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

(GENEVA, 28 September - 1 October 2010)

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REPORT OF THE EIGHTEENTH SESSION OF THE GCOS STEERING COMMITTEE

1. Opening of the Session

The Eighteenth Session (SC-XVIII) of the Global Climate Observing System (GCOS) Steering Committee (SC) was held at World Meteorological Organization (WMO) Headquarters in Geneva, Switzerland from 28 September - 1 October 2010. 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 1, the agenda for the session is given in Annex 2, the list of the available documents is included as Annex 3, and a consolidated list of actions is given in Annex 4.

1.1. Opening Remarks

The incoming Chair of the GCOS Steering Committee, Dr. Adrian Simmons, welcomed the SC members and other session participants. He noted that all but two of the fifteen existing members of the SC were present and that the two who could not attend this session sent observers in their place. He then introduced Mr. Jeremiah Lengoasa, the Deputy Secretary-General (DSG) of WMO, who welcomed participants and officially opened the session.

1.2 Welcome by WMO on Behalf of the Sponsors

The DSG, Mr. Lengoasa, welcomed the SC Members and invited experts to the session on behalf of the Sponsors. Mr. Lengoasa congratulated Dr. Simmons on taking over the leadership of the GCOS Steering Committee. He highlighted the continuing importance of GCOS, the release of IP-10 for COP-16, the important role GCOS has in the Global Framework for Climate Services (GFCS), the importance of adequately preparing for the 16th WMO Congress in May 2011, and the need to obtain adequate resources to support the GCOS programme. In discussing the release of the 2010 update of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (IP-10), he noted that although the political process has stalled, observations continue to be important, and therefore GCOS must continue to be engaged in the UN Framework Convention on Climate Change (UNFCCC) process. The DSG was pleased that the 2004 Implementation Plan (IP-04) has been broadly adopted by Parties to the UNFCCC and hoped this would be true for IP-10 as well. He commented that observations will be an important component of the GFCS, so there will be a significant role for GCOS in this new framework for climate services. A first draft of the report of the High Level Taskforce will be released for review in December. The DSG also noted that the SC Chair will be reporting to the 16th Congress and that Congress will be considering how to adjust to a new and evolving environment. There is thus both an opportunity and a challenge for GCOS in reporting to Congress. As for the GCOS budget, the DSG noted that WMO has continued to support the GCOS Secretariat despite 16 years of zero nominal growth. Nevertheless, he noted that it is critical to find other ways to support GCOS as well, including through the engagement of all the Sponsors.

1.3 Approval of the Agenda

The Chair 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, and, on this basis, it was approved.

1.4 Arrangements for the Session

Dr William Westermeyer, the Secretariat officer responsible for the organization of the session, briefed the participants on logistical issues and other useful information. He also outlined the process of producing the report of the session, noting that the draft session report would be developed from oral comments, PowerPoint slides, and the written documents participants had submitted; that the complete list of actions would be included in the report; that the draft report would be circulated to SC

members and other participants for comment prior to its finalization; and that the final SC-XVIII Report would be approved by the Chairman in the light of comments received on the draft. The session was also informed that the Government of Switzerland had graciously offered to host the reception which would take place on 28 September.

2. Report of the Director

Dr Carolin Richter, the Director of the GCOS Secretariat, reported on the status of the Secretariat. She reviewed the action items stemming from SC-XVII, noting that of 47 total actions only 7 remained incomplete. Those that were not considered to be ongoing and/or were the responsibility of entities other than the Secretariat or Steering Committee related to briefing the Executive Secretary of the Intergovernmental Oceanographic Commission of UNECSO (IOC), drafting a concept paper on the role of GCOS in the Global Framework for Climate Services (GFCS), developing a strategy for GCOS in support of development, assessing the status of hydrological networks for climate, and revising the GCOS Plan.

Most of the Director's comments dealt with the Secretariat budget situation. She emphasized the distinction between the core and programme activities of the Secretariat. The core activities include organizing the Steering Committee session and annual meetings of the science panels, the participation in key meetings related to space-based observations, and participation in the UNFCCC's Subsidiary Body on Scientific and Technological Advice (SBSTA), while programme activities include such things as providing support for the drafting of the 2010 update of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC, implementing regional activities, and assisting in the development of new observing networks and reporting on progress in their implementation.

The Secretariat's core activities are the activities that must be performed annually and are roughly covered by the voluntary contributions of the sponsoring organizations. The programme activities of the Secretariat, consisting of activities directly related to its mandate undertaken at either the global, regional, or national level, have been increasing in recent years and are, for the most part, not funded through the regular budget. Typically, the regular budget funds only the Director and her Administrative Assistant. The core and programme activities of the Secretariat, and the programme and science officers required to carry out these activities, must be funded through voluntary extra-budgetary resources. WMO also funds a substantial amount of overhead (office space, IT costs, cleaning services, and use of administrative services) for the work of the Secretariat. In recent years lesser amounts have been contributed, mostly as *in kind* resources, by the IOC (e.g., to fund the Ocean Observation Panel for Climate—OOPC) and the Food and Agricultural Organization (FAO) (e.g., to partially support the Terrestrial Observations Panel for Climate).¹

A key point made by the Director is that the Secretariat does not have sufficient funds beyond the end of 2010 to pay for the continuation of all current staff who are supported by extra-budgetary funding. These staff, moreover, are engaged in both core and programme activities. One graph presented by the Director clearly showed the downward trend in the amount and number of voluntary contributions in recent years, this despite significant contributions to the Secretariat from the governments of the United States and Germany. The Director noted that presumably there will be no increase of the regular budget and that voluntary contributions by WMO were also scheduled to decrease. Conversely, in response to a question from a Member, the Director observed that the Secretariat could usefully employ twice the number of staff to address the responsibilities that are being placed on it—if appropriate funding were available. The Chair noted that the declining and unstable budget situation made forward planning very difficult. The SC approved two Actions related to the budget.

Action 1. Annual Letter and Budget to Sponsors. The SC Chair and D/GCOS are asked to follow last year's practice of submitting a budget to accompany the annual letter to Sponsors; D/GCOS should provide the SC, at its annual meeting, with a budget outlook that includes an estimate of *in kind* as well as actual contributions to GCOS.

¹ However, the IOC provided \$20,000 of unearmarked financial support to the GCOS trust fund in December 2008.

Action 2. GCOS Budget Situation. The Chair is asked to express to the Sponsors the general concern of the SC as to the inadequacy of the GCOS budget, noting the mismatch between the available resources and the funds needed for carrying out the responsibilities the Secretariat is being asked to undertake. The Chair and D/GCOS together should explore all avenues to improve the budgetary situation.

3. Report of the Chair

The Chair of the Steering Committee reminded SC Members of the duties of the Chair as set out in the Sponsors' Memorandum of Understanding for GCOS. He drew particular attention to his responsibility to prepare annually, with the help of the GCOS Secretariat, a report of GCOS planning and implementation activities, including recommendations by the SC, and a comprehensive budget for all GCOS activities, and to present this report and budget to the Sponsors.

The Chair then reviewed the activities of the outgoing Chair, Dr. John Zillman, since SC-XVII as well as his own activities since assuming the Chair. He noted that Dr. Zillman carried out a number of duties on behalf of the incoming Chair during the first three months of 2010, in addition to providing considerable general support during the handover period. Among these were attendance at the GEO-VI Plenary in November 2009, where he expressed support for the formulation of the Climate Target for the Global Earth Observation System of Systems (GEOSS), and attendance at COP-15 in Copenhagen in December 2009, where he reported on GCOS to the Conference of the Parties (COP) Subsidiary Body on Scientific and Technological Advice (SBSTA). His own activities since assuming the Chair included participation in the Global Ocean Observing System (GOOS) Scientific Steering Committee meeting in London, the IOC Executive Council meeting in Paris, and the International Council for Science (ICSU) Visioning meeting, also in Paris.

He identified his expectations for the session as:

- Identification of the main issues for the Annual Report to sponsors and any messages to SBSTA and GEO additional to those contained in IP-10;
- Obtaining specific views on input to Sponsors on the Memorandum of Understanding (MoU), including on the Terms of Reference (ToRs) annexed to the MoU;
- Understanding on the scope of the GCOS and functioning of the programme as represented by the Secretariat, Panels, working groups, and GCOS Cooperation Mechanism (GCM);
- Identification of the main elements of the work programme for the next five years, beginning with an update of the Satellite Supplement in 2011;
- Seeking views on the timing and format of the next progress report (or Third Adequacy Report) and on a new/updated Implementation Plan; and
- Seeking broader views on what is supported by the Implementation Plan, e.g., is it just the UNFCCC or is the Plan for other entities as well?

Many of the major issues facing GCOS identified at SC-XVII continue to be important issues this year. The Chair grouped these into five categories:

- Matters concerning the GCOS/Sponsor relationship, including updating of the GCOS MoU and the status and funding of the GCOS Secretariat;
- GCOS in relation to UNFCCC, IPCC, GEOSS, and GFCS, to which list could be added the World Climate Research Programme (WCRP) and components of the Earth System Science Partnership (ESSP);
- Observation of cryospheric, biogeochemical, biological, ecological, and socio-economic variables, i.e., the organization and scope of GCOS;
- Networks, coordination, and capacity-building, including energizing the GCOS Cooperation Mechanism; and
- Strategic Planning and the work programme for next five years.

The Chair noted that an update of the Satellite Supplement to the 2004 Implementation Plan was being planned for 2011 and that the Secretariat and Steering Committee expected to undertake another Progress Report or perhaps third Adequacy Report, as well as another edition of the Implementation Plan, at appropriate times in the next five or so years. He proposed, and other SC Members agreed, that a report focusing on the GCOS role in adaptation would be appropriate, perhaps in 2012, and that once plans were set, it would be possible to search for funding for these activities. Concerning the Implementation Plan, the Chair wondered if this should be limited to the needs of the UNFCCC, noting that most actions in the Plan also support the needs of the IPCC and will support those of the GFCS. He stated that the next plan should clearly address all needs, not just those of the UNFCCC.

In discussion following the Chair's report, Members proposed that any report on adaptation should address not only *in situ* observations but satellite observation as well. It could also address capacity building and emphasize links to the GCM and regional development. Reanalysis was mentioned as an issue for which active coordination is needed over and above what is being done through the WCRP Observations and Assimilation Panel (WOAP). Several Members mentioned the need to plan for GCOS participation in the (likely to be huge) "Rio Plus 20" conference in 2012. There was some discussion of the continuing need to reach out to scientific communities, who still often do not know much about GCOS, and it was noted that an article on IP-10 is being planned for the Bulletin of the American Meteorological Society, with perhaps also a shorter article for EOS.

4. GCOS Panel Reports

4.1. Atmospheric Observation Panel for Climate (AOPC)

The session of AOPC scheduled for 26-30 April 2010 had to be cancelled at short notice due to the disruption to air travel caused by the eruption of the Eyjafjallajökull volcano. As early rescheduling of the session was impractical, it was decided not to hold a session in 2010 but to bring the 2011 session forward by two months from April to February (7-11). Following cancellation of the session, however, several teleconferences were held to discuss important issues and to provide a bridge to the 2011 session. Although the 2010 session of the AOPC was cancelled, at least several items of interest to the Panel had been considered just one month earlier at the WOAP meeting. In addition, several Panel members participated in the workshop on "Surface Temperature Datasets for the 21st Century," held 7-9 September at the Met Office (see agenda item 12.1). This meeting provided opportunities for informal communication in general and for a formal session of AOPC's Advisory Group on GSN and GUAN (AGG).

Dr. Adrian Simmons is continuing as Chair of the AOPC until such time as a new Chair can be appointed. He therefore reported on this agenda item and, in doing so, reviewed the AOPC's responses to several of the important actions arising from SC-XVII. In reporting on Action 7, *Coordination of GCOS Atmospheric Networks*, the Chair noted that AOPC's consideration of the implementation status of WIGOS and WIS, particularly as they concern the GCOS atmospheric networks, was one of the items that had to be postponed to the 2011 AOPC session. With a growing emphasis on adaptation, this issue has become a broader one. Some members noted that the terminology is becoming confusing, as acronyms – RBSN, RBCN, GSN, GUAN, GRUAN – seem to be proliferating. Members considered what to do about silent stations in baseline networks, and it was suggested that criteria for taking stations out of the network when they fail to meet minimum requirements needed to be developed.

Action 30 concerns the *African Monsoon Multidisciplinary Analyses Project (AMMA)*. It was noted that the Bamako and Pointe Noire stations, both operated by the Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), have stopped working. These stations are being considered for addition to the GCOS Upper Air Network (GUAN). However, as a rule, when one renovates a station, there is an expectation that it can fund operating costs for a number of years. Moreover, stations should be working before adding them to the network. Once the two West African stations are working again, the AGG will consider them for addition to the network.

Action 27, on *Peer Review of Climate Data Sets*, has been addressed through several initiatives. A letter on this topic was sent jointly in May to heads of organizations by the directors of GCOS and WCRP, a workshop on global surface temperature datasets was held (see agenda item 12.1), and a

WOAP Workshop on Evaluation of Satellite-Related Global Climate Datasets, to be hosted by ESA, is being planned for April 2011.

Finally, the Chair reviewed GRUAN, noting that its development is basically progressing well. Sites will operate radiosondes using best practices, even if there is less use of reference radiosondes than he had originally thought would be the case. It was noted that the GCOS Secretariat does not have the capability or mandate to manage the GRUAN, notwithstanding its support for development of the network. However, the GRUAN continues to develop under the scientific and technical coordination provided by the Lead Centre at DWD and the oversight and guidance provided by the AOPC Working Group on Atmospheric Reference Observations.

An invited expert noted that, on GSN, if operational network stations moved about a lot, one would not be able to detect climate change. One needs long-duration stations that are not too much influenced by what going on around them. The difficulty for GCOS is how to encourage operators to preserve the long-running stations, whether part of the GSN or not.

Action 3. AOPC Consideration of Silent Stations. The SC noted the AGG discussion on stations in the GCOS networks that are either silent or otherwise fail to meet minimum GCOS requirements and the need for guidance on how to act upon such GCOS network deficiencies. AOPC is asked to consider this issue and to report back to the SC, addressing, in particular, the case of stations that are unable to be rejuvenated using the GCM.

4.2. Ocean Observations Panel for Climate (OOPC)

The Chair of OOPC, Dr. Eric Lindstrom, reviewed the goals of the ocean observing system for climate. These include: providing data and information products for climate monitoring and forecasting, climate assessment, climate research, and outreach; supporting decision-making for adaptation to climate change; and serving as a foundation for both research and operations in global oceanography. The strength of OOPC lies in its members' knowledge of the state of the physical ocean and its variability, their knowledge of ocean observing requirements for climate and of the maturity of relevant ocean technologies, and their knowledge of coordinating mechanisms for ocean observations. Two more general goals of the OOPC are: 1) to provide updated information on the state of the ocean and its relevance to climate and society and to liaise with other programs to advocate for sustained ocean observations, and 2) to periodically review the component elements of the ocean observing system, compliance with climate observing requirements, integration of space and *in situ* components, and addition of new elements. Supporting the priorities that emerged from the OceanObs'09 conference, primarily to provide routine and sustained global information on the marine environment remains a strong emphasis of the OOPC. Some foci for future advocacy include:

- **State of the Ocean:** Improve and expand ocean climate indices at the OOPC web site;
- **Societal Relevance:** Provide stories and implications for society from ocean observations and ocean climate indices;
- **Brief Current Events:** Discuss El Niño, PDO, and weather/climate events at key meetings on the observing system;
- **State of the Observing System:** Provide up-to-date information on the status of satellite and *in situ* observing systems, including on data management and integration issues; and
- **Liaison and Review:** Continue to interact with the ocean/climate community and with other programs to advocate for sustaining and enhancing the observing system; review components of the system as necessary.

The OOPC Chair discussed the status of a number of actions requested of OOPC following SC-XVII. In particular, Action 9, which addresses the *GOOS Contribution to the UNFCCC*, the Chair mentioned that OOPC is currently engaged with the process that is developing a Framework for Ocean Observation. This framework will be completed in 2011 and implementation of the "roll-out" strategy will begin. Action 12, *Ocean Observations for Climate*, requested the OOPC to stress the benefits of the GCOS to IOC Member States. This action is ongoing, but the Chair noted that OOPC is interested in providing more and better *regional* information to serve users. The OOPC web site will be one means of accomplishing this. Action 13, on *Converging Requirements for Ocean Observations*, requested the OOPC to explore how the multiple needs for ocean observations could

be more effectively dealt with. The Chair introduced the concept of Essential Ocean Variables and noted that progress is being made in defining a set of such variables.

OOPC-14 was held in January 2010 in Miami, and a number of decisions and actions associated with this meeting were also reviewed. Among other things, OOPC will work to improve the societal relevance of its ocean climate indices, continue to maintain its focus on IP-10, review deep ocean observation requirements, call on research programs to articulate the need for sustained legacy observations in a systematic way, and encourage data sharing.

The OOPC Chair also participated in the GCOS Cooperation Mechanism (GCM) meeting the day before SC-XVIII began. Two projects introduced at that meeting for possible funding through the GCM were hiring of a travelling technician to sustain the pan-African network of sea level stations established by IOC/GLOSS and the deployment of five proposed moorings in the western tropical Indian Ocean to fill a significant gap in the Indian Ocean Observing System (IndOOS).

