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REPORT OF THE SIXTEENTH SESSION OF THE

**WMO-IOC-UNEP-ICSU
STEERING COMMITTEE
FOR GCOS**

(Geneva, 14-17 October 2008)

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REPORT OF THE SIXTEENTH SESSION OF THE GCOS STEERING COMMITTEE

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REPORT OF THE SIXTEENTH SESSION OF THE GCOS STEERING COMMITTEE

1 Opening of the Session

The Sixteenth Session (SC-XVI) of the Global Climate Observing System (GCOS) Steering Committee (SC) was held in Geneva, Switzerland on 14-17 October 2008 at the headquarters of the World Meteorological Organization (WMO). This report provides an overview of the presentations and discussion at the session and identifies specific action items flowing from the deliberations of the SC. The list of participants is provided in Annex I and the agenda in Annex II. Annex III is the list of documents for the session.

1.1 Welcome by the Chairman

The Chairman of the Steering Committee, Professor John Zillman, opened the session and thanked all the participants (see Annex 1) for their commitment to GCOS. After welcoming the Deputy Secretary-General of WMO, Professor Yan Hong, and inviting all present to introduce themselves, he extended special appreciation to the Panel Chairmen, Dr Adrian Simmons, Dr Ed Harrison, and Dr Han Dolman. He also thanked the Sponsor representatives, the special invitees, and the Secretariat and other representatives for their participation. He acknowledged the apologies of the SC members Prof Lucka Kajfez-Bogataj, Dr Greg Withee, Dr David Williams, and Dr Jack Kaye, but noted that Dr Kaye would be joining the session for certain items by teleconference. He also welcomed Dr Alexander Karpov as Acting Director of the GCOS Secretariat and informed the session that the Secretary-General of WMO, Mr Michel Jarraud, had advised that the Executive Heads of the other Sponsors had been consulted, a short list prepared, and the candidates for the Director of the GCOS Secretariat would be interviewed in the next few weeks with a view to appointment of a permanent replacement for Dr David Goodrich early in 2009. The Chairman noted the appreciation of all present to Dr Bill Westermeyer and his colleagues for the hard work that had gone into the preparations for the session.

By way of opening remarks for the session, the Chairman offered his view that:

- Achievement of the original 1990 vision for GCOS is critical to virtually every aspect of national and international climate research, monitoring, services, assessment, and policy development, and that an effectively operating GCOS is the essential foundation for a successful coordinated UN System response to climate change;
- The importance of GCOS is now enormously greater than when it was first conceived, and its accelerated implementation must be embraced as a global imperative for the next decade;
- GCOS is fundamentally a system of largely domain-based climate-relevant observing systems (including especially the Global Ocean Observing System (GOOS), the Global Terrestrial Observing System (GTOS), and the WMO Integrated Global Observing Systems (WIGOS)), and the aim of their Sponsors in establishing GCOS is that all these systems work together as an integrated whole to serve the full range of climate-related needs for observations. GCOS is thus essentially the climate-observing subset of the Global Earth Observation System of Systems (GEOSS); and
- The task of the SC is to advise the four Sponsors of GCOS and all those who plan and operate climate-relevant observing systems as to how best to achieve the GCOS vision and meet the totality of national and international needs for climate and climate-related observations.

The Chairman noted that he had been pleased to work with the WMO Deputy Secretary-General over many years on the planning and implementation of the global observing systems and, on behalf of the SC, he thanked Professor Yan Hong for his interest in, and support for, GCOS. He invited Professor Yan to address the session.

1.2 Welcome by WMO on behalf of the Sponsors

Professor Yan Hong welcomed the participants on behalf of the WMO Secretary-General, Mr Michel Jarraud, and also on behalf of the three other Sponsors of GCOS, the United Nations Environment Programme (UNEP), the Intergovernmental Oceanographic Commission (IOC), and the International Council for Science (ICSU).

Prof Yan noted that he was pleased to see that the special needs of developing countries for climate observations were to be considered at the session. He was also pleased to see that the subject of adaptation to climate change would be discussed, noting that there is a growing demand by decision makers for climate change information required for adaptation. In both regards, he commended the GCOS Secretariat for the initiative it has taken to facilitate the launch of the Climate for Development in Africa Programme (ClimDev Africa), which will be hugely important for adaptation efforts in Africa. He noted that although the Programme has been slow to get off the ground, there are clear signs that the programme is coming together and that a consortium of donors will soon provide the support needed to begin implementation. He stressed that WMO stands firmly behind this initiative and will do what it can to contribute to its success.

Prof Yan noted the strong and productive link that GCOS has developed with the UNFCCC and pointed out that this relationship has contributed to a substantial increase in the visibility of GCOS and, therefore, its parent bodies and enabled the GCOS Secretariat to more effectively represent the concerns, interests, and needs of the climate observing community. He noted that, since the last Steering Committee meeting, the Conference of the Parties to the UNFCCC has adopted the revised reporting guidelines on global climate observing systems that were proposed by the GCOS Secretariat, and he recognized the hard work that GCOS is in the process of doing to prepare by next June the report requested by the Subsidiary Body for Scientific and Technological Advice (SBSTA) updating progress made to date on implementing the 2004 Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC.

Prof Yan also drew attention to World Climate Conference-3 (WCC-3), noting that climate observing needs will be a key element in next year's Conference. He expressed his hope that WCC-3 will provide the strong reaffirmation of the concept of GCOS that is needed to ensure its accelerated implementation over the next decade.

He also mentioned the evolving relationship between GCOS and GEOSS, the Global Earth Observation System of Systems. GCOS is now widely accepted as the climate-observing component of GEOSS, and Prof Yan was pleased at the increasingly close alignment between GCOS and GEOSS in addressing the global need for climate observations.

Finally, Prof Yan noted that WMO has undergone a recent reorganization and that, as a result, the GCOS Secretariat is now housed within the Observing and Information Systems Department. This new structure, he noted, is already leading to greater coordination between GCOS and key WMO components, including especially the WMO Integrated Observing Systems (WIGOS). It is also one of several reasons why it is timely to now consider updating the Memorandum of Understanding (MOU) between the Sponsors that created GCOS.

The Deputy Secretary-General concluded by wishing the SC members a successful session and indicated that he looked forward to the results of their deliberations.

1.3 Approval of Agenda

The agenda for SC-XVI was constructed to facilitate SC review of progress with GCOS planning and implementation from both the system provider and system user perspectives and to focus attention on a number of strategic issues on which the Committee's in-depth advice/guidance to the Sponsors and participating organizations is needed to guide the further development of GCOS.

The Chairman asked the SC Members if they had any questions about the final draft agenda or wished to propose modifications to it. The Committee agreed that the agenda could be adjusted, as necessary, as the session proceeded.

1.4 Arrangements for the Session

Dr Westermeyer, the Secretariat officer responsible for the organization of the session, briefed SC members, Sponsor representatives, and other session participants on logistical issues and other useful information. He also outlined the steps that the Secretariat planned to follow in drafting the report of the session. He noted that all GCOS staff would be taking notes of presentations and discussions, with responsibility for covering particular agenda items allocated among staff; that the draft session report would be developed from oral comments, PowerPoint slides, and the written documents participants submitted; that the Chairman would summarize action items at the end of each first order item; that the complete list of actions would be included in the report; that the draft document would be circulated to SC members and other participants for a two-week comment period; and that the final report would be prepared and approved by the Chairman in the light of comments received on the draft.

2 Report of the Chairman

The Chairman introduced his written report. He suggested that it was largely an information document for noting by the SC but that he wished to identify some of the major issues he felt the SC would need to address later in the agenda and to indicate his expectations on the outcome of the session.

By way of background, the Chairman recalled his list of duties under Annex B of the GCOS Memorandum of Understanding (MOU) and summarized the general policy framework within which he had carried out those duties over the past year.

2.1 Report on activities since SC-XV

The Chairman provided an overview of his activities since SC-XV and mentioned, in particular:

- His letter of 25 March 2008 to the Executive Heads of the Sponsors, reporting on the outcome of SC-XV and the state of GCOS generally. He expressed appreciation for the helpful feedback received from the Sponsors;
- The concern in the GCOS community about the incorporation of the GCOS Secretariat into the Observing and Information Systems Department of WMO. He noted that, following consultation with the WMO Secretary-General, he considered that a fully satisfactory representation of the joint WMO-IOC-UNEP-ICSU nature and special status of the GCOS Secretariat had been agreed; and
- His own and other SC members' participation, on behalf of the SC, in a range of GCOS-related meetings and events, including the 2007 Bali session of SBSTA, the Cape Town Group on Earth Observations (GEO) Plenary and Ministerial Summit, the 29th session of the JSC for the WCRP, the Sixtieth Session of the WMO Executive Council and the 29th session of the IPCC.

He noted that information on these and other activities had been provided to SC members and other GCOS stakeholders during the year and summarized in the draft GCOS Annual Report 2007-08 for consideration later in the session.

2.2 Major Issues Facing GCOS

The Chairman referred to the rapidly changing environment within which the planning, implementation and further development of GCOS is proceeding and the complex web of interactions and partnerships involved in ensuring that all the key climate-relevant observing systems are encouraged and assisted to work together as an integrated whole. He believed that the most significant issues currently facing GCOS include:

- The need for a renewed sense of ownership and a reaffirmation of Sponsor support for the concept of GCOS;
- The importance of finalizing an updated strategic plan for GCOS;
- The need for continuing close links with the UNFCCC;

- The priority that must be given to the preparation of a high quality 2009 Progress Report to SBSTA and an update of GCOS-92;
- The need to resolve the extent to which, and the mechanisms through which, GCOS should include the observation of biological, ecological and socio-economic variables relevant to climate;
- The importance of establishing effective GCOS coordination mechanisms at the national level;
- The opportunities and challenges of further developing GCOS within the overall framework of GEOSS;
- Strategy for achieving a strong revalidation of GCOS from WCC-3;
- The critical importance of finding the funding mechanisms to ensure the long-term sustainability of the key observing systems which constitute GOOS, GTOS and WIGOS and hence, ultimately, GCOS; and
- The urgency of mobilizing increased financial support for the work of the GCOS Secretariat.

2.3 Expectations of the Session

The Chairman reminded SC members of the importance of formulating clear actionable advice to the Sponsors and specific follow-up actions for the Panels, Secretariat and other GCOS stakeholders. Among the most importance strategic outcomes he hoped for from the session were:

- Guidance for updating the GCOS MOU, revalidating the GCOS concept and strengthening Sponsor support for GCOS and its component systems;
- Agreement on responsibilities and timetables for updating the GCOS Plan and preparation of a supporting promotional brochure and poster;
- Explicit guidance for the finalization of the 2009 Progress Report to SBSTA and the update of GCOS-92;
- Development of an SC strategy for defining the role of GCOS as a framework for observation of ecological, biological and socio-economic variables related to climate impacts and adaptation;
- Strategy for mobilization of funding for implementation of the GCOS Regional Action Plans;
- Agreement on a framework for implementation of GCOS as the climate observing component of GEOSS;
- Reaffirmation of the role of the GCOS Steering Committee in supporting and promoting the climate-related functions of GOOS, GTOS and WIGOS;
- Agreement on the optimum balance of skills that will be needed on the SC to progress GCOS planning over the next 5-7 years; and
- Consensus on an effective mechanism for stronger information exchange within the GCOS community.

2.4 Advice from the SC

The SC noted the information provided by the Chairman and agreed that most of the issues raised in his report would be dealt with as Action items later in the agenda. In discussion following the Chairman's report, Dr Kevin Trenberth wondered whether GCOS is declining, muddling along, or in the ascendancy. In response, the Chairman noted that GCOS has been through several peaks and troughs of progress but appears poised for a new period of ascendancy. He pointed to several opportunities for GCOS in the near future, including those presented by the 2009 report to the UNFCCC on progress in implementing the 2004 Implementation Plan, the United Nations System coordinated action on climate change, and GCOS involvement in World Climate Conference-3 (WCC-3). The Chairman also noted that GCOS is emerging as a potentially successful component of GEOSS. Dr Trenberth wondered also if GCOS is visible enough, particularly given its place within the new structure of WMO. There appeared to be general agreement that the visibility of GCOS is not as high as it should be and that the concept of GCOS is not well understood, either within National Meteorological Services (NMSs) or elsewhere. The Chairman expressed his view that GCOS needs to be much better understood within NMSs and his belief that the Commission for Basic Systems and WIGOS could help in this regard. The representative of the ICSU, Dr Gisbert Glaser, responded to the Chairman's perception that the Sponsors don't feel the same sense of ownership of GCOS as they did 16 years ago by noting that, although this may be a perception, nothing has really changed.

If it is a perception, however, it needs to be addressed. Dr Trenberth suggested that an electronic newsletter would be a way to increase visibility and is important as it could pay off in terms of support and funding. Dr Kadi raised the issue of whether GCOS was giving adequate attention to regional and local climate observing needs

Some Sponsors questioned the position of the GCOS Secretariat in the new WMO structure, noting that the Secretariat was not reflected in the organization chart depicting this structure like other similar offices/secretariats, e.g., those of the WCRP and the IPCC. The Chairman responded that while it would be preferable to have the GCOS Secretariat represented as a separate "box," similar to the WCRP and IPCC Secretariats, the agreed representation made clear that GCOS is a joint activity of WMO, IOC, UNEP, and ICSU and that its primary role is support for the work of the Steering Committee. He stressed the importance of strong Secretariat support for the role of the SC in its annual advice to all four Sponsors.

Action 1. Report to Sponsors. The SC requested the Chairman to report to the Sponsors on the outcome of SC-XVI before the end of 2008 and to guide and assist the GCOS Secretariat, under its new Director, in ensuring prompt follow-up on the SC priority actions for 2009.

Action 2: Secretariat arrangements. Further to the actions taken by the Chairman, the SC encouraged the Sponsors to review the role and representation of the GCOS Secretariat in the new structure of the WMO Secretariat to ensure that the new arrangements fully reflect the joint sponsorship of GCOS and the intent of the GCOS MOU.

3 GCOS Panel Reports

3.1 Atmospheric Observation Panel for Climate (AOPC)

Dr Adrian Simmons presented the activities related to the Atmospheric Observation Panel for Climate (AOPC) in response to requests from the Steering Committee last year and outlined the main outcomes of the 2008 session of AOPC (AOPC-XIV). He reported on the recent focus of the panel on cryospheric issues; the assessment of progress in atmospheric observations for climate for the 2009 GCOS report; interaction of GCOS with space agencies, in particular the Committee on Earth Observation Satellites (CEOS), the Regional/Specialized Satellite Centres for Climate Monitoring (R/SSC-CM) initiative, and the European Space Agency (ESA) "climate change initiative;" and the development of guidelines for datasets and products meeting GCOS requirements.

On the latter point, space agencies coordinated under the R/SSC-CM and the AOPC/OOPC Working Group on Surface Pressure (with respect to the International Surface Pressure Databank) had expressed a wish for some form of recognition of their datasets from GCOS. AOPC-XIV in April 2008 recommended that data and product suppliers provide users with sufficient information to allow them to assess the extent to which the datasets meet GCOS requirements, i.e., to assess the climate worthiness of the datasets. Thus, providers should essentially perform a self-assessment of their datasets and products, including metadata for user needs. For this purpose, it was recommended that the suppliers should follow guidelines set by GCOS.

AOPC-XIV had agreed with the draft guidelines (8 April 2008) presented by the Secretariat, which were specifically developed for satellite datasets, but recommended that these guidelines also include "version management" of datasets and a possible later expansion to include a maturity index, once such a concept has been fully developed. The experience of WMO Regional Centres in providing data, products, and services to users should be considered in this regard. The SC endorsed the approach taken in developing the guidelines, encouraged their use, and thanked the AOPC and its Chair for the information and succinct summary of the activities undertaken. In addition, the SC noted that the draft guidelines should include the request for information on peer-reviewed publications related to the datasets and products. The SC also considered it would be useful if the GCOS Sponsors could advise on the precise role they would like the GCOS Secretariat to play in helping data providers follow those guidelines.

Dr Simmons also reported that AOPC-XIV had invited the GCOS SC to provide further guidance on the strategy of GCOS for providing and exploiting the data required for adaptation, while offering its

expertise to assist the SC in its deliberations. He identified the need to better understand the requirements of the adaptation community, as well as the requirement to demonstrate to that community the value of the climate observational record and the capabilities of existing observing systems.

The SC noted that the AOPC had reiterated the recommendation to discontinue routine provision of CLIMAT TEMP messages and that the WMO Executive Council at its 60th session charged the Commission for Climatology (CCI) and the World Climate Data and Monitoring Programme (WCDMP) (Dr Omar Baddour of the WMO Secretariat is responsible) to explore with WMO Members the implication of this recommendation for their work.

Action 3: Guidelines on data sets and products. The SC requested the Secretariat to expand the scope of the guidelines to in-situ observations and arrange for their review by the Panels and Sponsor representatives.

3.2 Ocean Observations Panel for Climate (OOPC)

Dr Ed Harrison, the Chair of the Ocean Observations Panel for Climate (OOPC), reported on the status of, and challenges faced by, the ocean component of GCOS, which is also the open-ocean component of GOOS.

OOPC's objectives are to develop recommendations for a sustained global ocean observing system in support of its Sponsors' climate objectives, including planned implementation; to continuously evaluate the system and promote its evolution; and to support global ocean observing activities through advocacy and in liaison with others regarding agreed observing plans.

Dr Harrison reminded the SC of the challenges associated with sustained ocean observations for climate. The ocean observing system remains largely in the hands of scientific researchers, funded and motivated by national research goals. Few National Ocean Services exist, and in general, despite the call by GEO and the IOC to identify national agents of implementation, few have come forward. Sustaining the observing system for the next decade via the research community would be a challenge. The post-CLIVAR (post-2013) international organizing framework for ocean science remains to be defined. The SC noted the critical role of JCOMM in jointly addressing the observational need of both the atmospheric and ocean communities.

Implementation of the *in situ* system continued over the past year, but the OOPC chair noted that despite good and steady progress in implementing the ocean observing system to roughly 60 percent of the goals stated in GCOS-92, the pace of improvement had slowed down. Nevertheless, the efforts of the past decade have led to a remarkable increase in observational coverage of the ice-free upper ocean, compared to the historical record. Argo and surface drifting floats have now reached their full implementation density. Concerns about the continuity of critical ocean satellite observations, as well as the in-situ components now in place, remain high. The SC recommended that Action 16 of the GCOS-92 Implementation Plan be reinforced, specifically that the initial ocean observing system be completed and sustained, that national agents for implementation be designated and supported, and that effective partnerships be established between ocean research and operational communities to assist implementation.

OOPC's efforts in the past year included supporting work on the data system (including metadata for temperature profiles, the development of GTS BUFR¹ templates for real-time oceanography, and improved system monitoring), *in situ* hardware (including profiles from instrumented animals, a sensor workshop), outreach to non-physical variable communities (including IMBER², carbon, and Census of Marine Life communities). OOPC has also been working with the analysis/forecast communities on observing system evaluation, and is continuing work on ocean climate indices, a number of which are updated in near-real-time on the OOPC web site (<http://ioc.unesco.org/oopc/>). Continuation of satellite altimetry (e.g., ocean topography missions) as a key space-based component of GCOS should be secured.

¹ Global Telecommunication System (GTS) Binary universal form for the representation of meteorological data (BUFR).

² Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)

In the year since the previous SC, notable ocean climate anomalies included a strong La Niña event, low summer Arctic sea ice (although work on inconsistencies in products was needed), and a slowing in the global mean sea level rise. It was pointed out that the impact of sea level variability depends strongly on local conditions and that regional water level monitoring is critical to establish vulnerability and thus is important for adaptation planning.

The transformation of ocean climate data into information was proceeding slowly through ocean analysis, reanalysis, and science. Much of the effort of the OOPC is focused on the development of the OceanObs'09 (<http://oceanobs09.net/>) meeting 21-25 September 2009 in Venice, Italy. This meeting seeks to expand the community involved in the sustained ocean observing system, set frameworks for the development of services for society, and define priorities for the coming decade. The OceanObs'09 conference will provide a forum in which to shape a new ocean science framework and to expand the stakeholder community, e.g., by linking the open ocean and coastal modules of GOOS. The structure of the meeting would draw from community-submitted white papers, which would then feed into invited plenary presentations. The outcomes of the meeting could provide input to the update of the GCOS-92 Implementation Plan, although the timing of the latter was an issue. The SC endorsed progress in organizing OceanObs'09 and urged the organizers to closely coordinate their efforts with the observational component of the planned World Climate Conference-3. Membership of Prof Martin Visbeck in the organizing committees of both events should ensure this linkage.

Key scientific challenges in the ocean include:

- Data coverage and quality, which are often not sufficient to ascertain uncertainties and trends;
- Sampling of the deep ocean, which is particularly poor;
- Increasing interest in decadal variability and carbon uptake, which is not reflected in budget priorities;
- Adjustment of ecosystems;
- Accurate mapping of sea ice cover by satellites; and
- Regional sea level rise.

The OOPC Chairman noted recent decreases in observations from Voluntary Observing Ships (VOS). Given the importance of VOS and VOSCLIM data for climate applications, the SC expressed concern about decreases in the VOS that arise from priorities that do not adequately reflect climate concerns, and especially about the masking of ship call signs leading to non-disclosure of the location of measurements. The SC strongly endorsed the efforts of WMO and IOC to explore with the shipping industry additional measures to remedy the situation beyond the current level of activity.

Action 4: OceanObs'09. The SC requested the Chairman, the Secretariat, and the Sponsors to help ensure the success of OceanObs'09, especially in respect of its outcomes on ocean observations for climate.

3.3 Terrestrial Observation Panel for Climate (TOPC)

Dr Han Dolman, the Chair of the Terrestrial Observation Panel for Climate (TOPC), reported on recent activities of TOPC with a focus on the following:

- *Establishment of standards for measuring terrestrial Essential Climate Variables (ECVs), including an inventory of existing standards and guidelines.* TOPC is currently charged with assessing the level of existing guidelines for standardized measurements of terrestrial ECVs. Four assessments have been completed and nine are available in draft form. These will be completed at the 11th session of TOPC in October 2008. The complete inventory will be presented to the UNFCCC SBSTA 29 in December 2008. This work will provide the technical basis for an international institutional framework for terrestrial observations currently being canvassed by WMO, FAO, and ISO. The SC noted the initiative by the Institute of Electrical and Electronics Engineers (IEEE) aimed at standardization of climate variables with a particular focus on carbon related variables. The SC encouraged all interested groups and institutions to participate in the establishment of a terrestrial framework, including WMO (CHy, CCI, and the CAgM in particular), FAO, ISO, and IEEE. The SC expressed its strong support for TOPC input to the GTOS-led work in this area.

