, terrestrial, and atmospheric chemistry observing systems in workshops since these activities are often

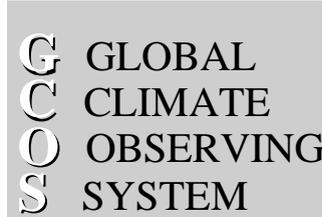
small or non-existent and are not represented nationally in a coherent way as is done by the NMHSs for meteorological observing systems;

- Our original goal of developing Actions Plans at regional workshops is clearly too ambitious. Perhaps the best we can do is inform participants, get initial regional input on deficiencies, and then have participants “buy in” to moving ahead on developing a regional Action Plan for improving their observing systems;
- Where a resolution can be agreed on, it can be a valuable tool to use in preparing reports and in reporting to the UNFCCC and other bodies. Such resolutions should be distributed widely;
- The Pacific Island workshop demonstrated that creating a new entity, such as the regional climate center envisioned in our discussion paper, may be difficult in many regions. However, a virtual organization with distributed responsibilities may be a more workable option to facilitate improvements in climate observations;
- Success in one region does not guarantee similar success in other regions. Each region is unique, and it will be necessary to learn as much as possible about region-specific issues, regional organizations, and cultural conventions in order to design effective workshops.



**South Pacific Regional Environment Programme (SPREP)**

PO Box 240  
Apia, Samoa  
Tel: (685) 21929  
Fax: (685) 20231  
Email: [sprep@sprep.org.ws](mailto:sprep@sprep.org.ws)



**GCOS Secretariat**

c/o World Meteorological Organization  
7 bis, Avenue de la Paix  
PO Box No. 2300, CH-1211 Geneva 2, Switzerland  
Tel: +41(22) 730-8275/8067  
Fax: +41(22) 730-8052  
Email: [gcossjpo@gateway.wmo.ch](mailto:gcossjpo@gateway.wmo.ch)

**RESOLUTION CONCERNING THE IMPROVEMENT OF GLOBAL CLIMATE OBSERVING SYSTEMS IN THE PACIFIC REGION**

***The participants<sup>1</sup> in the GCOS Pacific Islands Regional Implementation Workshop on Improving Global Climate Observing Systems,***

*Welcome:*

The opportunity provided by the GCOS Secretariat in partnership with SPREP, and with the support of WMO, UNEP, IOC, ICSU, to identify ways to improve observing systems for climate and in other activities related to climate observing systems in the Pacific region.

*Recalling:*

- (1) That the Conference of the Parties (COP) to the UN Framework Convention on Climate Change (UNFCCC) has encouraged Parties to actively support capacity-building in developing countries to enable them to collect, exchange, and utilize data to meet local, national, regional, and international needs (Decision 14/CP.4), and has recognized the need to identify priority capacity-building needs related to participation in systematic observation (Decision 5/CP.5);
- (2) That the COP to the UNFCCC has determined that the Global Environment Facility (GEF) should provide funding to developing countries to build capacity for participation in systematic observational networks to reduce scientific uncertainties (Decision 2/CP.4);
- (3) That Decision 5/CP.5 urges Parties to address deficiencies in the climate observing networks and to bring forward specific proposals for that purpose and to identify the

---

<sup>1</sup> American Samoa, Australia, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Tonga, Tuvalu, USA, Vanuatu, Solomon Islands, World Meteorological Organization (WMO), Intergovernmental Oceanographic Commission (IOC) Perth Office, Food and Agriculture Organization of the United Nations (FAO), Forum Secretariat (FORSEC), South Pacific Geoscience Commission (SOPAC), South Pacific Regional Environment Programme (SPREP), Global Climate Observing System (GCOS) Secretariat; East West Center, Hawaii; National Tidal Facility (NTF), Flinders University, Australia.

capacity-building needs and funding required in developing countries to enable them to collect, exchange, and utilize data on a continuing basis in pursuance of the UNFCCC; and

- (4) The role and importance of GCOS to facilitate systematic observation regionally.

*Recognizing:*

- (1) That Pacific Island countries are considered among the most vulnerable to the consequences of human-induced climate change, in particular, global warming and the potential threats associated with extreme weather events and sea level rise;
- (2) That improved observations of climate will enable provision of information and forecasts which will greatly assist the governments and national communities of member countries to prepare for the season-to-season and year-to-year variations of climate associated with El Niño and other natural phenomenon, as well as to detect and better prepare for long-term, human-induced climate change;
- (3) That Pacific Island countries currently face significant challenges associated with natural climate variability, including droughts, tropical cyclones, floods, sea level variations, and changes in ocean temperature;
- (4) That oceanic and atmospheric circulation patterns and ocean-atmosphere interactions in the Pacific play dominant roles in determining global patterns of climate change and climate variability;
- (5) That measurements of meteorological/atmospheric, oceanographic, and terrestrial variables in Pacific Island settings provide essential data for detecting and attributing climate change; for monitoring, understanding and predicting climate change and climate variability; for developing strategies to ameliorate the potential harmful effects of climate change and climate variability; and for advancing sustainable development globally; and
- (6) That the basic observation networks of National Meteorological and Hydrological Services (NMHSs) provide the foundation on which the strengthening of GCOS must be built.

*Encourage:*

- (1) The countries of the region to support their NMHSs to prepare national reports on activities related to systematic observation, as invited by the Parties to the UNFCCC in Decision 5/CP.5.

*Urge:*

- (1) That a regional Action Plan be prepared to form the basis for the preparation of a proposal(s) for funding improvements in observing systems for climate and in other activities related to climate observing systems in the Pacific region;
- (2) That the Action Plan be prepared in accordance with the following programme:
  - a) Within the next 3 to 4 months, SPREP members will develop initial reports on national requirements and priorities for improving observing systems for climate. These reports should be developed through coordination between NMHSs and PICCAP country teams, where appropriate, and could take advantage of the

current opportunity associated with the incremental funding recently provided by GEF to continue PICCAP programmes in participating countries. All SPREP members should strive to develop these reports in the context of national implementation programmes pursuant to the UNFCCC guidelines, making use of the "elements" paper prepared by the Workshop, as well as of guidelines contained in FCCC/CP/1999/L4/Add.1, and submit them to SPREP;

- b) Upon receipt of these reports, SPREP will develop a consolidated report on regional requirements and priorities for improving observing systems for climate. This report will be submitted to SPREP members for approval; and
- c) In cooperation with the Council of Regional Organizations in the Pacific (CROP) and the co-sponsors of GCOS, SPREP will facilitate the development of a Pacific GCOS Action Plan that will incorporate the priorities raised in the country reports, such as those in the initial National Communications, the SPREP-led Pacific Meteorological Services Needs Analysis Project (PMSNAP), and the outcomes of the Pacific Islands Conference on Climate Change, Climate Variability and Sea Level Rise held in Rarotonga, Cook Islands, 3-7 April, 2000 and the findings of the Pacific Islands Regional Implementation Workshop on Improving Global Climate Observing Systems held in Apia, Samoa, 14-15 August, 2000. In order to take advantage of opportunities to report to the UNFCCC, this regional Action Plan should be completed no later than June 2001 and, if possible, presented to the Seventh Conference of the Parties (COP-7) to the UNFCCC deliberations in July 2001. To facilitate this process, the Workshop participants recommend the creation of a core drafting team comprised of 4-6 people from SPREP members.

*Requests that:*

- (1) SPREP and GCOS Secretariat ensure that this resolution is widely distributed within the Pacific region and with appropriate collaborating partners;
- (2) SPREP, on behalf of SPREP Pacific Island country members, source PDF A, and other resources to assist with the development of the Action Plan and related GEF proposal;
- (3) SPREP, representing its member countries, in consultation with other CROP organizations, use the information developed in the Action Plan to prepare a Full Project proposal to potential donors, including GEF, to fund improvements in observing systems for climate and in other activities related to climate observing systems in the Pacific region;
- (4) Development partners consider financing appropriate elements of the Action Plan;
- (5) Parties to the UNFCCC in the region and the GCOS Secretariat bring this resolution to the attention of COP and its Subsidiary Bodies; and
- (6) NMHSs become actively involved in the preparation of their national reports on activities related to systematic observation, as invited by the parties to the UNFCCC in Decision 5/CP.5.

**ANNEX IX**  
**GCOS REPORT TO SBSTA-13/COP-6**

**G** GLOBAL  
**C** CLIMATE  
**O** OBSERVING  
**S** SYSTEM



**GLOBAL CLIMATE OBSERVING SYSTEM (GCOS):  
REPORT TO THE THIRTEENTH SESSION OF THE SUBSIDIARY BODY FOR SCIENTIFIC  
AND TECHNOLOGICAL ADVICE OF THE CONFERENCE OF THE PARTIES TO THE UN  
FRAMEWORK CONVENTION ON CLIMATE CHANGE  
(Prepared by the GCOS secretariat August 2000)**

## **INTRODUCTION**

At its twelfth session, the Subsidiary Body for Scientific and Technological Advice (SBSTA) invited the GCOS secretariat, on behalf of the agencies participating in the Climate Agenda, to report periodically on recent developments in the global observing systems for climate and on progress in responding to decision 5/CP.5.

This document reports on:

- results from recent monitoring of some key components of the GCOS which suggest that the system has continued to deteriorate since the last report to SBSTA-11 and COP-5 and requires the urgent attention of Parties;
- significant developments in the global observing systems for climate for the oceans and for terrestrial carbon; and
- GCOS's responses to decision 5/CP.5 including holding of regional workshops, determining the adequacy of the GCOS and in regard to facilitating an intergovernmental process.

## **1 RECENT MONITORING OF SOME KEY COMPONENTS OF THE GCOS**

The GCOS<sup>1</sup> was established in 1992 to ensure that the observations and information needed to address climate-related issues are obtained and made available to all potential users including the UNFCCC. It addresses the total climate system including physical, chemical and biological properties, and atmospheric, oceanic, hydrologic, cryospheric and terrestrial processes.

GCOS builds upon, and works in partnership<sup>2</sup> with, other existing and developing observing systems and also draws upon proven networks established under research programs. GCOS integrates satellite observations provided by national agencies together with surface based observations through its participation in the Integrated Global Observing Strategy (IGOS<sup>3</sup>) partnership. The latter brings together all of the global observing systems, the satellite operators, research funding agencies, and the international research programmes to address major observing system requirements including the carbon and the water cycles in the most cost effective manner.

One of the major activities of GCOS is the establishment of operational performance standards for its contributing networks. These enable GCOS to assess and report upon the actual effectiveness of those networks in meeting the needs of the users. As might be expected this activity is still in its infancy and the performance criteria for most of the networks are still under development. The following two sections outline performance information in two areas.

### Atmospheric Climate Observations

The GCOS Surface and Upper Air Networks (GSN and GUAN) were established as sub-sets of the full World Weather Watch (WWW) networks of WMO's Global Observing System operated to GCOS standards. Monitoring of the performance of the GSN and GUAN and archiving of their data<sup>4</sup> are now fully operational and some recent results are presented in Table 1. They show, by WMO Region and globally: number of stations; the percentage of "good" stations (i.e. those from which at least 90 per cent of required reports were received at the relevant monitoring Centre); the percentage of "inadequate" stations (i.e. those from which between 50 and 89 percent were received); the percentage of "unsatisfactory" stations (i.e. those from which between 1 and 49 percent were received); and the percentage of "silent" stations (i.e. those from which no data were received. This does not mean that all of these stations are not operational; they may be making some daily observations but, for different reasons their climate reports have not been received.).

**Table 1 Status of GCOS meteorological networks by WMO Region.**

	<b>WMO Region</b>	<b>No of stations</b>	<b>Percentage providing at least 90% of reports</b>	<b>Percentage providing from 50-89% of reports</b>	<b>Percentage providing from 1-49% of reports</b>	<b>Percentage of "silent" stations</b>
<b>GCOS Surface Network (GSN) - monitoring period: Jul-Dec 1999</b>	I - Africa	155	8	33	12	47
	II - Asia	262	37	26	2	35
	III - South America	120	33	16	8	43
	IV - North & Central America	157	72	9	10	9
	V - South-West Pacific	155	35	14	8	43
	VI - Europe	120	51	9	3	37
	Antarctica	20	50	20	0	30
	Global	989	39	19	6	36
<b>GCOS Upper Air Network (GUAN) - monitoring period: Jan-Jun 1999</b>	I - Africa	23	9	57	17	17
	II - Asia	26	62	11	0	27
	III - South America	17	24	35	6	35
	IV - North & Central America	20	40	10	5	45
	V - South-West Pacific	37	62	16	0	22
	VI - Europe	15	60	14	13	13
	Antarctica	12	75	8	0	17
	Global	150	47	22	6	25

Table 1 shows that the worst situation regarding the implementation of the GSN is in Africa, South America and the South-West Pacific where only about 50% of GSN stations have provided more than 50% of expected data. In addition about 45% of GSN stations in these regions are "silent". The worst implementation of the GUAN is in Africa, North & Central America, and South America, from where the relevant monitoring centres have received more than half the expected data from only about 60% of stations and about 40% of stations in these regions are "silent".

These data, based on performance of the GSN and GUAN, differ in detail from those presented to SBSTA-11 and COP-5 (FCCC/SBSTA/1999/10 paras 12 and 13 and Table 1) which indirectly inferred the performance of the GSN and GUAN from monitoring of the WWW and for a limited period only. But, as the GSN and GUAN stations were chosen, in part, on the basis of expected reliability, the data very strongly suggest that the situation has deteriorated over the last twelve months. Furthermore, analysis of the *quality* of those data which have been received indicates that they are not all to GCOS standards. It is apparent that these networks are completely inadequate for their intended purpose and that more focused resources are needed.

There are several reasons for the low reception rates and low quality. Some developing countries have problems maintaining stations because funds are inadequate for equipment, consumables, and ongoing operations. Other problems are caused by inadequate communications systems and lack of qualified staff. Some of these may be overcome as feedback from the monitoring centres is provided to the stations concerned. In addition to the need to improve transmission of current climate data, much useful historical data exist but have not yet been forwarded to the relevant archiving centres. Again, lack of funds for retrieving these data is a concern within some countries.

### **Ocean Climate Observations**

Monitoring systems for the operational ocean observing system have yet to be established and so this report provides information in Table 2 on the basic atmospheric/ocean surface variables, by major ocean basin, similar to that provided to SBSTA-11 and COP-5 (FCCC/SBSTA/1999/10 paras 14 and Table 2). The data represent the range of daily average percentages of the World Weather Watch (WWW) requirements met for each variable for a recent period; for these data, GCOS requirements are not likely to be much different. Since most of the observations are derived from voluntary observing ships (VOS) and drifting or moored buoys, there is considerable variation even within each ocean basin, and the table reflects this. The apparent excessive coverage in the North Atlantic applies only in very limited areas, usually close to coasts or in much-used shipping lanes, or where some ocean buoys are reporting every hour.

From an analysis of these and similar results, it is clear that the availability of data from the oceans is far from satisfactory at the present time: though performance is relatively consistent for most regions contained in the report to SBSTA-11, there are vast regions of the southern hemisphere's oceans - a key region for the global climate system - that remain almost completely void of data.

**Table 2 Information on the status of selected oceanographic data by ocean basin.  
(Based on monitoring during May 2000.)**

<b>Ocean Basin</b>	<b>Surface air pressure (percent WWW requirements)</b>	<b>Surface air temperature (percent WWW requirements)</b>	<b>Surface wind (percent WWW requirements)</b>	<b>Sea surface temperature (percent WWW requirements)</b>
<b>North Atlantic</b>	25-150	40-200	20-100	40-100
<b>South Atlantic</b>	10-50	0-25	0-20	15-70
<b>North Pacific</b>	5-50	20-60	20-70	40-100
<b>South Pacific</b>	<10 <sup>3</sup>	5-25	0-15	10-70
<b>Indian</b>	15-70	0-20	0-20	20-40
<b>Southern</b>	<10	<5	<5	<10

## 2 SIGNIFICANT RECENT DEVELOPMENTS IN GLOBAL OBSERVING SYSTEMS FOR CLIMATE

This section highlights two very important developments in components of the observing systems which are of particular interest to the Parties: in the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS).

### Ocean Climate Observations

There have been two significant events in this regard over the last year. First, an International Conference on the Ocean Observing System for Climate (OceanObs99), held in October 1999 in France, reached a consensus on an optimum mix of measurements needed for the ocean observing system for climate purposes. This has enabled the IGOS Partners to define, through an Oceans Theme, the way forward for the space-based component of the ocean observing system for climate.

#### *OceanObs99*

The Conference was bold in its vision and goals, successfully developing a broadly based and sound scientific rationale for the establishment of a sustained system. Practical El Niño forecasts, research on climate variability, climate change, and ocean and marine forecasts were prominent.

The requirements of GCOS and of the UNFCCC, as expressed particularly through COP's Decision 5/CP.5, were important factors considered. The participants were charged, in part, with identifying robust, high-quality techniques that would withstand the rigorous analyses required for climate change studies. In addition to examining the strengths of existing and pilot systems, the Conference identified weaknesses and gaps and discussed methods for addressing these deficiencies.

The Conference was purposefully structured to encourage consideration of, and agreement on, the value of a multi-purpose, integrated system. This value was evident in many areas, for example in the wide application of altimeter and wind vector measurements and in the many considerations of complementary data streams.

Issues of cost and returns on investment were explicitly considered. Highest priority was attached to those elements that were perceived to be reliable, efficient and sustainable, from the perspective of delivering both short and long-term value for the given investment. Proven methodologies were preferred to emerging or potential techniques.

Remote sensing has become a mature technology for collecting regular, global observations. Measurements of sea surface temperature, surface wind vectors, surface wave height, sea-ice and surface topography are considered fundamental. Continuity was seen as a major issue. It is important that effective strategies for the transition of proven experimental techniques into a sustainable, operational mode be developed.