The OOPC Chair responded to a question about biodiversity observations by affirming that OOPC is concerned about them and that OOPC may need to establish a new group to consider biodiversity issues. On deep ocean observations, he noted that OOPC needs to come up with a unified strategy, and on coastal observations, he noted that the new Framework for Ocean Observation does not make a distinction between coastal and ocean areas.

Interaction between OOPC and various groups is just beginning to assess and improve sea ice products and observational requirements. The Climate and Cryosphere Programme (CliC) is planning a workshop on sea ice concentration product intercomparison in late 2010-early 2011. This offers an opportunity for the groups to co-operate further on this issue.

Action 4. Outreach on Ocean Observation. The SC was pleased with the progress and direction of the OOPC, including its planned assessment of requirements for deep ocean observation. OOPC is encouraged to continue to place emphasis on outreach and identification of the societal relevance of ocean observation.

Action 5. Sea Ice. The GCOS Secretariat should inform the EC-PORS, particularly its Observation and GCW Task Teams, on the recommended actions and issues relevant to improved sea ice products and observational requirements as identified in GCOS IP-10, and request its assistance in facilitating coordinated actions with JCOMM/ETSI, WCRP/CliC, GCW and IICWG to address these issues.

Action 6. Sustaining Moored Arrays. The SC stressed the importance of sustaining the moored arrays and was concerned that continuity of data from moored arrays was at risk because of the increasing costs of servicing the moorings and the limited availability of vessels suitable to carry out this work. The SC Chair is requested to express this view of the SC in his annual report to the Sponsors.

Action 7. Dealing with Piracy and Vandalism. The SC noted that costs were exacerbated by piracy and vandalism. OOPC is invited to develop outreach material to emphasize the importance at local level of these ocean observations.

Action 8. Global Geodetic Infrastructure for sea level. The GCOS Secretariat is requested to communicate with the Secretariat of the Global Geodetic Observing System (GGOS) concerning the need for global geodetic infrastructure to maintain the terrestrial reference frame accuracy and stability at levels required for precise sea level measurements.

4.3. Terrestrial Observations Panel for Climate (TOPC)

The TOPC Chair, Dr. Han Dolman, identified key TOPC activities as contributing to the IP-10, providing input to the GCOS and GTOS Secretariats, participation in the development of the GEO Carbon Strategy, developing standards and guidelines for terrestrial observations, involvement of selected members with specific Global Terrestrial Networks (GTNs), and liaison with with WOAP on FLUXNET and global water and energy datasets.

He noted that there has been significant progress in defining internationally accepted standards for the terrestrial ECVs (moving toward ISO standardization). However, progress in establishing institutional support for *in situ* networks has been slow, and the objective of creating a comprehensive and well coordinated reference network for *in situ* observations of the fullest possible range of terrestrial ECVs is a continuing and still largely unmet challenge. The establishment of several GTNs in a number of areas (e.g., for hydrology, glaciers, and permafrost), where data collection takes place largely through *in situ* measurements, has nevertheless significantly improved the coordination and global coverage of these observations.

The TOPC Chair noted that observations taken for purposes other than climate, but with climate relevance, are often not made available. Good progress has been made in guaranteeing short-term continuity in the availability of high-resolution optical observations from satellites. The increasing commitment of space agencies to produce fundamental climate data records from existing systems has led to improved availability of global datasets, such as for burned area and land cover (and now also for glaciers through the European Space Agency (ESA) Climate Change Initiative (CCI)). The analysis of historical records, both *in situ* and satellite based, has been progressing slowly, however, and needs the urgent consideration of both space agencies and the potential users.

The GEO Carbon Strategy was reviewed in some detail by the TOPC Chair, who noted that GCOS and GTOS members had been involved in its development and that it was now in final form.

As in the OOPC discussion, the issue of biodiversity observations also arose under this agenda item. The issue is how far one goes in biodiversity monitoring. What are the boundaries between climate variables and impact variables? The view was expressed that GCOS may be “muddying the waters,” especially given various GEO Societal Benefit Areas (SBAs), by considering biodiversity ECVs. It was noted that it is hard to produce a record that one can interpret in the sense of climate change. The need for biodiversity reference sites should be brought to the attention of SBSTA. A suggestion was made that it may be even more relevant to bring the issue of biodiversity observations to the attention of the Parties to the Convention on Biological Diversity.

Soil moisture is a key parameter in land surface processes, and networks are currently under development. *In situ* networks have been launched at Rutgers University (with contributions from China and Russia) and at the University of Vienna (in cooperation with the European Space Agency). An issue is that documentation does not yet exist on ECV standards and guidelines. Progress is being made in GEWEX estimates of evaporation over land. A small workshop is to be organized for modelers and assimilators with ESA. Of note is that satellites can detect soil moisture from the top few centimetres only.

Action 9. Essential Ecosystem Records. The SC confirmed the view taken in finalizing IP-10 that it was inappropriate to identify biodiversity and habitat properties as ECVs, but emphasized strongly the importance of acquiring or generating essential ecosystem records (EERs) through co-located measurement of climate and ecosystem variables, in particular at the 35 or so global reference sites envisaged by TOPC. The SC Chair was asked to ensure that this is drawn to the attention of the UNFCCC in his statement to SBSTA.

Action 10. Global Reference Sites. TOPC is requested to continue to work to support establishment of the network of global reference sites, working with CEOS, GTOS, and the Fluxnet community as needed.

4.4 WCRP Observations and Assimilation Panel (WOAP)

The Chair WOAP² was unable to attend the SC session, so the SC Chair, who attended the last meeting of WOAP, provided a brief overview of that meeting. The SC Chair first drew attention to the WOAP discussion on data activities, noting WOAP’s wish to encourage the observations and climate modeling communities to identify observation data sets useful in model evaluation, establish guidelines for metadata to facilitate search and discovery, establish formats and metadata to facilitate analysis, and develop a strategy for making multiple datasets for model evaluation accessible in a

² Dr. Kevin Trenberth chaired WOAP through the March 2010 meeting of WOAP, held in Hamburg, Germany. The current Chair is Dr. Mike Manton.

way that parallels the CMIP model output archive. A related issue is metadata consistency across weather and climate communities. CMIP and CEOP have provided frameworks for access to model and observational datasets, including metadata standards. The WMO has developed standards for metadata for meteorological purposes which may not be fully aligned with those of CMIP.

The SC Chair also noted the discussion of organizing workshops to promote assessment of reprocessed datasets. For this issue, WOAP supports holding one or more workshops, perhaps led by GRP and ESA, to bring different teams together to assess algorithms and products. Shortly after the WOAP meeting, ESA indicated it is willing to host such a workshop, and GRP is interested as well. Sponsorship is desirable from space agencies, in particular.

Another highlighted issue pertained to the 4th International Reanalysis Conference. The recent release of several new data products has provided the impetus to begin planning for this conference. The Programme Chair will be Dr. Mike Bosilovich. The Conference is expected to be held in April 2012, most likely in the Washington DC area in close proximity to the resources of two of the latest reanalyses (CFSR and MERRA). The scope of the conference will include ocean, land, cryosphere and atmosphere reanalyses. The SC Chair has agreed to participate on the Programme Committee in his personal capacity, and he noted that it is likely to undertake another reanalysis in about three years.

There is a joint WOAP-AOPC working group on data sets for reanalysis. As a new initiative was underway for surface atmospheric datasets (see 11.1), the SC Chair noted that it remained to be considered whether there was a remaining need for the working group to consider upper-air datasets. The meeting noted however that there may be a need for organisation of the historical subsurface ocean datasets for use in reanalysis..

Action 11. Ocean Subsurface Data Sets for Reanalysis. The SC Chair is asked to liaise with the Chair of WOAP to ensure there is adequate management of ocean subsurface data sets for reanalysis, especially in the context of the development of coupled ocean-atmosphere reanalysis.

Action 12. Measurement of Solid Precipitation. The SC supported WOAP's concern about the measurement of solid precipitation for research and monitoring purposes and noted that similar concerns had been identified for climatological and operational hydrological purposes by WCRP-CliC, Commission for Climatology (CCI-XVI), EC-PORS/GCW, and the Northern Research Basin Program. The Chair of the SC was asked to liaise with the President of CIMO to express its support for the CIMO solid precipitation intercomparison and to request inclusion of a representative of GCOS in the design of the intercomparison to help ensure the needs of the climate community for accurate precipitation measurements are met.

5. Update on the Main Observing Systems Contributing to GCOS

5.1 WMO Global Observing System (GOS)

The WMO GOS is comprised of the surface-based component, the upper air component, the airborne component (AMDAR), and the space-based component. The presentation focused primarily on the space-based component.

The SC was invited by Dr. Barbara Ryan, representing WMO, to note progress with implementing the "Vision for the GOS in 2025." The Vision, which was finalized and adopted by the WMO Executive Council in 2009, expands the GOS to serve the needs of climate monitoring. It needs now to be implemented, which will be done in a stepwise process between now and 2025. Progress in implementing the Vision will be reflected through regular updates of the Coordination Group for Meteorological Satellites (CGMS) agreed baseline for the space-based GOS.

In the past few years, new satellite series have been launched, plans for future missions have been developed or redefined, and progress has been made towards the continuation of some R&D missions in a more operational mode. There is thus scope for updating the baseline configuration of the space-based GOS, taking into account the current capabilities, plans, and commitments of CGMS Satellite Operators to progress towards implementation of the new Vision.

Assuming that the next update would enter into force in 2013, it would not include all the elements called for by the Vision, but should be a significant step towards its full implementation. The revised baseline would be taken into account in the upcoming updates of the relevant WMO Manuals and Guides and would be a new reference for the CGMS Global Contingency Plan. Further updates would be considered in due course, with the aim to ensure by 2025 a full implementation of the Vision (see also item 9.2).

Challenges related to the GOS Vision include: continuity and improvement of operational constellations; sustained observation of all ECVs observable from space; transition from research to operations of priority, mature observations; the generation of quality control (QC) products; and integration issues related to network optimization, system interoperability, and composite products.

5.2 WMO Integrated Global Observing System (WIGOS) / WMO Information System (WIS)

The Steering Committee welcomed the overview of the WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS) provided by Mr. Elliot Christian of the WMO Observing and Information Systems Department. The creation of WIGOS is largely an attempt to rebrand the GOS, which has been seen as narrowly addressing only weather. WIGOS benefits were described as enabling WMO Members to meet expanding national mandates, e.g., to improve not only weather, but also water, climate and related environmental monitoring and services and to adapt to climate change; ensuring essential WMO support for the observational and information elements of the future GFCS; and contributing strongly to GCOS, GOOS, GTOS, and GEOSS by providing timely, quality-assured, quality-controlled and well-documented long-term observations. The implementation phase of WIGOS will run from 2012 to 2015, with the operational phase beginning in 2016.

The WIS updates the WMO Global Telecommunication System (GTS). However, in WIS WMO is taking a step beyond simply routing data messages. It is moving to an overarching approach based on managing data and information. The vision of WIS is to use international industry standards for protocols, hardware and software; build on the existing GTS, with special attention to a smooth and coordinated transition; provide time-critical data exchange, as well as data access and retrieval services; and support all WMO and related international programmes. Mr. Christian noted although nothing new is being invented, WIS provides a common way of describing the available data, including who has it and how it can be obtained.

GCOS has many external interfaces that are opportunities for WIS interoperability. A key site is the Global Observing System Information Centre (GOSIC), which has already been named as a candidate Data Collection or Production Centre (DCPC) in WIS. WIS interfaces would also be appropriate at GCOS Monitoring and Analysis Centres, in addition to the many specific atmosphere, ocean, and terrestrial Networks for observations, related data centres, and archives relevant to climate.

5.3 Global Atmosphere Watch (GAW)

Dr. Geir Braathen, accompanied by Ms. Oksana Tarasova, provided an update on the ozone and greenhouse gas components of GAW. The SC thanked them for the informative presentation. It noted that due to the cancellation of the AOPC meeting in April, the Panel had been unable to pursue the action from SC-XVII related to atmospheric chemistry, that is, to continue to place emphasis on monitoring the availability of data related to atmospheric composition and on promoting the improvement of coordination arrangements for both GAW and non-GAW networks, including comprehensive and prompt submission of atmospheric chemistry observations to data centres. Dr. Braathen noted several new global stations had been added to the GAW network, including Pyramid in the Himalayas, Trinidad Head in California, Neumayer in Antarctica, and Cape Verde off Africa. Another station, Mont Cimone in Italy, is in the pipeline.

The SC Chair inquired about aerosols, noting that there was no baseline network for them. He argued that the AERONET was a very useful network providing aerosol data in close to real time, but was informed that there are problems with standard measurement procedures, so creating a baseline network with global coverage might be difficult. Dr. Braathen intends to address this issue at the upcoming AOPC meeting.

An expert, Dr. Jim Butler, noted that greenhouse gas emissions are still going up exponentially and that it would be useful to have an observation system for regional scale data. Such a system would indicate how well we are doing in emission reduction efforts and wouldn't cost much to implement. It requires integration of satellite and ground-based systems, validation of the data, and good research. He believed such a system could be delivered in less than a decade.

Action 13. Data Availability in GAW Networks. The AOPC was requested to continue to place emphasis on promoting the improvement of data availability and coordination arrangements in both GAW and non-GAW networks, in particular in the case of aerosols.

5.4 Global Terrestrial Networks for Hydrology (GTN-H, GTN-R, GTN-L)

The eleven variables comprising the GTN-H were introduced by Dr. Wolfgang Grabs. The variables precipitation; snow cover, glaciers, and ice caps; river discharge; isotopic composition; groundwater; lake level and lake area; and water quality/BGC fluxes were said to have a "green" (operational) status. Evapotranspiration and water use were classed as "yellow." And soil moisture and water vapour were still considered "red" (non operational), although it is expected that soil moisture is rapidly moving toward "yellow" and eventually "green." Dr. Grabs reviewed the various networks comprising GTN-H. He noted that the Hydrological Applications and Run-Off Network (HARON) is composed of about 400 stations at the mouths of major rivers, the Global Runoff Data Centre (GRDC) has 7362 stations (most in the United States and Europe) with monthly discharge data, GTN-R has about 265 stations, the European Terrestrial Network for Rivers (ETN-R) has some 690 stations, and GTN-L monitors some 150 lakes and reservoirs. The further implementation of GTN-H will be done through agreed actions and demonstration projects, which will demonstrate the value of GTN-H data sets and tools and show how GTN-H data can be integrated with other types of data (e.g., socio-economic data).

Dr. Grabs recommends that the SC:

- Express its support of continued collaboration between GCOS and the WMO CLW/Hydrology branch in advancing GTN-H and its contributing networks;
- Stress the importance of global hydrological networks and, with these, efficient data exchange and adequate means of telecommunication;
- Promote the implementation of the HARON project;
- Reiterate the need to define, upgrade, and operate a global hydrology network for rivers (GTN-R) and express strong concern over the continuing decline of hydrological networks, especially the closure of climate-relevant stations;
- Call upon WMO Commission for Hydrology (CHy) to give the highest priority to addressing these issues and to facilitating appropriate remedial actions;
- Promote these issues at UNFCCC and COP, seeking adequate funding; and
- Seek improved implementation through active contributors.

The SC Chair questioned whether near-surface water vapour really should be classed as "red" given the wealth of routine synoptic measurements.

Action 14. Decline of Hydrological Networks. The SC Chair was asked to flag the decline of hydrological networks, especially the discontinuation of river gauge stations with long records, in his presentation to SBSTA.

Action 15. Collaboration in Advancing GTN-H. The GCOS Secretariat was encouraged to continue collaboration between with the WMO CLW/Hydrology branch in advancing GTN-H and its contributing networks.

Action 16. FLUXNET Data. D/GCOS was requested to contact D/GTOS to emphasize the importance of the FLUXNET data to the climate community and recommend that every effort be made to open the Fluxnet data base to the community at large.

5.5 Global Ocean Observing System (GOOS)

Dr. Keith Alverson reviewed the major accomplishments of GOOS between 2005 and 2010. These included:

- The implementation of the ocean observing system for climate, now 62% complete;
- Reporting to the UNFCCC, which ensures high visibility and national engagement;
- Enhanced understanding of global climate change – particularly detection and attribution;
- The launch of development for a Global Framework for Climate Services;
- The increased availability of relevant regional components of the GOOS in real time, thus enabling coastal hazard warnings and mitigation (e.g., for oil spills, storm surges, tsunamis, and cholera);
- The increased availability of new seasonal products derived from ocean observations (e.g., ENSO, Monsoon, drought, flooding, and fire regime forecasts); and
- The delivery of quotidian services (e.g., shipping and port traffic optimization, support for offshore wind and drilling operations).

Dr. Alverson noted that government engagement and willingness to commit resources for both implementation and coordination of ocean observations remains weak. He suggested that demonstrating clear societal benefits to catalyze “user pull” will require better advocacy and that the observing system, and especially the coastal module, will need redesigning to serve adaptation needs. An invited expert noted, and Dr. Alverson agreed, that it is becoming increasingly difficult to initiate new types of ocean observations (e.g., biodiversity observations). Emphasis still needed to be placed on sustaining those observations already being made.