- *Hydrological networks.* Dr Dolman expressed his concern about the continuing decline of river discharge stations. In particular, some stream gauges providing long-term time series have been deactivated due to financial constraints and the lack of recognition of their value for climate studies. For enhanced coordination of groundwater observations, access to data, and the establishment of common standards, Dr Dolman proposed that SC recognize the International Groundwater Research and Assessment Centre (IGRAC) as the international data centre for groundwater and as a key driver in implementing the Global Groundwater Monitoring Network.
- *Cryosphere issues.* Dr Dolman noted the increased focus of TOPC on cryosphere issues reflected in recent changes in panel membership. In this regard he stressed the importance of effective links between the three GCOS panels to ensure sustained monitoring of the cryosphere and to fully exploit the surge of information coming from International Polar Year (IPY) projects. To this end, the importance of timely and adequate provisions for data management was stressed. The SC recognized the importance of IPY legacy projects related to observations and the importance of establishing the Global Cryosphere Watch.
- *Carbon observation issues.* The SC was informed that TOPC is currently undertaking an effort to define the requirements for a carbon observing system jointly with the GTOS Terrestrial Carbon Observations Panel and the Integrated Global Observing Strategy (IGOS) carbon community. Efforts by the WMO GAW for *in-situ* measurements and the launches of the OCO and GOSAT satellites planned for January 2009 are essential in this context. The SC noted the potentially high relevance of a comprehensive carbon observing system in order to provide a scientifically sound, neutral approach to monitor carbon concentrations, sources, and sinks.
- *Endorsement of soil moisture as an ECV.* Dr Dolman raised the importance of soil moisture measurements for the initialization of climate models and the direct assessment of climate feedbacks, and stressed the relative maturity of reliably measuring soil moisture (or proxies thereof) from *in-situ* and space-based systems. The SC noted that no direct global trends in soil moisture were feasible to measure, but it acknowledged the great practical value of this variable.

The SC recognized the importance of adequate monitoring of groundwater resources and endorsed the initiative of the International Groundwater Assessment Centre to set up a Global terrestrial network on groundwater, the Global Groundwater Monitoring Network (GGMN). It noted that the next (11th) TOPC session is scheduled for 29 and 30 October 2008 in Rome.

Action 5: Soil moisture as an ECV. The SC supported the development of soil moisture as an ECV and encouraged all agents of implementation, such as CAgM, WCRP, and space agencies to work towards coordinated soil moisture observations from *in-situ* and space-based observing systems. The SC also requested the GCOS Secretariat to ensure representation of soil moisture in the WMO/CEOS observational requirements database.

4 Report of the GCOS Secretariat

Dr Alexander Karpov, the Acting Director, introduced the Report of the GCOS Secretariat. The first section of the Report provided an overview of how actions that were identified at the fifteenth session of the SC have been dealt with over the last year. He noted that most, but not all, actions had been completed by the Secretariat. He drew attention to Action 6 from SC-XV, the preparation and distribution of a joint letter from Sponsoring organizations urging the appointment of GCOS National Coordinators and establishment of cross-agency GCOS National Committees. This action, although not completed, is in process and will be discussed later in the session. With respect to Action 44, updating of the GCOS Plan, a draft has been prepared by the Chairman, and this draft will be refined following suggestions by the SC.

The report also contained an overview of the activities of the Secretariat since the last Steering Committee session. Various tasks were identified in which the Secretariat staff have been involved in the last year. The insecurity of funding for Secretariat staff was noted. Only the positions of Director and Administrative Assistant have relatively secure funding. All other staff members rely on extrabudgetary funding, and this is uncertain beginning in 2010. It was stressed that unless priority is given to fundraising activities in the near future, the Secretariat will have a critically low level of funds with which to operate in 2009 and may not be able to continue to employ staff that depend on

extrabudgetary resources by 2010. The SC acknowledged Germany for the support it has provided to Junior Professional Officers and interns and also the US for funding the GCOS Implementation Manager. The SC requested the Sponsors of GCOS (and other supporters of GCOS) to encourage national secondments to the GCOS Secretariat.

Information was also presented on how the principal tasks in which GCOS is engaged contribute to the expected results in the WMO Strategic Plan. The work of the GCOS Secretariat contributes in many ways to the WMO Expected Results (ERs), most notably to better climate predictions (ER2), improved provision of applications and services (ER7), broader use of outputs for decision making (ER8), and enhanced capabilities of developing National Meteorological and Hydrological Services (NMHSs) (ER9).

In the discussion that followed, the Chairman expressed his appreciation for the work of the Secretariat, but expressed his disappointment that it was not possible to complete all priority tasks that arose from SC-XV. He acknowledged the precarious funding situation of the GCOS Secretariat. He noted that the GCOS MOU requires the Chair of the Steering Committee to submit a comprehensive budget estimate for all GCOS planning activities and the activities of the Steering Committee and Secretariat to the Executive Heads of the Sponsors.

Action 6: Newsletter. The SC requested the Secretariat to update it (and the broader GCOS community) every few months on key activities and on important forthcoming events and issues via a simple brief email newsletter or similar mechanism.

Action 7: Secretariat funding. The SC requested the Chairman, as a matter of urgency, to brief the Sponsors on the precarious state of funding for the GCOS Secretariat and to urge that, for 2009-2010, they at least maintain the level of funding provided in recent years.

Action 8: GCOS budget. The SC requested the Chairman to work with the Secretariat to develop a comprehensive budget for the following years for submission to the Executive Heads of the Sponsors.

5 Sponsor Feedback and Guidance

5.1 World Meteorological Organization (WMO)

Dr Wenjian Zhang, Director of the WMO Observing and Information Systems Department, represented the WMO Secretary-General, Mr Michel Jarraud, at the session. Dr Zhang began his remarks by noting that the Fifteenth WMO Congress (May 2007) endorsed the overall strategy for further development of GCOS. He drew attention to Resolution 11 of Cg-XV, which urged Members "to enhance their support to the GCOS Secretariat, through secondment of experts and/or contributions to the Climate Observing System Fund or to specific planning and implementation mechanisms, so as to enable the Secretariat to support the full range of implementation agents in their efforts to establish an effectively-operating Global Climate Observing System." He pointed out, among other things, that the Resolution also requested the WMO Executive Council to keep the progress of the Global Climate Observing System under regular review and to provide support and guidance on its further development and implementation and that it requested the WMO Secretary-General to support the further planning, development and implementation of the Global Climate Observing System, including the actions in response to the needs of the Conference of the Parties to the UNFCCC and the recommendations of the 2004 Implementation Plan; to articulate, at all appropriate forums, the need for broad support by nations of the observational and resource requirements for implementing GCOS; and to provide all support possible for the work of the GCOS Steering Committee and its Panels and Secretariat.

Dr Zhang then went on to point out that:

- WMO recognizes that GCOS, as an integrated cross-domain system, contributes effectively to the achievement of WMO Expected Results 2 (enhanced capabilities of Members to provide better climate predictions and assessments), 4 (integration of WMO observing systems), 5 (development and implementation of the new WMO Information System), 6 (enhanced capabilities of Members in multi-hazard early warning and disaster prevention and preparedness),

7 (enhanced capabilities of Members to provide and use weather, climate, water, and environmental applications and services), 8 (broader use of weather-, climate- and water-related outputs for decision-making and implementation by Members and partner organizations), and 9 (enhanced capabilities of NMHSs in developing countries, particularly least developed countries, to fulfil their mandates) of the WMO Strategic Plan.

- Developing countries have special problems, not least with respect to securing the resources needed to implement regional GCOS Action Plans. The WMO Executive Council has encouraged the GCOS Secretariat and the GCOS Steering Committee to study the issue with a view to facilitating the necessary fundraising to help regions implement their plans.
- Much has changed since the original 1992 Memorandum of Understanding (MOU) establishing GCOS was last updated in 1998, including, for example, the greatly strengthened link GCOS has developed with the UNFCCC since that time, the emergence of GEOSS, and the establishment of WIGOS. Also noting that the outcome of WCC-3 may have some important implications for GCOS, Dr Zhang encouraged the Steering Committee to assess the need for updating the GCOS MOU and that it propose to the Sponsors elements that they should consider in renegotiating and revising the MOU. For similar reasons, WMO supports updating the 1995 GCOS Plan and encouraged the Steering Committee to propose a process for accelerated completion of the Plan.
- WMO is pleased that GCOS has a strong relationship with the UNFCCC and that this relationship has contributed to a substantial increase in the visibility of GCOS and, therefore, its parent bodies, thus enabling the GCOS Secretariat to more effectively represent the concerns, interests, and needs of the climate observing community.
- WMO understands the desirability of inviting the Food and Agriculture Organization (FAO), which is the main Sponsor of GTOS, to become a fifth Sponsor of GCOS. The terrestrial domain and the role of GTOS in meeting climate-related needs for observational data have assumed greatly increased importance, especially since the emergence of adaptation as a major thrust of the UNFCCC.
- WMO has taken action through its Space Programme to respond at several levels to the space-related aspects of the GCOS Implementation Plan and in particular to its Satellite Supplement (GCOS-107). Dr Zhang observed that WMO has agreed that the new vision for the space-based Global Observing System will address climate observation needs among its core objectives, in accordance with the GCOS Climate Monitoring Principles. WMO is pleased to mention that an active collaboration is developing with space agencies, the Coordination Group for Meteorological Satellites (CGMS), and the Committee on Earth Observation Satellites (CEOS) on these initiatives in support of GCOS.
- WMO recognizes that GCOS is still far from fully implemented and that a major effort is needed in most parts of the world to strengthen and maintain essential climate observing networks and systems. In this regard, WMO would like to commend the development of the Regional Action Plans produced through the now-completed GCOS Regional Workshop Programme and also the follow-up initiatives, such as the Climate for Development for Africa Programme, intended to facilitate the implementation of needed improvements in developing regions. WMO encourages the GCOS Steering Committee to continue such follow-up efforts as resources allow.
- Finally, WMO understands the need to pay increasing attention to the requirements for climate information for adaptation and would like to see the GCOS Steering Committee take steps to address observational needs for adaptation in future priority setting and planning.

5.2 Intergovernmental Oceanographic Commission (IOC)

Dr Albert Fischer spoke on behalf of Dr Patricio Bernal, the Executive Secretary of the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

Overall, the IOC has been very pleased with the efforts of the GCOS Secretariat and its panel chairs in coordinating and reporting on the efforts across all domains for the observing system for climate. GCOS provides visibility and advocacy for the climate-related components of the Global Ocean

Observing System (GOOS) with the UNFCCC. There are close links between GCOS and GOOS – the ocean module of GCOS is the open-ocean/climate module of GOOS, and they share, along with the WCRP, sponsorship of the Ocean Observations Panel for Climate (OOPC). IOC's major support of GCOS is through its financial support of the activities of the OOPC and provision of its technical secretariat.

The UN system has coordinated a response across all of its agencies, which have organized around Mitigation, Adaptation, Technology, and Finance. Dr Fischer noted that observations do not clearly fall within these key headings.

After the 2007 IPCC Fourth Assessment Report, there was a reduction in emphasis at higher political levels on climate science and monitoring and a growing emphasis on finding political solutions for mitigation of, and adaptation to, climate change. UNESCO and the WMO fought hard to maintain a clear role in the UN system for climate science, assessment, monitoring and early warning, and have been given joint lead of coordination across UN agencies of an initiative in "Enhanced Climate Knowledge for Better Decisions for Safety and Human Welfare." A meeting of UN agencies in late October, to be hosted by the WMO, will better define agency contributions to this knowledge base and define a work plan.

GCOS is recognized as the major component for observations and monitoring of the climate system; the WCRP and IPCC as leading efforts in scientific research and assessment; and a number of WMO programmes, including the World Weather Watch and World Climate Programme for climate predictions, warnings, and services.

The IOC has participated in the preparations for the World Climate Conference-3, to be held in 2009. The Conference will provide a way for the WMO and its partners, including IOC/UNESCO, to focus on climate knowledge delivery. The IOC encourages GCOS to keep reminding everyone that monitoring of the climate system underlies the development of knowledge and predictive ability for the climate system – both in change and in variability – and therefore underlies clear predictions, warnings, and services in climate.

IOC is pleased with the role of GCOS in connection with UNFCCC and plans stronger engagement in this context. Regarding the Progress Report on the GCOS Implementation Plan, to be delivered in 2009 to the UNFCCC, Dr Fischer noted that OOPC is the focal point for collecting information from GOOS and the IOC.

The IOC is a Sponsor of the OceanObs'09 Conference (referred to in the OOPC report), which will help pull together material for the update of the GCOS Implementation Plan, and also develop a vision for the provision of ocean-related services in climate and other areas for the coming decade.

5.3 United Nations Environment Programme (UNEP)

Dr Norberto Fernandez noted the importance of GCOS and the work of the GCOS SC and Secretariat to UNEP activities in observing, monitoring, risk issues, and particularly adaptation. Among the six new UNEP priorities are climate change adaptation and mitigation. Addressing these will raise the importance of GCOS even more, a development that complements the other GCOS Sponsors.

He mentioned several current major activities of UNEP, including the Climate Adaptation Network and the Assessments of Impacts and Adaptation to Climate Change project (AIACC), where GCOS data are supposed to play an important role and should be used to further develop adaptation strategies.

Emphasizing the African region now and in future, UNEP will ensure links to ClimDev Africa in its own programme, and UNEP would like to see more integration of climate and other environmental data in Africa. In this regard, coordination initiatives with other Sponsors were mentioned. In discussion, Dr Alan Belward noted that the importance of ClimDev Africa in supporting climate observations was underlined in a recent European Union (EU)/African Union (AU) agreement.

For UNEP, it is crucial that GCOS, GTOS, GOOS coordinate their efforts. GOOS was mentioned as having a crucial role in adaptation in coastal regions. UNEP supports the GCOS Chairman's efforts to update GCOS IP in 2009.

Dr Fernandez highlighted the importance to UNEP of ECVs as well as of their implementation in the terrestrial domain. In this regard, he again stressed the importance of coordination between GCOS and GOOS. Particular challenges will be the extent to which the choice of ECVs meets the demand for information by users and the extent to which the information supplied will actually be useful.

Dr Fernandez underlined UNEP's intention to include GCOS as the GEO climate 'societal benefit area' and to coordinate knowledge, data, and services within the GEO initiative.

Regarding GCOS funding, Dr Fernandez noted that the 2008-2009 UNEP contribution to GCOS will be sent to the Secretariat after a new agreement is approved.

5.4 International Council for Science (ICSU)

Dr Gisbert Glaser, on behalf of the ICSU Executive Director Dr Thomas Rosswall, presented the views of ICSU related to GCOS. He underlined the continuing commitment of ICSU to GCOS as a fundamental component to most science-related activities supported by ICSU.

As priority areas to be addressed by GCOS, Dr Glaser mentioned the updated 1995 GCOS Plan which he would like to see become a comprehensive GCOS Strategic Plan. This plan should set priorities for the coming 5-10 years, and address new challenges to the observing system related to adaptation and mitigation of climate change. It should also address the close links between research, observations, assessments, and policy. Moreover, the latter issue was addressed in the GCOS-WCRP-IGBP Sydney workshop on lessons learned from IPCC-AR4. The implications of the findings of this workshop for the future development of GCOS should be analysed in depth by the SC and used to update the GCOS Plan.

Dr Glaser informed the session of the recently completed, ICSU-led reviews of IGBP, WCRP, IHDP, and ESSP. Since all reviews cover climate and climate-related research and observations, ICSU invited the SC to take note of these reviews and of the recommendations made therein, with a view to strengthening cooperation between GCOS and these programmes. For example, GCOS could possibly learn how to better address nature-society linkages.

Further, Dr Glaser highlighted two new initiatives supported by ICSU, the programmes on Integrated Research on Disaster Risk, and on Ecosystem Change and Human Well-being. In both programmes, both providers and users of basic environmental data will be active, and GCOS should ensure recognition and appropriate collaboration with these programmes.

Dr Glaser agreed to assist the SC Chairman in writing a possible letter calling for support to GCOS activities. He noted that ICSU would welcome the opportunity to discuss how to improve the funding of GCOS. He finally informed the session that Dr Deliang Cheng, a Swedish national, was appointed as the new Executive Director of ICSU. He will succeed Dr Thomas Rosswall in early 2009.

6 GCOS Annual Report

The Chairman introduced the draft Annual Report for 2007-2008, noting that, although it had not been produced in the past, the GCOS Memorandum of Understanding requires the Chair of the Steering Committee "to prepare annually, with the GCOS Secretariat, a report of GCOS planning and implementation activities, including the considerations and recommendations by the Steering Committee, and to present this report to the sponsoring organizations." The Chairman outlined the content of the draft report for 2007-2008 and sought the views of the SC as to whether such a report should be prepared on a regular basis and whether SC members and others would be willing to contribute missing material for the 2007-2008 report.

Although there was a range of views, the general feeling of the SC members was that although there was substantial useful information in the report and its annexes, few people would likely read such a lengthy document. Therefore, it was concluded that it was not worth a major expenditure of time to produce such a report. Some SC members suggested that a much shorter document would be more useful. The annual letter that the Chairman sends to the Sponsors, for example, may be sufficient for most purposes. The ICSU representative noted that although the GCOS MOU does indicate that an

annual report should be produced, there is no need to be overly bureaucratic about this, in particular because no one is demanding it.

Another view was that such a document could be quite useful for outreach purposes. This year's report should therefore be completed, as it is a very useful document. It should be given a GCOS publication number and posted on the web and might be distributed, for example, at the upcoming UNFCCC meeting. There was general agreement, however, that any decision on future annual reports should await further assessment of their value.

Action 9. Annual Report. The SC requested that the Chairman and the Secretariat complete the 2007-08 Annual Report, give it a GCOS number, transmit it to the Sponsors, and consider where else it might be distributed.

7 Role of the Main Observing Systems Contributing to GCOS

7.1 WMO Observing Systems Contributing to GCOS

7.1.1 WMO Integrated Global Observing Systems (WIGOS)

Dr Alexander Karpov, in his capacity as head of the WIGOS Planning Office at the WMO Secretariat, gave an overview of the current status of implementing the WIGOS. He recalled the WMO EC resolution on WIGOS, through which WMO adopted the WIGOS development and implementation plan and the WIGOS concept of operations (CONOPS). GCOS is represented on the EC Working Group on WIGOS/WIS, which had developed these documents.

WIGOS foresees enhanced integration and coordination of WMO and WMO-Sponsored observing systems, with the ultimate goal of providing products and information. With WIGOS, WMO created an organizational, programmatic, procedural and governance structure that will significantly improve the availability of observational data and products. Three levels of integration have been defined:

- Instruments, instrument standards, and instrument interoperability and inter-comparison (CIMO);
- Data policy and data exchange (established WMO resolutions 40 and 25); WIS should be helpful in exchanging data; and
- Data quality management frameworks (data exchange and quality control).

Dr Karpov recalled five WIGOS pilot projects (PPs) intended to advance integration of WMO observing systems in specific areas led by WMO Technical Commissions, with PP IV (CIMO) and PP V (integration of marine observations into the WMO GOS) being most advanced. Dr Adrian Simmons informed the SC that the AOPC WG on Atmospheric Reference Observations had plans to consider GRUAN or elements thereof as a WIGOS PP at its next meeting on 2-4 March 2009. In addition to the WIGOS PPs, the meeting was informed of the status of WIGOS demonstration projects (DPs) to showcase specific benefits of enhanced integration of systems on the level of National Meteorological Services, possibly within a region, and with links to other institutions. The Steering Committee was briefed on the CBS WIGOS technical conference (TECO-WIGOS, 23-24 March 2009, Dubrovnik, Croatia), which will be the next step in the implementation of WIGOS, and which will include an agenda item on GTOS, GOOS, GCOS, and other WMO co-sponsored systems.

The SC appreciated the comprehensive overview of WIGOS activities and welcomed the full recognition of climate objectives within WIGOS by virtue of the inclusion of all WMO-related GCOS components, including appropriate consideration of institutional issues. Given the high commonality of purpose, structure, concept, and component observing systems of WIGOS and GCOS, a close GCOS-WIGOS relationship was seen as essential by the SC. The SC also agreed a) that representatives of WMO (as well as of IOC, UNEP and ICSU) and of the individual WMO-sponsored component observing systems of GCOS should continue to serve as ex-officio attendees at the annual sessions of the GCOS Steering Committee; and (b) that the GCOS Steering Committee Chairman should continue to serve ex-officio on the WMO EC Working Group on WIGOS and WIS.

7.1.2 The Surface-Based Component of the Global Observing System (GOS)

Dr Miroslav Ondráš (WMO OBS, Chief OSD) reported on progress in the operation of the climate components of the WMO Global Observing System and on the RBCN and GSN/GUAN in particular. Significant progress has been made over the past years, through:

- Increased focus on data quality, e.g., through instrument intercomparison campaigns and arrangement for the traceability of instrument performance;
- Improvements in upper-air measurements in Russia, China, some areas of the Tropics and the Southern Hemisphere; and
- Excellent collaboration between the WMO OBS Department and GCOS Secretariat in all areas, in particular on system improvement, capacity building and training of station operators, and GSN/GUAN rehabilitation activities.

Dr Ondráš noted that the GCOS Implementation Plan and Second Adequacy Report have been accepted by CBS as the Statement of Guidance (SoG) for the "Climate Monitoring" application area (including Climate Variability and Climate Change). The CCI Expert Team on Observing Requirements and Standards for Climate is developing the requirements for the "Climate Applications" area, and the Rolling Review of Requirements (RRR) process for this application will be studied together with the CCI-OPAG on Climate Applications and Services. The requirements together with a draft SoG will be presented to the CBS Expert Team on the Evolution of the GOS (ET-EGOS) in 2009.

The SC thanked the WMO OBS department for its efforts in improving climate-observing networks under its responsibility and for the good collaboration with the CCI and GCOS Secretariats.

Action 10: GOS support for climate. The SC requested the GCOS Secretariat to ensure coordination with the CCI Secretariat to provide consistent and coordinated input to the WMO RRR process related to climate requirements of the surface-based component of the GOS.

7.1.3 Global Atmosphere Watch (GAW)

Dr Slobodan Nickovic (WMO-GAW) presented a brief overview of the observational activities of the Global Atmosphere Watch (GAW) related to the three ECVs for atmospheric chemistry (ozone, aerosols, GHGs). He described the design of the GAW Aerosol Lidar Observation Network (GALION) for sand and dust storm prediction systems. He also showed some of the latest analyses from the WMO-GAW Global Carbon Dioxide Monitoring Network and Global Methane Monitoring Networks and discussed coordination activities of GAW with the terrestrial carbon observation community.