A multi-faceted, robust *in situ* network must also be implemented, in part as a complement to, and calibration for, remotely sensed data, but also for its own intrinsic value in various applications. The primary contributions include:

- C The tropical Pacific ENSO Observing System and its Tropical Atmosphere-Ocean (TAO) mooring array;
- C The global array of profiling floats, *Argo*, returning around 100,000 profiles of temperature and salinity annually;
- C A global surface drifter array and surface and subsurface networks operated from voluntary observing vessels;
- C Surface and subsurface reference sites, such as provided by sea level stations and fixed-point deep measurements;
- C Hydrographic measurements targeting the carbon cycle and the deep ocean circulation; and
- C Acoustic tomography in selected high latitude regions.

Many gaps are evident, in terms of global coverage and temporal sampling, in terms of quality and sophistication of processing, in terms of timely delivery, and in terms of missing information. The Conference agreed that strategies must be developed and supported to meet such needs. The GCOS provides an important mechanism for this purpose.

The development of a new paradigm for oceanography was one of the major achievements of the Conference. Free and wide availability of all data and products will now be the norm, not the exception. While the focus of the Conference was on measurement networks, all participants recognized the fundamental importance of models and data assimilation to the progress, prosperity and evolution of the observing system. The new paradigm is fashioned around the use of models to interpret and exploit data and to develop products that encourage wide adoption and value adding.

The degree of unanimity achieved by the Conference exceeded expectations, yet there is clearly much work remaining, both in terms of detail and in terms of implementation and sustained operation. However the ocean community can look forward with some confidence to an era of great prospect and opportunity, and also one of enhanced responsibility. And, in the longer term, the FCCC can expect a significant advance in meeting its requirements for ocean climate data from the situation described to in the report prepared by the GCOS secretariat for COP-4 (Comprehensive report on the development of the observational networks of the climate system; FCCC/CP/1998/MISC.2).

#### *The IGOS Oceans Theme*

The 'Oceans Theme' has, as overall goal, the creation of an observing system for the oceans that serves both the research and operational oceanographic communities. The Theme, the first of a series being developed under the IGOS Partnership, received preliminary endorsement at the IGOS Partners' meetings in early June 2000 and it is expected to be essentially complete by the end of this year.

A specific goal is to consider and study the full range of current and planned observations, while identifying potential gaps in future observations that might compromise ocean observational records. The Theme report presents a proposed set of long-term ocean observations and identifies a number of challenges for the improvement of knowledge about both the oceans and observing techniques. The set of observations is based on an evaluation of the range of requirements that have already been presented by GOOS, GCOS, and the Global Ocean Data Assimilation Experiment (GODAE).

The next five years will require development of institutional structures committed to:

- C managing the total data flow (*in situ* as well as satellite);
- C managing the production, distribution and quality assessment of relevant data products; and
- C working with end-users to ensure that the evolving system is responsive to their needs.

It is also recognised that observation protocols evolve with time and, therefore, that the stated observational requirements will need to be reviewed. It is the recognised applications that ultimately drive the shape of the requirements for the ocean observing system. The focus has been on observations which are needed to address important issues in ocean science, and through combinations of measurements and models, to support the production of an extensive range of products for a broad community of users. The applications are directly linked to societal needs relating to issues including climate and climate change, weather prediction, and seasonal-to-interannual forecasts. The data are needed for deriving fields of information about the ocean and for initialising and validating the models used to derive other products. In addition, there is also the need to improve how the data are assimilated into models.

In terms of the long-term continuity challenge, the Oceans Theme delineates observations, key issues, and objectives in the following areas: ocean topography, ocean vector winds, ocean biology, sea surface temperature, sea ice, precision gravity field or geoid, salinity, sea state and atmospheric pressure, and sea ice thickness.

In early 2000, space agencies made commitments to fill identified observation, data product and service requirements. The IGOS Oceans Theme Report will reflect these commitments, as well as identifying additional *in situ* observation requirements and commitments. At its June 2000 meeting, the IGOS Partners urged all Partners to accept the Ocean Theme Report as a strategy document for implementation and, as appropriate, to seek governing body approval at the earliest opportunity.

GOOS was urged to take the lead in implementing the Oceans Theme and CEOS agencies and all Partners were encouraged to make supporting contributions.

### **Terrestrial Carbon**

The IGOS Partners under the leadership of the Global Terrestrial Observing System (GTOS) have commenced the development of an integrated observing system to provide the information needed to document and understand the role of terrestrial carbon sources and sinks in the global carbon cycle. Key partners include IGBP, a number of national space agencies, WCRP, GCOS, FAO, UNEP and UNESCO and will build upon the assessment work currently underway in the IPCC.

This has involved, as a first step, the need to agree on the observation and modelling requirements; to harmonise the existing projects and activities that can contribute to a global observing system; and to ways to fill key gaps. Some requirements for estimating terrestrial carbon are well understood although in certain cases the continuity of their measurement is of concern. For example: land cover and land use change, leaf area, biomass burning (fire scars), solar radiation, atmospheric composition, surface fluxes, and crop and forest production are among the key observations for which method of measurement and use of data are well established.

Other observations are less well understood and/or techniques for their measurement may be needed before global observations can be implemented. The important issues include: biomass and its changes, canopy structure, CO<sub>2</sub> measurement from satellite platforms, atmospheric CO<sub>2</sub> concentration at a micro-scale, plant biogeochemistry, and meteorological parameters with a fine spatial resolution.

Although carbon is at the heart of many UNFCCC and other global change discussions, more systematic observations are needed in order to estimate pools and fluxes (which tend to be more short-term) and use models to validate and highlight gaps in our current knowledge. There is also a need to move beyond the current approach whereby process models are tested on a very small scale and then extended to the global scale.

Emphasis is being placed on understanding the current spatial distribution of the sources and sinks in terrestrial systems and seasonal, annual, interannual, and decadal fluxes in carbon stocks. TCO encompasses the terrestrial and associated atmospheric parts of the carbon cycle. However, efforts are underway to integrate this with the ocean carbon observation requirements which are already partly developed. A global observation network will allow the development and testing of both process-based ecosystem models, their extrapolation to larger scales, and the assessment of sub-continental-scale flux variability.

Two scientific meetings have been held this year to develop consensus on the observation requirements. The IGOS partners will consider the development of an operational system at their next meeting in November 2000.

GTOS has also been developing a global system of terrestrial observing networks (GT-Net) to facilitate the collection and exchange of terrestrial observations data under its Terrestrial Ecosystems Monitoring Sites database. So far climate-related networks have been established for Glaciers and Permafrost while a Hydrology network is in the initial stages of development.

## **3 GCOS'S RESPONSES TO DECISION 5/CP.5**

As the Parties will recall there were a number of components to decision 5/CP.5. The following sections will address how GCOS, its Sponsors and its Partners have responded to them.

### **Regional Workshops**

In response to 5/CP.5 (2), the GCOS secretariat had already begun to organise regional workshops to identify the capacity-building needs of developing countries. With support from the WMO, UNEP, the USA and Australia, the first workshop covering the South Pacific region will be held in Samoa in August 2000. Further workshops are under development building on offers of support from Canada, Japan, UNEP and EUMETSAT, including the holding of the second, probably in Africa, in the next six to nine months.

## **Analysis and Synthesis of Reports on Global Climate Observing Systems (5/CP.5 (9))**

Decision 5/CP.5 requested the GCOS secretariat to work with the Convention secretariat to develop a process for synthesising and analysing national reports on observations. There are four essential foundations for determining properly the adequacy of a global observing system for climate to meet the Convention's needs: the first, guidance to ensure adequate and consistent information from the Parties, was established at COP-5. The second is full reporting by all Parties; reporting from only Annex I Parties, no matter how detailed, will severely hamper adequate analysis of the global systems. Preliminary work has begun on the remaining two foundations: the analysis and synthesis of the reports, and the development of a report to the Parties on the adequacy of national contributions to a global climate observing system.

### **Intergovernmental Process**

Decision 14/CP.4 requested "IACCA, through the GCOS Secretariat to initiate an intergovernmental process for addressing priorities for action to improve observing systems and for identifying immediate, medium-term and long-term options for financial support." while decision 5/CP.5 requested the GCOS secretariat to continue this activity and to report on it to SBSTA-12.

The GCOS Secretariat took advantage of an informal meeting of government and other experts convened by Canada in February 2000, to consider the most appropriate form of intergovernmental process for improving observational systems. The participants strongly urged GCOS to pursue a multi-pronged approach: given the nature and range of the observing systems involved, they concluded that the best solution would be to make effective use of all of the existing inter-governmental mechanisms potentially available to GCOS through its sponsors agencies and their appropriate subsidiary bodies; to continue to engage the UNFCCC and its bodies, particularly SBSTA in addressing the specific needs associated with climate change; to encourage national co-ordination of all aspects of climate observations across the various disciplines and domains; and to increase the proportion of representatives of the operational community on the GCOS Steering Committee. These conclusions were communicated to the GCOS sponsoring agencies and to SBSTA-12 on behalf of the participants.

The Fifty-second Session of the WMO Executive Council (May 2000) and the Thirty-third Session of the IOC Executive Council (June 2000) each adopted a wide-ranging resolution on GCOS, with emphasis on its interaction with the UNFCCC, particularly with regard to decisions 4/CP.5 and 5/CP.5. It is anticipated that the matters related to the implementation of the systematic observations required by the UNFCCC will be brought to the attention of a number of intergovernmental meetings over the next year including sessions of the WMO's Regional Associations II, III and IV (respectively, Asia, South America, and North and Central America); of the WMO's Commissions for Hydrology, for Climatology and for Basic Systems; and of the Joint (WMO/IOC) Commission for Oceanography and Marine Meteorology). It is hoped that similar mechanisms can be developed involving both UNEP and the FAO. It should be noted that ICSU at its twenty-sixth General Assembly in September 1999 requested that their constituent bodies should become more actively engaged in the matter of systematic observations.

### *GCOS Implementation Strategy*

One of the key messages that has become apparent over the past year, due to the large number of agencies involved as Partners with GCOS in the implementation of global observing systems for climate, is the requirement for a clearly articulated Implementation Strategy that clearly identifies how governments will be involved as well as how GCOS will work with its Partners in the implementation of global observing systems for climate. A formal strategy will be considered by the GCOS Steering Committee at its next session in China in September 2000. It will emphasise the need to foster ownership by national governments in implementing a multidisciplinary and multidomain global observing system for climate by stressing the cost effectiveness of building on existing national systems that in many cases have been implemented and operated for other purposes including basic research. The strategy will also emphasise the key role of the COP in supporting the work of GCOS and its partners to implement a Parties-based global observing system for climate responsive to the needs of the Convention.

---

<sup>1</sup> GCOS is co-sponsored by the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the United Nations Environment Programme (UNEP) and the International Council for Science (ICSU).

<sup>2</sup> The GCOS Partners include the World Weather Watch (WWW), the Global Atmosphere Watch (GAW), WMO's Hydrology and Water Resources Programme (HWRP), the Global Ocean Observing System (GOOS), the Global Terrestrial Observing System (GTOS), the Global Environmental Monitoring System (GEMS), the Global Resource Information Database (GRID), the World Climate Programme (WCP, including data and monitoring, applications and services, impacts and responses, and WCP-Water), the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), the Intergovernmental Panel on Climate Change (IPCC), the Committee on Earth Observation Satellites (CEOS), the Integrated Global Observing Strategy-Partners (IGOS-P), and the United Nations Framework Convention on Climate Change (UNFCCC).

<sup>3</sup> GCOS is a Partner in the Integrated Global Observing Strategy, which takes a strategic view across all Earth observing requirements, i.e. it looks at observing requirements for climate, but also includes the needs of other multiple domains. IGOS evaluates the capabilities of current and planned satellite and surface-based observing systems to meet the user requirements, organised by theme or category. The IGOS Partners include:

- The Committee on Earth Observation Satellites (CEOS), which coordinates national agencies launching satellites.
- Integrated research programmes on global change within the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP);
- The International Group of Funding Agencies for Global Change Research (IGFA).
- International agencies sponsoring global observations, including the Food and Agriculture Organization of the United Nations (FAO), Intergovernmental Oceanographic Commission of UNESCO (IOC), International Council for Science (ICSU), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Environment Programme (UNEP), and World Meteorological Organization (WMO).
- The Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS) as well as GCOS, which organise global-scale operational observations of the climate, oceans and land surface.

<sup>4</sup> GSN and GUAN monitoring and archiving is undertaken through the collaborative efforts of the Deutscher Wetterdienst, the Japan Meteorological Agency, the UK Meteorological Office, the US National Climatic Data Center, and the European Centre for Medium-range Weather Forecasts

<sup>5</sup> Except in limited areas

## ANNEX X

### **REPORTS ON NATIONAL GCOS PROGRAMMES**

#### **(A) AUSTRALIA:**

##### **Consolidation of Australia's National Plans and Activities for GCOS/GOOS**

Decisions of the fourth and fifth sessions of the Conference of the Parties (COP-4 and COP-5) to the UN Framework Convention on Climate Change (UNFCCC), calling on Parties to address deficiencies and gaps in global climate monitoring systems, have provided a new impetus and urgency for the implementation of both the Global Climate Observing System (GCOS) and relevant aspects of the Global Ocean Observing System (GOOS). The Bureau of Meteorology has taken a key role in Australia's response to these decisions. Key elements of the decisions and of Australia's response relate to:

- Improvements in monitoring systems, including meeting the requirements appropriate to designated GCOS baseline stations in the GCOS Upper-Air Network (GUAN) and the GCOS Surface Network (GSN). During the year, all 16 designated Australian GUAN stations were made compliant with the requirement for soundings to attain heights of 5 hpa or higher. In doing so, Australia became the first country to fully meet this requirement. The Bureau also worked collaboratively with CSIRO and the Australian Institute of Marine Science (AIMS) to further develop plans for climate components of an Australian Ocean Observing System, within the context of the Oceans Policy and the Marine Science and Technology Plan, and contributed to the deployment of Argo ocean profiling floats in the Australian region;
- Reporting on the status of climate monitoring commitments as part of periodic national communications to the UNFCCC. The Bureau worked within the UNFCCC process, through co-chairing an informal group on research and systematic observation and through the secondment of a Bureau officer to the GCOS Secretariat in Geneva, to develop guidelines for national reports on climate monitoring systems which were adopted through Decision 5/CP.5 of COP-5 in Bonn (November 1999). Subsequently the Bureau accepted responsibility to coordinate preparation of the relevant elements of Australia's third national communication, to be submitted by November 2001;
- Establishment of an intergovernmental mechanism for GCOS to advise on priorities for action in meeting UNFCCC climate monitoring requirements. Following an informal meeting hosted by the Meteorological Service of Canada in February, attended by the Director of Meteorology, the concept of developing an informal network of National GCOS Coordinators as a *de facto* intergovernmental mechanism was proposed, pending the resolution of issues towards more formal actions. Plans were advanced for the first informal meeting of national GCOS coordinators in Melbourne in August 2000, with the principal item of discussion being the development of a standard (more detailed) format for national reports on climate monitoring. In addition to Australia, six countries and the GCOS Secretariat agreed to participate in the informal meeting;
- Support for a series of regional implementation workshops to assist developing countries in improving climate monitoring systems. The Bureau contributed substantially to the organization of the first such workshop, held in the Pacific region (Samoa) in August 2000, including the drafting of a key discussion paper on the development of an action plan for the region.

*Contact: Dr S. Barrell, Bureau of Meteorology, Melbourne, Australia.*

**(B) CANADA:**

**Status Report on Canada's GCOS Plan**

Background:

Canada is very supportive of GCOS and has developed a preliminary plan outlining Canada's potential contribution to it. The 157 page report entitled, "*Plan for Canadian Participation in the Global Climate Observing System (GCOS)*" was completed in April, 1999. Three key areas were identified as critical in moving the plan forward: securing funds to support Canada's monitoring networks and programs; completing more comprehensive scientific assessments to define the appropriate level of monitoring that Canada should be maintaining and finally developing an appropriate mechanism to coordinate GCOS efforts in Canada. Considerable progress has been made over this past year with regards to all three of these areas.

Funding:

The Government of Canada has allocated funds (Climate Change Action Fund) to address the climate change issue. Some of this short-term funding has been secured to undertake a number of the science assessment and network reviews identified in the GCOS Plan, to improve the quality and availability of certain climate information (e.g., making the climate station history metadata available on CDs) and to promote the awareness of this important issue with Canadians.

Within Environment Canada, internal resources have been targeted at upgrading and automating eleven vulnerable Reference Climatological Stations (RCSs) and thus ensure their longevity. Other resources are being expended on assessing data homogeneity at the 72 stations identified as Canada's contribution the GCOS Surface Network (GSN).

Numerous budget proposals are currently in the system that seek to obtain a higher level of government funding to support the departmental monitoring networks and programs. It is well recognized that these monitoring programs have significantly declined and that their on-going viability are in question. It is hoped that with the improved economic conditions in Canada that some further resources will be made available to deal with the monitoring issue.

Science Assessment and Network Reviews:

During this past year a comprehensive review of the requirements for supplementary climate observing was completed under contract. A major workshop planned for this winter will look at proposed network design and assess the adequacy for meeting GCOS needs.

In terms of the cryosphere, two major scientific assessments were identified. The first one, completed this past spring, addresses the information requirements for monitoring of glaciers, permafrost, etc. The second, dealing with lake/sea ice and snow monitoring needs, is scheduled to be completed this fall.

The hydrosphere review has also made significant advancements. Data from the initial set of 250 hydrometric stations in Reference Hydrometric Basin Network (RHBN) have been analyzed for trends attributed to a shifting climate. The knowledge gained from this scientific work in turn is being used to refine this network and make a strong case to protect these stations.

GCOS Co-ordination:

Considerable dialogue has taken place with regards to establishing a systematic observations board for coordinating and integrating activities among the numerous agencies involved with monitoring in Canada and to promote the GCOS goals. A number of organizational models are currently being looked at.