Dr. Alverson also noted that although ocean observations underpin a wide range of societal benefits at global and national levels, few people think about or understand this. The tide gauge network, on the other hand, provides benefits locally, and its value is better recognized. As an example, Dr. Barrell pointed out that most ocean observations are funded through research in Australia, but tide gauges are an exception, in large part owing to the 2004 Indian Ocean tsunami. It was noted that it is unlikely that oceanography will follow meteorology in the sense of eventually moving ocean research observations to operational observations and that the distinction between research and operations is not as clear in oceanography. Finally, Dr. Alverson highlighted the recent release of a major new publication, *Understanding Sea-Level Rise and Variability*.

5.6 Global Terrestrial Observing System (GTOS)

The Chairman of GTOS, Dr. Riccardo Valentini, provided an overview of GTOS that focused on the next five years (2010-2015). The vision of GTOS is to contribute to international policy decisions based on timely, reliable and comprehensive information about the status of the terrestrial environment, its components, and the natural resources it provides for humans and other species. Its mission is to facilitate the development, implementation and operation of systems, processes and collaborative arrangements that enable the acquisition of consistent, timely and accurate information on the global (and large-scale regional) terrestrial environment and its changes. To fulfil this mission GTOS: formulates, leads, monitors, and revises, as appropriate, the overall approach to global terrestrial observations; identifies systematic observations/variables that are required and defines their characteristics (e.g., standardization in observations and reporting); and advocates in the relevant international policy arena the adoption of the proposed variables, approaches and methods, taking the steps necessary to ensure their ongoing provision, availability, and use.

Dr. Valentini remarked that if ocean observations are challenging, terrestrial observations are even more so. However, he did mention some of the recent successes GTOS has had, noting, in particular, the Global Observation of Forest and Land Cover Dynamics (GOFD-GOLD) work on land cover methods and products, fire methods and products, REDD contributions, advocacy for continuity of satellite observations, and numerous regional networks; the Terrestrial Carbon Observation (TCO) initiative, including CarboAfrica and its outputs and *in situ* methods documentation; the work TOPC is doing with GCOS for the UNFCCC in defining terrestrial Essential Climate Variables (ECVs) and documenting their status (fourteen of the ECVs are in the terrestrial domain); and the work GTOS is doing with UN/ISO (International Organization for Standards) on developing a framework for

standardization. Dr. Valentini also noted as GTOS strengths the Global Terrestrial Networks (GTHs) for glaciers, hydrology, permafrost, lakes, rivers, and mountains.

Some foci for GTOS include climate change, land degradation, terrestrial carbon stocks and fluxes, and loss of biodiversity. Particular attention will be given to the impact these have on ecosystem services. Cross-cutting priorities are vulnerable ecosystems, in particular, coastal areas (particularly delta and mangrove ecosystems), mountains, snow and ice cover, and urban areas. GTOS intends to change its structure somewhat to address these issues. It will have three panels, including the current Terrestrial Observations Panel for Climate (TOPC), a TCO panel, and GOF-C-GOLD. GTOS is involved in sixteen tasks or sub-tasks with the Group on Earth Observations (GEO), including work with GEO on definition of a Global Carbon Observation System (GEOCARBON).

GTOS has also defined a supersites concept. There are some 400 Fluxnet sites worldwide, and GTOS would like to upgrade a few of these to supersites, e.g., in protected areas such as national parks.

The SC recognized the excellent work GTOS has done on the Reducing Emissions from Deforestation and Forest Degradation (REDD) issue. A question was raised about whether GTOS and GCOS had established links with the Convention on Biological Diversity (CBD) and what this would mean.

Action 17. Links to CCD and CBD. The GCOS Secretariat is asked to investigate the development of closer links to other conventions, in particular the United Nations Convention to Combat Desertification (UNCCD) and the Convention on Biological Diversity (CBD), whether through GTOS, GOOS, or directly.

5.7 Committee on Earth Observations Satellites (CEOS) Response to the GCOS-IP

The CEOS Climate Coordinator, Dr. Mitch Goldberg, began his presentation by thanking the GCOS SC for producing a good Implementation Plan. He said that CEOS is ready to respond to it and that it will provide a great opportunity to organize CEOS not only to prepare the report but also to execute it. CEOS, he noted, is now more capable, with the formation of virtual constellations and association with other important organizations such as WCRP, WMO and CGMS. The SC welcomed the activities already being undertaken by CEOS in developing its response to IP-10.

Notably, CEOS is establishing a working group on climate. Its mission will be to coordinate the implementation of the climate activity plans from the various CEOS Agencies, including:

- Review of the generation of Fundamental Climate Data Records (FCDRs) and derived ECV satellite products by Member Space Agencies;
- Identification of multi-agency implementation teams for each product and review their actions;
- Ensuring a coherent implementation plan exists for each product;
- Ensuring coordination of climate product generation with other relevant international initiatives;
- Making recommendations to the above teams and receiving recommendations from them, for transmission to the CEOS Plenary; and
- Ensuring compliance of satellite products with GCOS Monitoring Principles and with GCOS-128.

A task of current importance to CEOS is its Progress Report to UNFCCC SBSTA. This update of a previous report was delivered in September 2010 and is the third such report CEOS has prepared for SBSTA. The report also includes updates of other international climate groups where CEOS agencies are members and make significant contributions to the development of CDRs. These include the Global Satellite InterCalibration System (GSICS), the Sustained COordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM), the Coordination Group for Meteorological Satellites (CGMS), and the World Climate Research Programme (WCRP). CEOS will also be providing a Coordinated Response to the new GCOS Implementation Plan (IP-10). This is due in May 2011.

CEOS has created a template for use in describing satellite-related actions in IP-10. Use of this template should also help GCOS in the preparation of the planned update of the satellite supplement to the Implementation Plan. Regarding the template, Dr. Goldberg mentioned that it would be especially important to have information on targets and minimum thresholds. Such information will allow CEOS to see where it exceeds targets and areas where improvement is needed.

Action 18. CEOS Template. The Secretariat is asked promptly to circulate to all SC members for comment the template under development by CEOS to develop the response by space agencies to each satellite-related action in IP-10.

6. Sponsor Views on the Development of GCOS

6.1 World Meteorological Organization (WMO)

Ms. Barbara Ryan, Director, WMO Space Programme, represented WMO at the SC Session and began her presentation by stating that WMO is proud to be a sponsor of GCOS. Among the accomplishments she praised were the facts that GCOS has brought together an international community to focus on climate observations, has been responsible for the identification of the ECVs, has led the development of well-regarded implementation plans for climate observations, and has created important linkages with the principal global observing systems. She stated that a strong GCOS is essential for the future and highlighted her belief that its link to the still-developing GFCS will be important.

Among the challenges for GCOS Ms. Ryan noted were the zero-nominal-growth budget environment WMO faces and a continuing disconnect at the science/policy interface, for example, the fact that few policy makers recognize the importance of global observing systems for the formulation of sound policy. She stressed that the co-sponsored nature of GCOS continues to be important and that its co-sponsored status makes GCOS more powerful, regardless of who pays for what. She noted that there has been some sensitivity between the role of the Sponsors and the role of the Steering Committee in governing GCOS and, in particular, asserted that greater clarity is needed concerning the respective responsibilities of the SC and Sponsors for scientific and management guidance.

Ms. Ryan also brought to the attention of the SC some of the principal outcomes concerning GCOS of WMO Executive Council LXII. She noted that the Council concurred with the conclusion of the Expert Segment of the World Climate Conference-3 (WCC-3) that calls for strengthening both the *in situ* and space-based components of GCOS and free and open exchange of data. The Council emphasized the importance of observations generally and, in particular, for the success of the GFCS. It expressed its appreciation for the *Progress Report on the Implementation of GCOS 2004-2008*. The Council noted that it considers GCOS to be the climate-observing component of GEOSS. And it praised the establishment of a close link between GCOS and the Commission for Climatology.

Action 19. Steering Committee Role. The SC affirmed that it still sees its role as one of scientific and technical assessment, identification of requirements, and provision of advice and advocacy on contributing observing systems, as set out in its current terms of reference, rather than one of management of observing sub-systems. The SC Chair was asked to draw the attention of the Sponsors to this view, in the context of providing input to the review of the GCOS Memorandum of Understanding.

6.2 International Oceanographic Commission (IOC)

Representing the IOC, Dr. Keith Alverson provided highlights relating to GCOS of the XXV IOC Assembly (2009). The Assembly recommended that member countries designate a GCOS National Coordinator to represent all national agencies involved in ocean, atmospheric, and terrestrial climate observations; speed up the implementation of agreed actions that were reported as showing slow progress in the GCOS Progress Report; and support the OceanObs'09 Conference through the involvement of national scientific experts and representatives of relevant national agencies. Dr. Alverson also drew attention to some of the highlights of the XLIII IOC Executive Council meeting in June 2010. The Council noted the necessity of sustained ocean observations for climate research and services and for national climate adaptation strategies in the coastal zone; commended Member

States for their efforts in implementation; and expressed concern with the slowing of progress and with the fragility of the arrangements that support sustained ocean observations.

The Executive Council also noted the importance of GO-SHIP for climate monitoring and prediction and encouraged OOPC to ensure that the GO-SHIP initiative was part of a comprehensive strategy for deep-ocean observations. It welcomed OOPC efforts to improve its real-time ocean climate indices in the framework of regional climate impacts and called on Member States to provide the IOC Secretariat with examples of the use of ocean climate indices in national or local decision making for inclusion in the OOPC State of the Ocean website. And it urged Member States to address identified priorities and gaps and to ensure the sustained long-term operation of essential *in situ* and space-based ocean observing networks.

Dr. Alverson conveyed a message from the Executive Secretary of the IOC, Dr. Wendy Watson Wright. The IOC, noted Dr. Wright, supports GCOS as an important co-sponsored program delivering on IOC High Level Objective 2, which concerns mitigation of the impacts of and adaptation to climate change and variability. It strongly encourages actions be taken to improve the gender balance on the GCOS SC and the OOPC. And it suggests that expertise on climate change adaptation, specifically on adaptation to sea level rise, be added to the GCOS SC.

The SC expressed its continuing concern that the ocean component of the global observing system for climate continues to be fragile, with over-reliance on short-term research funding. This poses a growing risk to the sustainability and integrity of the observing system. Greater robustness in both national and international arrangements for agents of implementation for sustained observation in the ocean domain would contribute to improving the situation.

Action 20. Advocacy for Ocean Observations. The Chair and D/GCOS are requested to continue their advocacy for sustained observation of the ocean to the IOC and to communicate to IOC that the SC strongly supports the IOC review of the structures of GOOS governance. The SC also urges the IOC to consider, at its 26th Assembly (Paris, June 2011), what national institutions might be explicitly identified as appropriate to take responsibility for supporting sustained ocean observing for climate.

Action 21. Brochure linking observations to socioeconomic sectors. The GCOS Secretariat was requested to develop a brochure explaining how global climate observation contributes to addressing the major policy issues related to various socioeconomic sectors.

6.3 United Nations Environment Programme (UNEP)

The representative of UNEP, Dr. Norberto Fernandez, indicated that UNEP attaches great importance to the work of the GCOS, including that of its Secretariat and Steering Committee. The actions in the GCOS Implementation Plan are very relevant to a number of UNEP activities, including environmental observing, monitoring, scientific assessment, and alerts of emerging issues and trends, especially in the areas of climate change and adaptation and early warning.

As a sponsor of the global observing systems GCOS, GTOS, and GOOS, UNEP supports the coordination and integration of activities among these observing systems and processes to optimize results and to improve access to, and sharing of, global observing systems data and services to stakeholders in all countries—especially in developing, transitional, and least developed countries. UNEP also supports the efforts of the GCOS Secretariat to become the climate observing component of the GEOSS, acknowledging, at the same time, that additional work needs to be done to further improve such integration.

UNEP also attaches great importance to the work on ECVs in the terrestrial domain, which is being carried out by GTOS in cooperation with GCOS. Data on the ECVs are very relevant to UNEP's work in adaptation to climate change, ecosystem management, and other priority areas. Through its capacity development programme and activities, UNEP will assist countries in bringing ECVs into their national environmental information networks and integrated analysis processes in support of national planning and actions for adapting to climate change.

In the area of science and early warning, UNEP proposes to build a comprehensive global climate change early warning system (EWS-CC) together with partners from the UN system. This proposed

EWS-CC will provide two kinds of warnings: 1) short-term, operational warnings (with a time horizon of 6 months to 5 years) concerning the high risk of droughts, floods, heat waves and other threats, and 2) medium- to long-term early warnings (with a time horizon of 5 years to a few decades) concerning hot spots of increasing risks of climate impacts – such as resource conflicts, severe coastline erosion, or declining water supply. It will build on existing piecemeal early warning systems and take advantage of the latest science and technology. A meeting in November to discuss this initiative is being planned. The GCOS Secretariat will attend.

Also, to redress an important gap in scientific coordination in areas of vulnerability, impacts and adaptation to climate change, UNEP proposes to establish a new international joint programme called “*Programme of Research on Climate Change Vulnerability, Impacts and Adaptation*,” or PRO-VIA. The establishment of this platform follows strong appeals from prominent members of the vulnerability-impacts-adaptation research community for more cohesive and coordinated research efforts as governments, communities, and civil society gear up to adapt to climate change. The aim of PRO-VIA is help prioritize, accelerate, harmonize, mobilize, and communicate vulnerability-impacts-adaptation research. PRO-VIA will provide substantive input into a number of cross-cutting UN processes and existing areas of activity.

Action 22. Climate Change Early Warning Meeting. The SC welcomed the invitation extended to D/GCOS by UNEP to attend the UNEP “Global Climate Change Early Warning System Expert Consultation” meeting. The SC requested D/GCOS to attend this meeting and that D/GCOS and the SC Chair seek further opportunities for active engagement with UNEP.

6.4 International Council for Science (ICSU)

Dr. Howard Moore provided ICSU views on the development of GCOS. He began by affirming that ICSU attaches great importance to the work of GCOS, including its Secretariat, Panels, and Steering Committee and stressed that the provision of a long time series of *in situ* and satellite climate observations is fundamental for the advancement of earth system science and its related disciplines. He stressed the value and power of the co-sponsored nature of GCOS despite that fact that ICSU itself has not been able to contribute financially in recent years to its support.

At the previous session of the GCOS-SC, ICSU reported on Step 1 of its “Earth system research visioning process.” The outcome of this step was a report identifying “Grand Challenges of Global Sustainability Research.” Among the five grand challenges was the challenge to “develop the observation systems needed to manage global and regional environmental change.” This is a clear demonstration that the scientific community involved in Earth system and global sustainability research considers advancing the global Earth observing systems as vital for enhancing the sound science needed to manage global environmental change and move towards a sustainable future.

Dr. Moore noted that the 29th ICSU General Assembly (Maputo, October 2008) decided to establish the ICSU World Data System (WDS) as an ICSU Interdisciplinary Body. This new body will amalgamate the former ICSU World Data Centres and the Astronomical and Geophysical data Services (FAGS) as well as other ‘state of the art’ data centres and services. The objectives of the WDS are to ensure long-term stewardship and provision of quality-assessed data and data services to the international science community and other stakeholders. The WDS will incorporate new scientific data activities into a common, globally interoperable, distributed data system.

Finally, Dr. Howard noted the strong role ICSU will be playing in the Rio+20 meeting in 2012. ICSU intends to bring to this important meeting its view that governments need to step up significantly their support to the development of GCOS and the other global observing systems in the context of GEOSS. He suggested that GCOS may want to be involved in Rio+20.

Action 23. Rio+20. The SC stressed the importance of making the presence of GCOS felt at the Rio+20 meeting. D/GCOS and the SC Chair were asked to pursue this matter in collaboration with GTOS.

7. Other Views on How GCOS Can Serve Programmatic Needs

7.1 World Climate Research Programme

Dr. Ghassem Asrar, the Director of WCRP, introduced WCRP's requirements for climate observations. Stressing that the mission of WCRP is to improve climate predictions and our understanding of human influences on climate, Dr. Asrar noted that:

- Coordinated collection, analysis, and reanalysis of climate observations are essential for describing the structure and variability of the climate system; that
- Special efforts are required to obtain, analyse, and assimilate data from the new generation of environmental satellites; that
- In addition to the longer-term data for climate monitoring and analysis of time-dependent variations, there is a need to collect, analyze, and archive high spatial and temporal resolution data on physical variables and chemical constituents, using *in situ* as well as remote-sensing methods; and that
- A commitment is required for the progressive, coordinated, ongoing analyses and periodic reanalyses of observations necessary to incorporate lessons from new measurements and research.

A major concern is the development and improvement of climate data records (CDRs) that can be used for studies and assessments of climate variability and change, such as for the IPCC. Particular concerns for which activities are underway include:

- Continuity and homogeneity of observations, especially from space;
- The need for reprocessing of records in a coordinated way and with agreement on algorithms, and comprehensive validation, evaluation, and assessment of results; and
- The need for reanalysis to produce global gridded fields.

WCRP provides support to GCOS by:

- Advocating improved observations and analysis suitable for climate (satisfying the GCOS Climate Monitoring Principles designed to ensure continuity of record);
- Evaluating observations and promoting their reprocessing and reanalysis into global fields; developing new products and datasets; and developing analytical and diagnostic techniques to process observations and model data;
- Continuing to carry out studies on mechanisms and modes of variability that have contributed to observed climate anomalies;
- Promoting improved data assimilation and analysis;
- Providing advice on best datasets for various purposes (climatologies and time series) and indicating their merits and limitations; and
- Helping to improve and promote sound data stewardship, including data archiving, management, and access.