Dr Nickovic stressed the strong commitment of GAW to explicitly addressing the needs of the climate community, and that this was considered very important for the overall development of GAW. Dr Adrian Simmons enquired on the coordination between networks under the GAW umbrella and other networks outside GAW.

The SC recognized the vital contribution to GCOS by GAW networks for ozone, greenhouse gases, and aerosol observations, but considered that more information is needed on non-GAW atmospheric chemistry networks contributing to GCOS.

Action 11. Atmospheric chemistry. The SC requested the AOPC to explore the status of coordination arrangements in the area of atmospheric chemistry, involving GAW, non-GAW networks, the space community, and other relevant communities contributing to the atmospheric chemistry components of GCOS.

7.1.4 Hydrological Observing Systems

Dr Avinash Tyagi briefed the SC on coordination activities by WMO and other UN organizations related to worldwide hydrological observing networks and datasets. He recalled the structure of the Global Terrestrial Network–Hydrology (GTN-H), the WHYCOS networks, and data exchange issues in the water sector related to particular interests of water data and the distribution of institutional responsibilities in countries. Dr Tyagi also informed the SC about the perceptions of National

Hydrological Services related to the availability of hydrological data. He noted that the hydrological datasets to underpin climate models were largely unavailable at present and acknowledged that the hydrological community needs better awareness and understanding of these needs to facilitate effective data exchange. The SC considered that the issue of the continuing decline of hydrological networks should be raised to the level of UN Water and other high-level bodies as appropriate. The SC reaffirmed its encouragement to the WMO CHy to do all it can through its channels to draw attention to the importance of hydrological observations for climate purposes.

Action 12. Strengthening hydrological observations. The SC requested the Chairman to urge the GCOS Sponsors to elevate the issue of the continuing decline of hydrological networks to the level of UN Water. It asked the Secretariat to work with the WMO Climate and Water Department to help better explain the need for, and relevance of, hydrological observations for the full range of climate purposes. It also requested the Chairman to continue to liaise with the President of the WMO Commission for Hydrology in respect of the Commission's overall contribution to the implementation of the hydrological components of GCOS.

7.2 Global Ocean Observing System (GOOS)

Dr Albert Fischer spoke on behalf of Dr Keith Alverson, Director of the GOOS Project Office. First, Dr Fischer reminded members of the close integration between GOOS and GCOS: the climate component of GOOS and the ocean component of GCOS are identical. In addition, GOOS also has a coastal component, which is more loosely organized around regional alliances of varying capability and capacity. Depending on the attention to observational needs for regional climate forecasting, impacts of climate variability and change, some observations in coastal GOOS may become more relevant and should be considered. However, the multiplicity and varying priorities of the institutions making these coastal and regional observations is even more heterogeneous than for the global component of GOOS. It is difficult to treat them in a global way, as they are regionally organized, and they are not in agreement with WMO regions or terrestrial regions.

Dr Fischer pointed out that JCOMM (the WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology) is the main technical coordination body for implementation of the ocean observing system for climate, although this observing system has multiple roles and uses.

GOOS is cooperating with WIGOS through a JCOMM-led pilot project. This opens a perspective for even closer cooperation among the different observing networks of GOOS and WIGOS in their contribution to GCOS. The SC agreed that more regular consultation among GCOS, GOOS, GTOS, and WIGOS Chairs and Secretariats would be desirable in order to further improve cooperation. These observing systems have many of the same sponsors and share many goals, and so more regular consultation could be quite useful.

The Director of GOOS has a real interest in advocacy of the ocean observing system at high levels. He appreciates the role GCOS has played in linking GOOS to the SBSTA/UNFCCC. Notably, he would like to accompany the GCOS representatives to SBSTA in June 2009 at Bonn when the report on progress on the GCOS IP is presented and to Copenhagen at end of 2009 for COP 15. GOOS supports efforts in such fora to emphasize the importance of observations.

7.3 Global Terrestrial Observing System (GTOS)

The GTOS Programme Director, Dr John Latham, presented an overview of GTOS, its mission, and the GCOS-GTOS shared TOPC-panel.

Dr Latham noted that the SBSTA has called on the GTOS Secretariat to assess the status of the development of standards for each of the thirteen ECVs³ in the terrestrial domain. Difficulties have arisen because of the broad spectrum of relevant considerations, for example, the number of environmental variables involved, the geographic coverage and diversity of these variables, the need for in-situ as well as satellite measurements, and requirements for standardization. Overall, only a few standards for terrestrial ECVs have been developed. The apparent absence of standards can be

³ The terrestrial ECVs: snow cover, glaciers and ice caps, permafrost, river discharge, water use, groundwater, lake levels, albedo, land cover, FAPAR, LAI, biomass, and fire.

understood by considering the nature of terrestrial ECVs. Thus, *in situ* measurement approaches have been initially developed by individual agencies or research groups within countries, with no need for international coordination or standardization, and, for satellite measurements, complexity arises from differences among satellite sensors, their variable suitability to provide exactly the measurements needed, the limited spatial coverage, and the finite duration of individual missions. Dr Latham noted that reports on the status of each of the thirteen terrestrial ECVs are being prepared with support by GTOS Panels led by the Terrestrial Observation Panel for Climate (TOPC) and coordinated by the GTOS Secretariat. The reports will be available at SBSTA 29 in Poznan, Poland. He also noted that web pages have been created for each terrestrial ECV which contain background, a report, references, and all other materials gathered and which allow greater stakeholder participation and review of documentation.

Also to note is that GTOS has made a submission to the "Data and Observations" call of the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change. It has recommended that: political and financial support should be provided to allow the strengthening of existing *in situ* observational networks and the creation of new networks where required; development of a terrestrial framework should be supported by providing guidance; and the Parties to the UNFCCC should provide increased support for coordinated cross-comparison of products which are approaching an operationally-useful status, e.g. land cover, leaf area index, and albedo.

On the issue of developing a framework for the preparation of guidance materials, standards and reporting guidelines for terrestrial observing systems for climate, as advocated by the Conference of the Parties in 2003, Dr Latham indicated that much progress has been made and that three possible models had been considered. Some specific recommendations for the framework are that: standards should be developed on a scientifically sound basis; the framework should provide for the involvement of governments in the development of standards and guidance materials and in their implementation; access to those standards and guidance materials should be free and unrestricted; the process for developing standards, guidance materials and operation of framework should be cost-effective and sustainable and take into account existing standards and guidance materials; and the framework should be flexible in view of future needs. A Progress report has been prepared for SBSTA 29, to be held in Poznan, Poland. Considering the current investigations and the response so far received, the ISO/UN type mechanism would seem to be the most appropriate. However, a final decision will likely be based on the guidance received at SBSTA 30.

Dr Latham made some specific recommendations to the GCOS SC. He noted that:

- GTOS/GCOS collaboration is operational and effective in relation to the UNFCCC requirements on the Framework and ECV's; however, this needs to be broadened for ECV's in relation to adaptation and mitigation and capacity building;
- Cooperation should be strengthened on TOPC and also directly between the GCOS and GTOS Secretariats;
- GCOS and GTOS should develop joint awareness raising and funding strategies/proposals to support terrestrial networks within developing countries; and
- Pilot/demonstration projects could be established under the auspices of GCOS/GTOS.

The SC recognized the ongoing efforts of GTOS to help establish a framework for the standardization of terrestrial ECVs in collaboration with FAO, WMO, and ISO. It further commended the GTOS Secretariat for the preparation of status reports describing existing standards and guidelines for terrestrial ECVs. The SC reaffirmed its support for GTOS in these efforts, in particular, in its support for the UNFCCC. The SC confirmed its support for TOPC as the primary mechanism for GTOS/GCOS collaboration.

Action 13. Joint side events at SBSTA. The SC encouraged joint/combined side events at SBSTA 30 when the 2009 Progress Report and Update of GCOS-92 are introduced, as this would be one means of showing how GOOS, GTOS, and WIGOS are serving the needs of the UNFCCC within the framework of GCOS.

8 GCOS Implementation Mechanisms

8.1 The Role of Space Agencies

Prof Paul Mason gave an overview of the current status of space agency responses to the GCOS requirements from space. He stressed that most satellite missions were not designed for climate purposes and welcomed the increasingly effective coordination between space agencies through the CEOS, CGMS, and WMO Space mechanisms. Initiatives such as the Global Space-based Inter-Calibration System (GSICS) provided essential groundwork for enhanced calibration of satellite instruments and more consistent, homogeneous space-based datasets. Inclusion of climate objectives in the new vision of the space-based component of the WMO Global Observing System for 2025 is considered essential in this context. Prof Mason encouraged agencies to pursue the actions laid down in the CEOS response to the GCOS Implementation Plan and supported some level of prioritization in addressing these actions. The Virtual Constellations were noted as another user-driven mechanism to better exploit and coordinate existing capabilities in space. For example, the first direct result of the work done by the CEOS Virtual Constellation on Land Surface Imaging was first-time cloud-free imagery delivery from Landsat in support of reductions of greenhouse gas emissions from deforestation and forest degradation (REDD).

Dr Mitch Goldberg (NOAA, CEOS Climate Coordinator) presented a status report (via teleconference) on CEOS activities in support of climate needs. He briefed the SC on activities of the CEOS Working Groups (Cal/Val, Information Systems, Education), on the now six CEOS Virtual Constellations (precipitation, land surface imaging, atmospheric composition, ocean surface topography, ocean colour, ocean surface vector winds), and on progress against CEOS climate actions, both in the GEO work plan and in the CEOS response to GCOS-92.

Of the latter, a sub-set of 22 priority 1 actions has been the focus of activity in 2007 and 2008, encompassing all three GCOS domains and spanning a range of themes (continuity of missions, generation of fundamental climate data records, preserving climate records, access to products, better coordination, future needs). Progress was generally considered good, for example in the re-manifestation of climate sensors on NPP/NPOESS, coordinated reprocessing of ocean datasets, and plans for filling the current Landsat-class mission gap. In the next phase, a focus on initially 10 and ultimately 20 (out of 32) priority 2 actions was envisaged. The recently-completed CEOS progress report to the UNFCCC SBSTA-29 in December 2008, to be introduced to the SBSTA plenary by Thailand, was based on this information. In addition, the GEO work plan climate actions were more short-term, with the majority due to be completed by October 2008. The SC stressed the importance of the continuing role of GCOS, in consultation with WCRP where appropriate, in helping space agencies meet their climate objectives.

At the recent 22nd session of the CEOS Strategic Implementation Team, Dr Goldberg agreed to regularly compile one single CEOS progress report on all climate-relevant activities to inform both the GCOS and the GEOSS processes.

An international workshop organized under the auspices of the Atmospheric Chemistry Constellation (15-17 October 2008, hosted by NASA GISS) specifically looked at the adequacy of long-term datasets in this area for climate applications. Another international workshop to be hosted by NOAA NESDIS (17-19 November 2008) was intended to discuss the climate-worthiness of the Advanced Very High Resolution Radiometer (AVHRR) and High resolution Infrared Radiation Sounder (HIRS) data records.

The SC noted that community-based workshops and activities, such as the R/SSC-CM, required appropriate coordination and consultation with the climate research community to ensure that climate requirements are really met. It observed that all expert groups and mechanisms identified in GCOS-107, as relevant for the generation of FCDRs and ECV products, be appropriately involved in all follow-up activities, such as the R/SSC-CM and community-based workshops.

The SC warmly welcomed the progress made by space agencies in addressing the climate-observing requirements in GCOS-92 and GCOS-107. It reemphasized the importance of extending current short term mission plans so as to ensure the long-term continuity of key observational records.

Action 14. Climate observations from space. The SC requested the Chairman, Panel Chairs, and Secretariat to take all appropriate steps to encourage and assist the space-based Earth observation community to ensure the long-term continuity of all essential climate observations from space.

8.2 Regional Implementation Activities

Dr William Westermeyer of the GCOS Secretariat provided a status report on developments in the GCOS Regional Activities Programme since the last Steering Committee session. His report focused on the Climate for Development in Africa Programme (ClimDev Africa), the GCOS implementation strategy meeting held in Belize for the countries of Central America and the Caribbean, the project "Climate Observations and Regional Modeling in Support of Climate Risk Management and Sustainable Development," which has obtained the provisional support of the World Bank, and some potential future follow-up activities associated with the Regional Action Plans.

Regarding the ClimDev Africa Programme, it is clear that the Programme has been slow to get underway. The GCOS Secretariat was influential in facilitating the launch of the Programme, but now is involved mainly in an advisory capacity, as African institutions, including the African Union Commission, the UN Economic Commission for Africa, and the African Development Bank have, as intended, taken over the leadership of the Programme. Despite the slow start-up phase, there are some promising signs that the Programme is picking up steam. A consortium of likely donors, led by the UK's Department for International Development (DFID), recently completed an appraisal of the Programme document. DFID has indicated that the appraisal went well and that there is now an improved version of the document (the GCOS Secretariat has not yet seen this document). DFID indicated that there are still some governance issues to address, but that these would be dealt with at a meeting at the end of October 2008 with officials of the African Development Bank (AFDB). DFID also indicates that a more formalized arrangement with the AFDB is developing, a particularly good sign. In addition to this recent development, it can also be stated that WMO has now expressed a strong desire to be involved in the Programme. In particular, WMO has recognized the potential importance of ClimDev Africa to its Members in Africa and has indicated its intention to assist in the further development and implementation of the Programme, principally through its Climate and Water Department. Dr Alan Belward noted that, from his perspective, the involvement of GCOS in ClimDev Africa is seen by the EU and others as a big plus, giving the Programme more credibility. The SC encouraged all Sponsors to contribute actively to the ClimDev Africa Programme.

The implementation strategy meeting held in Belize with the collaboration of the Caribbean Community Climate Change Center brought together leaders of key regional climate and climate-related institutions and representatives of donor organizations to consider how projects first identified in the Action Plan for the region might be funded. The meeting was successful in linking potential donor agencies with regional institutions and even resulted in some new funds for the region and in expressions of interest in certain projects. This small-scale meeting, rather than the large-scale ClimDev effort, could become a model that could be successfully employed in other regions.

Concerning the project "Climate Observations and Regional Modeling in Support of Climate Risk Management and Sustainable Development," Dr Westermeyer noted the difficulties that the GCOS Secretariat and its partners have had in reaching final agreement with the World Bank on terms that would allow the project to proceed. He noted that further negotiation with the Bank will be required and that other alternatives might include seeking a consortium of donors rather than just the World Bank alone, or to attempt to fund the project entirely through another donor. While highly supportive of this initiative, SC members generally agreed that the primary role of the GCOS Secretariat is to guide and coordinate activities on behalf of the SC rather than to run projects.

Finally, it was noted that other potential targets of opportunity exist or could be developed for pursuing follow up activities associated with the Regional Workshop Programme.

Action 15. ClimDev Africa. The SC requested the Secretariat to continue its efforts to help the ClimDev Africa Programme get established, and, once established, to pursue opportunities that may develop through it to facilitate improvements in climate observing networks and systems in Africa.

Action 16. GCOS regional activities. The SC encouraged the Secretariat to organize activities in other regions similar to the Belize implementation strategy meeting as a means to promote implementation of Action Plan projects. The SC urged the Sponsors to assist in raising financial support for holding such workshops.

Action 17. Observations and regional modeling project. The SC encouraged the Secretariat to consider alternatives for funding the observations and regional modeling project if satisfactory arrangements for World Bank support could not be achieved.

8.3 National GCOS Programmes

The SC expressed its appreciation for the initiative of those nations that have established GCOS National Coordinators and formal national GCOS Programmes. Although time constraints did not allow oral presentations on all national programmes at the SC session, written status reports on the national GCOS programmes of Switzerland, Australia, France, Germany, Japan, and the Russian Federation were reviewed with appreciation. Given the recent achievements of the Swiss National GCOS Programme, a presentation was, however, made by the Swiss National Coordinator, Dr Gabriela Seiz, as an example of an outstanding national programme.

The Swiss GCOS Office, located at the Federal Office of Meteorology and Climatology MeteoSwiss, was established in February 2006. The main task of this office is the coordination of all climate relevant measurements in Switzerland. Furthermore, the Swiss GCOS Office is the contact point for collaboration with the GCOS Secretariat, as well as with other national GCOS National Coordinators worldwide.

The Swiss national activities include:

- The first comprehensive inventory of climate measurement series and international data centres in Switzerland, released in three languages in November 2007;
- A “National GCOS Round Table” every 8 to 10 months, designed to enhance the dialogue between the various federal offices, research institutes, and universities with climate measurements;
- Release of a new version of the Swiss GCOS website. See www.gcos.ch.
- Submission of historical daily values of precipitation, minimum and maximum temperature of Säntis and Grand St. Bernard (Jan 1864 - Dec 2006) to the National Climatic Data Center (NCDC).
- Evaluation of the representativeness of temperature and precipitation measurements. Sufficient representativeness was found for the temperature measurements, but an additional 46 precipitation stations will be needed to support the 28 NBCN stations to adequately describe the climatology of precipitation in Switzerland.

A milestone for Swiss GCOS activities has been the recent decision of the Swiss Federal Council on a long-term financial contribution to GCOS Switzerland (1.6 Mio CHF/yr), starting from 2010. This financial contribution will cover the operation costs of several long-term climatological data series, including carbon dioxide, freeze dates of lakes, snow water equivalent, glaciers, permafrost, and phenomenology, and of two international data centers in Switzerland (the World Glacier Monitoring Service (WGMS) and the paleo-historic database Euro-Climhist), whose futures were identified as uncertain in the Swiss GCOS inventory report.

The SC highly appreciated the comprehensive and well structured Swiss National GCOS Programme and commended it as a model for other countries. In addition, the SC recognized the tremendous amount of work done by other national GCOS programmes that have worked to produce national activity reports on implementing the GCOS-92 Implementation Plan following the invitation from SBSTA 23 in 2005 and SBSTA 27 in 2007 in Bali. These would serve as input for the 2009 comprehensive GCOS report on progress with the GCOS-92 Implementation Plan. They can be found on the UNFCCC site at http://unfccc.int/methods_and_science/research_and_systematic_observation/items/4499.php/.

8.4 System Improvement Activities

Mr Richard Thigpen, the GCOS Implementation Project Manager, provided a status report on direct GUAN and GSN station renovations. The report included a review of completed projects as well as an overview of current projects. His report also covered the activities of the Regional Technical Support Projects that operate in the Pacific and in the Americas, described plans to establish another such project in the southern part of Africa, and reviewed the CLIMAT/CLIREP and GUAN training workshops. He noted that greater emphasis is now needed on the quality of the observations, not just the quantity.

Mr Thigpen also reported on the establishment and operation of the nine CBS Lead Centers for GCOS and reported on the coordination meeting held in Iran in November 2007. He noted that budget support for these periodic meetings should be established within the GCOS Secretariat and that further guidance and leadership on this process should come from the Secretariat. He noted that enlarging the scope of responsibilities of this group from the GUAN and GSN to include the entire RBCN was under consideration. It was also noted that the above activities were conducted in collaboration with the WMO Observing Systems Division.

Finally, Mr Thigpen described the GCOS Cooperation Mechanism (GCM) and its role in supporting system improvements in developing countries. He noted that 6 countries currently routinely provide funds towards renovation projects.

The Committee noted the progress made by the Implementation Project Manager and warmly thanked the US for supporting his activities. The Committee further noted the great progress made by the CBS Lead Centers and thanked the host countries for their efforts in support of the centers. Further, the Committee noted the need for budget support from the Secretariat for the Lead Center Coordination Meetings.

The SC recognized the importance of the GCM process in supporting the goals of GCOS and, in particular, expressed appreciation for the organization of the 4th GCM session held in Bonn in June 2008. The SC was especially grateful to Mr Howard Diamond, the U.S. GCOS National Coordinator, for his continuing chairing of the GCM Donor Board.

Action 18. CBS Lead Centers. The SC requested the Secretariat to coordinate with the WMO Observing and Information Systems (OBS) Department and the Development and Regional Activities Department (DRA) to ensure the continuity of support to the CBS Lead Centers, including establishment of the necessary leadership, guidance, and budget support for the biennial coordination meetings.

Action 19. GCOS Cooperation Mechanism. The SC urged the GCOS Sponsors to encourage their Members to participate in the GCM. It requested the Secretariat to organize the 5th GCM session in 2009 in concert with the SBSTA-30 session in Bonn in June 2009. It also requested the Secretariat to work with the ad hoc GCM Donor Board Chair to coordinate the development of an invitation letter and agenda.

8.5 The Legacy of the International Polar Year and the Global Cryosphere Watch

Dr Vladimir Ryabinin spoke about the legacy of the International Polar Year (IPY) on behalf of Dr Edward Sarukhanian and reviewed the concept and state of the development of the WMO Global Cryosphere Watch (GCW) on behalf of Dr Barry Goodison. In discussing the IPY, he noted that the Sub-Committee on IPY Observations has developed a draft roadmap towards an IPY observing systems legacy. The main observing initiatives contributing to the creation of such a legacy include:

- Sustaining Arctic Observing Networks (SAON), with an Integrated Arctic Ocean Observing System (iAOOS), Arctic-HYCOS, and *Integrated* AON;
- A Pan-Antarctic Observing System (PANTOS), with a Southern Ocean Observing System;
- The WMO GCW;

- A Polar Satellite Constellation; and
- The Polar Regional Climate Outlook Forum (PCOF).

Dr Ryabinin discussed a unique opportunity for WMO, in consultation with ICSU and other international organizations, to launch an International Polar Decade as a long-term process of research and observations in polar regions to meet requirements of climate change studies and prediction to benefit societal needs. He noted that one of the main problems in the implementation of the IPY is the absence of a support system for quick, easy and reliable identification of, and access to, IPY data, as well as of a formal pathway for IPY scientists to archive their data and metadata for future studies.

Dr Ryabinin also discussed the establishment of a Global Cryosphere Watch (GCW) as an important component of the IPY legacy. The WMO Congress requested the WMO Inter-commission Task Group on IPY to establish an ad-hoc expert group to explore the possibility of creating such a global system and to prepare recommendations for its development. The SC congratulated Drs. Ryabinin and Goodison on their work in developing the WMO GCW and encouraged its development as a mechanism for integrating and coordinating cryospheric observations within GCOS. The SC noted that implementation of the GCW would make an important contribution to GCOS.