Contact:

*Mr Barry Greer, Director-General,  
Atmospheric Monitoring and Water Survey Directorate,  
Meteorological Service of Canada,  
Environment Canada*

**(C) CHINA:**

**Developing Course of GCOS in China**

**Summary**

The China Committee for GCOS (GCOS-China) was established in Beijing on July 4<sup>th</sup>, 1997. Prof. Wen Kegang, president of GCOS-China and the administrator of China Meteorological Administration (CMA), presided over at the conference. The Expert Working Group of GCOS-China was set up on July 5<sup>th</sup>, 1997 and held the first plenary session. Prof. Yi Yunqi, head of Expert Working Group, made a report entitled Working Report of the First Plenary Session of Expert Working Group for GCOS-China (the draft). The report described future work arrangement, obligation, contents and style of work as well as rules.

**The organization of GCOS-China:**

The Committee of GCOS-China headed by China Meteorological Administration, consists of 13 ministries and bureau such as State Environmental Protection Administration, State Oceanic Administration Chinese Academy of Sciences, State Planning Commission, State Science and Technology Commission, Ministry of Foreign Affairs, State Education Commission, Ministry of Finance, Ministry of Agriculture, Ministry of Forestry, Ministry of Water Resources, and Civil Aviation Administration of China. The expert group and the office were set up under the China Committee, and the experts were from 13 ministries and bureaux mentioned above.

There are a president, an executive vice-president, 3 vice-presidents in the commission. The Administrator of CMA takes up the post of the president, and a member of the commission from CMA takes up the post of executive vice-president while the posts of 3 vice-presidents are taken up by members of the commission from the State Bureau of Environmental Protection, the State.

The commission's executive branch (the office of the GCOS China Committee) is set up in CMA, and now its conventional affairs will be finished by the Department of Observations and Telecommunication/CMA and the Department of Forecasting Services and Disaster Mitigation/CMA:

The main activities of GCOS-China in 2000:

- To take part in the 'Informal Meeting on Developing and Intergovernmental Mechanism Process for GCOS', held in Canada.
- To prepare the 'Primary National Programme of GCOS-China' and take part in the ninth session of GCOS Steering Committee.
- To reform the organization of the GCOS-China Committee's office. The director of the office is Prof. Xu Xiaofeng, who is the director of the Department of Observations and Telecommunications/CMA. The vice-director for the office is Prof. Zhou Shuguang, who is the vice-director of the Department of Forecasting Services and Disaster Mitigation/CMA.
- To be reconfirming the commission and the experts.
- To prepare to hold the second GCOS-China Committee Plenary session and the fourth plenary session of the expert working group.

*Contact: Mr Xu Xiaofeng, Director-General, Dept. of Communications and Observations, China Meteorological Administration.*

**(D) GERMANY:**

## **National GCOS Activities in Germany 1999/2000**

9th session of the GCOS Steering Committee,  
12. - 14.09.2000,  
Beijing, China

The following information updates the report given at the 8th session of the GCOS SC in February 1999.

### **1) Organizational matters**

Reports on GCOS activities have been given by Mr. Vent-Schmidt, head of the German GCOS Office and WMO/CCI rapporteur on GCOS matters, on several occasions such as meetings of the CCI Advisory Working Group and WMO Congress.

A second National GCOS Meeting was organised by the German GCOS Office and hosted by the German GOOS Secretariat at the Federal Maritime and Hydrographic Agency (BSH) on 31.7./ 1.8.2000 in Hamburg. Participants covered almost all components of the observing systems for climate as well as the research domain represented by Prof. Grassl. The main items discussed have been the envisaged regional GCOS Workshop for Europe and the national reports on observing systems for climate based on decision 5/CP.5. The participants also discussed the need for a national GCOS Plan and an update of the German GCOS brochure as well as arrangements for future national GCOS coordination.

### **2) Present activities**

#### **German GCOS - News:**

- **Global monitoring activities:**

The GCOS Surface Network (GSN) Monitoring Centres (GSNMCs) operated by the Japan Meteorological Agency (JMA) and the Deutscher Wetterdienst (DWD), started monitoring the availability of CLIMAT messages on the GTS (with special focus on messages from GSN stations) in January 1999. Since January 2000 the monthly precipitation amount is quality checked by the GPCC of DWD and the monthly mean temperature is quality checked by JMA. A GSN data set is sent to World Data Centre A for meteorology including the GSN climat messages and information from the quality checks. An Internet site ([http://www.dwd.de/research/klis/gsn\\_mc/](http://www.dwd.de/research/klis/gsn_mc/)) provides information on the status of the monitoring and the monitoring results. Monitoring Reports covering the period Jan-Jun 1999 and Jul-Dec 1999 have been sent to WMO and published on this site.

Mr. Rösner, head of the German GSNMC, presented GSNMC-results on several meetings such as AOPC-VI (Geneva, April 2000), 2nd National GCOS Meeting (Hamburg, July 2000), and Informal Meeting of National GCOS Coordinators (Melbourne, August 2000).

- **RA VI regional climate monitoring activities:**

Since the first edition, covering the year 1994, the Deutscher Wetterdienst (DWD) issues the "Annual Bulletin on the Climate in WMO Region VI". Up to now there is no similar climate bulletin for the other WMO Regions. The very good response to this publication is reflected by an excellent support of the broad majority of National Weather Services of

the Region: 37 of the 48 WMO member countries of RA VI provided input, a great part of it electronically. The 1999 edition will soon be published. It is planned to make this report also available on the Internet.

- **EUMETSAT Satellite Application Facility (SAF) on Climate Monitoring (CM-SAF):**

The CM-SAF successfully passed a first review. The Review Board (chaired by Prof. Grassl) sees the CM-SAF as a unique European activity in the field of climate monitoring aiming at operational implementation. The Review Board is not aware of a similar activity in other regions, although all Parties to the UN Framework Convention on Climate Change are committed by unanimous decisions of the Conference of the Parties to contribute to climate monitoring in order to detect climate change.

The Deutscher Wetterdienst with support from EUMETSAT and WMO is organising a Training Workshop (20.-22.11.2000, Dresden, Germany) for the forthcoming CM-SAF. The objectives for the Workshop are:

- make potential users aware of the CM-SAF
- inform the user community on the ongoing developments and the future operational products
- start training users in the best possible use of the CM-SAF outcome
- consolidate the definition of the user requirements for the forthcoming Operational Phase
- initiate co-operation / feedback procedures / support concerning validation of CM-SAF products.

- **HWR/GCOS expert meeting (Geisenheim, Germany, June 2000):**

The DWD and the [Research Institute Geisenheim](#) jointly hosted the HWR/GCOS expert meeting on the establishment of a Global Hydrological Network for Climate (Geisenheim, Germany, 26 - 30 June, 2000). The meeting was prepared by WMO and GPCC. The goal of the meeting was to discuss and conceive a system of global hydrological networks with regard to GCOS and GTOS and to the variables precipitation, discharge (runoff), evapotranspiration, relative humidity/vapour pressure, snow water equivalent, soil moisture, surface water storage fluxes, ground water fluxes, water use, BGC transport, and isotopic composition of water. A report including recommendations is being prepared. More information is available from the meeting website: <http://www.dwd.de/research/gpcc/ghyclim2000/>.

## **German GOOS - News:**

Within the new WMO project *VOS Clim*, Voluntary Observing Ships (VOS) with reliable observations for climate will be selected. The DWD will as soon as possible actively contribute to this project. The Global Collecting Centres (GCCs) operated by DWD and UKMO will also be involved in the project *VOS Clim*.

Mr. Kohnke, head of the German GOOS Secretariat, is nominated as interim co-president of the newly formed JCOMM (Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology).

## **German GAW - News:**

GAW measurements at Hohenpeissenberg and Zugspitze are continuing.

The first phase of the DACH cooperation between Austria, Switzerland and Germany was finished in 2000 and a report on the state of the developed meteorological filters for identifying local signals in the ambient air data at the GAW stations Jungfraujoch, Sonnblick, Zugspitze and Hohenpeissenberg was published.

The German Quality Assurance / Science Activity Center was reactivated by the German Federal Environmental Agency with a contract to Prof. Mohnen at IFU in Garmisch. This financial support will cover the expenses for this and next year. In addition, the Bavarian Ministry of Environment intends to support a training and capacity building center for the Global Atmosphere Watch at Zugspitze. WMO has welcomed this contribution as it will significantly enhance its educational efforts particularly in developing countries. WMO has therefore agreed to provide additional funds for these training activities.

## **Update of contributions and/or activities of international data centres:**

- **Global Precipitation Climatology Centre (GPCC):**

The GPCC products comprise up to now datasets of gridded monthly area-mean precipitation for the global land surface and the period January 1986 to July 2000. This Monitoring Product is based on rain gauge observations disseminated in near real-time from worldwide about 7,000 meteorological stations. It provides monthly precipitation totals from rain- and snowfall in mm/month as well as precipitation anomalies of the reference period 1961-1990 and is routinely being updated month by month. All data being used have been quality-controlled. For more information on GPCC see: <http://www.dwd.de/research/gpcc/>.

On request of WMO, more than 150 countries have supplied additional data from totally about 40,000 stations to the GPCC in order to improve the accuracy of the analyses. A new gridded data set based on the full collective of the delivered data is expected to be available by end of the year 2000.

The GPCC projected a large-scale hydrological study jointly with the GRDC, and scientists from the Universities of New Hampshire (Vorosmarty) and of Tokyo (Taikan Oki). Project goal is to assess the reliability of observed precipitation and run-off data based on comparison of both using hydrological models.

Another project proposal has jointly been prepared by Prof. C.-D. Schönwiese (Univ. of Frankfurt) and B. Rudolf (GPCC) with regard to the WCRP Study on Climate Variability (CLIVAR). Goals are the compilation of a quality-controlled and homogenized global climatic dataset covering the total observational period and its statistical analysis.

- **The Arctic Precipitation Data Archive (APDA):**

The GPCC also participates in the WCRP Arctic Climate System Study (ACSYS). The Arctic Precipitation Data Archive (APDA) is in development. In this framework the GPCC collects snow cover and depth data and will analyse gridded liquid water equivalents from the Arctic hydrological basin (<http://www.dwd.de/research/gpcc/acsys/>).

A plan of phase 2 of the APDA project has been designed with an extension of the activities on the entire cryosphere with respect of the WCRP Study on Climate and Cryosphere (CLIC). The GPCC applied for funds of the German Polar Research Programme.

- **Global Collecting Centre (GCC) - News:**

The total data collected in 1999 was about 0,8 million observations (42%) less than in 1998! Contributions came from 14 countries, which still represent less than one third of all Marine Climatological Summary Scheme (MCSS) countries. One new contributor was registered. Details are given in the 'Global Collecting Centres for Marine Climatological Data, Annual Report 1999', provided to WMO/IOC JCOMM.

- **BALTEX MDC - News:**

No significant changes to previous report may be reported. Regularly updated information is available at [http://www.dwd.de/research/baltex/e\\_baltex.html](http://www.dwd.de/research/baltex/e_baltex.html).

- **GRDC - News:**

From July 2000, Dr. Thomas Maurer became the new head of the Global Runoff Data Centre (GRDC), being the successor of Dr. Néstor Correa and his predecessor Dr. Wolfgang Grabs (who moved to WMO headquarters in December 1999).

In June 1999 the Fourth GRDC Scientific Steering Committee Meeting was held in Koblenz, where GRDC reiterated its preparedness to support the goals of the Global Observing Systems in any way possible. In particular the committee shared the view that the co-ordinated effort to establish a meta-database for global climatology-related data is of considerable necessity. (The creation of such a meta-database also was main subject of two meetings in Paris and Koblenz, held in February and March 1999, which resulted in a proposal to the WMO.) The Committee noted that clear definitions of the needs are necessary to avoid the creation of a meta-database which in future would be impractical to maintain. G3OS were requested to identify basic needs for such a system.

*Contact: Mr Volker Vent-Schmidt, German GCOS Office, Deutscher Wetterdienst, Germany.*

## **(E) JAPAN:**

### **Japan Activity Report for GCOS Steering Committee, Ninth Session**

#### **1. Introduction**

Japan has been conducting climate observations by various governmental organizations and universities. Climate-related activities of Japan to contribute to the Global Climate Observing System (GCOS) are summarized below.

#### **2. Observations**

##### **2.1 Meteorological Observations**

In the framework of the World Weather Watch (WWW) of the World Meteorological Organization (WMO), surface, upper-air and marine meteorological observations have been conducted as shown in Fig. 1.

Surface meteorological observations are made at 159 meteorological offices of the Japan Meteorological Agency (JMA), of which 18 stations are included in the proposed GCOS Surface Network (GSN). In addition, JMA operates an automatic weather station network, which is called the Automated Meteorological Data Acquisition System (AMeDAS). AMeDAS consists of more than 1300 unmanned stations to observe meteorological parameters: wind direction and speed, air temperature, precipitation and sunshine duration.

Upper-air observations are made at 18 ground-based stations and on board four observation vessels of JMA. Seven ground-based stations of them, including one located in Antarctica, are registered in GCOS Upper-Air Network (GUAN). The Aerological Observatory (Tateno, WMO index No. 47646), which is one of the GUAN stations, started the High-altitude Upper-air Observation covering the level up to 5hPa at every 1200UTC from 1 July 1999. JMA is planning to extend the High-altitude Upper-air Observations to the other GUAN stations in future.

Marine meteorological observations are made by observation/research vessels, voluntary observing ships (VOS) and moored/drifted buoys.

##### **2.2 Observations of greenhouse gases and ozone**

In the framework of the Global Atmosphere Watch (GAW) of WMO, the observations of greenhouse gases and ozone have been carried out.

Surface atmospheric concentrations of greenhouse gases such as carbon dioxide, methane, chlorofluorocarbons, and nitrous oxide are monitored at Ryori (WMO Index No. 47513), Yonagunijima (47912), Minamitorishima (47991) and the Japanese Antarctic station at Syowa (89532) as shown in Fig. 2. Observations of oceanic and atmospheric carbon dioxide are made on board observation vessels in the western Pacific Ocean. Similar observations are also made on board a container ship in the northern Pacific. Air sampling of carbon dioxide, methane, and carbon monoxide in the upper troposphere has been made on board scheduled flights between Japan and Australia.

Ozone observations are made at five stations in Japan, i.e. Sapporo (47412), Tateno/Tsukuba (47646), Kagoshima (47827), Naha (47936), Minamitorishima (47991) and at Syowa (89532) in Antarctica as shown in Fig. 3. Solar ultraviolet B (UV-B) radiation is also monitored at the same stations except of Minamitorishima.

### 2.3 Oceanographic Observations

Oceanographic observations are conducted by various organizations in Japan such as the Hydrographic Department of the Japan Coast Guard (JHD), JMA, the Japan Fisheries Agency, universities, the Japan Marine Science and Technology Center (JAMSTEC) of the Scientific and Technology Agency using observation/research vessels, ocean data buoys (surface mooring/drifted buoys) and subsurface drifting floats (Fig. 4).

The Government of Japan decided to contribute to the new global ocean observing initiative known as Argo (Array for Real-time Geostrophic Oceanography). Deployment of several hundreds of profiling floats in the western North Pacific Ocean and its adjacent region is planned under the collaboration of JAMSTEC, JMA and JHD for the five year period from 2000 to 2004.

As a regional pilot project of the Global Ocean Observing System (GOOS), North-East Asian Regional GOOS (NEAR-GOOS) is in operation to facilitate the exchange of oceanographical observation data in north-east Asian region among participating countries, such as China, Japan, Republic of Korea and the Russian Federation, through Internet. Japan is playing a central role in NEAR-GOOS operating two databases, one for real-time mode databases operated by JMA, and the other for delayed mode databases operated by JHD. The project is expected to demonstrate the usefulness of the international exchange system of oceanographical observation data and is expected to extend the coverage of oceanographical observation from a limited area to the entire western Pacific in future.

In the framework of the Data Buoy Cooperation Panel (DBCP) of IOC/WMO, a number of drifting buoys are deployed by many Japanese organizations in the western North Pacific, Indian, Atlantic, and Arctic Oceans.

In the framework of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), sea surface/sub-surface temperature and oceanic current are observed by observation/research vessels and voluntary observing ships. Real-time data are collected by JMA and exchanged through the Global Telecommunication System (GTS) of WWW.

Periodical oceanographic surveys with extensive observation programs are conducted on board the observation/research vessels in the oceanic region around Japan as well as along the fixed traverse, e.g. 137° E (since 1967) and 165° E (1996) meridians in the western Pacific.

The research vessel "Mirai" has been commissioning oceanographic observation since 1997, and has participated in activities related to international programs; WOCE, CLIVAR (the Climate Variability and Predictability Study) and JGOFS (Joint Global Ocean Flux Study). Array of mooring buoys (TRITON buoys) has been deployed by JAMSTEC in the warm pool area in the Pacific Ocean since 1998 and formed a basin-wide tropical ocean/climate monitoring system with TAO array (Fig 5). The array is to be extended to the eastern tropical Indian Ocean and mid-latitude Pacific Ocean in 2000.

Ten tidal stations along the coast of Japan and the one at Syowa in Antarctica are participating in the international observation network of the Global Sea-Level Observing System (GLOSS).

### 2.4 Observations from Space

Japanese satellite programs are shown in Fig. 6.

Geostationary Meteorological Satellite (GMS) series have contributed to various kinds of operational climatic works and climate research programs since 1978. As a successor to currently operational GMS-5, a Multi-functional Transport Satellite (MTSAT-1R)

is scheduled to be launched in early 2003. One more infrared channel sensor will be added to the Imager of MTSAT improving the capability of observations near the earth's surface.

The Advanced Earth Observing Satellite (ADEOS) was launched in 1996 and ceased its operation in June 1997 by National Space Development Agency (NASDA). The Tropical Rainfall Measuring Mission (TRMM) was launched in 1997 and is continuing to acquire remarkable data. TRMM has provided world's first 3D precipitation image and other unprecedented data invaluable for meteorological and climatological studies.