WCRP's research priorities include quantification and communication of uncertainties in climate change information/knowledge; regional, inter-annual to seasonal, and decadal climate prediction/projection; information needs for adaptation planning, mitigation strategies, and assessing risks of climate variability and change; and promoting and enabling timely, reliable, and easy to access climate information and knowledge.

Action 24. Data Set Intercomparison. The SC strongly supported the facilitation by WCRP and GCOS of data set intercomparison. The Panel Chairs and Members are encouraged to engage fully in this process.

7.2 Intergovernmental Panel on Climate Change (IPCC)

On behalf of the IPCC Secretariat, Dr. Alexander Zeitsev briefed the SC on IPCC issues relevant to GCOS. He noted that Working Groups I, II, and III of the Fifth Assessment Report (AR5) are due to release their reports in September 2013, March 2014, and April 2014 respectively. The Synthesis Report will be released in September 2014. A new set of scenarios will be used, and AR5 plans to

address the issue of what constitutes dangerous interference with the climate system. Some 831 experts will be involved in AR5, of which about 30 percent will be from developing countries and about 25 percent female.

Dr. Zeitsev noted that an independent review of IPCC processes has been carried out by the Interacademy Council and that the IPCC has analyzed the recommendations in this report. The goal is to increase openness and to ensure quality. Dr. Zaitsev suggested that when AR5 is released in 2014 GCOS, WCRP, and the IPCC could analyze what is needed for observations. The SC Chair proposed that a joint workshop on this subject could provide input for a third GCOS Adequacy Report and suggested that the SC may need to give some thought as to how to prepare for this.

The SC noted the importance of the identification in the Second Assessment Report (AR2) and Third Assessment Report (AR3) of factors related to observations limiting the conclusions that could be drawn by the Working Groups and the consequent key needs for observations and research. The SC noted that the Fourth Assessment Report (AR4) had not followed this practice, although it had identified key uncertainties from which observational needs could be inferred.

Action 25. Statement of observation and research needs in AR5. The Chair of the SC, and, subject to his agreement, the Chair of the WCRP JSC, are requested to address a letter to the co-chairs of the AR5 WGs with the aim of achieving a clear identification and statement of key observation and research needs from the AR5 process.

7.3 UN Framework Convention on Climate Change (UNFCCC)

The representative of the UNFCCC Secretariat, Ms. Rocio Lichte, reminded the SC of the decision on systematic climate observations that the Conference of the Parties (COP) made at COP-15 in Copenhagen (9/CP.15). The decision expressed the appreciation by the Parties of the *Progress Report on the Implementation of the Global Observing System for Climate in support of the UNFCCC 2004-2008* (August, 2009). The report recognizes significant progress in improving observing systems for climate, but also the limitations with respect to continuity, gaps, and needs. She noted that the decision invites Parties and UN agencies and organizations to address the priorities and gaps identified in the Progress Report. It invites the GCOS Secretariat, under the guidance of the GCOS SC, to update the 2004 GCOS Implementation Plan, taking into account emerging needs in climate observations (e.g., adaptation needs). The decision also encourages GTOS to implement a framework for terrestrial observations as a joint UN and ISO mechanism and CEOS to continue coordinating and supporting implementation of the satellite component of the GCOS.

Ms. Lichte drew attention to the upcoming session of SBSTA (SBSTA 33, Cancun, Mexico, 30 Nov – 4 Dec 2010) in which the following issues relevant to global observations will be considered: the updated Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (IP-10, from GCOS), FCCC/SBSTA/2010/MISC.9; progress with climate-related terrestrial observations and related activities (e.g., terrestrial ECVs) (from GTOS), FCCC/SBSTA/2010/MISC.10; and progress in the coordinated response by space agencies involved in global observations to GCOS and the UNFCCC (from CEOS), FCCC/SBSTA/2010/MISC.11.

Ms. Lichte noted several elements relevant to observations in the latest negotiating text by the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA). In particular, the text as available at the time of the SC meeting³ contains proposals related to supporting the further development and implementation of the GFCS; taking into account the best available science and observed impacts in reviewing long-term goals; enhancing adaptation actions under the proposed Adaptation Framework [for Implementation]; strengthening data, information, and knowledge systems; and improving climate-related research and systematic observation for climate data collection, archiving, analysis, and modelling, including the strengthening of existing institutional arrangements and expertise.

Finally, she remarked that high-quality observations of climate on a systematic and continuous basis were the underlying requirement for a number of needs that have been identified through the UNFCCC process. This is particularly the case for the review of long-term goals by 2015 (as called

³ Negotiations under the AWG-LCA are in process. Information presented during the SC meeting were based on the current version of the draft texts, only presenting information on issues under discussion.

for under the Copenhagen Accord and which should take into account best available science) and for producing products and services for users and decision makers (such as those to be delivered under the GFCS). Furthermore, analysis and interpretation of data and observations is needed, and adaptation to climate change will require a stronger regional and local focus and hence data and observations at these scales.

Action 26. Establishing Coordinator and Focal Point Links. The GCOS Secretariat is asked to encourage GCOS National Coordinators to establish links with their national UNFCCC focal points, for example through the proposed Rockefeller Center meeting.

7.4 Satellite Community – CGMS, GSICS, and SCOPE-CM

Ms. Barbara Ryan reviewed developments related to the Coordination Group for Meteorological Satellites (CGMS), the Global Space-Based Inter-Calibration System (GSICS), and especially the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM).

The aim of SCOPE-CM is to address the requirements of GCOS in a cost-effective, coordinated manner, capitalizing on existing expertise and infrastructures. Its objective is to provide continuous and sustained high-quality ECV satellite products (Climate Data Records) on a global scale. A number of pilot projects are underway, including projects on clouds and aerosols; water vapour, clouds, and precipitation; surface albedo, clouds, and aerosols; winds and clear sky radiances; and upper tropospheric humidity. Next steps for the programme include: more involvement from research agencies and/or those working on ECVs; broader testing of the maturity model/matrix; testing of concepts with oceanic and terrestrial ECVs; and continued advancement of dialogue between operational and research communities.

The SC expressed appreciation for the reprocessing of geostationary satellite data undertaken by EUMETSAT and JMA under SCOPE-CM Pilot Project 4, and for the availability of these data for use by reanalysis groups worldwide. The SC further recalled the commitment by space agencies to systematically reprocess their geostationary satellite data record for use in reanalysis (Action A-11 in the CEOS Response to the GCOS IP-04), including the generation of Atmospheric Motion Vectors (AMVs) and clear-sky radiances from the complete geostationary constellation. It noted that NOAA's record of geostationary satellite data had yet to be reprocessed. The SC welcomed the work the WMO Space Programme to investigate and advance a space-based architecture for climate monitoring.

Action 27. Reprocessing of Geostationary Satellite Data. The GCOS Secretariat was requested to inform the SCOPE-CM Executive Panel that the SC appreciated the efforts of EUMETSAT and JMA in undertaking reprocessing of their geostationary satellite data, and emphasized the need for a corresponding reprocessing of GOES data.

Action 28. Free and open access to satellite products. The GCOS Secretariat was requested also to express to the Panel the importance of free and open access to satellite products and of user-friendly mechanisms for making products available.

8. Opportunities for GEO and GCOS

8.1 Group on Earth Observations (GEO) Feedback to GCOS

Dr. Rob Koopman, representing GEO, was pleased to report that GEO now has 82 members and 52 participating organizations. GCOS and all of its Sponsors count among the participating organizations. GEO's strategic target on climate was recalled to be the achievement of effective and sustained operation of the global climate observing system and reliable delivery of climate information of a quality needed for predicting, mitigating, and adapting to climate variability and change, including for better understanding of the global carbon cycle. This target will be reached through:

- The full implementation of the Global Climate Observing System as the climate observing component of GEOSS, including the closure of critical gaps, to ensure the availability of all climate and climate-related observations needed to support GEOSS;
- Promotion of data sharing as well as coordination of data management and exchange systems;
- Contributions to major advances in the monitoring and prediction of climate on seasonal, interannual, and decadal time scales, including the occurrence of extreme events;
- Strengthened GCOS support for the assessment role of the IPCC and the policy development role of the UNFCCC; and
- Enhanced efforts for data rescue and digitization.

A key point made by Dr. Koopman was that GEO and GCOS must deliver consistent messages. Such consistency is not just nice to have but is mandatory for credibility, and it pays off. Dr. Koopman noted that the GEO 10-Year Plan represents the consensus of its Members and Participating Organisations on the way forward in Global Earth Observations and that GEOSS is effectively built from in-kind contributions from its Members and Participating Organisations, which are aligned to the common objectives of the 10-Year Plan. This alignment is facilitated by a matrix of concerted actions (SBA and cross-cutting tasks) and associated targets to focus international collaboration and harmonisation. This is the GEO Work Plan. Increasingly, the objectives of the 10-year plan and the Tasks in the Work Plan are used as requirements for funded government tenders (e.g., in the European Commission's 7th Framework Programme).

Dr. Koopman reported that the final update of the 2009-2011 GEO Work Plan has been submitted for endorsement at the GEO-VII Plenary in Beijing in November 2010. The next GEO Work Plan will cover 2012-2015. Ministerial Summits are scheduled for 2010, 2013, and 2015. The end of this Work Plan period also marks the due date for achieving the GEOSS Strategic Targets. Drafting of the plan is starting "now."

Apart from the political leverage it can bring, Dr. Koopman stressed that working within the GEO Work Plan provides benefits related to data sharing, data management and architecture, and quality assurance, harmonization, and integration. He noted that GEO is also providing a broad platform for the integration of carbon observations, the carbon community of practice, and the forest carbon tracking initiative. GEOSS can be used to optimize the efforts to benefits ratio.

8.2 GCOS Input to GEO-VII and the 2010 Ministerial Summit

The SC Chair introduced this item. He affirmed that both he and the Director of GCOS would attend GEO-VII. Also of note is the fact that GCOS will be sharing a booth at the meeting with ICSU, GOOS, and GTOS. Some talk has been heard of a possible call for a "gap analysis." The Chair stated that he would stress that such an analysis is not needed for things that are already being done. The SC stressed that efforts should be made in Beijing to emphasize needs for *in situ* observations.

Dr. Sue Barrell, "wearing her hat" as a member of the GEO Executive Committee, expressed her view that the relationship between GCOS and GEO is valuable, and she endorsed the need for consistency. If the message of working together is clear, there can be benefits for both. She also noted that GCOS should explore building on the Cape Town Declaration. She advised that tasks should be structured effectively and that GCOS is well positioned to state priorities in new tasks. Tasks should be set as "open tasks" and should not, as in the early days of GEO, simply state what we are planning to do anyway. They should be structured in a way to draw others in.

Action 29. GEO-VII Plenary. The SC Chair was encouraged to intervene as appropriate at GEO-VII on a number of issues identified during the course of this SC Session.

9. WMO Technical Commissions

9.1 The Commission on Climatology and GCOS

Dr. Thomas Peterson, a former member of AOPC and the current the President of the WMO Commission on Climatology (CCI), provided via teleconference an overview of the Commission and of its interaction with GCOS. The Commission is organized to address four main areas: climate data

management, climate monitoring and assessment, climate products and services, and climate information for adaptation and risk management. Dr. Peterson drew attention to the Annual State of the Climate Report, a report that tracks GCOS ECVs. It can be accessed here: <http://www1.ncdc.noaa.gov/pub/data/cmb/bams-sotc/2009/bams-sotc-2009-chapter1-introduction-lo-rez.pdf>. While the CCI seeks to promote international collaboration, the reality is CCI cannot force countries to do anything, including releasing data. It can only undertake actions that volunteers will embrace, actions that are typically directly related to the mission of the volunteer's institution.

Dr. Peterson showed one slide that indicated there are still substantial opportunities to increase GCOS Surface Network (GSN) data. He then reviewed the principal IP-10 Actions in which CCI is named as the principal Agent for Implementation.

Action C13 asks CCI to collect, digitize, and analyze the historical atmospheric, oceanic, and terrestrial data records from the beginning of instrumental observations in a region and submit to International Data Centres. CCI supports and encourages this but notes that the main action is with the World Weather Records (WWR) and in educating people about the value of observational analysis. Action A2 asks CCI to make further progress in the systematic international exchange of both hourly SYNOP reports and monthly CLIMAT reports from the WWW/GOS RBSN. CCI supports and encourages this also but has no team actively working on this action. Action A4 asks CCI to apply the GCOS Climate Monitoring Principles (GCMPs) to all measurements relevant for climate from surface networks. Dr. Peterson notes that CCI's contribution is primarily through documents providing guidance and encouragement on these matters.

Action A5 is to implement guidelines and procedures for the transition from manual to automatic surface observing stations and to conduct an expert review of the impact of increasing use of automatic stations on the surface climate data record. CCI currently has no one working on this but two groups of volunteers could be asked to address these tasks. Action A7 calls for submission of all precipitation data, including hourly totals where possible and radar-derived precipitation products, from national networks to the International Data Centres. Although CCI supports this no one is working on it at the present time.

CCI would like to see GCOS undertake several activities. These include: asking CBS-GCOS regional and monitoring centres to improve CLIMAT transmission from all stations rather than just the GSN and asking CBS-GCOS regional centres to become involved in World Weather Records by January 2011.

The SC expressed its appreciation of NCDC's hosting and CCI members' efforts on producing the annual state-of-the-climate report. It also appreciated CCI's response to IP-10 *in situ* actions and suggested it should identify a lead agency for each action in order to continue to push forward. The Chair saw a role for GCOS as a bridge between CCI and CBS.

Action 30. Prompt Submission of World Weather Records. The SC recognized the importance of prompt submission of comprehensive national input to World Weather Records, and requested the AOPC to consider the actions needed.

Action 31. Informing Agents of Implementation. The SC welcomed the CCI President's discussion of the actions from IP-10 for which CCI was identified as an Agent for Implementation. The Secretariat is requested to draw the attention of all international bodies identified as Agents for Implementation to the actions for which they had been identified as potentially responsible, and to invite them to respond accordingly.

9.2 Commission on Basic Systems (CBS)

Dr. Sue Barrell, Vice President of CBS, reviewed GCOS-related activities in CBS. She remarked that CBS is the mechanism through which Members contribute expertise related to: development, implementation, and operation of integrated systems (i.e., for observing, data processing, data communication, and data management); provision of public weather services; and response to requirements of all WMO Programmes and opportunities provided by technological developments. CBS is the lead Technical Commission for the overall World Weather Watch Programme (WWW), the

WMO Space Programme, the Public Weather Services Programme, and the implementation of WIS and WIGOS. It has 313 members from 140 countries, and is the largest of the technical commissions.

She discussed the Rolling Review of Requirements (RRR) process and noted that its principal aim is to address the extent to which *in situ* and space-based systems meet user requirements for observations. One of the twelve applications areas is climate monitoring. The RRR process focuses on WMO programmes and co-sponsored programmes and benefits all users of WMO observing systems, including GCOS.

Dr. Barrell noted that a new Implementation Plan for the Global Observing System (GOS) will be developed in 2015. This Plan will include WMO-owned and co-sponsored systems, and will include input from GCOS and the climate community. It will be based on the new Vision for GOS in 2025 that was approved by the WMO Executive Council in 2009. The SC Chair noted that the timeframe for developing the GOS Implementation Plan is not so different from the timeframe for the next edition of the GCOS Implementation Plan. Therefore, GCOS and CBS should perhaps try to work in parallel, e.g., on adequacy and implementation issues.

Dr. Barrell also mentioned that the CBS Rapporteur on GCOS matters (Mr. Matthew Menne) has highlighted the need for improvements in the exchange of data from the GSN stations, in particular, sub-daily temperature, precipitation, and other variables relevant to climate variability and extremes. It is understood that data exchange is often a telecommunications issue and failure to exchange data is not caused by any underlying shortcoming in observational practice or by local data policy.

The SC was pleased to see references to GRUAN and recognition that its management will eventually be moved under CBS. CBS is making several contributions to the GFCS. These include an activity on defining and implementing space-based architecture for climate monitoring, development of the Vision for the GOS in 2025, which will encompass a comprehensive response to needs for climate monitoring, and the development of guidelines and procedures for the transition from manual to automatic observing stations. Finally, Dr. Barrell noted that many actions from IP-10 were addressed by the above activities.

The SC discussed the importance of humidity as a climate variable and as a chemically important variable in the upper stratosphere. It noted new developments in operational systems for measuring humidity. This topic could be considered in the future as an emerging issue, and AOPC will give this particular attention and report back to the SC in one or two years. Also, SC Members noted that it is useful to hear what the Commissions are doing. Perhaps in the future it would be useful to hear from CIMO, CAS, and JCOMM, as well as CBS and CCI, probably on a rotating basis. It was also stated that it would be useful to hear from the Commissions of the other Sponsors of GCOS.

Action 32. Aligning CBS and GCOS Planning. The SC noted that CBS was preparing an implementation plan for the GOS for presentation to Congress in 2015 and that this plan would take note of GCOS requirements for atmospheric climate observations. It will be important to align this planning with GCOS's own activities in assessing adequacy and developing a new implementation plan, which is likely to take place in the time frame 2013-2015. AOPC was requested to consider this in depth.