The mission of the GCW would be to: 1) implement the IGOS Cryosphere Theme (CryOS); 2) support reliable, comprehensive observations of the elements of the cryosphere through an integrated observing approach on global and regional scales and in collaboration with relevant national and international programmes and agencies; 3) provide the scientific community with the means to predict the future state of the cryosphere; 4) facilitate assessment of changes in the cryosphere and their impacts, and to use this information to aid the detection of climate change and to support decision making and environmental policy development; and 5) provide authoritative information on the current state and projected fate of the cryosphere for use by the media, the public, and decision and policy makers.

In summarizing his presentation, Dr Ryabinin invited the GCOS SC to:

- Note the major pan-Arctic, pan-Antarctic observing initiatives aimed at securing the legacy of the IPY and endorse them as a contribution to GCOS;
- Support the idea of exploring an International Polar Decade as a means of facilitating more sustainable observations in Polar Regions;
- Express support to consideration of the development of an IPY data portal as a WIS pilot project;
- Note the establishment of the WMO EC Panel of Experts on Polar Observations, Research and Services, and identify areas where cooperation and coordination between GCOS and the Panel are required;
- Endorse the GCW as the mechanism for integrating cryospheric observations drawing on the work of GTOS, GCOS and GOOS; and
- Identify an expert to join the ad-hoc expert team developing the scoping study for the GCW.

The SC generally supported these proposals. However, it expressed its concern related to provisions for effective data management and sharing in the context of the IPY and recommended that appropriate data management plans for future IPY-type projects be developed well in advance. The SC urged that the new WMO EC Panel of Experts on Polar Observations, Research, and Services, which is taking over from the former EC Working Group on Antarctic Meteorology, not dilute the earlier Working Group focus on Antarctic observations. Dr Ryabinin responded that it was a valid concern but that the new Polar Panel was expected to retain all services which are now associated with the WMO EC Working Group on Antarctic Meteorology. He also noted that the Antarctic Working Group will be retained as a subgroup in the broader Polar Panel.

The SC stressed the importance of the continuation of observations in polar regions after the formal end of the IPY. It endorsed the IPY legacy projects related to observations and wished to encourage nations to continue relevant activities. It also supported the Polar Decade concept, noting that it could help ensure the continuity of observations in polar regions.

9 User Perspectives on the Extent to Which GCOS is Meeting User Needs

9.1 World Climate Research Programme (WCRP)

In his brief to the Committee, Dr Ghassem Asrar, Director of the World Climate Research Programme (WCRP), stressed the importance of continuing the close partnership between WCRP and GCOS. WCRP was particularly relying on GCOS in the advocacy for, and provision of, long-term sustained observations for climate research. He informed the SC about the current discussion of a new long-term strategy for WCRP, extending to 2015. The independent review of WCRP undertaken by its Sponsors WMO, IOC, and ICSU (which will be available early next year) was contributing to this discussion. The review highlighted the need for collaboration with GCOS and emphasized the importance of better world-wide coordination of reprocessing activities, the identification and use of algorithms for reprocessing, and a common use of data formats. The important role of the WCRP Observations and Assimilation Panel (WOAP) was recognized in this context.

Dr Asrar specifically commented on the under-utilization of available climate data records and called for the establishment of a climate information system, thereby going beyond pure observations and research, but also reaching out to end users.

The SC noted the importance of continuing a close partnership between WCRP and GCOS to ensure long-term sustained observations and data sets in support of climate research. It reaffirmed its appreciation of the work of the three jointly-sponsored domain-based panels (AOPC, OOPC, and TOPC) and welcomed the joint sponsorship of WOAP as an excellent example of this collaboration.

9.2 WCRP Observations and Assimilation Panel (WOAP)

The Chair of the WCRP Observations and Assimilation Panel (WOAP), Dr Kevin Trenberth, briefed the SC on collaboration between GCOS and WCRP related to climate-quality datasets in the past and presented major outcomes of the recent session of the WOAP. He recalled past actions by WCRP and GCOS to urge space agencies, through a series of letters to the CEOS Chairs (the latest in January 2008 as a follow-on to a request to WOAP from the SC-XV in October 2007), to follow the recommendations expressed in the Satellite Supplement to the GCOS Implementation Plan and take note of refined priorities highlighted in conclusions of WOAP sessions. These included the continuing need for climate data records and reprocessing and reanalysis of past records to improve the continuity and homogeneity of records. Continuation of this interaction with CEOS was deemed essential, in particular, in the areas of concerted action in algorithm development and evaluation of results. Also, international coordination of reanalysis activities should be improved, and national efforts perpetuated wherever possible. The joint AOPC/WOAP Working Group on Reanalysis Datasets (chaired by Dr Russell Vose) has started providing valuable groundwork on dataset issues.

Dr Trenberth strongly emphasized that current regional climate information was in most cases not of adequate quality to usefully underpin decisions related to adaptation. Reliable predictions were needed for the assessment of impacts and vulnerability, particularly on regional scales. These predictions would, unlike in the case of current global climate models, require proper initialization by observational data. In this regard, Dr Trenberth saw it is an imperative to build a climate information system. Since global warming is “unequivocal,” to quote the IPCC, and some warming is guaranteed, adaptation to climate change is essential. To assess vulnerability, devise coping strategies, determine possible impacts, and plan for future changes requires information. The following information is essential: 1) observations (atmosphere, oceans, land); 2) analysis (comprehensive, integrated products); 3) assimilation; 4) attribution (understanding the causes of change); 5) assessment (of global and regional impacts for planning purposes); 6) predictions (on multiple time scales); and 7) decision making (related to impacts and adaptation).

Dr Trenberth briefed SC on the main outcomes of WOAP-3 (29 September – 1 October, Boulder, USA) and presented the set of recommendations from that meeting. The main topics addressed at the WOAP-3 meeting included: 1) the progress achieved during the last two years in relation to observations, especially space agencies and CEOS, reprocessing and reanalysis, interactions

between GCOS and WCRP activities, and participation in GEOSS; 2) the transition of WCRP projects and datasets beyond 2013; 3) the assessment of activities and results of the Task Group on Data Management and the Joint Working Group on Observational Data Sets for Reanalysis; 4) development of the report to this GCOS SC meeting; 5) exploration of the role of WOAP in World Climate Conference-3 (31 Aug-4 Sept 2009) and OceanObs09 (21-25 September 2009); and 6) development of contributions to the WCRP implementation plan, taking advantage of the outcome of the workshop on lessons learned from IPCC AR4. The meeting expressed concerns over lack of adequate coordination and recognition.

Dr Trenberth also noted that the IPCC AR4 did not include a section on future directions of research and monitoring to support future IPCC assessments. The structure of the IPCC AR5 is being developed through international scoping meetings over the next year. Currently there is no well-recognized authoritative statement on future needs for IPCC assessments. The joint WCRP-GCOS-IGBP meeting in Sydney in 2007 provided a forum to develop some of those needs, and the results are being well publicized. However, the IPCC itself provides the most recognized mechanism for developing a consensus in the climate community and for promoting the results in influential fora.

Dr Trenberth also noted that the written report from WOAP includes a number of action items and comments on aspects of the observing system that should be noted by GCOS and its panels. There was not time to go through these in the oral presentation, but they are listed as Appendix IV of this report.

The SC welcomed the increased number of atmospheric reanalyses but encouraged agencies involved to ensure that: 1) attention is devoted to taking advantage of lessons learned from other reanalysis efforts and the improved datasets, and 2) adequate resources are made available for evaluation and assessment of the reanalysis products.

The SC endorsed the WOAP commendation of CEOS for the increases in reprocessing of space-based observations but noted the need for increased coordination of reprocessing among different groups and an expanded effort on evaluation and assessment of the products.

9.3 World Climate Data and Monitoring Programme (WCDMP)

Dr. Omar Baddour briefed the SC on recent activities in the WCDMP, noting new initiatives that have been developed as well as challenges. There is an increasing pressure on NMHSs to provide data for climate change detection studies, which should improve in terms of time-delay and accuracy and be available nationally as well as internationally. Furthermore, due to the progress in technology, climate monitoring is in constant need of an effective world-wide collaboration in updating strategies and in developing new techniques, tools, and procedures relevant to all aspects of climate data. There are several challenges that need to be taken up by the WCDMP, mostly related to data rescue, data availability, and data management.

New initiatives comprise:

- The development of a set of recommendations and guidelines by the CCI Expert Team on Observing Requirements and Standards for Climate to address the minimum requirements for climate observation networks to meet present and future needs for national climate services and to manage climate related risk.
- The collation of material on climate observations and data management on a CD-ROM for developing and least developed countries.
- The Mediterranean Climate Data Rescue (MEDARE) project, undertaken in collaboration with CCI, the University of Tarragona, the NMHSs in the Mediterranean Basin, and other international stakeholders. The long-term goal of the project is to develop a comprehensive high quality instrumental climate dataset for the Mediterranean area with a focus on the GCOS ECVs for improving monitoring, detecting, and predicting climate variability and change at regional and national levels, and for developing strategies for managing risks of, and adaptation to, climate change.
- The CLIMSOFT-WIS Demonstration project. The project aims to improve climate data discovery through the WIS by putting in place the software/hardware interface for historical climate data and

metadata exchange through the WMO Information System. The concept is also being developed for other Climate Data Management Systems (CDMSs).

- Implementation of “climate watch” systems in various WMO Regions (in collaboration with WCASP, CCI, CBS, and WMO regional offices). The project includes the development of best practices in organizing climate watch systems and providing climate advisories on ongoing and foreseen climate anomalies and their negative impacts.

The SC noted that improvement in CLIMAT reporting would greatly help the CCI climate monitoring goal.

Action 20: CLIMAT reporting. The SC encouraged CBS Lead Centers for GCOS to see what they can do to encourage all CLIMAT stations to report on a regular monthly basis and to promote the preparation of CLIMAT messages at key stations that do not currently report CLIMAT.

Action 21: WCDMP and GCOS collaboration. The SC agreed that the WCDMP and GCOS Secretariats should explore the scope for coordination of regional activities in the future and/or organize joint workshops to promote a common understanding of requirements and needs for observations, climate data, and climate services.

9.4 World Climate Applications and Services Programme (WCASP)

Dr Rupa Kumar Kolli reported on the World Climate Applications and Services Programme (WCASP). He began by underlining that relevant climate information is expected to improve policy and decision making in many sectors, but also noting that there is significant variability in the demand for and supply of climate information at the national level. The objectives of WCASP are: 1) to develop user-targeted climate services, 2) to provide services for sustainable development at national, regional, and global levels, 3) to contribute to strategies for adapting to, and mitigating, the adverse impacts of climate and its variation, 4) to increase user awareness and liaison, 5) to partner with national/international agencies dealing with application sectors, 6) to develop practical methods and techniques, including climate prediction products, and 7) to implement the Climate Information and Prediction Services (CLIPS) project.

Dr Kolli noted that a number of new developmental needs and associated climate service needs have emerged in many areas, among which are assessment of climate change and variability with a regional focus, identification of key vulnerabilities, seasonal to interannual prediction and regional climate outlooks, downscaling and climate scenarios, and climate risk management.

Dr Kolli reviewed the functions of Regional Climate Centers (RCCs), noting that they will provide operational long-range forecasting and climate monitoring, data services, climate applications, and training and capacity building, among other things. These centers will be launched by WMO Regional Associations based on regional needs and priorities and will be complementary to, and supportive of, NHMSs. The RCCs are also expected to be involved in downscaling and development of regional-scale prediction products. Associated Regional Climate Outlook Forums (RCOFs) would provide an outreach arm to engage regional climate/user communities and to build networks of communities sharing common climate problems, particularly in developing regions.

Dr Kolli also highlighted the great potential of NMHSs to provide “effective” climate services for a wide range of societal benefit areas, such as health, energy, and agriculture. He stressed the importance of predictions of climate variability over the next season or two (seasonal to inter-annual forecasts). Also of note was his review of the WMO Initiative to Support Climate Change Adaptation. The mission of this new initiative is to facilitate provision of user-oriented climate information, products, advisories, and services to support national and regional climate risk assessment, climate adaptation planning, and sustainable development. He noted that this initiative aims to tap into complementary efforts under different programmes, including GCOS, to meet user needs.

The SC noted that the WCASP climate prediction framework will need strong observational support and user participation to be effective. It reaffirmed the key role of GCOS in underpinning the work of the WCASP.

Action 22: GCOS support for adaptation. The SC requested the Secretariat to ensure that GCOS activities related to the needs of the adaptation community are appropriately coordinated with the WMO Initiative on Adaptation to Climate Change (WIACC).

9.5 Water Resources

Dr Avinash Tyagi recalled the results of the “Expert Meeting on Water Manager Needs for Climate Information in Water Resources Planning,” focusing on perspectives of water managers on climate information needs. With water availability as a primary goal, water managers require downscaled (regional and basin wide) information on precipitation, temperature, and wind fields. Both climate predictions and information on extremes on those scales would be necessary to support water resource management – information that climate models cannot deliver to date. He reinforced the importance of observations for the verification of statistical downscaling as well as regional predictions.

Furthermore, Dr Tyagi noted that the Expert Meeting stated a communication gap between the fields of climate science and water management because of conservatism in water management. For example, long-term trends usually are not derived from long-term climate information but from hydrological records. As these hydrological data are nationally available and water managers mostly have no requirement of integrating information from international data centres to their planning, the expression of data-sharing necessities is very sparse. It was also recorded that, more generally, commitment to the improvement of communication is lacking, for example in technical issues. The Expert Meeting concluded that an initiative on “Water Management and Climate Information” should be launched, but no progress has been achieved so far.

Noting the increasing importance of climate information for water resources management, the SC urged the WMO Climate and Water Department to treat as a priority the development and implementation of an initiative on water management and climate information.

The SC welcomed the opportunity for the GCOS Secretariat to work with the Climate and Water Department to strengthen the role of GCOS in meeting the needs of water managers in all countries.

Action 23: Climate information for water management. The SC requested the Secretariat to work with the WMO Climate and Water Department to develop an expanded formulation of the needs of water managers for climate observations.

9.6 Intergovernmental Panel on Climate Change (IPCC)

The IPCC Secretary, Dr Renate Christ, recalled some of the major outcomes of the 2007 IPCC AR4, namely that “global warming is unequivocal” and that anthropogenic warming has had a discernible impact on many physical and biological systems. In the same vein, she stressed the finding of WG II that gaps in observations of impact variables persisted, with particular scarcity in developing countries. She recalled some of the main findings of the GCOS-WCRP-IGBP 2007 Sydney workshop in stating that improved observation networks were most needed to enhance the research capability on changes in physical, biological, and socio-economic systems and to improve the understanding of the responses of natural and man-made systems to climate change.

Along with the new IPCC Bureau structure, Dr Christ presented the planned timeline for the IPCC AR5: scoping meetings are planned for 2009, with anticipated approval of the outline by the IPCC 31st Bureau in late 2009/early 2010; completion of the WG I AR5 is planned for 2013; and completion of WG II and III reports is planned for 2014. She also briefed the SC on the new scenario development process for AR5, in which a parallel approach, based on representative concentration pathways and levels of radiative forcing, was preferred over a sequential approach based on emissions scenarios as used in previous assessments. As being of particular interest to GCOS, Dr Christ concluded with announcing the upcoming meeting of the IPCC Task Group on Data and Scenario Support for Impacts and Climate Analysis (TGICA) on 19-21 November 2008 in Geneva.

The SC noted the value of establishing a link between GCOS and the IPCC Task Group on Data and Scenario Support for Impact and Climate Analysis (TGICA) and accepted with appreciation the

invitation from the IPCC Secretary to have a GCOS representative attend the next TGICA meeting, which will take place in Geneva on 19-21 November.

9.7 UN Framework Convention on Climate Change (UNFCCC)

Ms Rocio Lichte presented an overview of recent developments under the UNFCCC relevant to global observations. Her presentation covered recent climate observing issues taken up by the Subsidiary Body for Scientific and Technological Advice (SBSTA); a discussion of the Nairobi Work Programme on Impacts, Vulnerability, and Adaptation to Climate Change (NWP); and a look at adaptation under the Bali Action Plan.

Ms Lichte noted that the revised UNFCCC reporting guidelines on global climate change observing systems, which were based on a proposal by GCOS, were adopted at COP13 in Bali. These guidelines will be used by Annex I Parties for the preparation of national reports on systematic observations that Annex I Parties provide in conjunction with their national communications (as of their 5th national communication) and are voluntary—but recommended for use—for non-Annex I Parties. Ms Lichte also recalled the request to GCOS for a comprehensive report on progress with the GCOS-92 Implementation Plan (GIP), to be delivered in June 2009. She highlighted the invitation to Parties to provide additional information on their national activities in implementing the GIP and noted that 16 Parties had provided such information to date. (This information is posted on the UNFCCC website (see <http://unfccc.int/4499.php>)).

Referring to the outcomes of SBSTA 27 in Bali, she mentioned that SBSTA expressed concern that the Regional Action Plans produced under the GCOS Regional Workshop Programme remain largely unimplemented and urged international organizations and development agencies to provide further technical and financial support, through existing cooperation programmes, to advance the implementation of the Action Plans. SBSTA has also underlined that the contributions of the GEOSS to the needs of the UNFCCC would be made mainly through GCOS.

Ms Lichte noted that although reports from GTOS and CEOS would be introduced at SBSTA 29 in Poznan, it is planned that they would be considered at SBSTA 30 in Bonn in June 2009 in conjunction with the comprehensive report on progress with the GCOS-92 Implementation Plan. Likewise, although there will be a short GCOS statement at SBSTA 29 (see Section 10.3), there will be no in depth discussion of systematic observing issues at SBSTA 29 and COP14, since such discussion is planned to be deferred to SBSTA 30.

Turning to the Nairobi Work Programme on Impacts, Vulnerability, and Adaptation to Climate Change (NWP), Ms Lichte focused on the data and observations theme. She noted, in particular, GCOS and WMO participation in the March 2008 expert meeting on data and observations in Mexico City and reviewed some of the recommendations of the workshop participants. Among other things, she highlighted that the participants recommended defining data and information needs for adaptation, identifying the minimum networks needed for adaptation, increasing user awareness of existing data, promoting the recovery of historical data, and addressing barriers to the dissemination and exchange of data. She noted that the NWP is now entering a second phase in which there will be greater emphasis on regional activities, a push to promote regional climate centers and networks, and more emphasis on adaptation planning and practices, among other things.

Regarding the Bali Action Plan, Ms Lichte highlighted the new negotiation process that has been launched, the Ad hoc Working Group on Long-Term Cooperative Action (AWG-LCA). The GCOS Secretariat was asked to contribute its thoughts on observation issues relevant to adaptation to the Chairman of the Working Group, who is developing a paper that will be reviewed at the 4th session of the AWG-LCA to be held in conjunction with COP14 (cf. Section 10.3 of this report).

In discussion, Prof Mason pointed out that adaptation requires different information than, for example, climate change detection, e.g., information on a sub-regional scale. He stated his belief that the Parties to the Convention may think scientists know more than they actually do about the climate of the future, and hence, about our ability to adapt to it. There is therefore a skill versus perception problem. The reality is that we do not necessarily understand the climate to which we will have to adapt. Without improvements in predictive skill, countries may do more harm than good in using

inadequate data to produce poor predictions leading to implementation of defective adaptation strategies.

The SC noted that the UNFCCC web site would like to link to atmospheric, ocean, and terrestrial climate data sets and proposed that the UNFCCC Secretariat consider linking to the Global Observing Systems Information Center (GOSIC) site at <http://gosic.org>. The GOSIC is a key data portal for GCOS, GOOS, and GTOS that has been designed specifically to aid a wide variety of users in finding relevant climate data and information. The SC invited a presentation on GOSIC next year, as had been done at previous SC sessions.

The SC agreed that the visibility and profile of GCOS should be maintained within the UNFCCC process under Article 5 of the Convention through the SBSTA agenda item on “research and systematic observation.” The representatives of GCOS should use this visibility to communicate the system of systems concept of GCOS and promote the role of GOOS, GTOS, WIGOS, and the other component observing systems in meeting the needs of the Convention.

Action 24. GOSIC report to SC-XVII. The SC requested the Secretariat to organize a status report on GOSIC for SC-XVII, as had been provided to earlier SC sessions.

9.8 GCOS in Support of the UN System Coordinated Action on Climate Change

Dr Elena Manaenkova, Director of the WMO Cabinet and External Relations Department, briefed the SC on the UN System Coordinated Action on Climate Change and on how this was relevant to GCOS. She explained that the UN Chief Executives Board on Coordination (CEB) has launched an initiative under the leadership of the UN Secretary-General to coordinate action on climate change throughout the entire UN System and with other elements of the international community. She noted that a coordination framework has been established, teams have been activated, and consultations are under way. She also noted that the CEB was preparing a document on the UN system work on climate change for COP-14.

The initiative has five focus areas, including adaptation, technology transfer, reducing emissions from deforestation and forest degradation, capacity building, and financing. It also has four cross-cutting areas, which encompass climate knowledge (science, assessment, monitoring, and early warning), support for global, regional and national action; public awareness; and promoting a climate-neutral UN. WMO and UNESCO have been given joint lead roles for the climate knowledge cross-cutting area. These two organizations have been asked to convene a forum for coordination, integration, and dissemination of climate change knowledge to make available climate information for access and use by the public and by policy and decision-makers world-wide to support, among other things, the UNFCCC process and development of the IPCC 5th assessment report. The forum would address scientific issues related to adaptation, especially with respect to the energy, agriculture and fisheries, disaster risk reduction, freshwater, health, transport, and oceans sectors. It would emphasize the point that investment in climate knowledge is investment in safety and human welfare. Among priority areas for the climate knowledge cross-cutting theme will be to sustain and enhance systems that provide critical data and information on weather, climate, biodiversity, water, biomass resources, and human welfare. This will be facilitated in part by the UN Climate Knowledge Web Portal on the UN Climate Change Gateway.

The need to increase climate knowledge is fundamental to policy development, and the concern for improving such knowledge is featured prominently in many UN documents. The importance of improving observations is clear, and thus GCOS is seen as having a substantial role to play. Dr Manaenkova pointed out the need to promote enhanced government commitments to improving observations and visibility for data providers; the relevance of observations and assessment of impacts and adaptation; and the requirements for observations for downscaling, forecasting, and assessments.

The GCOS Chairman suggested that the SC needs to make clear that the observing systems are fundamental to all aspects of climate knowledge but that they will only function well if the individual UN-Member countries make them work. Members agreed that GCOS needs to be seen as the overall framework for providing observational support for the UN System Coordinated Action. The monitoring

system managed by the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) was mentioned as a possible addition to the GCOS. Ms Rocio Lichte of the UNFCCC Secretariat noted that the UNFCCC is recognizing that more and more is happening on adaptation within the UN system and that a paper on adaptation is being prepared for the UNFCCC sessions in Poznan. She also indicated that there is increasing awareness of the importance generally of observations and noted, for example, that there will be a workshop on risk management/reduction at COP14 (under the AWG-LCA), which she expects will provide an opportunity to stress the need for observations.