NASDA is now developing the AMSR-E instrument to be flown on the US NASA's EOS-PM1 (Aqua) in 2000, ADEOS-II in 2001, and the Advanced Land Observing Satellite (ALOS) in 2003.

NASDA is studying the Global Change Observation Satellite-A1 (GCOM-A1) and -B1 (GCOM-B1) for launch in 2006 (target). NASDA is also studying the ATMOS-A/Global Precipitation Mission (GPM) in collaboration with NASA for launch in 2007 (target). NASDA is studying the Earth Care Mission in collaboration with ESA for launch in 2008 (target).

### **3. Data analysis and application**

#### **3.1 Four-dimensional data assimilation**

In order to make effective use of data from atmospheric and oceanographical observations, four-dimensional data assimilation (4DDA) techniques are effectively used, which produces the grid point values of climatic parameters homogeneous in time through the analysis based on considerations of consistency among data from various types of observations and between observed data and numerical model outputs.

As for atmospheric data, the accumulated products of the 4DDA carried out routinely for daily weather forecasts are important and useful in climate studies. An upgrade of the JMA global data assimilation system is scheduled in March 2001 by use of an improved global model on the occasion of the upgrade of the computer resources. The vertical resolution of the model is increased in the stratosphere for better use of satellite radiance data.

JMA started the operation of global snow-depth analysis for numerical weather prediction using SYNOP data in March 2000. An intercomparison of operational snow-depth analyses at the Deutscher Wetterdienst (DWD), the Canadian Meteorological Centre and JMA was conducted to check the quality of the analyses.

In order to improve the seasonal prediction of Asian monsoon and regional water resources, the GEWEX Asian summer Monsoon Experiment (GAME), a regional program of the Global Energy and Water Cycle Experiment (GEWEX) of the World Climate Research Programme (WCRP) has been carried out under the international coordination led by Japanese scientists. The special observation data during IOP (Intensive Observation Period, from April to September 1998) are assimilated in the JMA global 4DDA system with T213 resolution. The 4DDA analysis will be released to the international community in September 2000 by JMA. The special observational data sources include the Asian Automatic Weather Station Network, as well as a series of surface radiation monitoring sites. Some of these stations will be maintained for long-term monitoring. GAME will also contribute to the WCRP Coordinated Enhanced Observing Period (CEOP) in the first half of this decade.

JMA has operated the Ocean Data Assimilation System since 1995 for early detection of El Niño events. JMA also started the operation of a coupled ocean-atmosphere model for El Niño forecasting in 1998. The output of the assimilation system is used for an initial condition of the forecasting by the model.

As for data on greenhouse gases and ozone layer, a 4DDA technique with a chemical transport model are being developed.

### 3.2 Data management and international cooperation

The WMO World Data Centre for Greenhouse Gases (WDCGG) operated by JMA collects and archives greenhouse gases monitoring data from all over the world, and provides data to scientists, policy-makers and other users.

Quality Assurance/Scientific Activity Centres (QA/SACs) have been established by WMO to oversee the quality of the data produced under GAW. JMA operates the QA/SAC for Asia and the South-West Pacific to promote the technical cooperative activities for ensuring high quality of the data in the region, including calibration and intercomparison of standard gases, training seminars and site visit to monitoring stations and laboratories.

In August 1997 CCI/WMO agreed that the availability and quality of CLIMAT messages being distributed over the GTS should be globally monitored by monitoring centres. Following this agreement, JMA and DWD offered to serve as GSN Monitoring Centres. JMA and DWD started real-time monitoring of CLIMAT messages from GSN stations and submission of biannual monitoring report to the GCOS Secretariat from 1999.

The climate data obtained in Japan is available at the following centers:

JMA provides the observed and analyzed meteorological data sets essentially required for monitoring climate, detection of global warming, and researches on climate.

The Earth Observation Data Analysis Research Center (EORC) of NASDA is operated to collect, process, archive and provide the data of observations obtained by the earth observation satellites which play an important role in climate observations.

The Japan Oceanographic Data Center (JODC) operated by JHD collects, processes, archives and provides the oceanographic data obtained through Japanese observations.

### 4. Future activities

The observations on land surface conditions (vegetation and moisture) and the cryosphere including snow fall and sea ice (area and depth), which should be developed and strengthened because only insufficient data sets are available at present. For the contribution to these fields Japanese researchers are playing central roles to promote GAME.

In order to stimulate the oceanic observation program further, the active participation of Japan in the procedure for building up the GOOS should be ensured. The great expectation is directed to the on-going plan for establishing the array of mooring buoys allocated by use of the colossal research vessel.

The application of precipitation data along the river and of the run-off data in the climate study should be promoted. For this purpose, it is important to establish close connection with the currently planned program of the Flow Regimes from International Experimental Network Data in Southeast Asia and the Pacific (Asian FRIEND) which aims at establishment of river runoff data archive in the Asian Pacific region.

Utilization of data of greenhouse gases and the ozone obtained in various research programs should be promoted.

It is of urgent need to establish the system in which the huge amounts of data from satellites are collected, processed, and archived for climate studies.

It should be noted that the earth observing satellites capable of the observation of the same parameters as the preceding ones should be launched successively for the long-term continuation of climate data.

*Contact: Dr N. Sato, Numerical Prediction Division, Japan Meteorological Agency, Japan.*

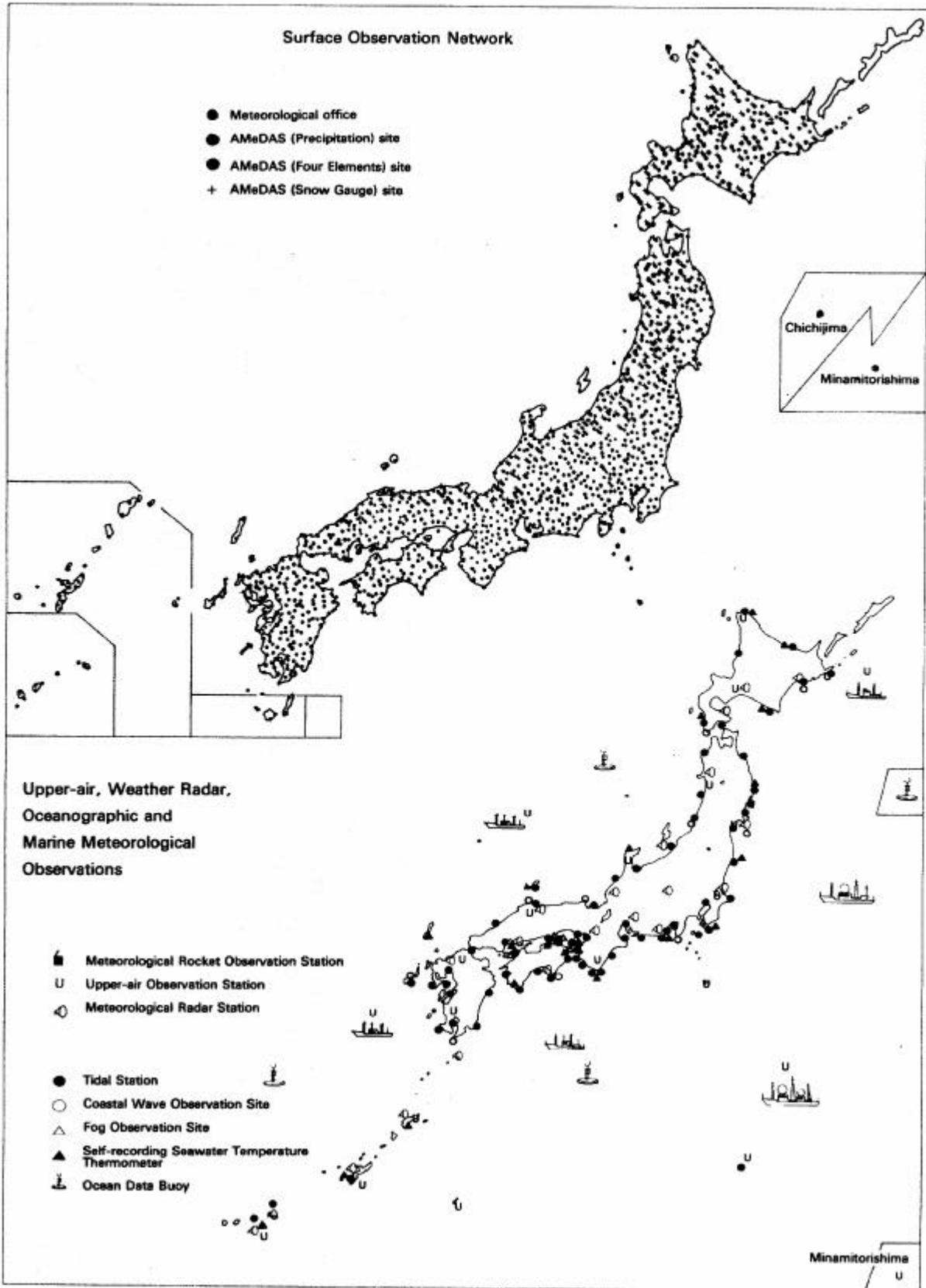


Fig.1 Meteorological observation network in Japan

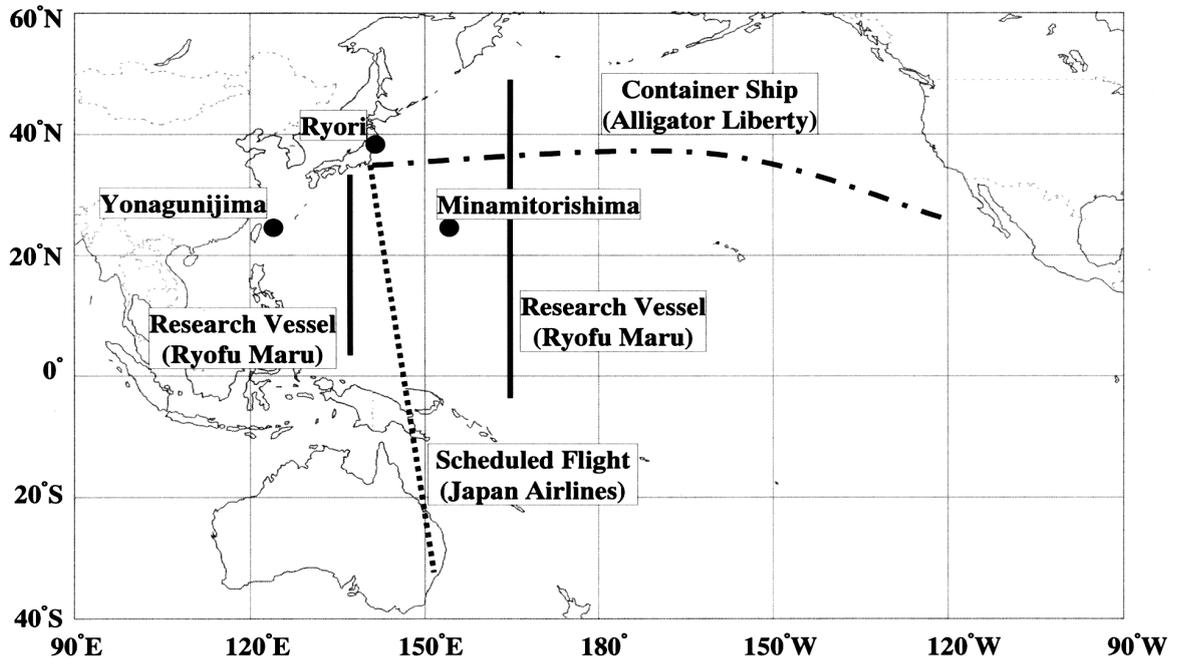


Fig.2 Observation network of greenhouse gases operated by Japan

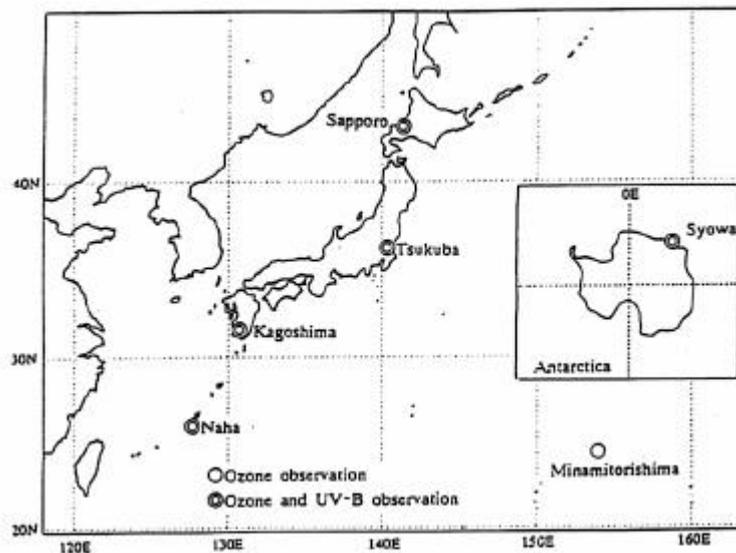


Fig.3 Observation stations of atmospheric ozone and harmful ultraviolet radiation (UV-B) operated by Japan

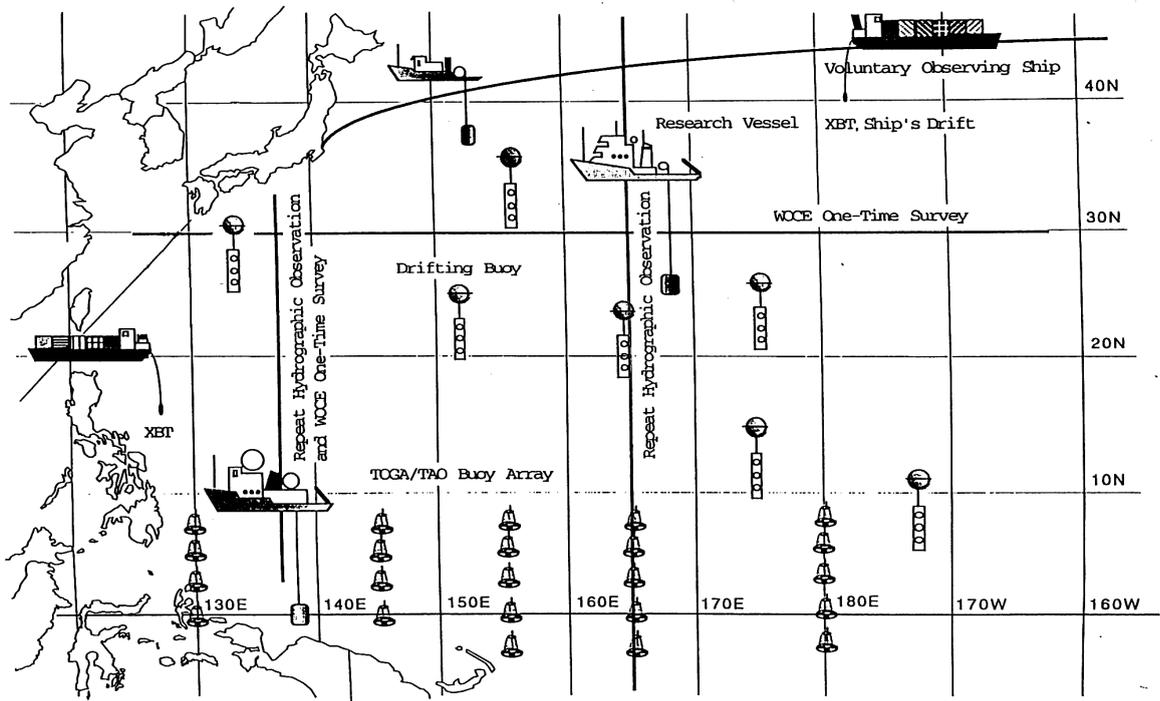


Fig.4 Japanese oceanographic observation related to GCOS

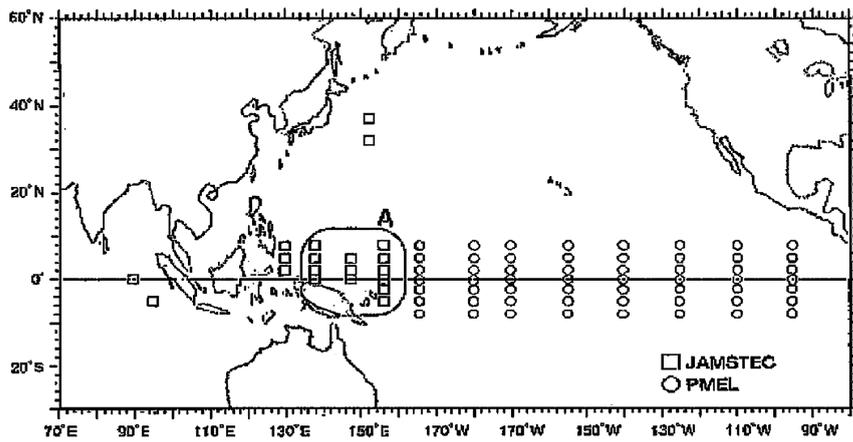


Fig.5 Array of TRITON/TAO buoys  
 Rectangles denote the mooring sites of TRITON buoys. Area "A" denotes presently deployed buoys.

### Summary of Japanese Earth Observation Satellite Programs

<b><u>- In Operation</u></b>	<b><u>Launch</u></b>	<b><u>Instruments</u></b>	<b><u>Remarks</u></b>
( JERS-1	2/1992	Out of operation on Oct., 1998)	Land Obs.
GMS-5	3 /1995	VISSR	Meteorological service
( ADEOS	8/1996	Out of operation on June, 1997 )	
TRMM	11/1997	PR,TMI,VIRS,CERES,LIS	U.S./Japan joint program
<b><u>- Under Phase C/D (Fully Funded)</u></b>			
ADEOS-II	2001	AMSR, GLI, SeaWinds, ILAS-II, POLDER, DCS	ADEOS F/O
ALOS	2003	PALSAR(L),AVNIR-2,PRISM	Land Obs. High Resolution
MTSAT-1R	2003	Imager	Meteorological service
MTSAT-2	2004	Imager	Meteorological service
<b><u>- Under Phase A</u></b>			
GCOM-A1	2006	ODUS, SOFIS, Opportunity instrument	
GCOM-B1	2006	SGLI, AMSR F/O, AlphaSCAT	
ATMOS-A/GPM	2007	PRS, TMI	TRMM F/O <i>Joint mission with NASA</i>
ATMOS-B/Earth Care	2008	A-LIDAR, CPR, FTIR	<i>Joint mission with ESA</i>

Fig. 6 Summary of Japanese Earth Observation Satellite Program

**(F) RUSSIAN FEDERATION:**

**GCOS-related Activity in the Russian Federation**

Climate-related observations have been conducted by the Federal Agency for Hydrometeorology and Monitoring of Environment and organisations of National Academy of Science. Below only the operational part of the activity is considered.