Action 33. GRUAN. The SC welcomed the steps being taken by CBS towards integration of the GRUAN into CBS structures. D/GCOS was requested to discuss within the WMO OBS Department the appropriate participation in the next Implementation and Coordination Meeting for the GRUAN.

Action 34. Participation of Commissions in SC Meetings. D/GCOS was further requested to consider inviting Commissions other than CBS and CCI to attend SC meetings from time to time and to coordinate with GOOS and GTOS concerning equivalent arrangements for their technical commissions.

10. The Global Framework on Climate Services—Update on GFCS Development

Dr. Buruhani Nyenzi, the Manager of the Secretariat for the High-Level Taskforce (HLT) that is considering governance and implementation issues for the Global Framework for Climate Services, briefed the SC on the work of the HLT. He stated that a draft of the Report of the HLT will be available on the web for government and expert review by 1 November 2010. He noted that a consultative meeting will take place at COP-16 in Cancun at the end of November and that the report will be finalized, taking account of feedback received on the draft, in January 2011. The Report will then be sent to the UN Secretary-General and will be considered at the WMO Congress (Cg 16), to be held in Geneva in May, 2011. At Cg 16, WMO will decide how best to pursue the implementation of the GFCS in the following four-year financial period.

The chapters of the nine-chapter report that appear to have most relevance to GCOS are chapters one, two, eight, and nine. Chapter 1 deals with the importance and current availability of climate information. Chapter 2 addresses current earth, atmosphere, and ocean observing systems that are maintained to support climate research and services. It looks at global coordination, mechanisms (technologies and networks/systems) to exchange data, and the data policy frameworks that enable the exchange of climate data and related information). Chapter eight deals with implementation and chapter nine deals with governance issues.

The SC stressed that provision of climate services needs to be accomplished across a broader and more diverse set of national agencies than the meteorological services. Although the GFCS is being developed under the auspices of WMO, the process has to engage other international organizations to be successful at regional and national levels. To ensure this broader engagement, the traditional forms of WMO coordination and communication with national Permanent Representatives (PRs) may need to be enhanced in order to make them more relevant in the context of providing climate services. Meteorological services by their nature are concerned primarily with the observation, science and forecasting of atmospheric phenomena. However, climate services require significant inputs from agencies working in the oceanic and terrestrial domains, and this will require substantial national and international interaction.

The SC further noted that many international observational and research programmes and systems for climate were designed by scientists to meet primarily “detection and attribution” goals. The key to GFCS will be to sustain user-targeted systems designed with “impacts, vulnerability and adaptation” goals. Operational meteorological networks were primarily designed for weather forecasting and prediction, and the networks required for climate to address vulnerability, adaptation and impacts remain to be fully identified and established. While WMO Permanent Representatives (PRs) are overall representatives of their nations to the WMO and are well placed to address those issues that apply to their national meteorological services, the GFCS will require new, non-traditional WMO channels of communication and coordination to ensure its success.

The SC Chair noted that the need for national coordination that the GFCS would require is linked to the concept of GCOS National Coordinators. Clearly, the functions of GFCS national coordinators would (or should) be substantially the same as that GCOS National Coordinators. It was proposed, therefore, that if the anticipated meeting of GCOS National Coordinators is funded, it could address these parallel coordination issues. GCOS National Coordinators must be part of any national GFCS coordination mechanism.

The SC was informed by the Chair that earlier in the year he had been requested to convene a small network of experts to respond to any requests for expert advice that arose from the work associated with preparation of the HLT report. This had been done, and the team had been consulted about a request from the GFCS Secretariat for input to the chapter on observations in the HLT report. The SC was disappointed to learn that there had been a lack of feedback or further information from the GFCS Secretariat following the submission of text.

Action 35. SC Views on GFCS Communication. The Chair was requested to convey to the WMO Secretary-General (SG) the SC’s views on the coordination and communication process for the GFCS.

Action 36. Expert Advice to the GFCS. The SC Chair was asked to communicate to the WMO SG that the SC and nominated experts remained willing to re-engage with the process should expert advice on the GFCS still be required, in particular with regard to finalising chapters 8 and 9 of the report.

11. Data Issues

11.1 Analysis of Surface Temperature – UKMO Workshop Summary

Dr. Stephan Bojinski of the GCOS Secretariat reported on the workshop, “Creating Surface Temperature Datasets to Meet 21st Century Challenges” (Exeter, 7-9 September 2010). This workshop was organized following a UK Met Office-led proposal for developing a land surface air temperature databank, as endorsed by the WMO CCI-XV session in March 2010. The workshop was sponsored by a range of institutions, including WMO (both the Climate and Water Department and the Observing and Information Systems Department), the WCRP, the GCOS Secretariat, and the US GCOS Office. It brought together some 80 climatologists, metrologists, statisticians, IT specialists, and network and archive operators from all over the world to discuss ways and means to better integrate existing surface temperature (and associated) records into a new “databank.” The primary objective for all data is to be fully and transparently documented and traceable to their source.

Some of the draft recommendations are potentially of high importance to WMO and cosponsored programmes WCRP and GCOS were that:

- The importance of free and unrestricted data exchange of monthly and daily data for climate was repeatedly emphasized;
- A new data format mandatory to all WMO Members for daily summaries (equivalent to the CLIMAT format for monthly summaries) should be developed and implemented;
- Guidance to the further development of the proposed databank should be provided by WMO, WCRP, and GCOS representation to the ad-hoc steering group; and
- A WMO representative should be nominated for the governance task team (to develop a 1-2 page proposal for a governance structure for the follow-up to this initiative.

Several NMHSs pledged to contribute datasets to the databank that have so far not been available in international data centres (such as China, Russia, and Indonesia). The importance of much stronger scientific guidance, both from within and outside the climate community (e.g., from statisticians and metrologists) was repeatedly stressed.

The GCOS Steering Committee (SC) welcomed the surface-temperature initiative and general outcome of the workshop held at the Met Office. In particular, the activity was seen as crucial for the re-establishment of widespread trust in the analysis and conclusions of studies of the surface temperature record. The importance of traceability to international standards of measurement was restated; the importance of the outreach component was emphasized; and it was considered important also that the project make arrangements for the provision of feedback to data providers as to the assessed quality of their data. The SC is pleased to invite the ad-hoc committee established by the Workshop to report to the SC on the conclusions that the ad-hoc committee and its subgroups reach.

Action 37. Communicating with the Ad Hoc Committee. The SC Chair was requested to communicate the SC’s views to the Chair of the *ad hoc* committee taking the initiative forward and to invite the *ad hoc* committee to report on progress and recommendations to the next session of the SC.

11.2 Global Observation System Information Center (GOSIC)

Mr. Howard Diamond summarized developments related to GOSIC. He noted that the success of the GOSIC is dependent upon, and has benefitted from, feedback from users, in order to assure that it remains a relevant, effective, and efficient tool for data access to a wide variety of users. The GOSIC is constantly evolving to help meet users’ data access needs, and people are encouraged to utilize the portal site and provide feedback to the staff. The GOSIC staff is open to incorporating new

features and improving existing ones, as well in collaborating with other global environmental data access activities. Therefore, people are encouraged to visit the GOSIC Portal at <http://gosic.org>, use the tools there, and provide feedback on any possible improvements that might be able to be incorporated to improve the access to climate data and information.

The GOSIC's overriding goal is to best serve the data access needs of all of GCOS (atmosphere, ocean, and terrestrial), and as such, it serves as a data portal for GCOS. That does not mean that it is the sole route to such data; however, the GOSIC has the potential to serve as a unifying facility for GCOS that reaches across the various domains and gets GCOS out of the mold of being perceived as being only about the GSN and GUAN. The GOSIC facility also helps GCOS reach out to the greater GEOSS community. It has established linkages in the GEOSS Data Registry as well as obtained membership on the GEO Data Architecture team dealing with data integration and analysis.

Rather than give a lengthy PowerPoint presentation, Mr. Diamond took some time to show the GOSIC web site to the SC. The SC thanked Mr. Diamond for his presentation and demonstration and welcomed the initiative of NCDC in establishing and operating the GOSIC. The SC endorsed the continued operation of GOSIC by NOAA on behalf of GCOS.

Action 38. GOSIC Review. The science panels were requested for their respective domains to review the contents and links to data sets contained in the GOSIC portal with a view to optimizing them.

12. A Review of the 2010 Update of the *Implementation Plan for the Global Observing System for climate in Support of the UNFCCC (IP-10)*

Dr. Paul Mason, the leader of the Task Team that prepared IP-10, provided an overview of this updated Plan. Key points, extracted from the summary of IP-10 prepared for the SC, are noted below.

- The 2010 Update of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC ("IP-10", GOOS-184, GTOS-76, WMO/TD-No. 1523) including the updated list of GCOS Essential Climate Variables (ECVs) was published on 31 August 2010 in response to a request by Parties to the UNFCCC.
- The Implementation Plan was prepared under the overall guidance of the GCOS Steering Committee and its Chairs (initially Dr. John Zillman, followed in January 2010 by Adrian Simmons), and supported by a Task Team led by Dr. Paul Mason and including the GCOS Panel Chairs and staff of the GCOS, Global Ocean Observing System (GOOS) and Global Terrestrial Observing System (GTOS) Secretariats.
- Focusing on the timeframe 2010-2015, the IP-10 replaces the 2004 Implementation Plan, taking account of the latest status of observing systems, recent progress in science and technology, the increased focus on adaptation, enhanced efforts to optimize mitigation measures, and the need for improved predictions of climate change. In its work, the task team considered advice from experts and from GCOS co-sponsoring organizations, including WMO and IOC. Over 450 comments were received on the draft open community review.
- Implementation of the 138 actions recommended in the IP-10 would provide the sustained and global observations of ECVs in the atmosphere, in the world's oceans, on land, and from space, required to ensure that countries have the observational information needed to understand, predict, and manage their response to climate and climate change over the 21st century and beyond. Undertaking the actions over the coming five years will strengthen the climate research, modelling, analysis and capacity building activities required to build and maintain a global climate observing system. Each action states relevant "agents for implementation," timelines, performance indicators, and estimated annual costs associated with the action.

- The GCOS Essential Climate Variables (ECVs), as identified in the IP-10, were originally developed to support the needs of the UNFCCC and the IPCC. The ECVs are increasingly being used by the climate community and institutions such as meteorological services, space agencies, and policymakers for framing priority action in support of climate observations.
- The IP-10 encompasses 50 ECVs including soil moisture, soil carbon, and ocean oxygen content, and recognizes the role of chemical precursors in forming the atmospheric composition ECVs ozone and aerosols. Although biodiversity and habitat properties are important to climate impact studies, these variables are not mature enough to be elevated to an ECV as only aspects of these complex properties can be measured, and only at a relatively small number of sites. Therefore, the Plan seeks the establishment of “Essential Ecosystem Records” at sites where such observations will be conducted.
- The estimated total costs of implementing the IP-10 are 2.5 billion US\$ annually, given as additional annual costs on top of the costs for maintaining and operating the existing networks, systems and activities required to address climate needs but that are in many cases not specifically designed for climate purposes. The total cost estimate is also broken down into satellite-related and open ocean-related costs, and costs for enhancements in developing and developed countries.
- Overall, IP-10 places stronger emphasis on Earth system cycles, and it clearly states the need for sustained and coordinated reanalysis and reprocessing in support of climate research, monitoring and the analysis of trends. In addition, the IP-10 provides initial recommendations and associated cost estimates in identifying basic regional needs for observations in support of adaptation planning. Such observations are mostly related to measuring the local climate and the availability of water (e.g., surface temperature, precipitation, river runoff) and to coastal marine sites, including tide gauges.
- The GCOS Steering Committee approved the release of this Implementation Plan for general publication and for submission to the UNFCCC in August 2010. It will be considered by Parties at SBSTA 33, to be held in conjunction with COP 16 in Cancún, Mexico.
- Publication of the IP-10 will be broadly communicated through appropriate channels. In order to ensure a strong response to the Plan, it is suggested that GCOS Panels, Secretariat and partners duly inform all “Agents for Implementation” and engage and further support them in addressing the Actions identified in the Plan.
- Space agencies, through CEOS, have indicated their interest in an updated Satellite Supplement to the IP-04 in order to respond to IP-10. A GCOS expert meeting to discuss updating the Satellite Supplement is tentatively planned for the week 10-12 January 2011.
- In addition to meeting the needs of the UNFCCC, a fully functioning GCOS – as the climate observing component of GEOSS – would address a broad range of user needs for systematic observation of the ECVs. It would support other UN Conventions and initiatives, such as the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), the initiative “Acting on Climate Change: The UN System Delivering as One,” and also the evolving development of the GFCS.

Dr. Mason also noted that the IP-10, like earlier GCOS documents, must be used with caution, as its focus on gaps in the observing system could possibly be used to undercut the UNFCCC process. He emphasized that this report, in contrast to IP-04, specifically addresses national scale adaptation and impact needs to mirror the evolution of the UNFCCC. He suggested that the SC needs to give some thought to ecosystem records and variables. GCOS links to the International Geosphere-Biosphere Programme (IGBP) and International Human Dimensions Programme (IHDP) are weak, so it will be a challenge to see what GCOS can do. Dr. Mason proposed that GCOS undertake an *in situ* equivalent to the Satellite Supplement soon to be updated in response to IP-10. He also noted that while impact variables, habitats, and biodiversity were too vague to be considered ECVs, they were nevertheless very important. The biggest driver of biodiversity loss is habitat loss, and the biggest driver of habitat loss is deforestation, so measuring deforestation is very important. In reporting to SBSTA, it would be useful to point out these interrelationships, but Dr. Mason suggested the GCOS text needs to indicate

that the difficulties of monitoring these variables are understood. It should further be emphasized that the role of GCOS is to assess and advise on observing system requirements.

The SC acknowledged the outstanding job Paul Mason had done for GCOS over the years, in particular in his recent role of leading the preparation of the Progress Report and IP-10. The SC recalled its earlier discussion under Agenda item 4, and Action 9 in particular. An important question of how GCOS could, and the extent to which it should, work with partners to seek the large level of network improvement in developing countries identified in IP-10 is addressed under agenda item 13.

Action 39. Satellite Supplement to IP-10. The Secretariat was requested to prepare a satellite supplement to IP-10 based on updating GCOS-107 and welcomed Paul Mason's offer to lead this operation.

Action 40. GCOS Product for 2012. The committee discussed whether it would be appropriate to prepare an *in situ* supplement, or, alternatively, a report on data requirements for adaptation in 2012. Dr. Ed Harrison and Dr. Lucka Kajfez-Bogataj were invited to develop the idea of what could be produced as a key GCOS document in 2012, consulting more widely as necessary, and, in particular, looking at a possible focus on observational needs for adaptation from a cross-domain perspective.

13. Regional Development

13.1 An Overview of Regional Activities

Dr. William Westermeyer of the GCOS Secretariat provided an overview of the regional activities in which the Secretariat has been engaged and introduced a draft strategy for facilitating the update and implementation of the GCOS Regional Action Plans (RAPs).

He first addressed the status of the Climate for Development in Africa Programme (ClimDev Africa), noting that the African Development Bank (AFDB) has granted four regional climate institutions, led by ACMAD (but also including ICPAC, the SADC DMC, and Agrhymet), \$30 million for institutional support activities; a new entity, the Africa Climate Policy Centre (ACPC) is being established at UNECA with financial backing from the UK's Department for International Development (DFID) to implement the policy component of ClimDev Africa; and the African Development Bank (AfDB) is establishing a ClimDev Africa fund and hopes raise funds to fill it through a donor conference. [Note that about two weeks after the SC ended, the ClimDev Africa Programme was formally approved at the African Development Forum in Addis Ababa by the heads of the African Union Commission, the UN Economic Commission for Africa, and the AfDB]. No projects have been implemented yet, and procedures for funding projects are still unknown. However, observations are an important component of ClimDev Africa, and this new programme represents an important opportunity for GCOS and WMO to facilitate improvements in climate observing systems in Africa.

It was noted that Action 32 of SC-XVII asked the Secretariat to develop a strategy on how to facilitate the update and implementation of the GCOS RAPs. These RAPs contain substantial information on observing system priorities in developing countries, and the UNFCCC has repeatedly urged their implementation. There is also continuing interest within regions in the RAPs. However, RAP projects are becoming dated and must be revised and refined before they could seriously be considered for funding. Several SC Members expressed the view that the regional activities of GCOS are important to continue. However, if the RAPs are to be refreshed, it is important that a clear path to implementation of their projects be identified.

A possible strategy for doing this was proposed. The steps would require that GCOS:

- Identify regional partner willing to provide leadership on observations;
- In coordination with this partner, secure funding for a regional implementation strategy meeting, such as the one held in Belize for Central American and Caribbean countries;
- Assist the region to review priorities in the original Action Plan for the region;
- Select 3 or 4 priorities from the original Plan and/or one or more new priorities, as relevant, and revise and refine (or develop) them as necessary;
- Identify potential funding agencies and invite them to take part in the meeting; and
- Encourage greater regional cooperation at the meeting, e.g., on regional-scale proposals.