10 GCOS in Support of the IPCC and UNFCCC

10.1 Learning from IPCC AR4: Possible Implications for GCOS

Dr Stephan Bojinski briefed the SC session on the key outcomes of the 2007 joint GCOS-WCRP-IGBP workshop, "Future Climate Change Research and Observations: Learning from the IPCC Fourth Assessment Report," held on 4-6 October 2007 in Sydney, Australia.

He recalled that, in order to obtain feedback on observational issues in connection with the 2001 IPCC Third Assessment Report (TAR), GCOS had organized, in 2002, a workshop focusing on observations only, whereas the 2007 Sydney workshop was intended to address both research and observations needs in light of the experience of the Fourth Assessment Report (AR4). Sixty-six IPCC Coordinating Lead Authors and Lead Authors from IPCC Working Groups I and II discussed gaps in, and needs for, climate observations and possible implications for the evolution of the observing system. In conjunction with a survey preceding the workshop, the group provided a set of urgent needs and recommendations, while the list of existing ECVs was generally endorsed. Dr Bojinski noted that the majority of these recommendations were already well represented in the GCOS-92 Implementation Plan.

As a result of the Sydney workshop, the following key areas of remaining uncertainty were identified: observational needs in support of adaptation, radiative properties of the atmosphere (aerosols, clouds), the cryosphere, the hydrological cycle (including precipitation), and the marine, as well as, terrestrial carbon cycle.

Besides the official report of the workshop itself (GCOS-117), an Earth Observing System (EOS) news item on the results of the workshop appeared on 11 March 2008, and a peer-reviewed article has been accepted for publication in the Bulletin of the American Meteorological Society (BAMS).

Dr Bojinski further noted that, in the Summaries for Policymakers of Working Groups I and II of the AR4, the need for enhanced observations and the inadequacies in data coverage in many areas received relatively little attention. However, the Technical Summaries of Working Groups I and II contain chapters on robust findings and key uncertainties arising from the AR4, many of which include observation and dataset issues. The SC expressed its hope that, through the election of Prof Thomas Stocker as Co-Chair of the IPCC Working Group I for the Fifth Assessment Report (AR5), and through the potential future observer status for GCOS at IPCC sessions, observational issues and needs will be more explicitly reflected in the IPCC AR5.

The SC commended the GCOS, WCRP, and IGBP Secretariats for jointly organizing the workshop on future needs for climate research and observations. Dr Fernandez of UNEP remarked that responsibilities of the different international mechanisms charged with coordination of Earth observations and environmental assessments should be clearly identified. The SC urged the GCOS Sponsors, directly and through their Members, to assist the IPCC in future assessments in the identification of gaps and needs in climate observations and datasets, thereby facilitating implementation of Article 5 of the UNFCCC.

Action 25. IPCC AR5 identification of climate observing needs. The SC requested the Secretariat to consult with the Joint Planning Staff for the WCRP with a view to a joint approach from the Chairs of the Joint Scientific Committee of WCRP and the GCOS SC to the Chairman of the IPCC to urge that the IPCC AR5 address future needs for research and observations to support future assessments. The SC also recommended that the IPCC be invited to participate fully in the review of the GCOS-92 Implementation Plan and help to identify observation needs for the AR5 and beyond.

10.2 GCOS and Adaptation

At the invitation of the SC Chairman, Dr Michael Glantz attended the session to help launch an SC discussion on the appropriate role for GCOS in response to the need for observational information in support of the growing concern about the impacts of, and the need for adaptation to, climate change. Dr Glantz prepared two thought-provoking presentations, the first titled "Climate-Related Impacts: Does GCOS Have a Role?" and the second "Selling Uncertainty...and What You Can Do about It."

In introductory remarks, Dr Glantz noted that the bad news for the climate community is that the spotlight is shifting away from science issues of IPCC Working Group I and more toward the impacts questions of IPCC Working Group II. He also noted that the climate future is arriving earlier than expected, e.g., in the form of melting Arctic sea ice, the melting Greenland ice sheet, rising sea level, warm ecosystems moving upslope, global melting of glaciers, etc. Also of importance is that society is now undeniably a component of the climate system. Coping with climate change thus requires mitigation, adaptation, *and* prevention. He introduced the notion of creeping environmental problems (CEPs), and pointed out that solutions to CEPs are likely to be late, incremental, and less effective than having addressed them early through mitigation or preventive measures. What is needed, he said, are early warning systems that can provide wake-up calls to politicians, and these are fundamentally based on observations and monitoring of the climate, its impacts on human activities, and ecological processes.

Dr Glantz noted that GCOS has a window of opportunity in the changing focus between science and impacts. Decisionmakers are very concerned about impacts in their jurisdictions. New strategies and tactics need to be identified for coping with climate change and its impacts on human activities and ecological processes, and these need to be supported by adequate resources and monitoring.

Dr Glantz observed that the World Climate Impact Assessment and Response Strategies Programme (WCIRP) was split from WCRP and other elements of the World Climate Programme (WCP), in part because WMO does not deal with impacts issues. He believed that these two subprogrammes should be reintegrated. On this point, the Chairman noted the importance of restructuring or revalidating the WCP at WCC-3 because the original concept of the WCP embracing four interrelated components underpinned by GCOS has essentially collapsed. The SC briefly reviewed the various international programmes and systems providing observational support for impact assessment and adaptation initiatives. It concluded that it did not have sufficient information on the scope of the programmes and agreed that the Secretariat should consult with the Secretariats of the IGBP, Diversitas, GTOS, UNEP, and others to gain a better overview of existing activities and plans.

Action 26. Observations for Adaptation: The SC requested the Secretariat to consult with the Secretariats of IGBP, Diversitas, GTOS, UNEP, etc. in assessing and building observation capacity for adaptation. It asked for the preparation of a strategy document on the GCOS role in support of adaptation for consideration at its 17th session.

10.3 Contribution of GCOS to SBSTA29/COP14, Poznan, Poland

The Chairman will have the opportunity to make a short statement on GCOS at SBSTA 29, which is held in conjunction with COP14 in December 2008 in Poznan, Poland. The SC reviewed the draft of an extended version of the statement prepared by the Secretariat. The draft begins by commending the reports from the GTOS Secretariat and CEOS that will be introduced at SBSTA 29. It then briefly mentions five key issues that GCOS would like to bring to the attention of SBATA. It notes: 1) GCOS is on track to deliver the progress report on GCOS-92 in June 2009; 2) the importance of establishing national coordination mechanisms, 3) the importance of addressing observation needs for adaptation, 4) the continued importance of improving observations in developing countries, noting, in particular, the success of the implementation strategy meeting held in Belize to facilitate the implementation of the Regional Action Plan for Central America and the Caribbean, and 5) recent developments in launching the ClimDev Africa Programme, with a special appeal to Parties to the Convention to support this programme.

The SC was generally satisfied with the draft statement, but on the issue of addressing observational needs for adaptation, members proposed that additional material be added to clarify that improved and sustained observations of oceanic and terrestrial variables are needed as well as fine-scale and

high resolution atmospheric observations. Also, the statement has now been modified to note that effective adaptation to future climate change requires that regional aspects of climate change be predicted on decadal and longer timescales to the extent possible, and that reliable estimates of uncertainty should be attached to such predictions.

The Secretariat produced a second document giving the preliminary views on adaptation under the new UNFCCC Ad Hoc Working Group on Long-Term Cooperative Action (AWG-LCA). The document notes that the Chair of the August 2008 AWG-LCA meeting was invited to prepare a document assembling the ideas and proposals of Parties, taking into account those by *accredited observer organizations* with respect to, among other things, adaptation. The UNFCCC Secretariat proposed that the GCOS Secretariat contribute to this document. In response, the GCOS Secretariat proposed 1) including observation issues in National Adaptation Plans of Action, 2) appointing GCOS National Coordinators and Committees, 3) pressing Parties to provide resources to implement Regional Action Plans, 4) encouraging Parties to support ClimDev Africa, 5) encouraging greater data exchange, especially to take advantage of the opportunities that new and improved regional modelling presents, 6) the sharing of tailored climate services and the building up of capacity to use them, and 7) encouraging developed countries to participate actively in the GCOS Cooperation Board. The SC noted, but did not have the time to discuss, this brief document.

10.4 2009 Report to SBSTA and GCOS-92 Update

Prof Mason informed the SC about the preparation of a comprehensive report on progress in the implementation of actions identified in the GCOS Implementation Plan (GCOS-92), as requested by the UNFCCC's SBSTA in November 2005. The Progress Report, planned for submission in draft form to the UNFCCC Secretariat by April 2009, makes use of information from national communications, the reports on additional information on national activities (of which some 20 have been received to date), GCOS monitoring and analysis centres, and GCOS panels and partner observing systems.

A kick-off meeting on the report, with participation by GCOS panel chairs, the GCOS Steering Committee Chairman, and Secretariat staff from GCOS, GTOS and GOOS was held on 30 June-2 July 2008. Aiming at an overall length of roughly 30 pages, participants started drafting an outline of the report, as well as collecting information on progress against each of the 131 actions identified in the GCOS Implementation Plan. While the gathering of relevant information is ongoing, e.g., from a number of 'agents for implementation,' the next meeting to advance the report is planned for 24-26 November 2008. An extended open review period of the draft report will ensure community consensus as well appropriate feedback by Parties to the UNFCCC.

Prof Mason stressed as main objectives of the Progress Report the acknowledgement that progress is almost entirely due to national and partner organizations. A good balance would need to be struck in the Report between examples for good progress, partial progress, and the absence of advances, using appropriate (and overall encouraging) language.

In conjunction with the 2009 Progress Report, an update of the 2004 GCOS-92 Implementation Plan was planned, for likely completion by mid-2009. This update will mainly aim to provide extra detail to the current document where this is missing, as well as incorporate new and emerging developments, such as the increasing focus on adaptation. For this purpose, results of the 2007 Sydney workshop "Learning from the IPCC AR4," as well as input from an expert meeting scheduled for 2-5 February 2009 will be used. It is planned to invite about 30 experts covering the atmospheric, oceanic and terrestrial domains, who will undertake a critical review of existing requirements in the Implementation Plan, such as the GCOS networks and the list of Essential Climate Variables.

Prof Mason anticipated little to no alteration of the Satellite Supplement to the GCOS-92 Plan in the context of this update. Along with the Progress Report, a period of open review was foreseen. In the context of the WMO Rolling Review of Requirements process, the updated plan will provide an updated Statement of Guidance for Climate Monitoring (covering climate change and climate variability).

Action 27. The 2009 Report and GCOS-92 Update. The SC requested the Secretariat to do everything possible to ensure that the 2009 Progress Report and the planned update of the

GCOS-92 Implementation Plan are completed in good time and that Prof Paul Mason and the Panel Chairs are provided with the necessary support.

11 GCOS as the Climate Contribution to GEOSS

11.1 GEO Views on How GCOS Can Serve More Effectively as the Climate Observing Component of GEOSS

Dr Mike Tanner of the GEO (Group on Earth Observations) Secretariat provided an overview of the main goals and objectives of GEOSS, with a focus on activities in support of the Climate Societal Benefit Area (SBA). He stressed that a strong climate component of GEOSS was essential for its overall implementation and pointed out the value of better coordination and collaboration of the various GEO members and participating organizations in achieving that goal. Dr Tanner recalled the 2008 G-8 Hokkaido Toyako Summit Statement that “we [the G-8] will accelerate efforts within the Global Earth Observation System of Systems (GEOSS), which builds on the work of UN specialized agencies and programs, in priority areas, *inter alia*, climate change and water resources management, by strengthening observation, prediction and data sharing.” Ultimately, better links should be achieved, through GEOSS, between the various elements contributing to climate information, such as observing systems, data processing centres, models, dissemination systems, and decision-support capabilities.

Dr Tanner mentioned several activities under the GEO umbrella, such as GEONETCAST, GEOPORTAL, and the development of GEO Data Sharing Principles, noting that these address the need for better data access in all SBAs. Furthermore, he gave details on selected activities falling under climate tasks of the current GEO Work Plan for 2007-2009, namely:

- Sustained Reprocessing and Reanalysis Efforts
- Key Climate Data from Satellite Systems
- Key Terrestrial Observations for Climate
- GEOSS IPY Contribution
- Global Ocean Observation System
- Seamless Weather and Climate Prediction System

Dr Tanner concluded with the suggestion for a workshop involving all GEO Climate SBA task teams in the first half of 2009, with goals of achieving better coordination among those task teams and of agreeing on a common way forward.

Action 28. GEO workshop. The SC expressed appreciation for the GEO Secretariat offer to organize a workshop in 2009 to discuss and coordinate the efforts of GEO climate task teams and address gaps, synergies, and linkages and agreed that, as far as possible given existing commitments and available resources, the SC and the GCOS Secretariat would be pleased to collaborate in this activity.

11.2 GCOS Views

The Chairman reviewed the relationship between the GCOS and GEOSS, noting the opportunities for synergy between the two initiatives. He pointed out that if GCOS is essentially defined as “the climate observing component of GEOSS,” as has now been generally accepted, the institutional challenge is to bring the planning and implementation of GCOS into alignment with the strategy, targets, and work plans of GEO—and vice versa. The view has been expressed that GCOS needs to be correctly described in GEO documents and that collaboration works best when there is clarity about roles and responsibilities. The Chairman stressed the point that any observing system that meets the needs of the GEOSS Climate Societal Benefit Area (SBA) must also meet the climate-related needs of the eight other GEOSS SBAs.

Prof Zillman reported that he had been invited to serve on a GEO Target Task Team that has been asked to reformulate the 2015 targets for GEOSS. He introduced draft versions of the 2015 targets for the Climate SBA, which he had provided to the GEO Task Team. After some discussion on a redraft prepared by a subgroup of the Panel Chairs, the Steering Committee endorsed the following revised statements for consideration by the GEO Target Task Team:

“Recognizing that GCOS is the climate observing component of GEOSS and that the GCOS Implementation Plan identified the essential actions required, GEO will support full implementation and sustained operation of the climate components of:

- The World Meteorological Organization Integrated Global Observing Systems (WIGOS);
- The Global Ocean Observing System (GOOS); and
- The Global Terrestrial Observing System (GTOS).

GEOSS will ensure the availability of the observations from GCOS component systems to support:

- All GEOSS SBA communities;
- All components of the World Climate Programme, including the WCRP;
- International and national research and applications programmes;
- The assessment role of the IPCC; and
- The policy development role of the UNFCCC and other conventions,

through promotion of policies for data sharing and of appropriate systems for data management and exchange.”

The Director of the GEO Secretariat, Dr José Achache, noted that GEOSS was intended to encompass the entire end-to-end value chain and was about more than just enhanced coordination of observing systems. Several members of the SC highlighted the need for better understanding of the GEO mechanism and raised questions about the added benefits of GEOSS. Dr Zaitsev pointed out that the establishment of GEO was initially seen by many as a sign that observations would be taken seriously by its founding members and that the influence of GEO would lead to significantly more resources for observations becoming available. The SC expressed its hope that a strong GEO mechanism would ultimately lead to additional resources for Earth observations, including especially climate-related observations, through existing international mechanisms.

The SC noted the common objectives and the importance of mutual understanding, recognition, and effective coordination between the GCOS and GEO/GEOSS mechanisms. It expressed its desire that they be mutually reinforcing and supportive and encouraged closer interaction between the GCOS and GEO Secretariats to that end.

The SC noted that the GEO mechanism should provide an opportunity to increase the financial support for achieving the objectives of the GCOS Implementation Plan and the climate data and information needs of all nine SBAs.

Action 29. Harmonizing of GCOS and GEOSS. The SC requested the Chairman, the Panels, and the Secretariat to continue to work toward alignment of the objectives, targets, and workplans of GCOS and the GEOSS Climate SBA.

Action 30: GEOSS Climate SBA targets. The SC requested the Secretariat, on behalf of the Chairman, to advise the GEO Secretariat on the proposed reformulated target statement for the GEOSS Climate SBA prepared by the SC.

11.3 The GCOS Contribution to the GEO Work Plan 2009-2011

Dr Bojinski briefed the SC on the contribution of GCOS bodies to the GEO Work Plans 2007-2009, as well as on the proposed contributions to the new 2009-2011 Plan. As a participating organization of GEO, GCOS has been identified as co-lead for two tasks of the 2007-2009 GEO Work Plan, namely CL-06-01 (*Sustained Reprocessing and Reanalysis Efforts*) and CL-06-02 (*Key Climate Data from Satellite Systems*). In particular for the latter task, reporting to the GEO Secretariat occurs on a regular basis (i.e., every three months). Further, GCOS has been recognized as a contributing organization to 11 other tasks.

In the preparatory phase of the GEO Work Plan 2009-2011, the GCOS Secretariat successfully proposed a new task, *Climate Information for Decision-making, Risk Management and Adaptation*, for inclusion in the draft. This task, associated with the Climate SBA (CL-09-01) led by GCOS and WCRP, provides a mechanism for reporting to GEO on progress in both the ClimDev Africa

Programme and the proposed World Bank project, "Climate Observations and Regional Modelling in Support of Climate Risk Management and Sustainable Development." In August 2008, the GCOS Panels and Secretariat provided a set of comments to the 2009-2011 GEO Work Plan v1.

A new version of this Work Plan has been released on 1 September 2008. A letter from the GCOS Secretariat has been sent to the GEO Secretariat, suggesting the re-formulation of GCOS-related tasks under the Climate SBA to the following:

"Accelerate the implementation of the Global Climate Observing System (GCOS) through enhanced support for the key climate-relevant components of the Global Ocean Observing System (GOOS), the Global Terrestrial Observing System (GTOS) and the WMO's GOS, GAW, and hydrological networks in line with the 'Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC.' This Task should have four sub-tasks:

- (a) Key climate data from satellite systems [currently AR-09-03a]
- (b) Key terrestrial observations for climate [currently AR-09-03b]
- (c) Key marine observations for climate [currently element of AR-09-03d]
- (d) GCOS Regional Action Plans: In collaboration with the various regional climate and observing system organizations in the development and resourcing of an implementation strategy for the ten GCOS Regional Action Plans."

Based on a review of all comments, version 3 of the GEO 2009-2011 Work Plan will be released in October 2008, for eventual acceptance at the GEO-V meeting in Bucharest. In conclusion, Dr Bojinski noted that GCOS was striving to actively contribute to the GEO/GEOSS process, but cautioned that this was putting additional strain on limited Secretariat resources.

The SC thanked Dr Bojinski for his update and encouraged the Secretariat to continue to work with the GEO Secretariat to provide effective coordinated GCOS input to the GEO Work Plan.

12 GCOS and the World Climate Conference-3

Dr William Nyakwada outlined the main elements that the World Climate Conference-3 (WCC-3) would cover and provided an overview of the ongoing planning of the Conference. He noted that the expected outcome of WCC-3 is a global action that would facilitate efforts to reduce the risks associated with the current and future climate conditions through the integration of climate prediction and information services into decision-making.

Some desirable actions include: strengthening observation networks and the provision of climate prediction and information; integrating regional and national infrastructures (climate services and networks) to deliver targeted climate prediction and information for national governments, other agencies, and the private sector; advancing the scientific and technical capabilities needed to provide more credible and user-oriented climate prediction and information; and enhancing the ability of governments, societies, and institutions to access and use climate prediction and information services.

Dr Nyakwada addressed the difficulties in visibility of observational institutions, such as GCOS, when compared to ones with a publicly more visible output, such as the IPCC, but underlined the fundamental importance of sound observations to the IPCC. The WCC-3 will be generally orientated toward the development of climate services, as they underpin the development of effective climate policies. Since the attention of policymakers has focused more on mitigation than climate observations, the importance of observations needs to be communicated more effectively, as well as the necessity of enabling the NMHSs through additional funding. Thus, consideration of observational issues should be a key topic at WCC-3

Mr Stefan Rösner presented overall WCC-3 planning and provided more detailed information on the different proposed sessions in the light of considerations for observations and the possibilities for GCOS to participate in the Conference process and outcomes. Like Dr Nyakwada, he accentuated the expectation of the WCC-3 organizers that the Conference should address the demand for annual to multi-decadal climate products and services. He listed several possibilities where the SC could contribute to placing GCOS in the WCC-3 process and strengthen observational issues in general.

The most GCOS-relevant elements of the plenary sessions will be “*Needs for Climate Information*,” and “*Mainstreaming Climate Information for Adaptation*,” but also “*The Climate Prediction and Information Challenge*” and “*Extremes and Hazard Early Warning Systems*” should be considered as important. An overall goal for GCOS in these plenary sessions should be encouraging speakers to emphasize the need for, and role of, climate observing systems.

Concerning the parallel sessions of WCC-3, the session titled “*Observation Needs for Climate Information, Predictions, and Applications*,” will be the most important, and here, a goal for GCOS should be to draft actionable, achievable, and measurable recommendations based on White Papers, the key points of which are to be incorporated in the Ministerial Declaration at the end of the Conference. The “*Round Table for Climate Information on Adaptation*” also provides an opportunity for GCOS to introduce and address the importance of observations. Another possibility for GCOS to influence the conference is the invitation to the SC to propose potential candidates for speakers, authors of White Papers, and session chairs.

SC members noted the importance of the WCC-3 as a platform for GCOS and the meteorological community to emphasize the value of climate observations. The SC acknowledged that input in the form of white papers on (1) needs, and (2) capabilities of climate observing systems was required for WCC-3.

Action 31. GCOS and WCC-3. The SC requested its members and the Secretariat to contribute as much as possible to helping the GCOS representative on the WCC-3 planning process, Mr Stefan Rösner, ensure that GCOS and climate observations issues are properly treated at the Conference.

13 GCOS Governance

13.1 GCOS Memorandum of Understanding

The Chairman outlined the background on the GCOS Memorandum of Understanding (MOU), noting that it first came into force in 1992 and was last updated in 1998. Given that the MOU is supposed to be reviewed every four years and has not been updated in ten, it is now seriously out of date. In addition to the formal requirements for review, the Chairman provided several reasons for updating the MOU at this time. These included the development of strong links with the UNFCCC process since the MOU was last updated, the potentially strong role for GCOS in supporting a coordinated UN System response to climate change, the perceived importance of having the Food and Agriculture Organization join as a Sponsor, the emergence of GEOSS as an overarching framework for the development of GCOS, the establishment of WIGOS, the establishment of the GCOS Cooperation Mechanism and Board, and the changing status of the World Climate Programme and Climate Agenda.