*Surface meteorological network.* Surface meteorological observations are conducted at 1618 stations eight times daily. 129 stations are included in GSN network of which 18 stations are located in remote regions with severe climatic conditions. 10 GSN stations have been conserved recently, and at present time they do not operate because of the supply difficulties.

*Upper-air network.* GUAN upper-air network includes 12 radiosonde stations of which 2 stations are located in Antarctica. At present 4 stations are conserved and the remaining stations provide 57% reports on assumption that observations must be conducted two times daily.

*Greenhouse gas and aerosol network.* Three stations have been included in the network of CO<sub>2</sub> monitoring that operate under the Global Atmospheric Watch (GAW) programme. These are: island Bering (East Arctic), island Kotelny (New Siberian islands) and Teriberka (Cola peninsula). At present Teriberka station is the only one that is in operation (observation started at 1988). Programme of measurements of methane concentration was initiated at this station since 1997. Total ozone is measured at 27 stations.

Background atmospheric turbidity are measured at 10 stations, chemical composition and acidity of precipitation at 12 stations and characteristics of atmospheric electricity at 2 stations (Voeikovo and Irkutsk). All data are collected at Voeikov Main Geophysical Observatory (MGO), quality controlled and published in the "Review of the air pollution in Russian Federation" and "Review of the background condition of environment in the Community of Independent States".

*World Radiation Data Centre (WRDC).* The Centre was established in the Main Geophysical Observatory, St. Petersburg in 1964 under the auspices of the WMO. It collects the following characteristics of the surface radiation: daily totals of global radiation (global = direct + diffuse); daily totals of diffuse radiation; hourly totals of radiation balance; monthly and daily totals of sunshine duration. Its catalogue comprises observation from 1306 sites all over the world. The data are quality controlled, processed and published in the Bulletin "Solar Radiation and Radiation Balance Data. World Network" since 1965. The Bulletin has been distributed among the National Meteorological Services and other organizations participating in the exchange of solar radiation data. Recently an electronic version of the Bulletin has become available. For more information on WRDC see: <http://wrdc.mgo.rssi.ru>.

*Contact:*

*Dr V. Meleshko,  
Voeikov Main Geophysical Laboratory,  
St. Petersburg,  
Russian Federation*

**(G) UK:**

**Summary of UK contributions to GCOS**

GCOS Surface Network (GSN) Stations

1. The designated GSN stations in the UK are: Lerwick, Stornoway, Eskdalemuir, Valley, Waddington and Camborne. All of these currently meet the GCOS standard for surface observing.
2. The UK run GSN designated stations overseas are St Helena, Halley and Rothera. Of these St Helena and Halley currently meet the GCOS standard. Rothera provides observations at 6 hour intervals, since 1991 observations there have been made with a MAWS (Marine Automatic Weather Station).

GCOS Upper Air Network (GUAN)

3. The designated GUAN stations in the UK are: Lerwick and Camborne. The Met. Office has, this year, brought these stations up to the GCOS standard, by the provision of larger balloons to enable high altitude soundings to meet the GUAN requirement for data to at least 30 hPa.
4. Other UK run GUAN designated stations include Gibraltar, St Helena, Mt Pleasant and Halley. The Met. Office stations at Gibraltar and Mount Pleasant have also been brought up to GCOS standards this year by the use of larger balloons. Funding (approx £60K at each) to upgrade St Helena and Halley has not yet been identified.

Hadley Centre GUAN Data Analysis Centre

5. The Met Office Hadley Centre is responsible for one of the two GUAN Data Analysis Centres (the other centre is the NOAA/NCDC). The primary responsibilities of the Hadley Centre GUAN Data Analysis Centre are (i) to improve the monthly station data base, (ii) improve bias adjustments to monthly data, (iii) analyse monthly upper air data, (iv) provide grid products with reduced biases, and (v) to create global and regional monthly statistics. At the Hadley Centre CLIMAT TEMP monthly data are received regularly, but data from other sources (e.g. National Met Centres) and monthly statistics calculated by NCDC are also used.

Global Atmospheric Watch (GAW) Stations

6. The Met Office runs Lerwick, Eskdalemuir and Camborne as Regional Global Atmospheric Watch (GAW) stations, each making a limited set of atmospheric measurements. Work is undertaken at Lerwick and Camborne, under contract to the Department of the Environment, Transport and the Regions (DETR), to measure total column stratospheric ozone using ground-based Dobson spectrophotometers and to measure profiles using ozone sondes at Lerwick.
7. In addition the 3 sites are WMO Baseline Surface Radiation Network (BSRN) stations making measurements of solar and terrestrial radiation, where these data are forwarded to the World Radiation Data Centre at St Petersburg.

8. DETR also funds national air quality networks measuring (at the surface) ozone, oxides of nitrogen, sulphur dioxide, carbon monoxide, hydrocarbons, particulates and lead, and an acid deposition network. DETR is also funding work on monitoring long lived trace gasses at Mace Head and the University of East Anglia.

#### Ocean Observations

9. The UK contribution to Argo is being actively progressed. The Met. Office is responsible for managing and co-ordinating the UK contribution to Argo, for which funding is being provided by DETR, Ministry of Defence and the Natural Environment Research Council (NERC), and which involves a number of UK agencies/organisations (The Met. Office, Southampton Oceanography Centre, British Oceanographic Data Centre and the UK Hydrographic Office). The aim is to establish by Mar 2003 the capacity to deploy, operationally, about 50 floats each year as the UK contribution to the international Argo array. Part funding (10%) has also been provided by the UK for the IOC Argo Information Centre and Co-ordinator.

10. An initial procurement of 10 floats has been made and these should be deployed in the Irminger Sea (North Atlantic) later this year. There are plans to deploy some 20 to 30 floats in the Southern Indian Ocean in 2001 to 2002. Hadley Centre climate simulations suggest this region is likely to provide a strong signal of climate change. In addition there is an intention to deploy floats in the Southern Atlantic and funding (through NERC) is being sought to establish a Southern Ocean Argo Data Centre in the UK.

#### Marine Observations

11. Under the guidance of the IACMST (Inter-Agency Committee on Marine Science and Technology) GOOS Action Group, a review has been completed on marine environmental observations being made around the UK by various Government Departments and Agencies. The review concluded by identifying four basic objectives: the desirability of having observations for more parameters at existing observation sites, the need to secure the continuation or restoration of observations with a long history, the desirability of having more, simple, observations at more sites and the desirability of establishing a Marine Environmental Change Network to parallel the existing terrestrial and freshwater system. It was concluded that these objectives could be achieved without major additional funding if organizations work collectively and in partnership.

#### *Contact:*

*Mr Jon Turton,  
Ocean Applications Business Development and International Programmes Manager,  
The Met. Office,  
Bracknell, UK*

**(H) USA:**

**U.S. National GCOS Report**

The U.S. has been involved with GCOS since its inception. Since 1992, there has been a considerable amount of work done by various federal agencies, particularly in the support of the international GCOS Steering Committee, as well as the work of the GCOS data, space, and science panels, in planning GCOS, defining its requirements, and contributing parts of the initial system. NOAA's National Climatic Data Center (NCDC) in Asheville, North Carolina, supports a number of GCOS data management activities. In November 1999, a full-time national GCOS program manager position was established and filled by NOAA/NESDIS to manage the national GCOS program. The primary focus of this position is to coordinate the development of a national GCOS program that involves all U.S. federal agencies with a role in climate observing and monitoring. The agencies include all of NOAA's line offices, the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), the U.S. Departments of Energy and Agriculture, the Environmental Protection Agency (EPA), and the U.S. Geological Survey. In addition there has been participation by the National Academy of Science (NAS), as well as national representatives from the Global Ocean Observing System (GOOS), Global Terrestrial Observing System (GTOS), the ICSU International Geosphere-Biosphere Programme (IGBP), and the ICSU World Data Centre system. As part of this effort, a national GCOS Steering Group was formed in January 2000 in order to coordinate the various activities of the national GCOS program. The group has met five times during calendar year 2000, and a formal Terms of Reference is under development. The initial focus of the group is the production of a national report detailing the current state of the various components of GCOS in the U.S.

After the establishment of the national coordination group, the national GCOS programme manager will be looking at writing an overall GCOS Plan which defines the U.S. GCOS programme; developing a programmatic-based web page that will include access to GCOS data and metadata at NCDC, as well as to the Global Observing System Information Center currently hosted at the University of Delaware; coordinating GCOS with other climate activities within the US including the US Global Change Research Program, the CLIVAR Programme Office, the Office of the Federal Coordinator for Meteorology, and the Federal Geographic Data Committee. The national GCOS program manager is also responsible for providing a national focus for coordinating international GCOS activities with the GCOS Secretariat's office at the WMO, an informal network of other national GCOS coordinators, the UNEP GRID program, as well as the Committee on Earth Observing Satellites' Working Group on Information Systems and Services (CEOS-WGISS).

The national GCOS program is an overarching effort that encompasses elements of the atmospheric, oceanographic, terrestrial, and satellite programs from various U.S. agencies. For example, the NOAA Office of Global Programs (OGP) is leading a comprehensive, multi-year, cross-NOAA initiative, which will build a long-term ocean component of GCOS. The OGP, National Weather Service (NWS), and NESDIS have worked in partnership to define an optimum mix of measurements needed to meet the goals of climate monitoring, and put together a 10-year initiative for 2000-2010 that will be jumpstarted in the 2002 timeframe. Much of this work was built around the OceanObs99 Conference that took place in Saint-Raphaël, France, in October 1999. That conference reviewed current scientific climate program priorities, existing, as well as, planned observational efforts that address those priorities. This review served as the basis for establishing community consensus on the most viable candidate technologies and implementation strategies for implementing a comprehensive, integrated, international ocean climate observing system in support of research, forecasting, and climate assessment.

Further, the GCOS program manager serves as the national focal point for GCOS to

the GCOS Secretariat at the World Meteorological Organization (WMO). In accordance with decisions adopted at the Fifth Session of the Conference of Parties (COP-5) of the UN Framework Convention on Climate Change (UNFCCC) in November 1999, the US GCOS Program Manager, along with the aid of the national GCOS steering group, will develop a national report in time for submission to the meeting of the COP-7 in Marakesh, Morocco, in November 2001. The U.S. has been a key participant in meetings focused on developing a better intergovernmental process for GCOS, as well as looking for resources to better support the GCOS Secretariat's office at the WMO. Further, COP-5 invited the GCOS Secretariat to continue to assist and facilitate the establishment of an appropriate intergovernmental process to identify the priorities for action to improve global observing systems for climate.

The Meteorological Service of Canada (MSC) hosted an informal meeting in Toronto, Canada, from February 7-8, 2000 to discuss the need and structure of an intergovernmental process for GCOS. One of the decisions from that meeting was the encouragement of the use of a network of national coordinators to help facilitate an intergovernmental process for GCOS rather than creating a new process. Therefore, the Australia Bureau of Meteorology (BOM) took the opportunity to propose an informal meeting of national GCOS coordinators to primarily discuss a common format for national GCOS reports as well as further discussing an intergovernmental process for GCOS. As a result, the first national GCOS coordinators meeting was held in Melbourne, Australia, at the BOM from August 9-11, 2000 with representatives from Australia, Finland, Germany, the Netherlands, New Zealand, Sweden, and the United States. Other national GCOS focal points were invited but, while they expressed interest, were not able to attend for one reason or another. The main topic of discussion and work centered on developing a supplemental format for the national GCOS reports that will be due at COP-7. The U.S. has offered to host the next such meeting in the May/June 2001 timeframe at the NCDC in Asheville, NC. With the finalization of national GCOS reports occurring around that time, this will be a good opportunity for national coordinators to meet again. In addition, the U.S. has been supportive of regional workshops for developing countries called for at COP-5. The first such workshop was held in Apia, Samoa, from August 14-15, 2000, and an action plan for better involving the nations of the South Pacific in a sustained climate observation program under the auspices of GCOS is being developed.

In September 1999, the Secretary General of the WMO issued a letter to all member states with GCOS Surface Network (GSN) stations requesting that historical daily and monthly CLIMAT data from their GSN stations be submitted to World Data Centre-A for Meteorology at the NCDC. The GSN is a global network of 989 surface weather observation stations that were selected based upon a number of parameters (Peterson et al 1997). To date NCDC has received GSN data from 26 nations. However, a number of countries certain to send their data have not done so yet, so the expectation is that the number of nations submitting data will soon rise. Unfortunately the data are being received on a variety of media and in a variety of formats that are not in accordance with the original WMO request. In addition, not all requested data parameters are being consistently provided. This has precipitated the need for NCDC to formulate new procedures for processing and archiving the data. The US GCOS Program Manager has forwarded specific GSN data formatting problems to the GCOS Secretariat at the WMO. NCDC is creating an inventory of the historical data received; is collecting current daily and monthly data; entering that in a data base; and is developing a web access to that to produce both flat files as well as graphs of Yearly Mean Temperatures and Yearly Precipitation Total. This web access is still in the experimental stage and is not yet publicly available.

NCDC's monitoring is done in conjunction with the two GSN Monitoring Centres located at the Deutscher Wetterdienst (DWD) in Offenbach, Germany, and the Japan Meteorological Agency (JMA) in Tokyo, Japan, which began operational monitoring of CLIMAT-GSN formatted data beginning with the data for January 1999 (with quality monitoring being added from January 2000). A sample file of data for January 2000 was sent to NCDC's Data Ingest and Processing Branch by JMA at the end of March 2000. The file

contains both monitoring and quality control (QC) information and is presently being evaluated. Currently, DWD provides the monitoring information and JMA provides the QC information (precipitation QC is provided by the DWD's Global Precipitation Climatology Centre), along with the complete exchange format for transmittal to NCDC. Upon approval, the two GSN Monitoring Centres plan on sending monthly data to NCDC for archival and dissemination via World Data Center-A on a routine basis approximately 6 weeks after the end of a data month.

The GCOS Upper Air Network (GUAN) is a global network of 150 upper air stations. While no official GCOS-sponsored GUAN data have been received at NCDC to date, a considerable amount of GUAN data already exist at NCDC from previous efforts such as the Comprehensive Aerological Reference Data Set (CARDS) project. The various organizations' activities are still in their formative stages, with formal endorsement of the respective roles of NCDC, the Hadley Centre of the UK Met Office, and the European Centre for Medium-Range Weather Forecasts still to be determined.

Finally, NCDC is currently working on the development of a system of performance indicators to which a user can pose relatively complex questions about observing systems. These include not only *in situ* systems such as the GSN and GUAN, but also remote sensing systems. Seven basic types of performance indicators have been identified: number of observing platforms; spatial coverage; length of record; data completeness; data quality; timeliness of receipt; and homogeneity. The project has started with the GSN and GUAN. The system will be web-based and will be powered by Geographic Information System software. The goal of this project is to provide observing system managers the ability to monitor the health of their networks, remedy deficiencies in a timely manner, and answer a variety of complex queries that present the information in a variety of formats (i.e., graphs, tables, and maps). This system will aid in the monitoring of GCOS information to assure that high quality controlled data necessary for climate studies are available to the end-users.

While there has been considerable progress made in developing a coordinated U.S. national GCOS program, there are still many issues that will require continued efforts. For the atmospheric program, in addition to the GSN and GUAN, other national networks such as the National Weather Service's Cooperative Observer Network; NCDC's new Climate Reference Network; NOAA's flask sampling network; as well as the Department of Energy's radiation monitoring, will need to be incorporated. There has been a lot of work done on the terrestrial side that has not been well coordinated with GCOS and this will be a challenge for the national program manager to begin incorporating this work into the overall GCOS framework. In addition, the development of a national GCOS web page and a permanent U.S. budget to better administer the program are other issues being pursued.

*Contact:*

*Mr Howard Diamond,  
US GCOS Programme Manager  
NOAA/NESDIS,  
Silver Spring MD,  
USA*

(Intentionally Blank)

## ANNEX XI

(\*\*DRAFT #2\*\*)

# GCOS IMPLEMENTATION STRATEGY: IMPLEMENTING GCOS IN THE NEW MILLENNIUM

## Background to the Strategy

Since the establishment of GCOS in 1992, several important changes have occurred which have significantly influenced the scope and focus of its activities. It is timely then to revisit its implementation strategy and seek the most effective means for GCOS to achieve its goals. Some of the critical factors are:

- When originally established in 1992 there was an implicit expectation that GCOS would be directly responsible for the implementation and operation of the global observing systems for climate. Since then the oceanic and terrestrial domain-based observing systems, GOOS and GTOS have been established and are increasingly involved with implementing many of the observing systems required by GCOS. In addition, the WMO clearly expects that the atmospheric component of GCOS will be implemented in cooperation with their technical commissions including the CBS and with the World Weather Watch (WWW). At the same time, the GCOS Sponsors have emphasized that GCOS needs to “ensure” that the systems required by the climate community are indeed implemented and operated in an appropriate manner.
- The nature of GCOS as a crosscutting observing system involving multiple domains, multiple observing systems components, multiple users and linked to multiple intergovernmental mechanisms, has not been adequately articulated or exploited. Despite the clear intention of its Sponsors, it is often, incorrectly, assumed that GCOS speaks for the atmospheric domain.
- Extensive planning in the first few years led to the publication of the design for an Initial Operational System (IOS) in 1995, and much work has been carried out since then in its implementation. However, scientific understanding has developed and new issues have emerged such as the need for integration of observations from different domains and better understanding and monitoring of the carbon and water cycles.
- While progress has been made in implementing GCOS, many essential components of the current observing systems used for climate purposes are deteriorating. Sustained effort will be required to prevent further deterioration and to reverse the trend.
- As a result of the continuing evolution of satellite sensors, both in terms of new sampling techniques and improved quality and accuracy, new climate-relevant satellite data allow for the development of composite observing systems that both complement and extend the *in situ* observing networks of the past. These space-based observations also have a need for *in situ* observations for calibration, quality control as well as providing a link to the historical data.
- The resource base available for GCOS is not adequate to its mission of ensuring the implementation of an integrated global observing system for climate.