RAPs might also be advanced through participation in informal (i.e., other than Regional Association sessions) meetings of NMHS directors. As an example, the Secretariat attended the Informal Conference of South-East European NMHS Directors (ICEED) meeting, Istanbul, Turkey and provided a status report on the RAP for Eastern and Central Europe. The organization of a first meeting of GCOS National Coordinators was also discussed. Funding prospects for such a meeting through the Rockefeller Foundation Bellagio Center appear to be strong.

An SC Member pointed out that WMO has strategic implementation plans for WMO regions and suggested that GCOS could become involved in this process. Another proposed that the Secretariat needs to look at each region and figure out who has a strong national coordinator or regional centre and try to work with that person or centre. Several SC Actions related to regional activities are given after section 13.4.

13.2 ACMAD and ClimDev Africa

Dr. Mohammed Kadi, the Secretary-General of the African Centre of Meteorological Applications for Development (ACMAD), briefed the SC on ACMAD's objectives. He also reviewed the history of, and provided some detail on, ACMAD's role in ClimDev Africa. (Dr. Kadi is the coordinator for ClimDev Africa activities at ACMAD). The purpose of ClimDev Africa is to enhance climate observations, products, and services for development needs in Africa. The AfDB has given ACMAD and three other regional climate institutions in Africa a 3-year (2010-2012) grant of \$30 million to strengthen the operational African regional climate institutions and to initiate a strategic partnership with the Weather Information for All (WIFA) initiative. ACMAD will be the executing agency for the four institutions. This so-called first component of ClimDev Africa will go under the name of AfriClimServ, and the ACMAD Governing Board will provide high-level oversight of the grant.

Another ACMAD project, the African Early Warning and Advisory Climate Services (AEWECS) project, comes within the ambit of ClimDev Africa. This project aims to strengthen the capacities of African countries in the prevention of risks and socio-economic impacts related to climate variability and climate change through relevant and adapted tools and services for climate early warning and advice. Five pilot projects address food security, water resources, health, coastal zone issues, and the protection of life and property in various parts of Africa.

Dr. Kadi made four recommendations to the SC. He proposed that the SC

- Fully support the AfDB grant to African Climate Institutions and other coordinated initiatives;
- Recommend, as matter of priority, that the initial support provided by AfDB be extended to effectively strengthen capacities and infrastructure of NMHSs, and also of GCOS, as stated in Climdev Africa programme documents;
- Advocate for a financial mechanism to support recovery of African *in situ* infrastructure for climate observations and to bring it up to a standard level; and
- Liaise with institutions, such as ACMAD, to support, follow up, and contribute to the implementation of the GCOS RAPs for Africa. (In this regard, he suggested the possibility of establishing an MoU between GCOS and ACMAD).

The SC noted that it may be useful to build an inventory of donors (or potential donors), so as to be better able to keep track of which donors are active in Africa and of who is doing what. It was noted by Dr. Kadi that some active countries include Spain, Korea, Finland, and France. In addition to the AfDB, the World Bank is also actively providing support (although not directly for observations).

13.3 How GCOS Can Better Contribute to Improving Observing Systems in Developing Regions

This presentation, given by SC Member Dr. Dileep Kumar (on behalf of himself, Dr. Abel Afouda, and Dr. Mohammed Kadi) responds to Action 33 of SC-XVII, which called for preparation, by SC Members from developing countries, of thoughts on how the GCOS Programme could better contribute to

improvements in climate observing systems in developing regions. Dr. Kumar observed IP-10 notes that although individual activities are coordinated internationally through a variety of programmes, organizations, and agencies, *success* will depend mainly on national and regional entities to translate the Plan into reality. He sees that an immediate necessity is for country to continent-wide efforts to integrate climate observations and management with sustainable development activities. The ClimDev Africa Programme has not made much of a difference yet, and thus only a few countries are aware of linkages between observations and development.

Dr. Kumar proposes that GCOS help for developing countries is needed to:

- Educate and convince countries to invest in environmental and climate investigations in their own interest;
- Conserve funds by avoiding investigations that often duplicate observations or follow unsound practices;
- Encourage policy makers and funding agencies to support and implement climate programmes with a central focus and national approach;
- Urge countries to appoint national coordinators and committees, using pressure through international agencies where needed;
- Emphasize the importance of land-atmosphere-ocean coupled observations;
- Recognize National Services (NMHSs and others) as in charge of the observing systems of GCOS, GOOS, GTOS, etc., and help maintain quality controls to meet required standards; and
- Convince countries of the need to recover and submit historic data to international data centres for the benefit all.

In addition, Dr. Kumar recommended that to improve climate observations and programmes in his South Asia region, as well as in others, it is necessary to:

- Impress upon countries that climate observations are necessary for sustainable development and for maintaining a healthy climate and environment;
- Prepare the ground work by educating regional policy makers on the necessity of regional cooperation in sustained climate and environmental observations;
- Identify regional partners for implementing and improving climate observations. (This could be done in two ways: 1) through international initiatives and 2) by promoting cooperation among regional countries through bodies like the South Asian Association for Regional Cooperation (SAARC);
- Organize “Belize-type” meetings for regional and international organizations (including policy makers and funding agencies) interested in improving climate observations;
- Revisit RAPs for necessary changes in objectives, potentially adding new ones, where required, and preparing updated RAPs with restructured priorities;
- Approach funding agencies for support for the RAPs; and
- Continue to encourage countries and regions to be involved with the integration of their climate monitoring.

The SC Chair remarked that these recommendations fit well within the GCOS Terms of Reference. The Chair also agreed with a Member comment that one way in which to get people involved in sustained observations would be to conduct short-term intensive field campaigns. Such campaigns would help one see if the assimilation products being put out by ECMWF, for example, are useful in regions where comprehensive observations are lacking. Sustainability of observations might also come through association with the GFCS.

13.4 The GCOS Cooperation Mechanism and System Improvement Activities

This agenda item was addressed in two parts. In the first part, Mr. Wim Monna provided a brief overview of the GCOS Cooperation Mechanism (GCM) meeting, which he had chaired the day before SC-XVIII began. As a separate report of this meeting will be prepared, only the highlights of Mr. Monna’s presentation are given here. Some of the views of the GCM participants included the following:

- The GCM may play a combination of advisory and management roles;

- Discussion of GCOS in WMO Regional Association sessions could help establish GCOS national and regional coordinators;
- GCOS national and regional coordinators should work with local organizations;
- Local organizations should be encouraged to express needs and priorities as user-pull is important;
- Coordination is needed in receiving countries so as to avoid duplication of effort;
- The UNFCCC's National Adaptation Programmes of Action (NAPA's) for the least developed countries should be reviewed for cooperation opportunities;
- Links with Regional Climate Centres (RCC's) and other regional organizations should be improved, e.g., to follow-up on RAP implementation;
- A brochure on the socio-economic aspects of observations could be developed by GCOS;
- Links could be strengthened with the Global Facility for Disaster Reduction and Recovery (GFDRR), as well as with development banks; and
- National delegations to COP-16 could be encouraged to include Systematic Observation in a long-term agreement on climate change, with a view to enhancing the possibilities for obtaining structural financing for observations.

Mr. Monna also noted that GCM "shopping lists" are now also being encouraged to address priority terrestrial and ocean observing needs as well as atmospheric needs. At this GCM meeting, some ocean priorities mentioned were moorings in the Western Indian Ocean and tide gauges around Africa, and some terrestrial priorities included soil moisture and satellite reference sites.

In the second part of this agenda item, Mr. Dick Thigpen, the GCOS Implementation Project Manager, gave a status report of his activities. His primary activities included involvement in direct GUAN and GSN station renovation, Technical Support Projects, and activities related to CBS Lead Centres for GCOS. GUAN equipment repairs have been made at Harare, Zimbabwe and Dar es Salaam, Tanzania, and radiosondes have been sent to Dar es Salaam, Mauritius, and Harare. GSN revitalization has been undertaken at Aragats High Mountain station in Armenia, at four stations in Uruguay, and at 8 stations in Angola. The net result of GUAN and GSN activities has been the continued improvement in the operation of these networks and the acquisition of additional historical data and metadata and incorporation of this data into the archive.

The activities of the CBS Lead Centres for GCOS continued with a full compliment of 9 centres. The centres have agreed to report yearly prior to the AOPC meeting, although only 5 centres reported this year. The Lead Centres have accepted to include all of the Regional Basic Climatic Network (RBCN) stations within their Terms of Reference.

The GCOS Cooperation Mechanism continues to function well with contributions from Switzerland, Germany, Spain, the UK, and the Netherlands. The US continued its support of the contract for the Implementation Manager, and many additional contributions of direct support have been received. However, it should also be noted that IP-10 estimates that the funds needed annually to address observational needs in developing countries amount to \$600 million. While the GCM contributions are important, they are not nearly enough to address the needs identified in IP-10.

An important issue raised by Mr. Thigpen is the question of sustainability. Renovation is easy. How to keep renovated stations going, e.g., when the supply of radiosondes runs out, is more difficult, as the operation of some stations will always need to be supported. It was noted that one possible (partial) solution to this issue is to ask WMO to conduct periodic inspections of the subset of GSN and GUAN stations using its technical experts, e.g., those from the Development and Regional Activities Department. As a first step, a WMO representative could be asked to attend the next AOPC meeting to discuss this possibility. It was also suggested that an endowment fund could be established to address continuing needs. How this might be done could also be considered at the next AOPC meeting. Finally, the idea of having station operators conduct self-audits was proposed as one way to better identify and address needs.

Action 41. Tracking ClimDev Africa. The SC was pleased to learn of the progress of ClimDev Africa, and ACMAD's role in it, and recognised that GCOS and WMO still had a potential part to play in its implementation. The SC encouraged the GCOS Secretariat to keep a watching brief on implementation of ClimDev Africa and report back to the SC or Panels as appropriate, with the aim of identifying where GCOS may further assist implementation.

Action 42. Regional Action Plans. The SC recognized the work done in the past on the development of Regional Action Plans and was concerned that the general lack of progress in subsequent implementation had resulted in plans becoming outdated and of lessening value. It would be in favour of GCOS engaging in revision of the RAPs, but only as part of wider development initiatives that offered a realistic prospect of implementation. The GCOS Secretariat was encouraged to explore any avenue that offered the prospect of real progress in improvement of regional climate observation and related activities, such as data recovery, especially for those regions where the scope for improvement was large.

Action 43. Capacity Building and the GCOS MoU. The SC noted more generally that a strategy is needed for the role GCOS plays in the development of capacity, and that this should be reflected in the updated MoU. The SC Chair was asked to draw this issue to the attention of the Sponsors.

Action 44. GCOS National Coordination. The SC Chair was requested to promote GCOS National Coordination at the GEO Plenary under the agenda item on national and regional activities.

14. GCOS Preparation for WMO Cg-XVI

SC Member Dr. Alexander Zaitsev led discussion of this agenda item. He made three proposals for how GCOS could inform Permanent Representatives (PRs) and members of national delegations about important GCOS issues. First, he suggested that GCOS develop a new flyer to be distributed at Congress. He noted that not only will there be many new PRs at Congress but that they will be heading delegations of people who likely will not know much about GCOS. The flyer should be simple and, importantly, should be available in different languages.

Second, he suggested that the GCOS Secretariat organize a general Side Event so as to bring key GCOS issues to the attention of Member countries. For example, a Side Event could focus on a review of IP-10 and/or address regional activities. GTOS and GOOS might also be included in this Side Event. Third, Dr. Zaitsev suggested that the Secretariat try to participate in the regional meetings PRs will be having during Congress. This would give GCOS the opportunity to discuss implementation of the Regional Action Plans and also promote the appointment of GCOS national coordinators. Finally, Dr. Zaitsev noted that GCOS will be reporting separately (i.e., and not as part of the Observing and Information Systems Department) during Congress, as it did in the last Congress, and that this clearly has advantages for GCOS.

Action 45. Preparations for Congress XVI. D/GCOS, in liaison with the SC Chair, was requested to develop arrangements for the Sixteenth WMO Congress, including a Side Event along the lines discussed and a set of short presentations to the regional groupings.

15. Emerging Issues Discussion

15.1 Biodiversity and Ecosystem Observations

This agenda item was divided between Dr. Eric Lindstrom, the OOPC Chair, who focused on the ocean domain, and Dr. Bradley Reed of the GEO Secretariat, who focused on the terrestrial domain. Dr. Lindstrom chose to focus his presentation on outcomes of the OceanObs'09 Conference, and, in particular on the outcome inviting governments and organizations to embrace a new framework for a Sustained Global Ocean Observing System over the next decade. A Task Team, which included D/GCOS, was established to develop this new ocean observing framework. The Team's overarching goal was to recommend a framework for moving global sustained ocean observations forward in the next decade. Such a framework would integrate feasible new biogeochemical, ecosystem, and physical observations while sustaining present observations; consider how best to take advantage of existing structures; and foster continuing interaction between organizations that contribute toward, and are in need of, sustained ocean observations. Dr. Lindstrom noted that the framework could be considered a reformulation of how one thinks about GOOS and how it is organized.

The report of the Task Team was sent to its sponsors on 1 October 2010. It will be considered by, among others, the JCOMM Management Committee in November, the I-GOOS Board in December, and the IOC Assembly in June 2011.

Dr. Reed provided an overview of the GEO Biodiversity Observation Network (GEO BON). He noted that In April 2002, the Parties to the Convention on Biological Diversity (CBD) committed themselves to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on Earth. Biological diversity is still being rapidly lost, with nearly all status measures showing negative trends. This is an important issue for human well-being because the supply of ecosystem services (those services provided by nature from which humans derive benefit) depends on adequate levels of biodiversity. Dr. Reed emphasized that it is critical to understand the importance of biodiversity observations and how such observations support assessments. These assessments underlie policy development and thus CBD decisions, i.e., in a manner analogous to the relation between climate observations and the UNFCCC.

Although the number of existing biodiversity observations is very large, these observations are very uneven in spatial, temporal, and topical coverage. They range from genetic to species to ecosystem level with observations being made in the laboratory, in the field, and from satellite imagery. The observations exist in a variety of different formats and are scattered among thousands of independent systems, making it difficult or impossible to access the data and limiting our ability to conduct global or regional assessments.

The vision for GEO BON is for a coordinated, global network that gathers and shares information on biodiversity, provides tools for data integration and analysis, and contributes to improving environmental management and human well-being. GEO BON operates with eight working groups that provide coverage at the genetic, species, and ecosystem levels. These include working groups for genetics, terrestrial species monitoring, terrestrial species change, freshwater ecosystem change, marine ecosystem change, ecosystem services, *in situ*/remote sensing integration (integration and modelling across scales), and data integration and inter-operability (informatics and portals).

Dr. Reed suggested several things for the attention of GCOS. GCOS can help in promoting understanding that that Biodiversity loss is related to climate. It can support GEO BON and other efforts to extend and coordinate ongoing efforts for biodiversity observation. And it can help raise the priority for supporting selected observations (e.g., 30m repeat global land cover).

Action 46. Follow-up to Ocean Framework. The SC expressed its appreciation for all the work undertaken by the Chair of OOPC in his capacity as Chair of the IFSOO-TT and to D/GCOS for the role she played in developing the report. D/GCOS was asked to arrange for the Secretariat to provide follow-up for the development of the framework.

Action 47. Support of GEO BON. D/GCOS was requested to communicate to the Director of GEO the support of the GCOS SC for the GEO initiative toward global coordination of biodiversity observations.

15.2 Forest Carbon Monitoring

Dr. D. James Baker, Director of the Global Carbon Measurement Programme, described, via teleconference, the need for national forest carbon monitoring systems and the current status of forest carbon monitoring. He discussed a role for GCOS in forest carbon monitoring, noted the GEO role in launching the Global Forest Observing Initiative (GFOI), and suggested that there is now a real opportunity to look for the best ways of achieving mutual support between the GFOI and GCOS structures, processes, and plans.

It is widely understood that minimizing deforestation and forest degradation would contribute greatly to emission-reduction efforts. In addition, creating and restoring productive forestlands are two of our best options to sequester carbon from the atmosphere. Nonetheless, these significant potential contributors to global climate change strategies have not yet been part of climate solutions due to the historic inability to measure accurately enough their contributions to carbon emissions and

sequestration. The inability of nations to produce credible evidence of their compliance with forestry-related provisions has prevented inclusion of these practices in climate agreements.

Now with new satellite technology, better ecosystem models, and improved data-delivery capabilities, it is possible to design forest carbon monitoring, reporting, and verification systems that can provide the required accuracy to allow forestry practices to become a key strategy for achieving global climate change mitigation goals. While the technical capacities exist, much work remains to develop national institutions and the international framework to provide operational systems for continuous and verifiable carbon information. This is essential for demonstrating compliance with international climate treaties. Such information will also provide a credible foundation for evolving carbon markets, and these will enable efficient financing of emissions reductions and create economic incentives for sound forestry, poverty reduction, and other social benefits.

Dr. Baker noted that the evolution of global weather forecasting services provides helpful insights and a useful model for establishing an operational system to monitor, report, and verify (MRV) forest carbon emissions and sequestration. Since such an MRV system would need an operational global capability to provide products of important societal value, its development could parallel the development of operational weather forecasting systems. Regular and routine systematic observations and measurements will be essential for effective reporting.