The ICSU representative, Dr Gisbert Glaser, very much welcomed the idea of updating the MOU, noting that the previous one had become obsolete and that much has changed in recent years. Dr Glaser brought to the attention of the SC the fact that the Interagency Coordination and Planning Committee for Earth Observations (the ICPC—comprising the representatives of the Executive Heads of the four Sponsors) has already begun to work on an umbrella MOU for GCOS, GTOS, and GOOS, noting that all three are in need of updating and that, rather than update each separately, a single generic MOU was being considered. This “umbrella” MOU would contain individual annexes or sub-MOUs. The idea of the ICPC was to show the Earth observations community that the observing systems are linked and that the Sponsors have a common overarching position. Only one thing would change for GCOS, according to Dr Glaser, and that would be the umbrella MOU “over” the GCOS MOU showing the interlinkages among the three co-sponsored observing systems.

The Chairman pointed out that it is important that an overarching MOU not reinforce the old G3OS concept. GCOS is not equivalent to GOOS and GTOS. It cuts across all three observing system domains—atmospheric, terrestrial, and oceanic—and hence must be seen as cross-cutting to WIGOS as well as to GOOS and GTOS. He also expressed his view that a revised MOU should not weaken the responsibility of the SC to provide the Sponsors and all concerned with GCOS implementation with independent, expert advice on the future direction of GCOS.

The SC agreed that the distinctive character of GCOS should be preserved in a new MOU and agreed that the basic elements and structure of the existing MOU are appropriate to preserve in the new MOU. It also agreed that the 1998 MOU should be revised and updated along the following lines: (a) Recital of the major additional elements of background and context since 1998; (b) Inclusion of FAO as an additional UN System co-Sponsor of GCOS; (c) Reformulation of the purpose, goals, objectives and scope of GCOS as an internally consistent statement of the GCOS Mission; (d) Identification of GCOS as the climate observing component of GEOSS; (e) Recognition of the full range of GCOS user communities, including the IPCC and the UNFCCC COP and its subsidiary bodies; (f) Increased emphasis on the resourcing of GCOS through sustained contributions from Sponsors and from individual donors, including a definition of the role of the GCM; (g) Consideration of a reversion to JSTC (Joint Scientific and Technical Committee) and JPO (Joint Planning Office) terminology to better reflect the essential interagency sponsorship of GCOS; (h) Establishment of clearer arrangements for funding of the ongoing resourcing of the GCOS planning functions and the JSTC/JPO; and (i) Explicit reference to the role of GCOS implementation coordination at the national level in all countries.

Action 32. *Revising the GCOS MOU.* The SC requested the Chairman and the Secretariat to draw its views on revision of the GCOS MOU, as summarized above, to the attention of the Sponsors.

13.2 The GCOS Plan

The Chairman reminded the SC of the origin of the GCOS Plan. Following the initial agreement, recorded in the April 1992 MOU between WMO, IOC, UNEP and ICSU, to establish GCOS under the guidance of the Joint Scientific and Technical Committee (JSTC), the JSTC prepared the "Version 1.0 GCOS Plan" as a comprehensive framework and strategy for its progressive implementation by building on the various established global atmospheric, oceanic, and terrestrial observing systems of its Sponsors. However, the Version 1.0 Plan has never been updated and, although there are ten "Regional Action Plans" and a 2004 "Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC" (GCOS-92), there is now no comprehensive internally consistent strategic plan for the further development of GCOS, and no up-to-date "Introduction to GCOS" to facilitate communication and promotion.

Discussion led by the Chairman focused on the finalization of an updated GCOS Plan, a first working draft of which had been submitted to SC-XV. It was suggested that identifying the updated document as "the GCOS Plan" could lead to confusion with the GCOS-92 Implementation Plan. It might be preferable, therefore, to refer to the document as the "GCOS Strategic Plan" or "GCOS Prospectus." It was also pointed out that the current draft falls short of being a strategic plan for the future of GCOS and, at the moment, is more of a description of GCOS. The Chairman agreed that his 2007 draft was a skeletal one and that it still needs much work. He proposed that its completion be assigned as a priority task for the new GCOS Secretariat Director and that it be finalized by mid 2009.

Action 33: *GCOS Strategic Plan.* The SC requested the Secretariat to finalize the draft GCOS Plan, with appropriate input and review by SC members, in parallel with work on updating GCOS-92, with a view to the revised Plan being completed by mid-2009.

13.3 The Role of GCOS National Coordinators

Dr William Westermeyer introduced the draft joint letter to be sent by the GCOS Sponsors to encourage countries to establish appropriate national coordination mechanisms, including designation of GCOS National Coordinators and creation of National Committees, for the implementation of GCOS on a national level.

The draft letter and revised TORs will need to be finalized and approved by representatives of the four Sponsors of GCOS through the Interagency Coordinating and Planning Committee (ICPC). Once all Sponsors agree on the text of the two documents, the signatures of the Executive Heads will need to be added to the letter. It is intended that the letter be sent to the focal points in each country of each of the Sponsors. In the case of the WMO, for example, this would be the Permanent Representative of the Member with the WMO. There are several possibilities for sending the letter, but the one that

appears most effective and efficient appears to be to have each Sponsor send a copy of the jointly signed letter and TORs, using its own letterhead, to its respective national focal point. The letter itself urges consultation by "colleague national focal points for WMO, IOC, UNEP and ICSU, as appropriate, to establish the necessary channels of communication."

In discussion, it was proposed that the distribution mechanism allow, as far as possible, for the special circumstances prevailing in particular countries. It was agreed that the Secretariat list all GCOS National Coordinators (as well as GCOS Focal Points for GSN and GUAN) on its web site.

Action 34. GCOS National Coordinators. The SC asked the Secretariat to facilitate, through the ICPC, the sending of a letter from the GCOS Sponsors to appropriate national authorities to encourage the appointment of GCOS National Coordinators and establishment of GCOS National Committees.

14 The GCOS Work Programme to SC-XVI

14.1 Recommendations and Action Items

The Secretariat introduced a document bringing together all the main action items that had emerged from the earlier discussion. The SC considered each of these items in turn and, in some cases, proposed modifications or the merging of two or more actions into one. Some additional actions and recommendations were also proposed. The final versions of these actions and recommendations are now included in the appropriate sections of this Report and are also consolidated in Appendix V.

14.2 Advice to GCOS Sponsors

The SC agreed that, as soon as the report of the session is finalized, the Chairman should write to the Executive Heads of WMO, IOC, UNEP, and ICSU, providing them with a copy of the GCOS Annual Report for 2007-2008 and the SC-XVI session Report, along with a summary of the most important outcomes, emphasizing, as appropriate, the specific items identified by the Committee for consideration by one or more of the Sponsors. As indicated in Action 1, this should be completed before the end of 2008.

14.3 Guidance to Panels

The SC requested the Secretariat to extract from the session report the essential Action Items and guidance appropriate to each of the Panels and to assist the Panel Chairs in their follow-up activities.

14.4 Guidance to the Secretariat

The SC authorized the Chairman and the Panel Chairs to continue to guide and advise the Secretariat, as necessary, in the follow-up action on its decisions. It encouraged the Secretariat to assist the process by maintaining an up to date Secretariat Action Sheet.

15 Other Business

15.1 Arrangements for SC-XVII

Dr Albert Fischer, on behalf of the IOC, offered to host the seventeenth session of the SC at IOC Headquarters in Paris, France. The SC accepted this offer. It was further agreed that the session would commence on Tuesday and end on Friday, beginning either 20 October 2009 or 27 October 2009. The final dates will be determined by the Chairman and Secretariat Director as soon as possible after checking on the availability of SC members and on possible scheduling conflicts. The Chairman also indicated that suggestions or offers for the 2010 venue would also be welcome.

15.2 Steering Committee Membership and Related Issues

The SC met, in camera, along with representatives of the Sponsors, to consider its advice to the Sponsors on future membership of the Committee. It noted that it had not been possible to finalize the appointment of four new members who had already been agreed by ICSU due to the need to revisit issues of geographical, discipline, and gender balance in the light of the WMO priorities and further vacancies expected in 2009. The SC reviewed a table of current members and suggested some replacement candidates.

The SC noted that it would be appropriate to submit a new integrated set of proposals to the Sponsors early in the new year. The list should consist of approximately 12 experts listed in priority order for seven vacancies. It was agreed that, in the light of the list of candidates reviewed and new proposals from SC members, within the following few weeks an integrated submission would be cleared with the Chairman and Panel Chairs before formal submission to the Executive Heads of the Sponsors through the established channels.

The Chairman advised that he had discussed the need for appointment of a new Chairman of the SC for 2010-11 with the Secretary-General of WMO and had agreed to consult informally and provide the Secretary-General with a short list of potential new Chairs early in the new year.

Action 35: SC Membership. The SC requested the Secretariat to prepare a consolidated list of proposals for new members on the basis of its advice, and to clear these with the Chairman and Panel Chairs before submitting them formally to the Secretary-General of WMO on behalf of the Sponsors early in 2009.

Action 36: New SC Chair. The SC requested the Chairman to continue confidential consultation on potential candidates for SC Chair 2010-2011 and provide a short list of candidates to the Secretary-General of WMO in the first quarter of 2009. The Chairman requested all members to provide him with their suggestions, in confidence, before the end of 2008.

15.3 Carbon offsetting GCOS Meetings

Dr Bojinski described a proposal by the GCOS Secretariat to make GCOS-related meetings more “climate-friendly,” that is, to compensate for the greenhouse gas emissions produced as a result of conducting GCOS-related meetings through climate change mitigation activities elsewhere. In doing so, GCOS would follow the example set by the UNFCCC (since 2005), other United Nations bodies and international organizations, and organizing committees of major events, such as the 2004 Olympic Games in Athens.

Given that air travel related to international and regional meetings accounts for more than 95 percent of total emissions (see e.g., FCCC/SBI/2005/9, paragraph 10), Dr Bojinski suggested following a top-down method for estimating GHG emissions, using schemes from existing organizations such as FutureForests or myclimate.org.

Carbon emissions related to the 2007 Sydney workshop (see item 10.1), jointly organized by GCOS, WCRP and IGBP, and largely funded through extra-budgetary sources, were offset through a contribution to a mitigation project in Cambodia (“Fuel wood saving with improved cookstoves in Cambodia”). This mitigation project, developed by the Zurich, Switzerland-based non-profit organization myclimate.org (www.myclimate.org) and implemented by the French NGO GERES (www.geres.eu), together with local manufacturers and authorities, supports the introduction of more efficient charcoal cooking devices in nine provinces of the country, thereby reducing both carbon emissions and the stress on local use of forests. Taking the top-down calculation approach used by myclimate.org, 381 tons of CO₂-equivalent caused by the workshop were offset at a price of 14 €/t CO₂-eq, resulting in a contribution to the project of total 5336 € (8954 CHF on 31 Oct 2007).

Using the same boundary conditions as in the above-mentioned case, the price for a carbon-offset certificate for the 2008 session of the GCOS Steering Committee, considering all participants’ air

travel only, would be at roughly 625 € (986 CHF on 26 Sep 2008). This is roughly 2.5 percent of total meeting costs.

Dr Bojinski noted that WMO EC-LX had requested that “the Secretary-General [...] develop a climate-friendly operations concept [for the WMO Secretariat],” but “emphasized that WMO regular budget resources must not be used to purchase carbon offsets.” (WMO ECLX, June 2008, Abridged final report with resolutions, WMO-No. 1032; paragraph 9.1.12).

After some discussion, the SC agreed, in principle, to explore ways to make GCOS secretariat operations more climate-friendly.

Action 37. Carbon offsetting GCOS meetings. The SC asked the GCOS Secretariat to consult with the GCOS Sponsors on the possibilities of supporting carbon-offsetting schemes, including a lump sum contribution from Secretariat funds. This support was intended to compensate for carbon emissions related to GCOS meetings. If no Secretariat-funded approach is deemed appropriate, the SC agreed that participants in GCOS meetings be invited to make voluntary personal contributions to such schemes.

16 Close of the Session

The Chairman closed the session at 1315 hrs on 17 October 2008 with thanks to the Sponsors, the Steering Committee members, invitees, and other participants and especially to Dr Alexander Karpov, Dr William Westermeyer, Dr Stephan Bojinski and all members of the GCOS Secretariat. He wished all members of the Steering Committee a successful year ahead.

APPENDIX I

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APPENDIX II

AGENDA FOR SC-XVI

1. Opening of the Session
 - 1.1 Welcome by the Chairman
 - 1.2 Welcome by WMO on behalf of the Sponsors
 - 1.3 Approval of Agenda
 - 1.4 Arrangements for the Session
2. Report of the Chairman
 - 2.1 Report on activities since SC-XV
 - 2.2 Major issues facing GCOS
 - 2.3 Expectations of the Session
3. GCOS Panel Reports
 - 3.1 Atmospheric Observation Panel for Climate
 - 3.2 Ocean Observations Panel for Climate
 - 3.3 Terrestrial Observation Panel for Climate
4. Secretariat Report, GCOS Secretariat
5. Sponsor Feedback and Guidance
 - 5.1 WMO
 - 5.2 IOC
 - 5.3 UNEP
 - 5.4 ICSU
6. GCOS Annual Report
 - 6.1 Review of draft GCOS Report 2007-2008
 - 6.2 Guidance for 2008-2009 Report
7. Role of Main Observing Systems Contributing to GCOS
 - 7.1 WMO Observing Systems
 - 7.2 GOOS
 - 7.3 GTOS
8. Review of GCOS Implementation Mechanisms
 - 8.1 Role of Space Agencies
 - 8.2 Regional Implementation Activities
 - 8.3 National GCOS Programmes
 - 8.4 System Improvement Activities
 - 8.5 The IPY legacy and the Global Cryosphere Watch
9. User Perspectives on the Extent to Which GCOS is Meeting User Needs
 - 9.1 WCRP and Other Climate Research Programmes

- 9.2 WCRP Observations and Assimilation Panel
 - 9.3 WCDMP: Monitoring and Data Management
 - 9.4 Climate Applications and Services
 - 9.5 Water Resources
 - 9.6 IPCC
 - 9.7 UNFCCC
 - 9.8 GCOS in Support of the UN System Coordinated Action on Climate Change
- 10. GCOS in Support of the IPCC and UNFCCC
 - 10.1 Learning from the IPCC AR4: Possible Implications for GCOS
 - 10.2 Observational Needs for Impacts Assessment and Adaptation
 - 10.3 Contribution to SBSTA/COP-14
 - 10.4 2009 Report to SBSTA and GCOS-92 update
- 11. GCOS as the Climate Contribution to GEOSS
 - 11.1 GEO Views on How GCOS Can Serve More Effectively as the Climate Component of GEOSS
 - 11.2 GCOS Views
 - 11.3 The GCOS Contribution to the GEO Work Plan 2009-11
- 12. GCOS and the World Climate Conference-3
- 13. GCOS Governance
 - 13.1 GCOS Memorandum of Understanding
 - 13.2 The GCOS Plan
 - 13.3 The Role of GCOS National Coordinators
- 14. The GCOS Work Programme to SC-XVII
 - 14.1 Recommendations and Action Items
 - 14.2 Advice to GCOS Sponsors
 - 14.3 Guidance to Panels
 - 14.4 Guidance to the Secretariat
- 15. Other Business
 - 15.1 Arrangements for SC-XVII
 - 15.2 Steering Committee Membership and Related Issues
 - 15.3 Carbon-offsetting GCOS Meetings
- 16. Close of the Session

APPENDIX III

LIST OF DOCUMENTS

Doc. No.	Description
1	<u>Provisional Agenda (Secretariat)</u>
1.1	<u>Opening of the Session (J. Zillman)</u>
1.2	<u>Welcome by WMO on behalf of the Sponsors</u>
1.3	<u>Approval of the Agenda (J. Zillman)</u>
1.4	<u>Arrangements for the Session (A. Karpov/W. Westermeyer)</u>
2	<u>Report of the Chairman, SC (J. Zillman)</u>
3.1	<u>Report of the Chairman, AOPC (A. Simmons)</u>
3.2	<u>Report of the Chairman, OOPC (E. Harrison)</u>
3.3	<u>Report of the Chairman, TOPC (H. Dolman)</u>
4	<u>GCOS Secretariat Report, (A. Karpov/W. Westermeyer/S. Bojinski)</u>
5.1	<u>Sponsor Feedback and Guidance: WMO (W. Zhang)</u>
5.2	<u>Sponsor Feedback and Guidance: IOC (A. Fischer)</u>
5.3	<u>Sponsor Feedback and Guidance: UNEP (N. Fernandez)</u>
5.4	<u>Sponsor Feedback and Guidance: ICSU (G. Glaser)</u>
6	<u>GCOS Annual Report (J. Zillman)</u>
7.1 INF.	<u>WMO Observing Systems Contributing to GCOS (J. Zillman)</u>
7.1.1	<u>WMO Observing Systems Contributing to GCOS - Update on WIGOS (A. Karpov)</u>
7.1.2	<u>WMO Observing Systems Contributing to GCOS (M. Ondras)</u>
7.1.3	<u>WMO Observing Systems Contributing to GCOS (L. Barrie)</u>
7.1.4	<u>WMO Observing Systems Contributing to GCOS (A. Tyagi/W. Grabs)</u>
7.2	<u>GOOS (A. Fischer)</u>
7.3	<u>GTOS (J. Latham)</u>
8.1.1	<u>Contribution by Space Agencies to GCOS Implementation (P. Mason/Secretariat)</u>
8.1.2	<u>CEOS Report (M. Goldberg by telephone)</u>
8.2	<u>Regional Implementation Activities (W. Westermeyer)</u>
8.3.1	<u>GCOS National Report: Switzerland (G. Seiz)</u>
8.3.2	<u>GCOS Implementation Issues at the National Level : Russian Federation (A. Zaitsev)</u>
8.3.3	<u>National GCOS Activities in Japan</u>
8.3.4	<u>National GCOS Activities in Australia (D. Walland)</u>
8.3.5	<u>National GCOS Activities in Germany (S. Rösner)</u>
8.3.6	<u>Main Elements of the French Response to the GCOS IP (GCOS-92) (R. du Juvanon du Vachat)</u>
8.4.1	<u>System Improvement Activities (GSN, GUAN, etc.) (R. Thigpen)</u>
8.4.2	<u>Report of the Fourth Meeting of the GCOS Cooperation Board (Secretariat)</u>
8.5	<u>The IPY Legacy (E. Sarukhanian)</u>
9.1	<u>WCRP and Other Climate Research Programmes (G. Asrar)</u>
9.2	<u>WCRP Observations and Assimilation Panel (K. Trenberth)</u>
9.3	<u>WCDMP: Monitoring and Data Management (O. Baddour)</u>
9.4	<u>Climate Applications and Services (R. Kolli)</u>
9.5	<u>Water Resources (A. Tyagi / W. Grabs)</u>
9.6	<u>IPCC (R. Christ)</u>
9.7	<u>UNFCCC (R. Lichte)</u>
9.8	<u>GCOS in Support of the UN System Response to Climate Change (E. Manaenkova)</u>
9.8 INF. 1	<u>Letter from the UN Secretary General dated 30 May 2008</u>
9.8 INF. 2	<u>UN Climate Change Knowledge Initiative</u>
10.1	<u>Learning from the IPCC 4th Assessment Report: Possible Implications for GCOS (Secretariat)</u>
10.2	<u>Observational Needs for Impacts Assessment and Adaptation (M. Glantz)</u>
10.3.1	<u>Draft Statement to SBSTA-29/COP-14 (W. Westermeyer/J. Zillman)</u>
10.3.2	<u>GCOS Views on Adaptation under the AWG-LCA (W. Westermeyer)</u>
10.4	<u>2009 GCOS Progress Report and GCOS-92 Update (P. Mason/S. Bojinski)</u>

11.1	<u>GCOS as the Climate Observing Component of GEOSS (J. Zillman)</u>
11.2	<u>The GCOS Contribution to GEOSS and the GEO Work Plan 2009-11 (S. Bojinski)</u>
11.3	<u>GEO Views on How GCOS Can Serve More Effectively as the Climate Component of GEOSS (M. Tanner)</u>
12	<u>GCOS and the World Climate Conference-3 (WCC-3) (S. Rösner and W. Nyakwada)</u>
13.1	<u>GCOS Memorandum of Understanding (J. Zillman)</u>
13.2	<u>The GCOS Plan (J. Zillman)</u>
13.3	<u>The Role of GCOS National Coordinators (W. Westermeyer)</u>
15.2	<u>Carbon-offsetting GCOS Meetings (S. Bojinski)</u>
INF.1	<u>Provisional List of Participants</u>

APPENDIX IV

MAJOR ISSUES FOR GCOS AS NOTED BY THE WOAP CHAIR

IPCC and GIP update. As IPCC develops the scope of the AR5, it will be important that observation needs are considered and included appropriately. The GSC should invite IPCC to participate fully in the review of the GIP and help identify observation needs for the AR5 and beyond. WCRP groups should contribute as required through expert meetings and written contributions to the review of the GIP.

Cryosphere ECVs. Some questions have been raised in the research community about the handling of ECVs in the cryosphere in the GCOS Implementation Plan. It would be appropriate for the GCOS Panels to liaise with the CliC community to review the handling of ECVs in the cryosphere in the GIP. The CliC SSG and the GCOS Panels should examine the list of cryosphere ECVs for completeness, bearing in mind the IGOS Cryosphere observational requirements for snow and ice. This action should be done as part of the current revision of the GIP. In the longer term, the WMO Global Cryosphere Watch (GCW) is expected to play a role in this process and in the implementation of the appropriate observing systems.

GRUAN. The GRUAN was identified in the GIP as a high-priority addition to the global climate observing system. The WOAP endorses the initiatives of AOPC to promote the development of the GRUAN and encourages the Panel to maintain close scientific oversight of the project.

Continuity of observations. Continuity needs to be further promoted in agencies that fund sustained observation networks for climate in all domains. The JSC and the GSC should continue to promote the vital importance of continuing support of sustained observing systems for climate research and applications

Ozone profile observations. Continuity of satellite capability for limb atmospheric profiling for some important species beyond 2013 is under threat. Currently, several satellite instruments provide global measurements of stratospheric ozone profiles with good vertical resolution (ACE-FTS/SCISAT-1, GOMOS/Envisat, MAESTRO/SCISAT-1, MIPAS/Envisat, MLS/AURA, OSIRIS/Odin, SCIAMACHY/Envisat, SABER/TIMED, SMR/Odin). However, the number of vertical profiling sensors will decrease significantly over the next several years, and the continuity of the satellite record of ozone (and other stratospheric key species) profiles, especially in limb viewing mode, is jeopardized. The only secured future ozone profile sensor is the OMPS (Ozone Mapping and Profiling Suite) to fly on NPP (NPOESS Preparatory Project). There will likely be another OMPS-Limb sensor on one of the NPOESS satellites, but other future missions have not yet been confirmed. As part of its continuing dialogue with CEOS, WOAP should draw attention to the possible intermediate-term gap in the monitoring of profiles of ozone and related species.