- The global impacts of the 1997-1998 El Niño have increased public awareness of the need to improve the observational basis for seasonal-to-interannual prediction and to reduce the impacts of future El Niños by monitoring regional impacts of climate variability.
- The Kyoto Protocol and recent decisions from the Conference of Parties to the UNFCCC have highlighted the political interest in improving systematic observation to meet the needs of the Convention, including climate change detection and attribution and assessing climate impacts for the purposes of mitigation and adaptation. The global carbon budget is receiving increased attention with consequent implications for GCOS in terms of reliable measurements.

These factors demand that GCOS articulate an updated implementation strategy, which clearly states its roles and responsibilities in implementing a global observing system for climate and its relationships with the other components of the global environmental observing system.

(*\*\*\*DRAFT #2\*\*\**)

## **Implementing GCOS in the New Millennium**

### **1. INTRODUCTION**

Since inhabiting the Earth, humans have adapted and modified their lifestyles in response to climatic conditions and their regional and temporal variations. The variation in seasonal conditions from year to year has usually been accommodated by careful planning. Humans have also adapted, but more slowly, to longer-term variations, now usually referred to as climate change. Such adaptations have often been dramatic in nature, including the widespread migration of peoples to other regions.

Our present knowledge of climate and its variability is based primarily on three sources of data. The first is the routine collection of atmospheric, ocean and land surface data by meteorological and oceanographic agencies, and a variety of agencies concerned with terrestrial issues. Such data were predominantly collected for other purposes such as weather forecasting, aviation and marine operations, agricultural production, and hydroelectric generation. Because they were not collected for climate purposes, gaps and inadequacies have inevitably appeared as the new needs for climate information have developed. The second is the database resulting from environmental research projects such as those of the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP). Such data have, more often than not, taken explicit account of climate needs but the projects have limited lifetimes and cannot be expected to satisfy the operational and long-term needs of the climate community. The third consists of historical or proxy data contained in the ice cores, sediments, tree rings and the like.

In the national and international debates about climate change and variability, adequate information has not been available for governments to answer critical policy questions. Recent scientific developments have demonstrated that seasonal climate predictions can frequently be made with useful skill at lead times of 6-12 months. Effective implementation of such operational products requires the continuation of a range of research observations in the atmosphere and the oceans as well as their extension into other regions of the globe. The development of effective national and regional responses to seasonal predictions, climate variability and change, as well as extreme events, requires a detailed assessment of local and regional climate information. Such local and regional information must be a natural extension of a global system. Finally it is clear that the research community requires access to long-term records of the climate system to effectively understand both climate change and short-term variability.

The WMO, IOC of UNESCO, ICSU, and UNEP have established the Global Climate Observing System (GCOS) to ensure the sustained operation of global observing systems for climate to meet the requirements not only of this generation, but also to be the basis of a system for future generations. GCOS is directed by a Steering Committee (SC) based on advice from scientific and technical panels with the support of a small Secretariat.

### **2. THE SCOPE**

The scientific strategy of GCOS is based on the concept that analyses and models of the climate system require an adequate observational base to be effective in addressing climate variability and change on both seasonal-to-interannual and decadal-to-centennial time scales. The quantity, quality, and continuity of the observations required demand that a systematic global programme be implemented.

The detailed plans for GCOS have taken a comprehensive approach to climate issues. They have considered the full range of issues, including the requirements of users/participants at local, regional and global scales, the contributions of existing research and operational programmes and data systems, and the participation of both international and national organizations. The scientific scope includes atmosphere, ocean, land surface, cryosphere, hydrosphere, and ecosystem processes. The plans also consider the resources needed to establish, coordinate, and manage an effective system.

The approach adopted in the design of an Initial Operational System (IOS) for GCOS was based on meeting the following priority observational needs for:

- International policy-making on climate change, including comprehensive, long-term observations of climate parameters for early detection and documentation of climate change and for determining regional distributions of changes in climate, their timing, and their impact on ecosystems;
- Operational product preparation, including data for initialization and validation of models for seasonal- to-interannual prediction;
- National and regional assessment of the impacts of climate variability, extreme events and climate change;
- Research into the processes and variability of the climate system, in particular the long-term systematic observations needed to support such research.

In addition, the GCOS-IOS gave specific attention to the need for:

- Ensuring proper integration among all observing systems through close coordination during both design and implementation phases;
- A comprehensive approach for data and information management which addresses data quality; collection techniques and methods; merger, assimilation and analysis; dissemination; and archiving;
- Building upon the global observing capabilities of space-based sensors and combining these with *in situ* observations to link past and future data sets as an integral part of an integrated global observing strategy;
- Active involvement of developing countries through capacity building.

GCOS is being implemented by nations, with the cooperation and participation of, *inter alia*, the following GCOS partners:

- World Weather Watch (WWW)
- Global Atmosphere Watch (GAW)
- Hydrology and Water Resources Programme (HWRP)
- Global Ocean Observing System (GOOS)
- Global Terrestrial Observing System (GTOS)
- Global Environmental Monitoring System (GEMS)
- Global Resource Information Database (GRID)
- World Climate Programme (WCP, including data and monitoring, applications and services, impacts and responses, and WCP-Water)
- World Climate Research Programme (WCRP)

- International Geosphere-Biosphere Programme (IGBP)
- Diversitas
- International Human Dimensions Programme (IHDP)
- Intergovernmental Panel on Climate Change (IPCC)
- Committee on Earth Observation Satellites (CEOS)
- Integrated Global Observing Strategy Partnership (IGOS-P)

### 3. THE STRATEGIC FRAMEWORK

When establishing an implementation strategy for the next decade there are several factors that should be considered.

Firstly, since governments around the world already spend billions of dollars taking observations that are relevant to climate, GCOS cannot expect to build a new standalone system solely for climate purposes. Fiscal prudence means that GCOS must be built wherever possible upon existing systems. While this may be efficient from a fiscal perspective, it will mean that the GCOS requirements must be explicitly addressed by contributing networks for them to be effective in meeting climate user needs. When the needs of users cannot be met by improving or adapting current systems, GCOS will seek to mobilize support of nations for new research programmes, technological developments or operational observing systems

Secondly, the three domains (atmosphere, oceans, terrestrial) are in different stages of maturity. GCOS must therefore adopt different approaches for each of the domains:

- Because of the prior existence of the meteorological network, and the early recognition of the importance of quality and continuity, GCOS can develop its strategy primarily in terms of supplementation and selective enhancement for its atmospheric networks;
- For the oceans, GCOS and GOOS can work with JCOMM to make operational a number of research networks as well as to extend existing networks into new areas of the globe;
- For terrestrial networks, a major issue is to focus local and regional networks into a global system and to utilize the new satellite observations to provide global estimates of important terrestrial parameters. At present, the climate change issue provides a primary motivation for investment in new activities to understand and observe the global carbon cycle.

Thirdly, national agencies and regional entities are the primary funders and operators of observational systems and networks. For an effective global climate observing system, all nations must be convinced of the need to take and exchange the observations identified by GCOS with special attention to involving developing countries. National and regional needs for climate observations go beyond those currently included in GCOS. Consequently, the current stated needs of GCOS represent a minimum climate observing system and not necessarily a sufficient one from a national perspective. Since data from remote regions such as the southern oceans are required for a truly global system, nations will have to agree to deploy and operate networks in partnership in these remote regions. Many of these partnerships are already in place but others will be needed.

Fourthly, due to the breadth and complexity of a global climate observing system, the GCOS Secretariat will have to work through existing international and regional coordination mechanisms and promote new mechanisms where necessary. In addition, it must articulate performance standards which can be monitored to demonstrate to governments and others, where progress is being made and where more effort is needed.

Finally, many climate users need information on trends, including variability and extreme events as well as in climate means. This will require combining past, present and future observations from different instrumentation and from different time periods, which is a major scientific challenge but a fundamental requirement for GCOS. Obtaining global trends will depend increasingly on space-based technologies. Linking observations from space based technologies with past and present *in situ* observations poses special challenges in maintaining continuity and quality control of observations and will require an integrated systems approach.

#### **4. THE STRATEGY FOR THE NEW MILLENNIUM**

The long-term goal of GCOS is to facilitate and oversee the development of an integrated, responsive global observing system for climate that will “provide comprehensive information on the total climate system, involving a multi-disciplinary range of physical, chemical and biological properties, and atmospheric, oceanic, hydrologic, cryospheric and terrestrial processes” (as stated in the GCOS Memorandum of Understanding). Building upon the strategic framework in the preceding paragraphs, the GCOS strategy will be based on four principles and supporting enabling activities.

##### **1) Obtain the support of national governments for implementing a global observing system for climate. GCOS will:**

- Communicate with national governments, utilizing the GCOS partners, Sponsors and other appropriate mechanisms, on the importance of implementing an effective global climate observing system;
- Encourage the development of national programmes and implementation plans to build, maintain and operate the networks and observational platforms that comprise the GCOS-IOS. Such programmes and plans should recognize the multi-disciplinary nature of GCOS and the requirement not only to respond to global needs but also to contribute significantly to users at the national, regional and local level;
- Encourage governments to cooperate in observing the global commons, e.g., the oceans and Antarctica;
- Work with the intergovernmental processes of the GCOS Sponsors to encourage national participation in GCOS implementation. GCOS will participate in and inform these intergovernmental processes on the current status of the observing systems for climate, including reporting on the deficiencies and options for improvements in these systems;
- Inform the bodies of the UNFCCC regularly on the adequacy of the global observing systems for climate for the purposes of the Convention and seek their support for actions to address inadequacies;
- Encourage the identification of National Coordinators for GCOS to involve their national atmospheric, oceanographic and terrestrial agencies in systematic observations and act as an expert interface for GCOS information.

##### **2) Strengthen partnerships with operational and research observing, data management, and distribution systems. GCOS will:**

- Work with the GCOS partners, including the space agencies, and other appropriate programmes and organizations to ensure that GCOS requirements are incorporated in

the planning and implementation of the domain-based observing systems and the Integrated Global Observing Strategy (IGOS);

- Identify components of existing networks and platforms that meet the GCOS requirements and, with the appropriate partner, incorporate the identified component into GCOS, subject to the operating standards approved by the GCOS Steering Committee (and other appropriate bodies), the GCOS Principles of Involvement (Annex 1), and the GCOS/GOOS/GTOS Climate Monitoring Principles (Annex II);
- Work with the relevant GCOS partners to improve current networks or to establish new networks when GCOS requirements are not being met;
- Work with the research partners to transition research observing programmes into long-term, routine operating systems based on a clear requirement for those observations;
- Maintain on-line computerized information indicating the source and location of all networks, data sets and products contributed to GCOS.

### **3) Build capacity and correct deficiencies in the GCOS networks. GCOS will:**

- Identify regions and areas that have significant deficiencies in the GCOS-IOOS implementation and encourage the countries involved to develop action plans to address those deficiencies. These action plans will usually incorporate capacity building in developing countries for participation in GCOS;
- Work with interested countries, international agencies, and financial mechanisms to identify and assemble the resources to implement regional action plans;
- Work with GCOS partners to implement resourced action plans.

### **4) Keep GCOS relevant to the users and promote cost-effective improvements. GCOS will:**

- Continue to liaise with users to be aware of their requirements and incorporate changes in those requirements into GCOS;
- Work with the international research programmes in developing more effective and efficient approaches and incorporating improvements in research and technology into the operational observing systems;
- Work with the IGOS partners to address the requirements for observations of the carbon and water cycles, particularly to exploit the opportunities provided by new satellite technologies.

## **5. THE PRIORITY COMPONENTS OF GCOS**

Most present observing systems associated with climate parameters were put in place to meet objectives other than those identified by the climate community. However, many systems can meet requirements for climate data. A careful assessment of existing systems and their capability has been started and will continue. Building upon the reports of the IPCC and a series of meetings with a variety of users, the GCOS science panels for the atmospheric, oceanic, and terrestrial domains have designated key elements and identified networks that should contribute to GCOS. They have also proposed essential enhancements and augmentations to make them more effective in meeting climate requirements. Since only a brief description is provided here,

further details on GCOS plans and the supporting documents of the appropriate panels are available at <http://www.wmo.ch/gcos/web/publications.htm>.

## 5.1 Atmosphere

Climate has in the past been defined in terms of the average atmospheric or weather condition, usually calculated over a 30-year period. However, climate dynamics require a range of atmospheric data to understand the system and its natural variability on all time scales, especially decadal-to-centennial, to monitor the climate, to detect and attribute change, and for both seasonal-to-interannual and decadal prediction. Fundamentally, the necessary variables are those measured routinely as part of the World Weather Watch (WWW) of the WMO (e.g., surface, near-surface, and upper-air values of temperature, wind velocity, humidity, precipitation). Important atmospheric constituents (greenhouse gases and aerosols) that play a central role in atmospheric chemistry and in the radiative balance that require monitoring are currently part of the long-term research networks. Both *in situ* and satellite observations are required for global coverage with adequate vertical and horizontal resolution.

The GCOS Steering Committee has established an Atmospheric Observation Panel for Climate (AOPC) to do careful assessments of existing networks and new observing techniques and to recommend, and facilitate the development of, the basic GCOS observing networks or systems. GCOS and WCRP jointly support the AOPC.

As a first step in implementation, the GCOS Surface Network (GSN) and GCOS Upper-Air Network (GUAN) are being established as the international global baseline networks that provide the essential observations that will carry forward into the future the most valuable historic records of the climate system. They will also play the important role of ground-truthing remotely-sensed observations and as key reference sites for local, regional and national networks. In addition, the current GAW network has been adopted as the basis for the GCOS component that will provide both the concentrations and flux measurements of atmospheric constituents.

The following selected enhancements to current atmospheric systems are of high priority:

- Improved reporting and enhanced quality control in the GSN and GUAN networks of the WWW and definition of comparable satellite baseline networks;
- Increases in the number of drifting buoys and improved quality in ships making meteorological observations;
- Improved vertical distribution of tropospheric and stratospheric water vapour from satellite and *in situ* sounding instruments;
- Enhanced monitoring of tropospheric and stratospheric ozone;
- Establishment of GCOS quality standards required of GAW observations.

## 5.2 Oceans

The ocean plays many roles in climate: the world oceans have enormous potential for heat storage and transport; the ocean currents transport heat at rates far in excess of atmospheric transport; air-sea fluxes provide a means for transferring heat, momentum and trace species between the atmosphere and ocean; and the deep ocean provides a reservoir, not only for heat, but also for carbon dioxide and other greenhouse gases. In addition, its role in biogeochemical cycling is equally significant.

The GCOS Steering Committee has established an Ocean Observations Panel for Climate (OOPC) to do careful assessments of existing networks and new observing techniques

and to recommend, and facilitate the development of, the basic GCOS observing networks or systems. GOOS, GCOS and WCRP jointly support the OOPC.

In contrast with the atmosphere, the sparseness of ocean observations has been a major issue for the ocean community for many years. In response to this challenge, the OOPC has pursued an effective strategy building upon a range of research and pilot projects to build an operational system. A major conference on the ocean observations for climate purposes held in Saint Raphaël, France in October 1999 concluded, *inter alia*, that:

(i) Remote sensing has become a mature technology for collecting regular, global ocean observations. Measurements of sea surface temperature, surface wind vectors; surface wave height, sea-ice and surface topography are considered fundamental;

(ii) A multi-faceted, robust *in situ* network must also be implemented in part as a complement to, and calibration for, remotely-sensed data, as well as for its own intrinsic value in various applications. The primary contributions include the:

- Tropical Pacific ENSO Observing System and the TAO/Triton moored array;
- Global array of Argo profiling floats, which will provide of order 100,000 profiles of temperature and salinity annually;
- Global surface drifter array and surface and subsurface networks operated from voluntary observing ships;
- Surface and subsurface reference sites, such as sea level stations and fixed point deep measurements;
- Hydrographic measurements targeting the carbon cycle and the deep ocean circulation;
- Acoustic tomography in selected high latitude regions.

The following selected enhancements to current systems are of high priority:

- Expansion of the TAO/Triton observing system into other oceans;
- Increasing the number of Argo floats in data sparse and high latitude areas;
- Continuation of precision satellite altimetry and wind scatterometry missions;
- Expanded use of active and passive microwave sensor instruments;
- Expansion of long-term monitoring sites for observations of deep- and bottom-water renewal;
- Development of effective strategies for the transition of proven experimental techniques into a sustainable operational mode.

### 5.3 Terrestrial

Terrestrial ecosystems have an important role in determining the trace gas composition of the atmosphere affecting the Earth's energy budget. They also have a strong influence on surface albedo (solar energy, absorption and reflectance) and on the hydrological cycle. Characteristics of the land surface (vegetation cover, as well as cryospheric elements such as ice sheets and glaciers) are also important for predictions of the evolution of the climate system. Many of these variables are also critically important for assessing the impact of climate change, and as inputs into national policy-making. Under climate change scenarios, there will be major impacts on the distribution of flora and fauna, biogeochemical cycles, and energy and water fluxes. To understand these effects, it is essential that the measurements and analyses provide integrated atmospheric, hydrologic and ecological information over land, as well as input data from the socio-economic sectors.