The GEO Global Forest Observations Initiative (GFOI) has been developed to create a coherent international framework integrated with (and supporting) national carbon accounting systems to provide quality carbon information. GCOS, says Dr. Baker, can, and needs to be, part of this initiative. The GCOS and GEO/GEOSS processes should be brought into alignment, and it will be important for the GFOI to be seen as part of the existing global climate observing system that has been designed and progressively implemented within a well-defined and accepted overall framework. Thus, there needs to be a close connection between the GFOI, GCOS/GTOS, and CEOS. The GFOI can be seen as contributing to IP-10, as well as helping to meet the observing needs identified by GTOS.

Action 48. Forest Carbon Tracking. The SC Chair was requested to intervene at GEO-VI to support the Forest Carbon Tracking Task and its Global Forest Observations Initiative and to make the link to other CO₂ activities in IP-10, which could assist in the overall validation of the monitoring system. The intervention should also draw attention to the importance of ground measurements of soil carbon and the need for reduction of modelling uncertainties.

15.3 Supersites

This topic was largely skipped due to lack of time, although it had been discussed to some extent earlier under the agenda item devoted to TOPC. One action was proposed, however, and a comment made in passing addressed the need for a coordinated network of phenology observations. See also section 5.6 for a comment on GTOS and supersites.

Action 49. Supersites. TOPC is invited to consider promoting action on the rehabilitation and reanalysis of historic data from prototype short-term supersites, such as the BIGFOOT MODIS calibration campaign.

15.4 Introduction to the New GCOS ECV Wiki

The development of a Wiki for GCOS ECVs responds to Action 38 of SC-XVII, which requested the GCOS Secretariat to give high priority to development and implementation of a proactive strategy for promotion of GCOS. Ms. Anna Kuhn of the GCOS Secretariat described and demonstrated the work she has done in designing a draft Wiki. The Wiki can be a powerful tool, and one that is a self-maintaining resource of knowledge. The GCOS Wiki is intended to provide information on ECVs in addition to that already contained in IP-10. The main sources of information in developing it were the IP-10 and the technical supplement to the Second Adequacy Report. Suggested changes will be monitored by the GCOS Secretariat.

The SC thanked the GCOS Secretariat for the Wiki initiative and also the WMO colleagues who had provided support.

Action 50. GCOS ECV Wiki. SC Members were invited to provide feedback on the draft GCOS Wiki. The GCOS Secretariat was asked to liaise with GOSIC to publish the Wiki in the most effective way with regard to resources and to avoid duplication/competition. The Secretariat was also asked to update from time to time the GCOS page on Wikipedia, as resources permit.

16. GCOS Governance

16.1 Approving the Revised Terms of Reference (TORs)

The purpose of this agenda item was to introduce, and to obtain SC approval of, the revised draft Terms of Reference for the Atmospheric Observation Panel for Climate (AOPC), the Ocean Observation Panel for Climate (OOPC), the Terrestrial Observation Panel for Climate (TOPC), and the WCRP Observation and Assimilation Panel (WOAP). The revised General Regulations on Panel Members and Chairs for these four panels were also circulated. Only minor word changes to the TORs were suggested.

Action 51. Revised TORs for Co-Sponsored Panels. The SC approved the revised Terms of Reference for the panels co-sponsored by GCOS. D/GCOS was requested to liaise with the GOOS Secretariat to ascertain whether the section labeled "History" in the preamble to the OOPC TORs could be removed or amended.

16.2 Thoughts on Revising the GCOS Plan

Some consideration has been given in the last two years to updating the 1992 GCOS Plan (also known as the GCOS Strategic Plan) to take into account the new challenges that GCOS is facing and those it is expected to face in the future. As a document introduced at SC-XVII noted, the outcome of the World Climate Conference-3 and the update of the 2004 GCOS Implementation Plan, i.e., IP-10, make the revision of the GCOS Plan even timelier.

The need to update the original GCOS Plan was not recognized by all. Nevertheless, the SC as a whole agreed that an updated strategic plan for GCOS was important. However, the SC further agreed that work on this update should wait until after the expected revision by the Sponsors of the MoU establishing GCOS. A revised MoU was expected to be ready for approval by the WMO Congress.

17. GCOS Work Programme to SC-XIX

17.1 Review of Draft Decisions and Actions

Led by the SC Chair, the SC briefly reviewed the draft Actions that were discussed during the course of the session.

Action 52. Comment on Draft SC Actions. The GCOS Secretariat and SC Chair were requested to complete their drafting of actions within one week and to circulate them to all SC members and invited experts for comment by the end of October. The GCOS Secretariat and SC Chair should agree amendments to the Actions and embed them in a draft of the meeting report to be circulated for comment by early December.

17.2 Planning for Panel Sessions during 2010-2011

This brief session noted dates for some of the important meetings coming up in 2011. These include:

- Expert Meeting on Updating the GCOS Satellite Supplement, 10-12 January 2011 (Geneva)
- OOPC, 5-7 January 2011 (Paris)
- AOPC, 7-11 February 2011 (Geneva)
- TOPC, 10-11 March 2011 (Geneva)
- WCRP JSC, 4-7 April 2011 (Exeter)

- WOAP, 18-21 April 2011 (Frascati)
- WMO Congress, 16 May – 3 June 2011(Geneva)
- EC LXIII, 6-8 June 2011 (Geneva)
- IOC Assembly, 22 June – 6 July 2011(Paris)
- SBSTA, 1st week of June 2011(Bonn)
- GOOS SSC, 2-4 June 2011 (Paris)
- ICSU General Assembly, 26-30 2011 September (Paris)
- WCRP Open Science Conference, 24-28 October 2011 (Denver)

Under this item also a brief discussion about “Endorsers” vs. “Sponsors” took place. It was proposed that the Endorser label might be given to organizations that support GCOS but that do not contribute funds. The SC Chair offered to approach the WMO Secretary-General on this point when he will also discuss the issue of potential new Sponsors.

17.3 Arrangements for SC-XIX

The SC proposed that fewer presentations be made at the next SC session so as to allow for more in-depth discussion of agenda items. In particular, it was proposed that there will be no presentations at SC-XIX from those responsible for networks, it being agreed that the Panel Chairs themselves can address the relevant points. Representatives of at least some of the Technical Commissions may be invited to attend the next session, but they will not necessarily be given speaking slots. Information papers from representatives of WMO programmes would be useful to have, but, again, individual presentations would not necessarily be made. (Note that as the next SC session will not be in Geneva, it is likely that only one person will represent WMO in any case). If desirable, invitations to one or more people might be extended to make scientific presentations. Suggestions for topics and people are welcome. Still under consideration is whether Sponsors should be asked to make presentations or whether it would be preferable simply to let their views emerge during the course of the session. In any case, documents from the Sponsors will still be encouraged.

Several possibilities were considered for the venue for SC-XIX. These included Beijing, China; Goa, India, Denver/Boulder, USA; and Reading, UK. In discussion immediately following the SC session and taking into account travel costs, visa applications and related difficulties, already existing time constraints, and the attractive possibility to learn something about re-analysis and data assimilation, a decision was made to hold SC-XIX at ECMWF in Reading, UK, during the week of 19-23 September 2011. We have opted for a 3-day meeting, spread over 4 days, starting at lunch time on day one and ending at lunch at day four. This should allow convenient travel to and from London Heathrow Airport for all participants.

18. Other Business

18.1 General 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. The group was informed that two members will be rotating off the Committee after this session. In addition to the existing vacancy, this means that three members will need to be replaced. The SC is expected to be at full strength for the 2011 session.

19. Close of the Session

The Chairman closed the session at approximately 1230 on 1 October 2010 with thanks to the Sponsors, the Steering Committee members, invitees, and other participants. He especially thanked Dr Jack Kaye and Professor Ed Hill, who were retiring from the Committee. He also thanked Dr Richter, Dr Westermeyer, and the other members of the GCOS Secretariat for their work in organizing the session. He wished the Steering Committee and all its members a safe journey home.

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AGENDA FOR SC-XVIII

1. Opening of the Session
 - 1.1 Opening Remarks (Simmons)
 - 1.2 Welcome by WMO on behalf of the Sponsors (DSG)
 - 1.3 Approval of Agenda
 - 1.4 Arrangements for the Session (Richter/Westermeyer)
2. Report of the Director, GCOS Secretariat (Richter)
 - 2.1 A Review of Secretariat Issues
 - 2.2 Budget
 - 2.3 A review of actions from SC-XVII
3. Report of the Chairman (Simmons)
 - 3.1 Report on activities since SC-XVII
 - 3.2 Major issues facing GCOS
 - 3.3 Expectations of SC-XVIII
4. GCOS Panel Reports (45-minute reports, including discussion, focusing on follow-up to SC XVI action items and panel proposals for endorsement/decision by the Steering Committee).
 - 4.1 Atmospheric Observation Panel for Climate (Simmons)
 - 4.2 Ocean Observations Panel for Climate (Lindstrom)
 - 4.3 Terrestrial Observation Panel for Climate (Dolman)
 - 4.4 WOAP (Simmons)
5. Update on the Main Observing Systems Contributing to GCOS
 - 5.1 Global Observing System (GOS) (Ryan)
 - 5.2 WIGOS/WIS (Ryan)
 - 5.3 Global Atmosphere Watch (GAW) (Braathen)
 - 5.4 Global Terrestrial Networks for Hydrology (GTN-H, GTN-R, GTN-L)(Grabs)
 - 5.5 GOOS (Alverson)
 - 5.6 GTOS (Valentini)
 - 5.7 CEOS Response to GCOS IP (Goldberg)
6. Sponsor Views on the Development of GCOS
 - 6.1 WMO (Ryan)
 - 6.2 IOC (Alverson)
 - 6.3 UNEP (Fernandez)
 - 6.4 ICSU (Moore)
7. Other Views on How GCOS Can Serve Programmatic Needs
 - 7.1 WCRP and Other ESSP Programmes (Asrar)
 - 7.2 IPCC: Improving the GCOS-IPCC Interface (Zaitsev)
 - 7.3 UNFCCC (Lichte)
 - 7.4 Satellite community (CGMS—Ryan)

8. Opportunities for GEO and GCOS
 - 8.1 GEO Feedback to GCOS (Achache/Koopman)
 - 8.2 GCOS Input to GEO-VI and the 2010 Ministerial Summit (Simmons)
9. WMO Technical Commissions
 - 9.1 The Commission on Climatology and GCOS (Peterson)
 - 9.2 The Commission on Basic Systems and GCOS (Barrell)
10. The Global Framework for Climate Services--Update on GFCS Development (Love)
11. Data Issues
 - 12.1 Analysis of surface temperature—UKMO workshop summary (Bojinski)
 - 12.2 GOSIC review (Diamond)
12. A Review of the 2010 update of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (Mason)
13. Regional Development
 - 14.1 An Overview of Regional Activities—ClimDev Africa (Westermeyer)
 - 14.2 ACMAD and ClimDev Africa (Kadi)
 - 14.3 How GCOS can better contribute to improving observing systems in Developing Regions (Kumar, with Kadi and Afouda)
 - 14.4 GCM and System Improvement Activities (Monna, Thigpen)
14. GCOS Preparation for WMO Cg-XVI and other key meetings (Zaitsev)
15. Emerging Issues Discussion
 - 16.1 Biodiversity and ecosystem observations (Lindstrom for oceans; B. Reed for land--GEOBON)
 - 16.2 Forest carbon monitoring (J. Baker) (telecom)
 - 16.3 Supersites (Thigpen, with Belward)
 - 16.4 Introduction to new GCOS ECV Wiki (Kuhn)
16. GCOS Governance
 - 17.1 Approving the Revised TORs of the GCOS Panels (Richter)
 - 17.2 Thoughts on Revising the GCOS Plan (Richter)
17. GCOS Work Programme to SC-XIX
 - 18.1 Review of draft Decisions and Actions
 - 18.2 Planning for Panel Sessions during 2010-11
 - 18.3 Arrangements for SC-XIX (suggestions from Members)
18. Other Business
 - 19.1 General Steering Committee Membership and Related Issues (*In Camera*)
19. Close of the Session

AVAILABLE DOCUMENTS (D) AND/OR PRESENTATIONS (P)

Doc. No.	Description	D/P
0.0	Agenda	D
1.3	Arrangements for the Session	D
2	Report of the Director	P
2 INF	GCOS Publication List and Roll Out Plan	D,P
3	Report of the Chairman	D,P
4.1	Atmospheric Observation Panel for Climate (AOPC)	D
4.2	Ocean Observation Panel for Climate (OOPC)	D,P
4.3	Terrestrial Observation Panel for Climate (TOPC)	P
4.4	WCRP Observation and Assimilation Panel (WOAP)	D
5.1	Global Observing System (GOS)	D,P
5.2	WIGOS/WIS	D,P
	Additional information on WIS and WIGOS	D
5.3	Global Atmosphere Watch (GAW)	P
5.4	Global Terrestrial Networks for Hydrology (GTN-H, GTN-R, GTN-L)	P
5.5	Global Ocean Observing System (GOOS)	P
5.6	Global Terrestrial Observing System (GTOS)	P
5.7	Committee on Earth Observation Satellites (CEOS)	P
6.1	WMO Views on the Development of GCOS	P
6.2	IOC Views on the Development of GCOS	P
6.3	UNEP Views on the Development of GCOS	D
6.4	ICSU Views on the Development of GCOS	D,P
7.1	WCRP and Other ESSP Programme Views on How GCOS Can Serve	D,P
7.3	UNFCCC Views	D,P
7.4	Satellite Community--CGMS and SCOPE-CM	P
8.1	GEO Feedback to GCOS	P
9.1	The Commission on Climatology and GCOS	P
9.2	The Commission on Basic Systems and GCOS	P
10	The Global Framework on Climate Services--An Update	P
12.1	Analysis of Surface Temperature--UKMO Workshop	D,P
12.2	GOSIC Review	D,P
13	A Review of the 2010 Update of the GCOS Implementation Plan	D,P
14.1	An Overview of Regional Activities--ClimDev Africa, etc.	D,P
14.2	ACMAD and ClimDev Africa	D,P
14.3	How GCOS Can Better Contribute to Improvements in Developing Regions	D,P
14.4	Review of GCM meeting (Monna)	P
14.4	System Improvement Activities (Thigpen)	D,P
16.1	GEOBON (Reed)	D,P
16.1	Ocean Biodiversity and Ecosystem Observatoins (Lindstrom)	P
16.2	Forest Carbon Monitoring (Baker)	D,P
16.3	GCOS Supersites	P
16.4	GCOS WiKi	P
17	Approving the Revised TORs of the GCOS Panels	D
INF1	List of Participants	D
INF2	Draft GCOS Annual Report	D

The available documents and presentations may be found here:
<http://www.wmo.int/pages/prog/gcos/index.php?name=SC-XVIII>

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CONSOLIDATED LIST OF ACTIONS

Action 1. Annual Letter and Budget to Sponsors. The SC Chair and D/GCOS are asked to follow last year's practice of submitting a budget to accompany the annual letter to Sponsors; D/GCOS should provide the SC, at its annual meeting, with a budget outlook that includes an estimate of *in kind* as well as actual contributions to GCOS.

Action 2. GCOS Budget Situation. The Chair is asked to express to the Sponsors the general concern of the SC as to the inadequacy of the GCOS budget, noting the mismatch between the available resources and the funds needed for carrying out the responsibilities the Secretariat is being asked to undertake. The Chair and D/GCOS together should explore all avenues to improve the budgetary situation.

Action 3. AOPC Consideration of Silent Stations. The SC noted the AGG discussion on stations in the GCOS networks that are either silent or otherwise fail to meet minimum GCOS requirements and the need for guidance on how to act upon such GCOS network deficiencies. AOPC is asked to consider this issue and to report back to the SC, addressing, in particular, the case of stations that are unable to be rejuvenated using the GCM.

Action 4. Outreach on Ocean Observation. The SC was pleased with the progress and direction of the OOPC, including its planned assessment of requirements for deep ocean observation. OOPC is encouraged to continue to place emphasis on outreach and identification of the societal relevance of ocean observation.

Action 5. Sea Ice. The GCOS Secretariat should inform the EC-PORS, particularly its Observation and GCW Task Teams, on the recommended actions and issues relevant to improved sea ice products and observational requirements as identified in GCOS IP-10, and request its assistance in facilitating coordinated actions with JCOMM/ETSI, WCRP/CLIC, GCW and IICWG to address these issues.

Action 6. Sustaining Moored Arrays. The SC stressed the importance of sustaining the moored arrays and was concerned that continuity of data from moored arrays was at risk because of the increasing costs of servicing the moorings and the limited availability of vessels suitable to carry out this work. The SC Chair is requested to express this view of the SC in his annual report to the Sponsors.

Action 7. Dealing with Piracy and Vandalism. The SC noted that costs were exacerbated by piracy and vandalism. OOPC is invited to develop outreach material to emphasize the importance at local level of these ocean observations.

Action 8. Global Geodetic Infrastructure for sea level. The GCOS Secretariat is requested to communicate with the Secretariat of the Global Geodetic Observing System (GGOS) concerning the need for global geodetic infrastructure to maintain the terrestrial reference frame accuracy and stability at levels required for precise sea level measurements.