Terrestrial ECVs. The TOPC should consider the organization of some workshops and related activities to promote the development of land-domain data sets that meet the GCOS Monitoring Principles.

GEO interactions. The JSC and GSC should jointly request GEO to provide vital support to the global monitoring systems by (i) the promotion of data sharing across all nations, (ii) the development of international standards and regulations for the consistent monitoring of ECVs and related variables, and (iii) to promote the support by all nations to the global environmental monitoring systems. A critical example is the need to allow open access to hydrological data across the world; access to these data will be vital for the world to manage water availability in the coming decades. A further example is the need for sub-daily climate data to support the analysis of extreme events which have substantial impacts on human activities and natural ecosystems.

De-manifested climate instruments on NPOESS. The continuing possibility exists for a substantially reduced observing capability for climate purposes on NPOESS. In the continuing dialogue with CEOS, the JSC and GSC should continue to promote the importance of restoring the climate instruments on NPOESS or other platforms. WOAP expressed its support for the re-manifestation of the climate instruments on NPOESS

Climate Data Records. International collaboration on the development of climate data records is desirable. In the continuing dialogue with CEOS, the JSC and GSC should develop a mechanism

to enable CEOS to draw on the experience of WCRP programs in the development of FCDRs based on satellite data.

SST microwave observations. Continuity of the microwave SST data record is at risk. The GCOS Implementation Plan notes the value of microwave instruments in monitoring SSTs in all weather, and so the satellite agencies are encouraged to ensure the continuity of these measurements.

Ocean color. Potential lack of continuity in the climate record for high quality ocean color exists. As ocean color instruments evolve there is a tendency for the specific bands to change and for quality to be compromised. There is a need to ensure the high quality of the MODIS and other records continues into the future

VOS. The continuing decline in number of multivariate meteorological observations from VOS and loss of unique platform identifiers is a major concern. Owing to a range of resource and priority issues, support for the collection of VOS data has been declining. Platform identifiers are vital for quality control and bias correction. Insofar as these data provide valuable contributions to the global climate record, WOAP strongly encourages the relevant national meteorological agencies and commercial operators to support this activity.

ICOADS. ICOADS is an essential part of the climate data record, and a model for open data exchange. WOAP encourages the continual update of ICOADS and enhancement of its archive. This will require additional resources.

ISCCP. After the upgrade of ISCCP to climate data record quality, it is desirable to continue the record in an operational mode into the future. WOAP recognized the desirability of the transfer of the ISCCP processing system from NASA to NOAA in 2010 as a demonstration of the value and maturity of the ISCCP products, which were developed under the auspices of WCRP. The transfer of this system from research to operations is appropriate and could be a model for other data sets in the future. WOAP encourages the relevant agencies to ensure that the research community maintains a role in the scientific oversight and evaluation of ISCCP products after the transfer in 2010.

Dataset and product evaluation. WOAP is encouraged by the increasing number of global climate data sets and products being generated around the world. It is important for WCRP and GCOS to contribute to the continuing assessment and evaluation of these data and products in cooperation with the producers. WOAP encourages agencies to support the organization of workshops and working groups to support these activities.

Proliferation and coordination of reanalyses. There are an expanding number of atmospheric reanalysis efforts around the world and the associated cost of each activity is substantial. WOAP again notes the desirability for staggered reanalyses and is concerned about the evaluation of the resulting datasets. It is desirable to optimize the benefit of successive activities as they build on the lessons of previous activities.

Reanalyses of the Earth system. The scope of reanalysis continues to expand. The societal needs for reanalysis products across all climate variables means that reanalysis and associated data assimilation research is expanding to include the entire earth system. This research effort is a major initiative and will require close international cooperation to ensure that progress is based on the best science. The WCRP and GCOS communities will work closely with the relevant agencies to support these activities. The scientific challenges associated with these developments will require major commitments of expertise and infrastructure in the future.

Dataset development for reanalysis. There is a need for common data sets for reanalysis and climate diagnostics. The Working Group on Reanalysis Data Sets has made excellent progress in achieving its terms of reference. The Group has created an inventory of relevant data sets around the world, and there has been some progress in augmenting some data sets by building on existing data sets. It will be appropriate to get a commitment from groups preparing future global reanalysis to make use of the common data sets being coordinated by the Working Group. WOAP should write a letter supporting importance of data activities on reanalysis. It should support the incorporation of Haimberger updates to new sonde records in ways that retain the original records. It should emphasize the need for improved access and data availability, and catalogs. The activity likely needs resources, which might be garnered by proposals that exploit the WG connections. The activities should establish and identify and stability, so that some of this could be more formalized as a sustained commitment.

APPENDIX V

CONSOLIDATED LIST OF ACTIONS

Action 1: Report to Sponsors. The SC requested the Chairman to report to the Sponsors on the outcome of SC-XVI before the end of 2008 and to guide and assist the GCOS Secretariat, under its new Director, in ensuring prompt follow-up on the SC priority actions for 2009.

Action 2: Secretariat Arrangements. Further to the actions taken by the Chairman, the SC encouraged the Sponsors to review the role and representation of the GCOS Secretariat in the new structure of the WMO Secretariat to ensure that the new arrangements fully reflect the joint sponsorship of GCOS and the intent of the GCOS MOU.

Action 3: Guidelines on data sets and products. The SC requested the Secretariat to expand the scope of the guidelines to in-situ observations and arrange for their review by the Panels and Sponsor representatives.

Action 4: OceanObs'09. The SC requested the Chairman, the Secretariat, and the Sponsors to help ensure the success of OceanObs'09, especially in respect of its outcomes on ocean observations for climate.

Action 5: Soil moisture as an ECV. The SC supported the development of soil moisture as an ECV and encouraged all agents of implementation, such as CAgM, WCRP, and space agencies to work towards coordinated soil moisture observations from in-situ and space-based observing systems. The SC also requested the GCOS secretariat to ensure representation of soil moisture in the WMO/CEOS observational requirements database.

Action 6: Newsletter. The SC requested the Secretariat to update it (and the broader GCOS community) every few months on key activities and on important forthcoming events and issues via a simple brief email newsletter or similar mechanism.

Action 7: Secretariat funding. The SC requested the Chairman, as a matter of urgency, to brief the Sponsors on the precarious state of funding for the GCOS Secretariat and to urge that, for 2009-2010, they at least maintain the level of funding provided in recent years.

Action 8: GCOS budget. The SC requested the Chairman to work with the Secretariat to develop a comprehensive budget for the following years for submission to the Executive Heads of the Sponsors.

Action 9: Annual Report. The SC requested that the Chairman and the Secretariat complete the 2007-08 Annual Report, give it a GCOS number, transmit it to the Sponsors, and consider where else it might be distributed.

Action 10: GOS Support for Climate. The SC requested the GCOS Secretariat to ensure coordination with the CCI Secretariat to provide consistent and coordinated input to the WMO RRR process related to climate requirements of the surface-based component of the GOS.

Action 11: Atmospheric Chemistry. The SC requested the AOPC to explore the status of coordination arrangements in the area of atmospheric chemistry, involving GAW, non-GAW networks, the space community, and other relevant communities contributing to the atmospheric chemistry components of GCOS.

Action 12: Strengthening hydrological observations. The SC requested the Chairman to urge the GCOS Sponsors to elevate the issue of the continuing decline of hydrological networks to the level of UN Water. It asked the Secretariat to work with the WMO Climate and Water Department to help better explain the need for and relevance of hydrological observations for the full range of climate purposes. It also requested the Chairman to continue to liaise with the President of the WMO Commission for Hydrology in respect of the Commission's overall contribution to the implementation of the hydrological components of GCOS.

Action 13. Joint side events at SBSTA. The SC encouraged joint/combined side events at SBSTA 30 when the 2009 Progress Report and Update of GCOS 92 are introduced, as this would be one means of showing how GOOS, GTOS, and WIGOS are serving the needs of the UNFCCC within the framework of GCOS.

Action 14. Climate Observations from Space. The SC requested the Chairman, Panel Chairs, and Secretariat to take all appropriate steps to encourage and assist the space-based Earth observation community to ensure the long-term continuity of all essential climate observations from space.

Action 15. ClimDev Africa. The SC requested the Secretariat to continue its efforts to help the ClimDev Africa Programme get established, and, once established, to pursue opportunities that may develop through it to facilitate improvements in climate observing networks and systems in Africa.

Action 16. GCOS regional activities. The SC encouraged the Secretariat to organize activities in other regions similar to the Belize implementation strategy meeting as a means to promote implementation of Action Plan projects. The SC urged the Sponsors to assist in raising financial support for holding such workshops.

Action 17. Observations and regional modeling project. The SC encouraged the Secretariat to consider alternatives for funding the observations and regional modeling project if satisfactory arrangements for World Bank support could not be achieved.

Action 18. CBS Lead Centers. The SC requested the Secretariat to coordinate with the WMO Observing and Information Systems (OBS) Department and the Development and Regional Activities Department (DRA) to ensure the continuity of support to the CBS Lead Centers, including establishment of the necessary leadership, guidance and budget support for the biennial coordination meetings.

Action 19. GCOS Cooperation Mechanism. The SC urged the GCOS Sponsors to encourage their Members to participate in the GCM. It requested the Secretariat to organize the 5th GCM session in 2009 in concert with the SBSTA-30 session in Bonn in June 2009. It also requested the Secretariat to work with the ad hoc GCM Donor Board Chair to coordinate the development of an invitation letter and agenda.

Action 20: CLIMAT reporting. The SC encouraged CBS Lead Centers for GCOS to see what they can do to encourage all CLIMAT stations to report on a regular monthly basis and to promote the preparation of CLIMAT messages at key stations that do not currently report CLIMAT.

Action 21: WCDMP and GCOS collaboration. The SC agreed that the WCDMP and GCOS Secretariats should explore the scope for coordination of regional activities in the future and/or organize joint workshops to promote a common understanding of requirements and needs for observations, climate data, and climate services.

Action 22: GCOS support for adaptation. The SC requested the Secretariat to ensure that GCOS activities related to the needs of the adaptation community are appropriately coordinated with the WMO Initiative on Adaptation to Climate Change (WIACC).

Action 23: Climate information for water management. The SC requested the Secretariat to work with the WMO Climate and Water Department to develop an expanded formulation of the needs of water managers for climate observations.

Action 24. GOSIC report to SC-XVII. The SC requested the Secretariat to organize a status report on GOSIC for SC-XVII, as had been provided to earlier SC sessions.

Action 25. IPCC AR5 identification of climate observing needs. The SC requested the Secretariat to consult with the Joint Planning Staff for the WCRP with a view to a joint approach from the Chairs of the Joint Scientific Committee of WCRP and the GCOS SC to the Chairman of the IPCC to urge that the IPCC AR5 address future needs for research and observations to support future assessments. The SC also recommended that the IPCC be invited to participate fully in the review of the GCOS-92 Implementation Plan and help to identify observation needs for the AR5 and beyond.

Action 26. Observations for Adaptation: The SC requested the Secretariat to consult with the Secretariats of IGBP, Diversitas, GTOS, UNEP, etc. in assessing and building observation capacity for adaptation. It asked for the preparation of a strategy document on the GCOS role in support of adaptation for consideration at its 17th session.

Action 27. The 2009 Report and GCOS-92 Update. The SC requested the Secretariat to do everything possible to ensure that the 2009 Progress Report and the planned update of the GCOS-92 Implementation Plan are completed in good time and that Prof Paul Mason and the Panel Chairs are provided with the necessary support.

Action 28. GEO workshop. The SC expressed appreciation for the GEO Secretariat offer to organize a workshop in 2009 to discuss and coordinate the efforts of GEO climate task teams and address gaps, synergies, and linkages and agreed that, as far as possible given existing commitments and available resources, the SC and the GCOS Secretariat would be pleased to collaborate in this activity.

Action 29. Harmonizing of GCOS and GEOSS. The SC requested the Chairman, the Panels, and the Secretariat to continue to work toward alignment of the objectives, targets, and workplans of GCOS and the GEOSS Climate SBA.

Action 30: GEOSS Climate SBA targets. The SC requested the Secretariat, on behalf of the Chairman, to advise the GEO Secretariat on the proposed reformulated target statement for the GEOSS Climate SBA prepared by the SC.

Action 31. GCOS and WCC-3. The SC requested its members and the Secretariat to contribute as much as possible to helping the GCOS representative on the WCC-3 planning process, Mr Stefan Rösner, ensure that GCOS and climate observations issues are properly treated at the Conference.

Action 32. Revising the GCOS MOU. The SC requested the Chairman and the Secretariat to draw its views on revision of the GCOS MOU, as summarized above, to the attention of the Sponsors.

Action 33: GCOS Strategic Plan. The SC requested the Secretariat to finalize the draft GCOS Plan, with appropriate input and review by SC members, in parallel with work on updating GCOS-92, with a view to the revised Plan being completed by mid-2009.

Action 34. GCOS National Coordinators. The SC asked the Secretariat to facilitate, through the ICPC, the sending of a letter from the GCOS Sponsors to appropriate national authorities to encourage the appointment of GCOS National Coordinators and establishment of GCOS National Committees.

Action 35: SC Membership. The SC requested the Secretariat to prepare a consolidated list of proposals for new members, on the basis of its advice, and to clear these with the Chairman and Panel Chairs before submitting them formally to the Secretary-General of WMO on behalf of the Sponsors early in 2009.

Action 36: New SC Chair. The SC requested the Chairman to continue confidential consultation on potential candidates for SC Chair 2010-2011 and provide a short list of candidates to the Secretary-General of WMO in the first quarter of 2009. The Chairman requested all members to provide him with their suggestions, in confidence, before the end of 2008.

Action 37. Carbon offsetting GCOS meetings. The SC asked the GCOS Secretariat to consult with the GCOS Sponsors on the possibilities of supporting carbon-offsetting schemes, including a lump sum contribution from Secretariat funds. This support was intended to compensate for carbon emissions related to GCOS meetings. If no Secretariat-funded approach is deemed appropriate, the SC agreed that participants in GCOS meetings make voluntary personal contributions to such schemes.

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List of GCOS Publications

- GCOS-1**
(WMO/TD-No. 493) Report of the first session of the Joint Scientific and Technical Committee for GCOS (Geneva, Switzerland, April 13-15, 1992)
- GCOS-2**
(WMO/TD-No. 551) Report of the second session of the Joint Scientific and Technical Committee for GCOS (Washington DC, USA, January 11-14, 1993)
- GCOS-3**
(WMO/TD-No. 590) Report of the third session of the Joint Scientific and Technical Committee for GCOS (Abingdon, UK, November 1-3, 1993)
- GCOS-4**
(WMO/TD-No. 637) Report of the fourth session of the Joint Scientific and Technical Committee for GCOS (Hamburg, Germany, September 19-22, 1994)
- GCOS-5**
(WMO/TD-No. 639) Report of the GCOS Data System Task Group (Offenbach, Germany, March 22-25, 1994)
- GCOS-6**
(WMO/TD-No. 640) Report of the GCOS Atmospheric Observation Panel, first session (Hamburg, Germany, April 25-28, 1994)
- GCOS-7**
(WMO/TD No. 641) Report of the GCOS Space-based Observation Task Group (Darmstadt, Germany, May 3-6, 1994)
- GCOS-8**
(WMO/TD No. 642) Report of the GCOS/GTOS Terrestrial Observation Panel, first session (Arlington, VA, USA, June 28-30, 1994) (UNEP/EAP.MR/94-9)
- GCOS-9**
(WMO/TD-No. 643) Report of the GCOS Working Group on Socio-economic Benefits, first session (Washington DC, USA, August 1-3, 1994)
- GCOS-10**
(WMO/TD-No. 666) Summary of the GCOS Plan, Version 1.0, April 1995
- GCOS-11**
(WMO/TD-No. 673) Report of the GCOS Data and Information Management Panel, first session (Washington DC, USA, February 7-10, 1995)
- GCOS-12**
(WMO/TD-No. 674) The Socio-economic Benefits of Climate Forecasts: Literature Review and Recommendations (Report prepared by the GCOS Working Group on Socio-economic Benefits), April 1995
- GCOS-13**
(WMO/TD-No. 677) GCOS Data and Information Management Plan, Version 1.0, April 1995
- GCOS-14**
(WMO/TD-No. 681) Plan for the Global Climate Observing System (GCOS), Version 1.0, May 1995
- GCOS-15**
(WMO/TD-No. 684) GCOS Plan for Space-based Observations, Version 1.0, June 1995
- GCOS-16**
(WMO/TD-No. 685) GCOS Guide to Satellite Instruments for Climate, June 1995
- GCOS-17**
(WMO/TD-No. 696) Report of the GCOS Atmospheric Observation Panel, second session (Tokyo, Japan, March 20-23, 1995)
- GCOS-18**
(WMO/TD-No. 697)
(UNEP/EAP.MR/95-10) Report of the GCOS/GTOS Terrestrial Observation Panel, second session (London, UK, April 19-21, 1995)

GCOS-19 (WMO/TD-No. 709)	Report of the GCOS Data Centre Implementation/Co-ordination Meeting (Offenbach, Germany, June 27-29, 1995)
GCOS-20 (WMO/TD-No. 720)	GCOS Observation Programme for Atmospheric Constituents: Background, Status and Action Plan, September 1995
GCOS-21 (WMO/TD-No. 721) (UNEP/EAP.TR/95-07)	GCOS/GTOS Plan for Terrestrial Climate-related Observations, version 1.0, November 1995
GCOS-22 (WMO/TD-No. 722)	Report of the fifth session of the Joint Scientific and Technical Committee for GCOS (Hakone, Japan, October 16-19, 1995)
GCOS-23 (WMO/TD-No. 754) (UNEP/DEIA/MR.96-6) (FAO GTOS-1)	Report of the GCOS/GTOS Terrestrial Observation Panel for Climate, third session (Cape Town, South Africa, March 19-22, 1996)
GCOS-24 (WMO/TD-No. 768) (UNESCO/IOC)	Report of the Joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate, first session (Miami, Florida, USA, March 25-27, 1996)
GCOS-25 (WMO/TD-No. 765) (UNEP/DEIA/MR.96-5)	Report of the GCOS Data and Information Management Panel, second session (Ottawa, Ontario, Canada, May 14-17, 1996)
GCOS-26 (WMO/TD-No. 766)	Report of the Joint CCI/CBS Expert Meeting on the GCOS Surface Network (Norwich, UK, March 25-27, 1996)
GCOS-27 (WMO/TD-No. 772) (UNEP/DEIA/MR.96-7)	Report of the Expert Meeting on Hydrological Data for Global Observing Systems (Geneva, Switzerland, April 29-May 1, 1996)
GCOS-28 (WMO/TD-No. 793) (UNEP/DEIA/MR.97-3)	<i>In Situ</i> Observations for the Global Observing Systems (Geneva, Switzerland, September 10-13, 1996)
GCOS-29 (WMO/TD-No. 794) (UNEP/DEIA/MR.97-4)	Report of the Global Observing Systems Space Panel, second session (Geneva, Switzerland, October 16-18, 1996)
GCOS-30 (WMO/TD-No. 795)	Report of the sixth session of the Joint Scientific and Technical Committee for GCOS (Victoria, British Columbia, Canada, October 28-November 1, 1996)
GCOS-31 (WMO/TD-No. 803)	Proceedings of the fifth meeting of the TAO Implementation Panel (TIP-5) (Goa, India, November 18-21, 1996)
GCOS-32 (WMO/TD-No. 796)	GCOS/GTOS Plan for Terrestrial Climate-related Observations, version 2.0, June 1997
GCOS-33 (WMO/TD-No. 798)	GHOST - Global Hierarchical Observing Strategy, March 1997
GCOS-34 (WMO/TD-No. 799)	Initial Selection of a GCOS Surface Network, February 1997
GCOS-35 (WMO/TD-No. 839)	Report of the second Joint CCI/CBS Meeting on the GCOS Surface Network (De Bilt, The Netherlands, June 25-27, 1997)

GCOS-36 (WMO/TD-No. 844) (UNESCO/IOC)	Report of the Joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate, second session (Cape Town, South Africa, February 11-13, 1997)
GCOS-37 (WMO/TD-No. 845) (GOOS-10) & (GTOS-9)	Report of the Global Observing Systems Space Panel, third session (Paris, France, May 27-30, 1997)
GCOS-38 (WMO/TD-846) (GTOS-10)	Report of the Meeting of Experts on Ecological Networks (Guernica, Spain, June 17-20, 1997)
GCOS-39 (WMO/TD-No. 847) (GOOS-11) & (GTOS-11) (UNEP/DEIA/MR.97-8)	Report of the GCOS/GOOS/GTOS Joint Data and Information Management Panel, third session (Tokyo, Japan, July 15-18, 1997)
GCOS-40 (WMO/TD-No. 848)	Report of the GCOS/WCRP Atmospheric Observation Panel for Climate, third session (Reading, UK, August 19-22, 1997)
GCOS-41 (WMO/TD-No. 849)	Report of the Joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate (OOPC) Ocean Climate Time-Series Workshop, (Baltimore, (GOOS-33), MD, USA, March 18-20, 1997)
GCOS-42 (WMO/TD-No. 857)	Report of the seventh session of the Joint Scientific and Technical Committee for GCOS (Eindhoven, The Netherlands, September 22-26, 1997)
GCOS-43a (GOOS-36)	TAO Implementation Panel, sixth session (Reading, U.K., November 4-6, 1997)
GCOS-43b (GOOS-55)	International Sea Level Workshop (Honolulu, Hawaii, USA, June 10-11, 1997)
GCOS-44 (GOOS-61)	Report of the Joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate (OOPC), third session (Grasse, France, April 6-8, 1998)
GCOS-45 (WMO/TD-No. 922) (GOOS-58) & (GTOS-16) (UNEP/DEIA/MR.98-6)	Report of the Joint Meeting of the GCOS/WCRP Atmospheric Observation Panel for Climate and the GCOS/GOOS/GTOS Joint Data and Information Management Panel, fourth session (Honolulu, Hawaii, USA, April 28-May 1, 1998)
GCOS-46 (GTOS-15)	Report of the GCOS/GTOS Terrestrial Observation Panel for Climate, fourth session (Corvallis, USA, May 26-29, 1998)
GCOS-47 (WMO/TD-No. 941) (GOOS-67) (GTOS-20)	Report of the Global Observing Systems Space Panel, fourth session, (College Park, Maryland, USA, October 22-23, 1998)
GCOS-48	Report on the Adequacy of the Global Climate Observing Systems (United Nations Framework Convention on Climate Change, November 2-13 1998, Buenos Aires, Argentina)
GCOS-49 (GOOS-64)	Implementation of Global Ocean Observations for GOOS/GCOS, first session (Sydney, Australia, March 4-7, 1998)
GCOS-50 (GOOS-65)	Implementation of Global Ocean Observations for GOOS/GCOS, second session (Paris, France, November 30, 1998)