The GCOS Steering Committee has established a Terrestrial Observation Panel for Climate (TOPC) to do careful assessments of existing networks and new observing techniques

and to recommend, and facilitate the development of, the basic GCOS observing networks or systems. The TOPC is jointly supported by GTOS and GCOS.

Terrestrial/ecosystem observations for climate are being developed and implemented jointly with GTOS, GEMS (UNEP Global Environmental Monitoring System), HWRP (WMO Hydrology and Water Resources Programme) and other programmes and activities as appropriate, with an initial emphasis on networks for glaciers, permafrost, and carbon dioxide fluxes between vegetation and the atmosphere. Activities are also closely coordinated with the appropriate research programmes of IGBP and WCRP.

The following enhancements to current systems are of high priority:

- Improved and standardized ecosystem observations from existing and new sites;
- Increased monitoring and assessment of land cover and land use change using satellite and *in situ* observations;
- Systematic observations of the carbon cycle;
- Establishment of a global hydrological network for climate;
- Global observations of soil moisture;
- Improved satellite data to obtain information on area and volume changes in ice sheets, ice shelves and glaciers.

#### 5.4 Data and Information Systems

GCOS networks are designed to be end-to-end observation and data management systems developed for a variable or suite of variables that meet the standards defined by GCOS. The global observing systems share networks and data flows with other programmes. Thus a data flow established for the purpose of the World Weather Watch may also serve the needs of GCOS if it meets the appropriate standards. An end-to-end system includes: (1) acquisition, processing, and quality control of the data, (2) analysis, and production and delivery of data products at all stages of the data flow, (3) evaluation and feedback on the performance of the data flow, and (4) archival of all data, metadata, and products for future users.

Within GCOS, the responsibility for defining the needed data and information system for individual networks rests with the science panels. For example, AOPC has developed a model for defining atmospheric networks that integrates the data management activities in the process from the taking of observations to the producing of products and archiving of the data.

The Global Observing Systems Information Centre (GOSIC) provides information on the observing requirements, the operational data systems, and the access procedures for finding and obtaining data and products of GCOS, GOOS and GTOS. An Advisory Committee with representatives from all GCOS science panels (AOPC, OOPC, TOPC) has been established by the observing systems to provide guidance and oversight for GOSIC.

#### 5.5 GCOS Products

The GCOS SC and the science panels recognize the importance of developing products from GCOS data, in cooperation with appropriate centres and other scientific organizations. This is an activity currently under discussion within the science panels. As products are defined that in whole or in part depend on GCOS data, a product list will be maintained and used to communicate with clients about the needs and importance of GCOS.

## 6. IMPLEMENTING ACTIONS

The general approach adopted for implementing GCOS has been to:

- Define a series of end-to-end Baseline Networks (including *in situ*, satellite or composite), which address specific users' needs and can be reasonably implemented by a GCOS;
- Build partnerships with satellite operators, international research programmes, global observing programmes and others to develop new integrated approaches on cross-cutting issues of importance to climate users, such as the global carbon and water cycles. The Integrated Global Observing Strategy (IGOS) is a prime example. Others might be partnerships to develop data bases for adaptation to climate change. Specific components of these integrated approaches would be included in the Baseline Networks;
- Encourage more broadly the development and improvement of more comprehensive climate observing systems which address the stated goal of GCOS but go beyond the capacity of GCOS, e.g. regional climate networks.

In the broad sense, GCOS implementing actions can be organized under four headings, as elaborated below. Based on the Implementation Strategy articulated in Section 4, the Priority Components of GCOS discussed in Section 5 and the limited resources available, GCOS, through its Steering Committee and Secretariat, will pursue the following actions

### 1) Strategic Design:

In line with the principles of working closely with partners, building on existing observational activities and obtaining national support for implementing specific systems or activities, a key objective of the GCOS strategic design is to develop end-to-end Baseline Networks. In this regard, GCOS will:

- Develop an Acceptance Process for approving GCOS Baseline Networks;
- Define clearly the GCOS Baseline Networks, including the measurements taken, the standards and 'best practices', monitoring, analysis and archiving of the data and any products produced;
- Oversee the activities of the science panels and work with partners to ensure that GCOS standards are upheld;
- Pay special attention to cross-cutting issues among domains, to the development of new observing (e.g. satellite) and data assimilation techniques and to the evolution of composite observing systems;
- Work with partners, to the extent feasible, to further the development and improvement of comprehensive climate observations and data bases that go beyond the GCOS Baseline Networks and are important for regional and national applications.

### 2) Implementation Mechanisms:

The thrust of the discussion in Sections 3-5 has been on principles and strategy for implementing GCOS. Specific actions or mechanisms will be discussed here.

In response to decisions 14/CP.4 and 5/CP.5 on an intergovernmental process for GCOS, Canada hosted an informal meeting of experts to identify issues and elements related to an intergovernmental process for GCOS. From that meeting, the following elements were identified as the core mechanisms for implementation:

- Make more effective use of the congresses, assemblies, executive councils and other relevant bodies or commissions of the GCOS Sponsors to develop the links with and the involvement of governments in all aspects of GCOS. GCOS will engage the governing bodies using a consistent and complementary message, perhaps through the mechanism of common resolutions and will seek involvement between its Panels and the technical entities of the GCOS Sponsors (e.g., JCOMM, CBS);
- Engage the UNFCCC bodies in order to give Parties the opportunity to address deficiencies in observing systems required to meet their commitment to the Convention. GCOS will focus in particular on the actions adopted in Decision 5/CP.5 with regard to national reports, synthesis and analysis of these reports, the organization of Regional Workshops to improve observing systems in developing countries, and the reporting to COP/SBSTA on developments in the global observing systems for climate;
- Improve intra- and intergovernmental coordination by encouraging nations to identify a national GCOS coordinator. A network of national coordinators could enhance the intergovernmental mechanism process for GCOS. GCOS will work with interested nations to enlarge the core set of GCOS National Coordinators and prepare Terms of Reference;
- Use the Regional Workshops to develop linkages at the national level and to assess the adequacy of GCOS. GCOS will organize workshops, in conjunction with existing mechanisms such as WMO Regional Association meetings or regional components of GOOS and pursue the development of regional and national linkages to GCOS Networks;
- Increase the number of "operational" and/or senior governmental representatives on the GCOS-SC so that it can more properly perform its managerial or oversight role. GCOS will seek candidates for the GCOS SC that reflect a balance between science and operations in their experience.

In addition, GCOS will focus on developing ways to build support for implementing the GCOS Baseline Networks and for cooperating on climate observations generally. This will include active participation in the IGOS partnership, with other Conventions where appropriate and in bilateral activities where possible.

### 3) Regional Development and Capacity Building:

GCOS has a major regional initiative (Regional Workshop Programme) to develop regional action plans for improving climate observing activities and to build capacity for developing countries to participate in collection and use of climate data. This initiative responds to the invitation by the Conference of the Parties to organize regional workshops, in consultation with Parties and the GEF, to: 1) build capacity to participate in systematic observation; 2) identify deficiencies in observing systems in developing countries; and 3) develop specific proposals to overcome such deficiencies. In addition, GCOS will use this initiative to identify national contacts.

The GCOS Regional Workshop Programme has the overarching goal of developing a process within a region that will lead to real improvements in observing systems in developing countries. This programme, through a series of 10 regional workshops with related consultations and the development of regional action plans, will seek to:

- Contribute to the reporting of systematic observation and research needs by non-Annex I Parties as a part of their National Communications to the UNFCCC;
- Assist developing countries in identifying regional deficiencies in global observing systems for climate;
- Assess priority observing system needs and funding required to enable countries to allow them to collect, exchange, and utilize data on a continuing basis in pursuance of the UNFCCC; and
- Initiate development of action plans and proposals for improvements in observing systems.

The programme will have two phases: (1) Pilot Project lasting one year, consisting of two Regional Workshops; and (2) a series of eight additional Regional Workshops, each with associated follow-up activities, which would be implemented between mid-2001 and 2005. The programme will be managed by the GCOS Secretariat with guidance from a Regional Workshop Advisory Committee. GCOS has submitted a proposal to GEF, through UNDP, to fund the Pilot Project. During the Pilot Project GCOS will:

- Hold a Regional Workshop for the Pacific Island region in Apia, Samoa, August 14-15 2000 (completed);
- Facilitate the development of an Action Plan and Proposal following the Pacific Island workshop. Funds are required for this activity;
- Initiate planning for a second regional activity in Africa by organizing a colloquium and planning meeting at the Sixth WMO Technical Conference on Management for Development of Meteorological Services in Africa (November 2000); participating in the EUMETSAT African User Forum (September 2000); identifying a regional partner to organize and cosponsor a workshop; and obtaining the necessary funds;
- Hold a Regional Workshop in Africa in the first third of 2001 based on the planning activities. Funds are required for this activity;
- Facilitate the development of an Action Plan and Proposal following the African workshop. Funds are required for this activity;
- Review the above activities and adjust model for remaining Regional Workshops;
- Prepare a report on accomplishments and lessons learned for the Conference of the Parties (COP) to the UNFCCC and its Subsidiary Bodies for Scientific and Technological Advice (SBSTA) and for Implementation (SBI);
- Prepare a Project Brief and submit a full proposal to GEF for the remainder of the Regional Workshop Programme, which would begin in the second half of 2001 and continue to mid-2005.

**TIMELINE FOR PILOT PROJECT**

Activities 2000-2001	J	A	S	O	N	D	J	F	M	A	M	J	J	A
Pacific Island Workshop		■												
Pacific Island WS Follow-Up			■	■	■									
Meetings in Africa			■		■									
Preparation of African WS						■	■	■	■					
African WS										■				
African WS Follow-Up											■	■	■	
Review Pilot Project												■		
Report to COP													■	
Preparation of full Project Brief													■	
Begin second part of Regional WS PGM														■

**SCHEDULE FOR THE 10 REGIONAL WORKSHOPS**

	2000	2001	2002	2003	2004	2005
Pacific	•					
Africa 1		•				
R3		•				
R4			•			
R5			•			
R6				•		
R7				•		
R8					•	
R9					•	
R10						•

## 4) Outreach:

Another major conclusion of the Canada meeting on an intergovernmental process for GCOS was the need to build ownership in GCOS. Some recommendations toward this end include the need to incorporate further analysis of the costs and benefits of maintaining and enhancing observing systems, to improve communication with other decision-makers in the sphere of climate, and to develop a GCOS 'timeline' - i.e. significant events/opportunities over the next two years.

To address the needs to build ownership in GCOS, GCOS will develop an outreach strategy to support the principles articulated in Section 4, including:

- Developing a calendar of significant events/opportunities over the next one to two years;
- Participating where possible in the highest priority events that raise the profile of GCOS. These will include official events like the COP/SBSTA meetings, congresses, assemblies

and executive councils of GCOS Sponsors, major scientific, technical and (inter)governmental fora;

- Preparing communications materials to describe GCOS in laypersons' terms, to illustrate the components of GCOS for specific audiences;
- Designing tutorials for training clients in areas such as UNFCCC guidelines or preparing national communications on systematic observations;
- Using the GCOS Regional Workshop Programme and other similar activities to discuss the needs for climate observations and the GCOS strategy.

This section has tried to illuminate the medium-term actions that need to be taken to implement GCOS. Even these actions go beyond the current resources of the GCOS Secretariat but are a reasonable set of actions needed to achieve measurable progress over the next 2 to 5 years. Shorter-term actions (1-2 years) are discussed in the next section

## **7. SPECIFIC ACTIONS FOR THE GCOS SECRETARIAT**

The GCOS Steering Committee has identified a broad range of actions that should be undertaken to implement GCOS based upon the current strategy. However given the severe resource limitations facing GCOS, it is proposed to focus the activities of the GCOS Secretariat over the next inter-sessional period on the following:

- Complete the GCOS Implementation Strategy and develop an implementation timeline. Seek interagency and national commitments to the strategy. Develop a calendar of significant events;
- Provide oversight, advice on integration and cross-linkages, and generally facilitate the work of the three domain-based science panels so that they can continue to move forward with the development and implementation of specific components of GCOS;
- Continue to monitor developments in the international research programmes and satellite observing systems to identify opportunities for enhanced effectiveness;
- Articulate the requirements of GCOS and, as appropriate, those of its partners (WWW, GOOS, GTOS, etc.) at intergovernmental meetings, including the various WMO Technical Commissions, and at regional and international fora;
- Report to the governing bodies of the GCOS Sponsors on the implementation of GCOS and seek the support of their Members for implementation;
- Engage the Subsidiary Bodies of the UNFCCC/COP in building support for the implementation of global observing systems for climate on behalf of GCOS partners;
- Present the climate-related themes of the IGOS partners in reports and statements to SBSTA and the UNFCCC;
- Build a network of national GCOS focal/contact points to facilitate communication, develop national reports, and encourage the correction of deficiencies in current systems;
- Develop, in collaboration with the UNFCCC Secretariat, a synthesis/analysis process for the national reports on systematic observations due in November 2001, and use the

analysis as the basis for updating the GCOS "Adequacy Report" (GCOS-48) for presentation to COP-8;

- Complete the Pilot Project of the GCOS Regional Workshop Programme over the next year and develop a plan and proposal to GEF for the remaining regional (or sub-regional) workshops over the next 4 to 5 years. (This activity will build on current activities of the GCOS partners and current national and regional initiatives but will be conditional on obtaining additional resources);
- Assist in the development of proposals to address regional deficiencies and submit for funding to bilateral activities and international financial mechanisms, such as the GEF, as a follow-on to the Regional Workshop Pilot Project.

## **8. RESOURCE ISSUES**

Active participation of national and international organizations in the work of GCOS is essential. The four sponsoring organizations have broad membership, but there is a need in each nation for an identified focal point and coordination mechanism for climate activities, particularly to consider observational requirements in support of international programmes.

### *International Coordination and Oversight*

To date, support for GCOS has come principally from the sponsoring organizations, with important supplements from nations. These funds support the operational expenses of the small staff (2) and meetings of the panels and the Steering Committee. To accomplish the projected activities associated with implementation of the strategy, it is essential to increase the funding available for GCOS. At present, approximately US \$0.3M per year is available to support GCOS planning and coordination activities. Additional resources needed by 2001 are estimated to be about US \$1.5M per year. Moreover, based on projected activities, a total of four additional staff will be needed to conduct programme activities by 2001, possibly via long-term secondment. In addition, it is clear that many of the GCOS partners require additional resources for the activities they undertake on behalf of GCOS.

### *GCOS Monitoring and Archiving Centres*

One of the important functions to be undertaken as part of GCOS is the continuous monitoring of the performance of the contributing networks to ensure that they are meeting user requirements. This, together with the archiving of data for future analysis, are functions best carried out by existing national climate and other data centres. Such centres would provide regular reports, technical support, serve as sources of information to users/participants, and provide key expertise on evolving technologies. Finally, there is a clear need for an information centre where users can obtain information of the source and location of the various network components of GCOS. National commitments to undertake these international responsibilities will be required.

### *National Implementation*

As noted, participating countries must carry out observational activities, but many developing countries lack the capacity to carry out those functions. Sustained operational as well as project support from multilateral and bilateral funding agencies will be essential to address these weaknesses. This support will need to cover human resource development, equipment modernization, and operational infrastructure and supplies.

The establishment of independently functioning national programmes is not sufficient, as the global climate observing system is more than the sum of the national contributions. There

are many parts of the globe that are remote from all nations where observations are required. To assist in the deployment of resources and effective integration of the effort, a number of bodies will need to be established, if they do not exist already, to put in place the networks required in these remote regions.

## **9. CONCLUSIONS**

Implementing GCOS in the new millennium will require a substantially different strategy than the one previously followed by GCOS and than those of the GCOS partners. In the latter case they can proceed directly on a project basis. GCOS can proceed only by building a level of interest and ownership in the GCOS programme across a very broad spectrum of organizations, activities and viewpoints. The implementation strategy presented in this document seeks to recognize these complexities while still proposing specific steps to implement a global observing system for climate in a timely manner. The way forward will be difficult due to the multiplicity of issues, organizations, and systems and the continuing need to explain and rationalize the complexities of the many facets of climate observing systems at the scientific, programmatic, managerial, political and public levels within the world and national societies. Nevertheless, the importance of the climate problems demands that we try in spite of all these complexities and the limited resources available for implementation.

## ANNEX I

### **GCOS Principles of Involvement**

- P1. GCOS will deliver, on an operational basis, high-quality, well-calibrated, long-term observations of the climate system needed for: seasonal-to-interannual climate predictions; climate system monitoring; early detection of climate trends due to human action; improved understanding of the climate system; impact assessment and adaptation to current and future climates; and national economic and sustainable development applications. Climate observations are required in all three domains of the earth (atmospheric, oceanic and terrestrial).
- P2. Contributions to GCOS will implement one or more components or parts of the overall systems plans developed and agreed on the basis of the above design principles.
- P3. Contributions will recognize the GCOS requirement for long-term records that requires special attention to those aspects involving routine assessments of data quality, continuity and homogeneity as well as the need for permanent repositories for all contributed data.
- P4. Contributing nations and organizations have the right to determine and limit their contributions to GCOS and have full autonomy in the management of those contributions while recognizing these principles.
- P5. Use of the GCOS 'labels' implies acceptance to operate in accordance with the relevant principles of GCOS.
- P6. All contributions of data and products pertinent to GCOS will be described in internationally-accessible, on-line computerized directories that conform to agreed-upon standards, including a reference to the originator of the data and their location.
- P7. Contributions will be compliant with the GCOS data policies outlined below:

#### ***GCOS Data Policies:***

- D1. Internationally-agreed standards will be used to the greatest extent possible for the acquisition, processing, archiving, and distribution of data.
- D2. All data should be processed to a level that is generally useful to user communities without a detailed knowledge of the observing instrument (i.e. geo-bio-physical rather than engineering measurements). However, for data from those instruments that utilize sophisticated algorithms for this processing, adequate archives must be maintained to permit recalculation of the geo-bio-physical data as improved processing techniques become available.
- D3. The impact of new systems and technology or changes to existing systems or technology will be assessed prior to implementation and a suitable period of overlap for new and old observing systems will be followed upon implementation.
- D4. Full and open sharing and exchange of data and products will be practised for all GCOS users.