Action 9. Essential Ecosystem Records. The SC confirmed the view taken in finalizing IP-10 that it was inappropriate to identify biodiversity and habitat properties as ECVs, but emphasized strongly the importance of acquiring or generating essential ecosystem records (EERs) through co-located measurement of climate and ecosystem variables, in particular at the 35 or so global reference sites envisaged by TOPC. **The SC Chair was asked to ensure that this is drawn to the attention of the UNFCCC in his statement to SBSTA.**

Action 10. Global Reference Sites. TOPC is requested to continue to work to support establishment of the network of global reference sites, working with CEOS, GTOS, and the Fluxnet community as needed.

Action 11. Ocean Subsurface Data Sets for Reanalysis. The SC Chair is asked to liaise with the Chair of WOAP to ensure there is adequate management of ocean subsurface data sets for reanalysis, especially in the context of the development of coupled ocean-atmosphere reanalysis.

Action 12. Measurement of Solid Precipitation. The SC supported WOAP's concern about the measurement of solid precipitation for research and monitoring purposes and noted that similar concerns had been identified for climatological and operational hydrological purposes by WCRP-CliC, Commission for Climatology (CCI-XVI), EC-PORS/GCW, and the Northern Research Basin Program. The Chair of the SC was asked to liaise with the President of CIMO to express its support for the CIMO solid precipitation intercomparison and to request inclusion of a representative of GCOS in the design of the intercomparison to help ensure the needs of the climate community for accurate precipitation measurements are met.

Action 13. Data Availability in GAW Networks. The AOPC was requested to continue to place emphasis on promoting the improvement of data availability and coordination arrangements in both GAW and non-GAW networks, in particular in the case of aerosols.

Action 14. Decline of Hydrological Networks. The SC Chair was asked to flag the decline of hydrological networks, especially the discontinuation of river gauge stations with long records, in his presentation to SBSTA.

Action 15. Collaboration in Advancing GTN-H. The GCOS Secretariat was encouraged to continue collaboration between with the WMO CLW/Hydrology branch in advancing GTN-H and its contributing networks.

Action 16. FLUXNET Data. D/GCOS was requested to contact D/GTOS to emphasize the importance of the FLUXNET data to the climate community and recommend that every effort be made to open the Fluxnet data base to the community at large.

Action 17. Links to CCD and CBD. The GCOS Secretariat is asked to investigate the development of closer links to other conventions, in particular the United Nations Convention to Combat Desertification (UNCCD) and the Convention on Biological Diversity (CBD), whether through GTOS, GOOS, or directly.

Action 18. CEOS Template. The Secretariat is asked promptly to circulate to all SC members for comment the template under development by CEOS to develop the response by space agencies to each satellite-related action in IP-10.

Action 19. Steering Committee Role. The SC affirmed that it still sees its role as one of scientific and technical assessment, identification of requirements, and provision of advice and advocacy on contributing observing systems, as set out in its current terms of reference, rather than one of management of observing sub-systems. The SC Chair was asked to draw the attention of the Sponsors to this view, in the context of providing input to the review of the GCOS Memorandum of Understanding.

Action 20. Advocacy for Ocean Observations. The Chair and D/GCOS are requested to continue their advocacy for sustained observation of the ocean to the IOC, and to communicate to IOC that the SC strongly supports the IOC review of the structures of GOOS governance. The SC also urges the IOC to consider, at its 26th Assembly (Paris, June 2011), what national institutions might be explicitly identified as appropriate to take responsibility for supporting sustained ocean observing for climate.

Action 21. Brochure linking observations to socioeconomic sectors. The GCOS Secretariat was requested to develop a brochure explaining how global climate observation contributes to addressing the major policy issues related to various socioeconomic sectors.

Action 22. Climate Change Early Warning Meeting. The SC welcomed the invitation extended to D/GCOS by UNEP to attend the UNEP "Global Climate Change Early Warning System Expert

Consultation” meeting. The SC requested D/GCOS to attend this meeting and that D/GCOS and the SC Chair seek further opportunities for active engagement with UNEP.

Action 23. Rio+20. The SC stressed the importance of making the presence of GCOS felt at the Rio+20 meeting. D/GCOS and the SC Chair were asked to pursue this matter in collaboration with GTOS.

Action 24. Data Set Intercomparison. The SC strongly supported the facilitation by WCRP and GCOS of data set intercomparison. The Panel Chairs and Members are encouraged to engage fully in this process.

Action 25. Statement of observation and research needs in AR5. The Chair of the SC, and, subject to his agreement, the Chair of the WCRP JSC, are requested to address a letter to the co-chairs of the AR5 WGs with the aim of achieving a clear identification and statement of key observation and research needs from the AR5 process.

Action 26. Establishing Coordinator and Focal Point Links. The GCOS Secretariat is asked to encourage GCOS National Coordinators to establish links with their national UNFCCC focal points, for example through the proposed Rockefeller Center meeting.

Action 27. Reprocessing of Geostationary Satellite Data. The GCOS Secretariat was requested to inform the SCOPE-CM Executive Panel that the SC appreciated the efforts of EUMETSAT and JMA in undertaking reprocessing of their geostationary satellite data, and emphasized the need for a corresponding reprocessing of GOES data.

Action 28. Free and open access to satellite products. The GCOS Secretariat was requested also to express to the Panel the importance of free and open access to satellite products and of user-friendly mechanisms for making products available.

Action 29. GEO-VII Plenary. The SC Chair was encouraged to intervene as appropriate at GEO-VII on a number of issues identified during the course of this SC Session.

Action 30. Prompt Submission of World Weather Records. The SC recognized the importance of prompt submission of comprehensive national input to World Weather Records, and requested the AOPC to consider the actions needed.

Action 31. Informing Agents of Implementation. The SC welcomed the CCI President’s discussion of the actions from IP-10 for which CCI was identified as an Agent for Implementation. The Secretariat is requested to draw the attention of all international bodies identified as Agents for Implementation to the actions for which they had been identified as potentially responsible and to invite them to respond accordingly.

Action 32. Aligning CBS and GCOS Planning. The SC noted that CBS was preparing an implementation plan for the GOS for presentation to Congress in 2015 and that this plan would take note of GCOS requirements for atmospheric climate observations. It will be important to align this planning with GCOS’s own activities in assessing adequacy and developing a new implementation plan, which is likely to take place in the time frame 2013-2015. AOPC was requested to consider this in depth.

Action 33. GRUAN. The SC welcomed the steps being taken by CBS towards integration of the GRUAN into CBS structures. D/GCOS was requested to discuss within the WMO OBS Department the appropriate participation in the next Implementation and Coordination Meeting for the GRUAN.

Action 34. Participation of Commissions in SC Meetings. D/GCOS was further requested to consider inviting Commissions other than CBS and CCI to attend SC meetings from time to time and to coordinate with GOOS and GTOS concerning equivalent arrangements for their technical commissions.

Action 35. SC Views on GFCS Communication. The Chair was requested to convey to the WMO Secretary-General (SG) the SC's views on the coordination and communication process for the GFCS.

Action 36. Expert Advice to the GFCS. The SC Chair was asked to communicate to the WMO SG that the SC and nominated experts remained willing to re-engage with the process should expert advice on the GFCS still be required, in particular with regard to finalising chapters 8 and 9 of the report.

Action 37. Communicating with the Ad Hoc Committee. The SC Chair was requested to communicate the SC's views to the Chair of the *ad hoc* committee taking the initiative forward and to invite the *ad hoc* committee to report on progress and recommendations to the next session of the SC.

Action 38. GOSIC Review. The science panels were requested for their respective domains to review the contents and links to data sets contained in the GOSIC portal with a view to optimizing them.

Action 39. Satellite Supplement to IP-10. The Secretariat was requested to prepare a satellite supplement to IP-10 based on updating GCOS-107 and welcomed Paul Mason's offer to lead this operation.

Action 40. GCOS Product for 2012. The committee discussed whether it would be appropriate to prepare an *in situ* supplement, or, alternatively, a report on data requirements for adaptation in 2012. Dr. Ed Harrison and Dr. Lucka Kajfez-Bogataj were invited to develop the idea of what could be produced as a key GCOS document in 2012, consulting more widely as necessary, and, in particular, looking at a possible focus on observational needs for adaptation from a cross-domain perspective.

Action 41. Tracking ClimDev Africa. The SC was pleased to learn of the progress of ClimDev Africa, and ACMAD's role in it, and recognised that GCOS and WMO still had a potential part to play in its implementation. The SC encouraged the GCOS Secretariat to keep a watching brief on implementation of ClimDev Africa and report back to the SC or Panels as appropriate, with the aim of identifying where GCOS may further assist implementation.

Action 42. Regional Action Plans. The SC recognized the work done in the past on the development of Regional Action Plans and was concerned that the general lack of progress in subsequent implementation had resulted in plans becoming outdated and of lessening value. It would be in favour of GCOS engaging in revision of the RAPs, but only as part of wider development initiatives that offered a realistic prospect of implementation. The GCOS Secretariat was encouraged to explore any avenue that offered the prospect of real progress in improvement of regional climate observation and related activities, such as data recovery, especially for those regions where the scope for improvement was large.

Action 43. Capacity Building and the GCOS MoU. The SC noted more generally that a strategy is needed for the role GCOS plays in the development of capacity, and that this should be reflected in the updated MoU. The SC Chair was asked to draw this issue to the attention of the Sponsors.

Action 44. GCOS National Coordination. The SC Chair was requested to promote GCOS National Coordination at the GEO Plenary under the agenda item on national and regional activities.

Action 45. Preparations for Congress XVI. D/GCOS, in liaison with the SC Chair, was requested to develop arrangements for the Sixteenth WMO Congress, including a Side Event along the lines discussed and a set of short presentations to the regional groupings.

Action 46. Follow-up to Ocean Framework. The SC expressed its appreciation for all the work undertaken by the Chair of OOPC in his capacity as Chair of the IFSOO-TT and to D/GCOS for the role she played in developing the report. D/GCOS was asked to arrange for the Secretariat to provide follow-up for the development of the framework.

Action 47. Support of GEO BON. D/GCOS was requested to communicate to the Director of GEO the support of the GCOS SC for the GEO initiative toward global coordination of biodiversity observations.

Action 48. Forest Carbon Tracking. The SC Chair was requested to intervene at GEO-VI to support the Forest Carbon Tracking Task and its Global Forest Observations Initiative and to make the link to other CO₂ activities in IP-10, which could assist in the overall validation of the monitoring system. The intervention should also draw attention to the importance of ground measurements of soil carbon and the need for reduction of modelling uncertainties.

Action 49. Supersites. TOPC is invited to consider promoting action on the rehabilitation and reanalysis of historic data from prototype short-term supersites, such as the BIGFOOT MODIS calibration campaign.

Action 50. GCOS ECV Wiki. SC Members were invited to provide feedback on the draft GCOS Wiki. The GCOS Secretariat was asked to liaise with GOSIC to publish the Wiki in the most effective way with regard to resources and to avoid duplication/competition. The Secretariat was also asked to update from time to time the GCOS page on Wikipedia, as resources permit.

Action 51. Revised TORs for Co-Sponsored Panels. The SC approved the revised Terms of Reference for the panels co-sponsored by GCOS. D/GCOS was requested to liaise with the GOOS Secretariat to ascertain whether the section labeled "History" in the preamble to the OOPC TORs could be removed or amended.

Action 52. Comment on Draft SC Actions. The GCOS Secretariat and SC Chair were requested to complete their drafting of actions within one week and to circulate them to all SC members and invited experts for comment by the end of October. The GCOS Secretariat and SC Chair should agree amendments to the Actions and embed them in a draft of the meeting report to be circulated for comment by early December.

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LIST OF GCOS PUBLICATIONS SINCE SC-XVII

- GCOS-138**
(WMO-TD No. 1523) Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2010 Update)
- GCOS-139**
(GOOS No.) IOC Group of Experts on the Global Sea Level Observing System (GLOSS), eleventh session, Paris, France, 13-15 May 2009
- GCOS-140**
(WMO/TD No. 1526) Report of the Second GCOS Reference Upper Air Network Implementation and Coordination Meeting (GRUAN ICM-2) (Payerne, Switzerland, 2-4 March 2010)
- GCOS-141**
(WMO-TD No. 1528) Final Report of the Twelfth Session of the GCOS/GTOS Terrestrial Observation Panel for Climate (TOPC-XII) (Rome, Italy, 10-11 March 2010)
- GCOS-142**
(WCRP No.) Report from the Fourth Meeting of the WCRP Observation and Assimilation Panel (WOAP) (Hamburg, Germany, 29-31 March 2010)
- GCOS-143**
(WMO-TD No. 1530) Guideline for the Generation of Datasets and Products meeting GCOS Requirements (GCOS Secretariat, May 2010)
- GCOS-144**
(WMO/TD No. 1558) Guide to the GCOS Surface Network (GSN) and GCOS Upper-Air Network (GUAN)
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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 initiative
AMIP	Atmospheric Model Intercomparison Project
AMMA	African Monsoon Multidisciplinary Analyses
AOML	Atlantic Oceanographic and Meteorological Laboratory
AOPC	Atmospheric Observation Panel for Climate
APN	Asia-Pacific Network
ASAP	Automated Shipboard Aerological Programme
ARM	Atmospheric Radiation Measurement Program
ASECNA	L'Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar
AVHRR	Advanced Very High Resolution Radiometer
AREP	Atmospheric Research and Environment Programme (WMO)
AU	African Union
BAPMON	Background Air Pollution Monitoring Programme
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)
CCCCC	Caribbean Community Climate Change Centre
CCD	Convention to Combat Desertification
CCD/A	Climate Change Detection and Attribution
CCI	Commission for Climatology (WMO)
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
ClimDev Africa	Climate for Development in Africa Programme
CLIPS	Climate Information and Prediction Services
CLIVAR	Climate Variability and Predictability (WCRP)
CLW	WMO Climate and Water Department
CMA	China Meteorological Administration
CMM	Commission for Marine Meteorology
COCOS	Coordination of Carbon Observing Systems
CONOPS	WIGOS Concept of Operations
COP	Conference of the Parties (to UNFCCC)
COPES	Coordinated Observation and Prediction of the Earth System
CSD	Commission on Sustainable Development
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
EEZ	Exclusive Economic Zone
ENSO	El Niño/Southern Oscillation
ESA	European Space Agency
ESSP	Earth System Science Partnership
ET-ODRRGOS	Expert Team on Observational Data Requirements and Redesign of the Global Observing System
ETSI	Expert Team on Sea Ice
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
GCB	GCOS Cooperation Board
GCO	Global Carbon Observation
GCOS	Global Climate Observing System
GCM	Global Climate Model
GCMPs	GCOS Climate Monitoring Principles
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
GFCS	Global Framework for Climate Services
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
GPCC	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
GSSC	GOOS Scientific Steering Committee
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
GTN-SM	Global Terrestrial Network for Soil Moisture
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunication System
GUAN	GCOS Upper-Air Network
HALOE	Halogen Occultation Experiment
HOPC	Hydrological Observation Panel for Climate
HWR	Hydrology and Water Resources (Department, WMO)
IAEA	International Atomic Energy Agency
IAOOS	Integrated Arctic Ocean Observing System
ICOS	Integrated Carbon Observation System
ICSU	International Council for Science
ICPAC	IGAD Climate Prediction and Application Centre
ICPC	Interagency Coordinating and Planning Committee for Earth Observations
	International Fund for Agricultural Development
IFAD	
IGBP	International Geosphere-Biosphere Programme
IGACO	Integrated Global Atmospheric Chemistry Observations (IGOS Theme)
IGAD	Intergovernmental Authority on Development (East Africa)
IGOS	Integrated Global Observing Strategy
I-GOOS	Intergovernmental Committee for GOOS
IGOS-P	Integrated Global Observing Strategy Partnership
IGOSS	Integrated Global Ocean Services System
IICWG	International Ice Charting Working Group
IHDP	International Human Dimensions Programme
iLEAPS	Integrated Land Ecosystem–Atmosphere Processes Study
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)
IRDR	Integrated Research on Disaster Risk Programme IRDR
ISO	International Organization for Standardization
IP-04	Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2004)
IP-10	Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (2010)
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
JPO	Junior Professional Officer
JRC	Joint Research Centre (European Commission)
LAI	Leaf Area Index
LCA	Long-Term Cooperative Action
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
NAPAs	National Adaptation Programmes of Action
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
NMS	National Meteorological 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
OBS	WMO Observing and Information Systems Department
OOPC	Ocean Observations Panel for Climate
OPAG	Open Programme Area Group
OSes	Observing System Experiments
OSSEs	Observing System Simulation Experiments
PAntOS	Pan-Antarctic Observing System
PAGES	Past Global Changes (within IGBP)
PCOF	Polar Climate Outlook Forum
PECS	Programme on Ecosystem Change and Society
PICO	Panel for the Integration of Coastal Observations (GTOS-GOOS)
PMEL	Pacific Marine Environmental Laboratory
POGO	Partnership for Observation of the Global Oceans
PSC	Polar Satellites Constellation
QC	Quality Control
RAP	Regional Action Plan
RBCN	Regional Basin Climate Network
RCOF	Regional Climate Outlook Forum
RRR	Rolling Review of Requirements
RWP	Regional Workshop Programme
SAARC	South Asian Association for Regional Cooperation
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)
SMOS	Soil Moisture Observing System
SOG	Statement of Guidance
SOOP	Ships of Opportunity Programme
SOOS	Southern Ocean Observing System
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
TCDR	Thematic Climate Data Record
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
TSP	Technical Support Project
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
WCC-3	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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