GCOS-51 (GOOS-66)	Global Ocean Observations for GOOS/GCOS: An Action Plan for Existing Bodies and Mechanisms
GCOS-52 (GOOS-68)	TAO Implementation Panel, seventh session (Abidjan, Ivory Coast, November 11-13, 1998)
GCOS-53 (WMO/TD-No. 958)	GCOS Surface Network (GSN) Monitoring Centre Implementation Meeting (Offenbach, Germany, January 19-20, 1999)
GCOS-54 (WMO/TD-No. 953)	Report of the eighth session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS (Geneva, Switzerland, February 9-12, 1999)
GCOS-55	Report of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC), fifth session (Silver Spring, MD, USA, April 20-23, 1999)
GCOS-56 (GOOS-75)	Special Report of the Joint GCOS/GOOS/WCRP Ocean Observations Panel for Climate (OOPC), fourth session (May 17, 1999); The CLIVAR Upper Ocean Panel (UOP), fourth session (May 21, 1999); A Joint Planning Meeting of the OOPC and the UOP for the OCEANOBS99 Conference (Woods Hole, MA, USA, May 18-20, 1999)
GCOS-57 (WMO/TD-No. 978) (GOOS-79)	Report of the OOPC/AOPC Workshop on Global Sea Surface Temperature Data Sets (Palisades, N.Y., USA, November 2-4, 1998)
GCOS-58 (GOOS-71)	Report of the sixth session of the IOC Group of Experts on the Global Sea Level Climate Observing System (GLOSS)
GCOS-59 (GTOS-22)	Report of the GCOS/GTOS Terrestrial Observation Panel for Climate, fifth session (Birmingham, UK, July 27-30, 1999)
GCOS-60 (WMO/TD-No. 1004) (GOOS-70)	GCOS/GOOS/GTOS Joint Data and Information Management Plan, Version 1.0, May 2000
GCOS-61 (WMO/TD-No. 1031)	Report of the ninth session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS (Beijing, China, September 12-14, 2000)
GCOS-62 (WMO/TD-No. 1038)	Report of the Pacific Islands Regional Implementation Workshop on Improving Global Climate Observing Systems (Apia, Samoa, August 14-15, 2000)
GCOS-63 (WMO/TD-No. 1047) (GTOS-26)	Establishment of a Global Hydrological Observation Network for Climate. Report of the GCOS/GTOS/HWRP Expert Meeting (Geisenheim, Germany, June 26-30, 2000)
GCOS-64 (GOOS-107)	Report of the eighth session of the TAO Implementation Panel (TIP-8) (St. Raphael, France, October 15, 1999)
GCOS-65 (WMO/TD-No. 1055)	Report of the sixth session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC) (Geneva, Switzerland, April 10-13, 2000)
GCOS-66 (GOOS-108)	Report of the ninth session of the TAO Implementation Panel (TIP-9) (Perth, Australia, November 16-17, 2000)
GCOS-67 (WMO/TD-No. 1072)	GCOS Implementation Strategy: Implementing GCOS in the New Millennium

GCOS-68 (WMO/TD-No. 1093)	Report of the seventh session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC) (Geneva, Switzerland, April 30-3 May, 2001)
GCOS-69 (GOOS-98)	Report of the fifth session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), Bergen, Norway, June 20-23, 2000
GCOS-70 (GOOS-113)	Report of the sixth session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), Melbourne, Australia, May 2-5, 2001
GCOS-71 (WMO/TD-No. 1099) (GTOS-29)	Report of the GCOS/GTOS/HWRP Expert Meeting on the Implementation of a Global Terrestrial Network - Hydrology (GTN-H), Koblenz, Germany, June 21-22, 2001
GCOS-72 (GOOS-116)	Report of the seventh session of the IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Honolulu, April 26-27, 2001
GCOS-73 (WMO/TD-No. 1106)	Manual on the GCOS Surface and Upper-Air Networks: GSN and GUAN, April 2002
GCOS-74 (WMO/TD-No. 1109)	Report of the GCOS Regional Workshop for Eastern and Southern Africa on Improving Observing Systems for Climate, Kisumu, Kenya, October 3-5, 2001
GCOS-75 (WMO/TD-No. 1124)	Summary Report of the tenth session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS, Farnham, UK, April 15-19, 2002
GCOS-76 (WMO/TD-No. 1125)	Report of the eighth session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC), Wokingham, UK, May 20-24, 2002
GCOS-77 (GOOS-122)	International Workshop for Review of the Tropical Moored Buoy Network, September 10-12, 2001, Seattle, Washington, USA. Workshop Report
GCOS-78 (WMO/TD-No. 1126)	Report of the GCOS Regional Workshop for Central America and the Caribbean. "Observing Climate from Weather Extremes to Coral Reefs", San José, Costa Rica, March 19-21, 2002 (disponible también en español)
GCOS-79 (WMO/TD-No. 1133)	Interim Report to the sixteenth session of the Subsidiary Body for Scientific and Technological Advice of the UNFCCC by the Global Climate Observing System, Bonn, Germany, June 5-14, 2002
GCOS-80 (WMO/TD-No.1140)	Report of the GCOS Regional Workshop for East and Southeast Asia on Improving Observing Systems for Climate, Singapore, September 16-18, 2002
GCOS-81 (GOOS-124)	Seventh session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), Kiel, Germany, June 5-8, 2002
GCOS-82 (WMO/TD-No.1143)	Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC
GCOS-82 (ES) (WMO/TD-No.1176)	Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC – Executive Summary

GCOS-83 (WMO/TD-No.1155) (GTOS-33)	Report of the Global Terrestrial Network - Hydrology (GTN-H) Coordination Panel Meeting, Toronto, Canada, November 21-22, 2002
GCOS-84 (WMO/TD-No.1156) (GTOS-32)	Report of the GCOS/GTOS/HWRP Expert Meeting on Hydrological Data for Global Studies, Toronto, Canada, November 18-20, 2002
GCOS-85 (WMO/TD-No.1167)	Report of the GCOS Regional Workshop for Western and Central Africa on Improving Observing Systems for Climate, Niamey, Niger, March 27-29, 2003 (disponible en français)
GCOS-86 (WMO/TD-No.1183)	Report of the GCOS Regional Workshop for South America on Improving Observing Systems for Climate, Santiago, Chile, October 14-16, 2003 (disponible también en español)
GCOS-87 (WMO/TD-No.1189)	Summary Report of the eleventh session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS, Melbourne, Australia, April 7-10, 2003
GCOS-88 (WMO/TD-No. 1190)	Conclusions from the ninth session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC), Asheville, NC, USA, June 23-27, 2003
GCOS-89 (GOOS-140)	Report of the Eighth session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), Ottawa, Canada, September 3-6, 2003
GCOS-90 (GOOS-141)	IOC Group of Experts on the Global Sea Level Observing System (GLOSS), eighth session, Paris, France, October 13 and 16-17, 2003
GCOS-90bis	Report of the GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC), seventh session, Rome, Italy, December 16-18, 2003
GCOS-91 (WMO/TD-No.1221)	Summary Report of the twelfth session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS, Geneva, Switzerland, March 15-19, 2004
GCOS-91bis	Conclusions from the tenth session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC), Geneva, Switzerland, April 19-23, 2004
GCOS-92 (WMO/TD-No.1219)	Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC
GCOS-92 (ES) (WMO/TD-No.1244)	Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC – Executive Summary
GCOS-93 (WMO/TD-No.1238) GTOS-35	Summary Report of the eighth session of the GTOS/GCOS Terrestrial Observation Panel for Climate, Ispra, Italy, April 6-7, 2004
GCOS-94 (WMO/TD-No.1248)	Report of the GCOS Regional Workshop for Central Asia on Improving Observing Systems for Climate, Almaty, Kazakhstan, May 24-26, 2004 (имеется также на русском языке)
GCOS-95 (GOOS-143)	Report of the ninth session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), Southampton, UK, June 7-10, 2004
GCOS-96 (WMO/TD-No. 1255)	Analysis of Data Exchange Problems in Global Atmospheric and Hydrological Networks

GCOS-97 (WMO/TD-No. 1259)	Report of the GCOS Regional Workshop for South and Southwest Asia on Improving Observing Systems for Climate, New Delhi, India, October 11-13, 2004
GCOS-98 (GOOS-146)	Progress with the Initial Ocean Climate Observing System: A Report to the UNFCCC – April 2005
GCOS-99 (GOOS-149)	IOC Group of Experts on the Global Sea Level Observing System (GLOSS), ninth session, Paris, France, February 24-25, 2005
GCOS-100 (WMO/TD-No. 1283)	Report of the GCOS Regional Workshop for Eastern and Central Europe on Improving Observing Systems for Climate, Leipzig, Germany, April 26-28, 2005
GCOS-101 (WMO/TD-No. 1298) (GTOS-37)	Report of the 2nd Meeting of the GTN-H Coordination Panel, Koblenz, Germany, July 4-5, 2005
GCOS-102	Conclusions from the eleventh session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC), Geneva, Switzerland, April 11-15, 2005
GCOS-103 (WMO/TDN-No 1341)	Summary report of the thirteenth session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS, St Petersburg, Russian Federation, 5-8 October 2005
GCOS-104 (GOOS-150)	Report of the tenth session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate Tenth, Geneva, Switzerland, May 9-12, 2005
GCOS-105 (WMO/TD-No. 1374)	Conclusions from the Twelfth Session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC), Geneva, Switzerland, April 3-7, 2006
GCOS-106 (WMO/TD-No. 1337)	Report of the GCOS Regional Workshop for the Mediterranean Basin, Marrakech, Morocco, November 22-24, 2005
GCOS-107 (WMO/TD-No. 1338)	Systematic Observation Requirements for Satellite-Based Products for Climate
GCOS-108 (WMO/TD-No. 1358)	Climate Information for Development Needs an Action Plan for Africa, Report and Implementation Strategy, Addis Ababa, Ethiopia, 18-21 April 2006
GCOS-109 (WMO/TD-No 1363)	Summary report of the fourteenth session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS, Geneva, Switzerland 10-12 October 2006
GCOS-110 (WMO/TD-No. 1370) (GOOS No. 154) (WCRP No.)	Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC) Eleventh Session, Tokyo, Japan 16-20 May 2006
GCOS-111 (WMO/TD-No. 1371) (GTOS No. 43)	Summary Report of the ninth session of the GTOS/GCOS Terrestrial Observation Panel for Climate, Ispra, Italy 28-29 March 2006

GCOS-112 (WMO/TD-No. 1379)	GCOS Reference Upper-Air Network (GRUAN): Justification, requirements, siting and instrumentation options
GCOS-113 (WMO/TD-No. 1396)	Report of the Third Meeting of the GCOS Cooperation Board (Geneva, Switzerland, 27 April 2007)
GCOS-114 (WMO/TD-No. 1407)	Thirteenth Session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC-XIII) – Consolidated List of Conclusions, Recommendations and Action Items (Geneva, Switzerland, 23-27 April 2007)
GCOS-115 (WMO/TD-No. 1408)	Report of the Third Meeting of the GTN-H Coordination Panel (Koblenz, Germany, 17-19 September 2007)
GCOS-116 (WMO/TD-No. 1415)	Report of the Fifteenth Session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS (Paris, France, 16-19 October 2007)
GCOS-117 (WMO/TD-No. 1418)	Future Climate Change Research and Observations: GCOS, WCRP and IGBP Learning from the IPCC Fourth Assessment Report (4-6 October 2007)
GCOS-118 (WMO/TD-No. 1421)	Summary Report of the Tenth Session of the GTOS/GCOS Terrestrial Observation Panel for Climate (Rome, Italy, 15-16 November 2007)
GCOS-119 (WMO/TD-No. 1424)	Report of the Implementation Strategy Meeting for Central America and the Caribbean (Belize City, 28-30 January 2008)
GCOS-120 (GOOS-No.)	Report on the Meeting of “IOC Group of Experts on the Global Sea Level Observing System (GLOSS), tenth session (Paris, France, 6-8 June 2007)
GCOS-121 (WMO/TD-No. 1435)	GCOS Reference Upper Air Network (GRUAN). Report of the GRUAN Implementation Meeting (Lindenberg, Germany, 26-28 February 2008)
GCOS-122 (WCRP 9/2008) (WMO/TD-No. 1436)	Fourteenth Session of the GCOS/WCRP Atmospheric Observation Panel for Climate (AOPC-XIV) – Conclusions and Recommendations (Geneva, Switzerland, 21-25 April 2008)
GCOS-123 (WMO/TD-No. 1444)	Report of the Fourth Meeting of the GCOS Cooperation Board (Bonn, Germany, 12 June 2008)

GCOS List of Acronyms and Abbreviations

ACMAD	African Centre for Meteorological Applications for Development
ADB	Asian Development Bank
AfDB	African Development Bank
AGG	AOPC Advisory Group on GSN and GUAN
AIACC	Assessments of Impacts and Adaptation to Climate Change
AMIP	Atmospheric Model Intercomparison Project
AMMA	African Monsoon Multidisciplinary Analysis
AOPC	Atmospheric Observation Panel for Climate
APN	Asia-Pacific Network
ASAP	Automated Shipboard Aerological Programme
AVHRR	Advanced Very High Resolution Radiometer
AREP	Atmospheric Research and Environment Programme (WMO)
AU	African Union
BAPMON	Background Air Pollution Monitoring Programme
BUFR	Binary universal form for the representation of meteorological data
BOM	Australian Bureau of Meteorology
BSRN	Baseline Surface Radiation Network
CAS	Commission for Atmospheric Sciences
CBD	Convention on Biological Diversity
CBS	Commission for Basic Systems (WMO)
CCCC	Caribbean Community Climate Change Centre
CCD	Convention to Combat Desertification
CCD/A	Climate Change Detection and Attribution
CCI	Commission for Climatology (WMO)
ClimDev	Climate for Development in Africa
CDAS	Climate Data Assimilation System
CEOP	Coordinated Enhanced Observing Period
CEOS	Committee on Earth Observation Satellites
CGMS	Coordination Group for Meteorological Satellites
CHy	Commission for Hydrology (WMO)
CLIC	Climate and Cryosphere Project (WCRP)
CLIMAT	Report of monthly means and totals from a WWW land station
CLIPS	Climate Information and Prediction Services
CLIVAR	Climate Variability and Predictability (WCRP)
CMA	China Meteorological Administration
CMM	Commission for Marine Meteorology
COP	Conference of the Parties (to UNFCCC)
COPEs	Coordinated Observation and Prediction of the Earth System
DAO	Data Assimilation Office
DARE	Data Rescue (WCDMP project)
DBCP	Data Buoy Cooperation Panel
DFID	Department for International Development (UK)
DIM	Data and Information Management
DWD	Deutscher Wetterdienst
EC	European Community
EC	Executive Council (WMO)
ECMWF	European Centre for Medium-Range Weather Forecasts
ECVs	Essential Climate Variables
ENSO	El Niño/Southern Oscillation
ESA	European Space Agency
ET-ODRRGOS	Expert Team on Observational Data Requirements and Redesign of the Global Observing System
ET-EGOS	Expert Team on the Evolution of the Global Observing System
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites

FAO	Food and Agriculture Organization of the United Nations
fAPAR	Fraction of Absorbed Photosynthetically Active Radiation
FCDR	Fundamental Climate Data Record
G3OS	GCOS, GOOS and GTOS
GAW	Global Atmosphere Watch
GAWSIS	GAW Station Information System
GCO	Global Carbon Observation
GCOS	Global Climate Observing System
GCM	Global Climate Model
GDSIDB	Global Digital Sea-Ice Data Bank
GEF	Global Environment Facility
GEMS	Global Environment Monitoring System
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GEWEX	Global Energy and Water Cycle Experiment
GIP	GCOS Implementation Plan
GLIMS	Global Land Ice Measurements from Space
GLOSS	Global Sea Level Observing System
GMDSS	Global Maritime Distress and Safety System
GMES	Global Monitoring for Environment and Security
GODAE	Global Ocean Data Assimilation Experiment
GOFC	Global Observation of Forest Cover
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics
GOOS	Global Ocean Observing System
GOS	Global Observing System
GOSIC	Global Observing Systems Information Center
GPPC	Global Precipitation Climatology Centre
GPCP	Global Precipitation Climatology Project
GPS	Global Positioning System
GRDC	Global Runoff Data Centre
GRUAN	GCOS Reference Upper Air Network
GSICS	Global Space-based Inter-Calibration System
GSN	GCOS Surface Network
GSNMC	GSN Monitoring Centre
GTN	Global Terrestrial Network
GTN-E	GTN-Ecosystems
GTN-G	GTN-Glaciers
GTN-H	GTN-Hydrology
GTN-L	GTN-Lakes
GTN-P	GTN-Permafrost
GTN-R	GTN-Rivers
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunication System
GUAN	GCOS Upper-Air Network
HALOE	Halogen Occultation Experiment
HIRS	High Resolution Infrared Radiation Sounder
HOPC	Hydrological Observation Panel for Climate
HWR	Hydrology and Water Resources (Department, WMO)
IAEA	International Atomic Energy Agency
iAOOS	Integrated Arctic Ocean Observing System
ICSU	International Council for Science
IGBP	International Geosphere-Biosphere Programme
IGACO	Integrated Global Atmospheric Chemistry Observations (IGOS Theme)
IGAD	Intergovernmental Authority on Development (East Africa)
ICPAC	IGAD Climate Prediction and Application Centre
IGOS	Integrated Global Observing Strategy

IGOS-P	Integrated Global Observing Strategy Partnership
IGOSS	Integrated Global Ocean Services System
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research
INCOIS	Indian National Centre for Ocean Information Services
IOC	Intergovernmental Oceanographic Commission
IOD	Indian Ocean Dipole
IODE	International Oceanographic Data and Information Exchange
IOS	Initial Operational System (GCOS); Integrated Observing System (GOOS)
IPCC	Intergovernmental Panel on Climate Change
IPY	International Polar Year
ISCCP	International Satellite Cloud Climatology Project
ISO	International Standards Organization
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology
JCOMMOPS	JCOMM Observing Platform Support Centre
JMA	Japan Meteorological Agency
JRC	Joint Research Centre (European Commission)
LAI	Leaf Area Index
MCDW	Monthly Climatic Data of the World
MECE	Monitoring of Extreme Climate Events
MOU	Memorandum of Understanding
MPERSS	Marine Pollution Emergency Response Support System
MSC	Meteorological Service of Canada
MSU	Microwave Sounding Unit
NASA	National Aeronautics and Space Administration (USA)
NBCN	National Basic Climatological Network
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Prediction
NDACC	Network for the Detection of Atmospheric Composition Change
NGDC	National Geophysical Data Center
NMHS	National Meteorological and Hydrological Service
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	Net Primary Productivity
NPP	NPOES Preparatory Project
NWP	Numerical Weather Prediction
OOPC	Ocean Observations Panel for Climate
OPAG	Open Programme Area Group
OSes	Observing System Experiments
OSSEs	Observing System Simulation Experiments
PAGES	Past Global Changes (within IGBP)
PICO	Panel for the Integration of Coastal Observations (GTOS-GOOS)
PMEL	Pacific Marine Environmental Laboratory
POGO	Partnership for Observation of the Global Oceans
QC	Quality Control
RAP	Regional Action Plan
RBCN	Regional Basin Climate Network
RCOF	Regional Climate Outlook Forum
REDD	Reductions of Greenhouse Gas Emissions from Deforestation and Forest Degradation
R/SSC-CM	Regional/Specialized Satellite Centres for Climate Monitoring
RWP	Regional Workshop Programme
RRR	Rolling Review of Requirements
SAFs	Satellite Application Facilities
SAG	Scientific Advisory Group (GAW)

SBI	Subsidiary Body for Implementation (UNFCCC/COP)
SBSTA	Subsidiary Body for Scientific and Technological Advice (UNFCCC/COP)
SC	Steering Committee
SHADOZ	Southern Hemisphere Additional Ozone-sondes
SIA	Seasonal-to-Inter-annual Forecasting
SIP	Seasonal-to-Interannual Climate Prediction
SIT	Strategic Implementation Team (CEOS)
SOG	Statement of Guidance
SOOP	Ships of Opportunity Programme
SPARC	Stratospheric Processes and their Role in Climate
SPREP	South Pacific Regional Environment Programme
SST	Sea-Surface Temperature
START	System for Analysis, Research and Training
SURFA	Surface Flux Analysis Project
TAO	Tropical Atmosphere-Ocean Array
TCO	Terrestrial Carbon Observations
TEMS	Terrestrial Ecosystems Monitoring Sites
TOMS	Total Ozone Mapping Spectrometer
TOPC	Terrestrial Observation Panel for Climate
ToR	Terms of Reference
TOVS	TIROS Operational Vertical Sounder
TRITON	Triangle Trans-Ocean Buoy Network
UKMO	United Kingdom Meteorological Office
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UOP	Upper Ocean Panel (WCRP/CLIVAR)
UTLS	Upper Troposphere Lower Stratosphere
USGS	United States Geological Survey
VCP	Voluntary Co-operation Programme
VOS	Voluntary Observing Ship(s)
VOSCLim	Voluntary Observing Ships Climatology Programme
WCC3	Third World Climate Conference
WCDMP	World Climate Data and Monitoring Programme
WCP	World Climate Programme
WCRP	World Climate Research Programme
WDC	World Data Centre
WDCGG	World Data Centre for Greenhouse Gases
WGCCD	Working Group on Climate Change Detection
WGCV	Working Group on Calibration and Validation (CEOS)
WGNE	Working Group on Numerical Experimentation
WG-SP	Working Group on Surface Pressure
WHYCOS	World Hydrological Cycle Observing System
WIGOS	WMO Integrated Global Observation System
WIS	WMO Information System
WMO	World Meteorological Organization
WOAP	WCRP Observation and Assimilation Panel
WRAP	Worldwide Recurring ASAP Project
WWW	World Weather Watch (WMO)
XBT	Expendable BathyThermograph

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