- D5. The exchange of data will occur as rapidly as possible (near-real-time) following the observation. Corrections arising as a result of further quality control will follow at a later time.
- D6. Results of calibration, validation, algorithm changes, and data homogeneity assessments will be treated with the same care as the data themselves and will be made available to the user community and the designated international data centre.
- D7. Data sets established as part of international research programmes and designated as required for the indefinite future will be archived with the appropriate international data centre.
- D8. Information about the data holdings, including long-term quality assessments, supporting ancillary information (meta-data), and guidance and aids for locating and obtaining the data, should be readily available at both national and designated international data centres.

## ANNEX II

### **GCOS/GOOS/GTOS Climate Monitoring Principles**

1. The impact of new systems or changes to existing systems should be assessed prior to implementation.
2. A suitable period of overlap of new and old observing systems should be required.
3. The results of calibration, validation and data homogeneity assessments and assessments of algorithm changes should be treated with the same care as data.
4. A capability to routinely assess the quality and homogeneity of data on extreme events, including high-resolution data and related descriptive information, should be ensured.
5. Consideration of environmental climate-monitoring products and assessments, such as IPCC assessments, should be integrated into national, regional and global observing priorities.
6. Uninterrupted station operations and observing systems should be maintained.
7. A high priority should be given to additional observations in data-poor regions and regions sensitive to change.
8. Long-term requirements should be specified to network designers, operators and instrument engineers at the outset of new system design and implementation.
9. The carefully-planned conversion of research observing systems to long-term operations should be promoted.
10. Data management systems that facilitate access, use and interpretation should be included as essential elements of climate monitoring systems.

## ANNEX XII

### GCOS Steering Committee, Ninth Session

#### **CONSOLIDATED LIST OF DECISIONS, RECOMMENDATIONS AND ACTION ITEMS**

1. The SC noted the excellent progress that had been made in carrying out the actions that had been agreed at SC-VIII. It expressed its appreciation in particular to the GCOS Secretariat for its efforts in effecting this progress, as well as to the partners that had provided assistance and the countries and agencies that had contributed resources to carry out the activities of GCOS.
2. The SC requested the GCOS Secretariat, in consultation with the science panels and individual SC members, to develop, as a matter of urgency, possible methods which could be used to synthesize and analyze the National Communications on systematic observations for climate which are to be submitted to the UNFCCC/COP by November 2001. It approved in principle the process suggested at this meeting and requested that this process be extended to include other information on climate observations in order to develop a second report on the adequacy of global observing systems for climate.
3. The SC expressed its appreciation to the Meteorological Service of Canada for hosting the February 2000 Informal Meeting on an Intergovernmental Mechanism for GCOS. It noted the conclusions of that meeting and concurred that GCOS should focus on better use of existing mechanisms rather than the establishment of new ones. It recommended that this effort be targeted toward a limited number of selected mechanisms, both intergovernmental and non-intergovernmental, to communicate and maintain relations with the nations, programmes, agencies and other key partners in implementing GCOS.
4. The SC expressed its appreciation to the Australian Bureau of Meteorology for hosting the recent Informal Meeting of GCOS National Coordinators (9-11 August 2000). It welcomed this informal mechanism of interaction between GCOS and participating nations and agreed that it should be continued, noting with appreciation the offer of the USA to host another such meeting in the May/June 2001 time frame. The SC requested the GCOS Secretariat, in conjunction with participating nations, to prepare possible Terms of Reference for GCOS National Coordinators and to pursue the development of this mechanism as a way to implement GCOS within nations and, where appropriate, regionally.
5. The SC expressed support for the strategy of holding GCOS Regional Workshops to identify problems and deficiencies in selected regions and to develop Regional Action Plans. It also expressed satisfaction with the results of the recent Pacific Regional Workshop in Samoa. It nevertheless cautioned that workshops are only a means to identifying deficiencies and developing Regional Action Plans and are not an end in themselves.

6. The SC requested the GCOS Secretariat to ensure that the mechanism of Regional Workshops also be used to facilitate the identification of, and interactions among, National Coordinators for GCOS, to the extent possible.
7. The SC requested the GCOS Secretariat and Prof. Laban Ogallo, Co-ordinator of the Drought Monitoring Centre in Nairobi, Kenya, in collaboration with the GOOS Secretariat, to explore the modalities of holding a GCOS Regional Workshop in the Africa region.
8. The SC requested the Secretariat to prepare text for a draft decision to SBSTA13/COP-6 (13-24 November 2000 in The Hague) which could be used as necessary in response to the deliberations at those sessions.

### **AOPC**

9. The SC expressed its appreciation to the AOPC for the substantial progress made in implementation of the GSN and GUAN baseline networks. It noted the need to address the measurement of atmospheric trace gases in a similar manner via the GAW network and urged AOPC to begin such action as soon as feasible. The SC also recognized that the monitoring of regional climate will require regional networks beyond GSN and GUAN.
10. The SC noted the publication of the most recent GSN Monitoring Report and reiterated its appreciation to the Deutscher Wetterdienst (DWD) and the Japan Meteorological Agency (JMA) for carrying out this activity in support of the GSN. It also reiterated its appreciation to the World Data Centre A for Meteorology (NCDC, USA) for its efforts in establishing and maintaining the archive for GSN data.
11. The SC expressed its appreciation for the activities of the ECMWF and the Hadley Centre of the UKMO in monitoring and reporting on the data from the GUAN and requested the Secretariat to formalize recognition of their contributions as soon as possible.
12. The SC urged the WMO Commission for Basic Systems (CBS), through the WMO Secretariat, to instigate appropriate action to address the problems in the reporting of real-time data from the GSN, as identified in the GSN Monitoring Reports. It also urged that the results of the Monitoring Reports be brought to the attention of relevant WMO members as soon as possible, through whatever means are most appropriate. The SC noted with appreciation the activity begun toward this end through the engagement of a consultant and encouraged the continuation of such activity, as well as the establishment of routine liaison between the Monitoring Centres and the operators of the GSN and GUAN stations.
13. The SC reiterated the importance of obtaining historical baseline data from the GSN and GUAN stations. It urged the WMO Commission for Climatology (CCI), through the WMO Secretariat, to address in particular the issue of the submission of historical data from the GSN, as requested in the September 1999 letter to WMO Members, and to explore through the relevant WMO constituent bodies appropriate means to resolve any difficulties with respect to the submission of the daily data that are necessary to establish comprehensive baseline statistics.

14. The SC confirmed the requirement that GCOS baseline data, such as those from the GSN and GUAN, be available for free and open exchange as required by the WMO World Data Centres. It also recognized the importance of full public access to routine performance-monitoring information and thanked the GSN and GUAN Monitoring Centres for facilitating this capability through their respective World Wide Web sites.
15. The SC recognized the importance of assessing the quality of the analyses of global temperatures from surface, radiosonde and satellite data and encouraged the AOPC to pursue the establishment of an international framework for such quality assurance.
16. The SC recognized the importance of maintaining continuity of baseline satellite observations (e.g. MSU radiances) as a component of the GCOS and requested the Secretariat to facilitate appropriate liaison between the AOPC and the relevant satellite agencies toward this end.
17. The SC expressed its appreciation to the WMO and CEOS for supporting completion and publication of the Report on the Integration of Satellite and Ground-based Measurements of Ozone, originally begun as a CEOS Pilot Project. It encouraged the adoption of this activity under the IGOS framework, possibly as part of an Atmospheric Chemistry Theme, leading to eventual implementation of its recommendations.
18. The SC encouraged AOPC to continue working with relevant organizations to promote the analysis and utilization of GCOS data, particularly the production of reliable indicators of extreme events.
19. The SC acknowledged the progress to date in developing the GCOS Plan for Atmospheric Climate Observations and encouraged the AOPC to complete the plan as a high priority activity.
20. The SC encouraged the AOPC to pursue the planning for an international GCOS conference on 'Atmospheric Observations for Climate' which would, *inter alia*, promote the need for, and status of, the atmospheric observations required for climate applications.
21. The SC requested the AOPC to review its Terms of Reference in light of the additional responsibilities assigned to it as a result of the dissolution or modification of the cross-cutting panels, JDIMP and GOSSP, as well as recent developments in GCOS and the new implementation strategy. It requested that revised Terms of Reference be presented to the SC for approval at its next session or sooner.

### OOPC

22. The SC congratulated the OOPC for its contributions to the considerable progress made in implementation of the ocean observing system for climate. It noted in particular the progress made in the GODAE pilot project and its Argo initiative; the review of various components of the system leading, for example, to the revision of the SOOP plan; and the establishment of JCOMM as the formal implementation body for the ocean observing system. The SC also congratulated the OOPC, together with the WCRP/CLIVAR Upper Oceans Panel (UOP), for organizing the highly-successful Conference for the Ocean Observing System for Climate (OceanObs 99, Saint

Raphaël, France, October 1999) and looked forward to publication of the final proceedings.

23. The SC encouraged the OOPC to continue to work closely with JCOMM to ensure the satisfactory integration of the various elements of the ocean observing system for climate.
24. The SC endorsed the concept of a review of the ENSO Observing System by the OOPC and the CLIVAR UOP with a view to improving its efficiency and strengthening its potential for long-term continuity. It also endorsed the current emphasis being placed on the development of an ocean observing system for the Indian Ocean.
25. The SC noted with appreciation the agreement of POGO to provide support and leadership for the implementation of an array of fixed-point time series ocean measurement stations. It encouraged POGO to ensure that data from such stations, and from similar networks under the auspices of POGO, be made available for free and open exchange in real time.
26. The SC requested that the GCOS and GOOS Secretariats, in consultation with the OOPC, develop a joint paper for GCOS SC-X defining precisely which components of the GOOS Initial Observing System constituted a part of GCOS, and hence which would be described as 'GCOS Networks'.
27. The SC requested that the OOPC, in collaboration with the GOOS and GCOS Secretariats, agree on a set of performance metrics for ocean measurements for climate which could be used to grade the performance of the networks for purposes of, *inter alia*, providing reliable information to COP and SBSTA.
28. The SC recognized that the current responsibilities of the OOPC go well beyond those which were originally defined for the Panel (in effect now including all ocean physics, sea-ice and ocean carbon). Additional responsibilities have also been added as a result of the dissolution or modification of the cross-cutting panels, JDIMP and GOSSP. The SC thus agreed that the OOPC Terms of Reference should be reviewed and updated and requested the Panel to bring forward revised Terms of Reference for approval at the next session of the SC or sooner.

### TOPC

29. The SC expressed its appreciation to the TOPC for the progress achieved in implementation of the GTOS terrestrial networks. It noted in particular the progress made in preparing plans for global observation of terrestrial carbon (TCO) under the IGOS Partnership 'themes' activity. It reiterated the importance of carbon observations as a high priority for GCOS implementation and requested the Secretariat to promote acceptance of the TCO report by the IGOS Partnership and to pursue, in partnership with GTOS, IGBP and other agencies, the implementation of the report's recommendations.
30. The SC noted with appreciation the progress in development of the Global Terrestrial Network for Glaciers (GTN-G), including the support of the World Glacier Monitoring Service at the ETH-Zurich for this initiative. It also noted that the current participants did not necessarily include all nations which might be appropriate, in

particular all those countries having tropical glaciers. The SC therefore requested the Secretariat and the TOPC to review the list of participants and arrange for the sending of additional invitations to participate as appropriate. It also recommended that the Secretariat, working with GTN-G and TOPC, seek ways to find additional financial support for the network, and encouraged network participants to acknowledge the interaction between GCOS and GTN-G at all appropriate opportunities.

31. The SC noted with satisfaction the progress in the Global Land-Ice Measurements from Space (GLIMS) project and confirmed its importance to the comprehensive global observation of glaciers being undertaken through the GTN-G. It requested the TOPC to collaborate with GTN-G and GLIMS to ensure that results and techniques from GLIMS are effectively used in GTN-G. The SC also requested that the GCOS Secretariat seek ways to ensure the future continuity of space-based observations needed for this purpose.
32. The SC reaffirmed the need for a global hydrological observation network for climate. It thanked the Deutscher Wetterdienst (DWD) and the Forschungsanstalt Geisenheim for hosting the recent workshop on this topic in Geisenheim, Germany (26-30 June 2000), as well as the efforts of the WMO Hydrology and Water Resources Department (HWR), GTOS and TOPC in organizing that meeting. The SC noted with approval the recommendations of the workshop and requested the GCOS Secretariat to bring them to the attention of the many potential partners who would need to be involved in the implementation of the workshop recommendations.
33. The SC recognized the critical importance of observations of the global water cycle to understanding the climate system. It requested the GCOS Secretariat and science panels to support the WCRP and other partner agencies and programmes in developing a global water cycle theme for possible adoption by the IGOS Partnership.
34. The SC requested that the TOPC, in collaboration with the GTOS and GCOS Secretariats, agree on a set of performance metrics for terrestrial measurements for climate which could be used to grade the performance of the networks for purposes of, *inter alia*, providing reliable information to COP and SBSTA.
35. The SC requested the TOPC to review its Terms of Reference in light of the additional responsibilities assigned to it as a result of the dissolution or modification of the cross-cutting panels, JDIMP and GOSSP, as well as recent developments in GCOS and its implementation strategy. It requested that revised Terms of Reference be presented to the SC for approval at its next session or sooner.

#### **Implementation Strategy**

36. The SC accepted in principle the strategic approach contained in the GCOS Implementation Strategy but requested that several additions be made to the current draft. In particular, the SC requested that the GCOS Secretariat stress the urgency of implementing GCOS and add a new section that outlines the longer-range actions and priorities for implementation. It also requested that more emphasis be placed on the outreach and communication aspects of the document, to enhance its usefulness as a marketing tool for the GCOS programme.

### **JDIMP**

37. The SC noted the considerable effort that had been expended in establishing the Global Observing Systems Information Centre (GOSIC) and the significant progress made, and expressed its thanks to Prof. Webster and his team for leading this effort in support of the global observing systems.
38. The SC agreed that most of the functions originally defined for the JDIMP were now being, or could be, carried out through alternative mechanisms. In particular, it agreed that most DIM activities for the three observing systems could be handled by a small expert group for each system, as had been agreed by the GOOS SC. The SC therefore agreed to the dissolution of the JDIMP in its current form and expressed its thanks to the former panel members and Chairmen for their valuable contributions and services.
39. The SC endorsed the concept of a small 'GOSIC Advisory Committee' to provide guidance and oversight for GOSIC. This committee would consist of six members, two representing each of the atmospheric, oceanic and terrestrial domains. One of each of the two domain advisors would represent the interests of the climate observing systems and be selected from, respectively, the AOPC, OOPC and TOPC. The other would represent the non-climate observation interests in each domain. Establishment of this committee and development of its Terms of Reference would be led by GOOS, to whom the SC agreed to provide names of potential participants representing the atmospheric domain.
40. The SC agreed to invite the WMO to identify a DIM expert to serve on the GOSIC Advisory Committee.

### **GOSSP**

41. The SC noted the report on the activities of the GOSSP since SC-VIII and the options presented for possible alternative ways of carrying out the responsibilities of this panel in the future. It suggested that these responsibilities could be better served by adoption of the following:
  - Membership of each of the three GCOS science panels should include at least two experts on space-based observations in the relevant domain;
  - The science panels should be fully responsible for identification of the requirements for space-based observations in their domains;
  - The identified requirements should be incorporated as appropriate in relevant IGOS theme activities (through participation of appropriate members on the IGOS Theme Teams), and/or the WMO/CBS OPAG ET-RR (through membership on that ET) for incorporation into the WMO Statements of Guidance for the satellite operators; and
  - The Chairman of the GCOS SC may convene the appropriate experts of each panel, as necessary, to provide cross-domain advice and perspectives on space-based observations to the SC and to prepare an integrated GCOS perspective on space-based observation matters for use in various fora.

The SC requested that this proposed process be discussed with the other sponsors of GOSSP, and with its space-agency and other partners in the IGOS Partnership, to obtain their views prior to final adoption of this or an alternative structure.

42. The SC expressed its thanks to the members and Chairman of GOSSP for their valuable contributions and services to the global observing systems.

**Other**

43. The SC agreed that formalization of a process for designating a network, centre, database or other entity as a 'GCOS' entity should be pursued, using an approach of the type discussed. It requested that the Secretariat work with the science panels to develop appropriate criteria for such designation and prepare a revised proposal for consideration and approval by the SC as soon as feasible. In the interim, it agreed that entities that have traditionally been identified as GCOS entities should retain that designation.
44. The SC agreed that there was a particular need to strengthen the interaction between GCOS and UNEP. It requested that the SC Chairman formally participate in appropriate sessions of the UNEP executive bodies, as authorized by the terms of the GCOS Memorandum of Understanding.
45. The SC requested that GCOS enhance its participation and visibility in the CEOS arena, for example by increasing direct contacts between the SC Chairman and the CEOS Chairman and increasing interaction between the GCOS and CEOS Secretariats.
46. The SC felt strongly that the terminology 'G3OS' is misleading in that, *inter alia*, it implies that GCOS speaks for the full range of atmospheric observing systems. It recommended that this difficulty be brought to the attention of the GCOS, GTOS and GOOS sponsors at their next meeting for consideration of potential alternatives. The SC further recommended that the Global Observing System (GOS) of the WMO World Weather Watch be formally invited to participate in the semi-annual meetings of the sponsors of the global observing systems as the representative of the broad atmospheric observation systems.
47. The SC expressed its sincere appreciation to the China Meteorological Administration and Mr. Wen Kegang and his staff for the excellent facilities and gracious hospitality provided for the session.

(Intentionally Blank)

**ANNEX XIII**

**LIST OF ACRONYMS AND ABBREVIATIONS**

(To be Added)