



Submission from the Global Climate Observing System (GCOS) to SBSTA 39 on agenda item 8 Research and systematic observation

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The Global Climate Observing System (GCOS)

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Activity Report 2013

As an outcome of the Second World Climate Conference, the GCOS was established in 1992 to ensure that the observation and information needed to address climate-related issues are obtained and made available to all potential users. The goal of GCOS is that contributing observing systems together provide comprehensive information on the total climate system, involving a multidisciplinary range of physical, chemical, and biological properties and atmospheric, oceanic, hydrologic, cryospheric and terrestrial processes. GCOS is jointly sponsored by the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), and the International Council for Science (ICSU).

The 50 GCOS Essential Climate Variables (ECVs), set out in the 2010 GCOS Implementation Plan, are required to support the work of UNFCCC and the IPCC, and are both technically and economically feasible for systematic observation. It is these variables for which international exchange is required as a matter of priority for both current and historical observations.

The contributing systems include the climate-observing components of the IOC-led Global Ocean Observing System (GOOS), the FAO-led Global Terrestrial Observing System (GTOS), and the WMO Global Observing System (GOS) and Global Atmosphere Watch (GAW). A number of other research and operational systems in the domains of ocean, atmosphere, and land provide important contributions to GCOS as well. The observations themselves may be ground-based, or from airborne or satellite systems. GCOS is both supported by and supports the international scientific community, and the World Climate Research Programme (WCRP) co-sponsors the expert panels set up by GCOS for the atmospheric, oceanic and terrestrial domains (The Atmospheric Observation Panel for Climate – AOPC, the Terrestrial Observation Panel for Climate – TOPC, and the Ocean Observations Panel for Climate – OOPC). The composite observing system designated as the GCOS serves as the climate-observation component of the Global Earth Observation System of Systems (GEOSS).

At its 33rd session, the SBSTA invited the GCOS secretariat to report on progress made in the implementation of the 2010 updated GCOS implementation plan on a regular basis, at subsequent sessions of the SBSTA, as appropriate.

GCOS in support of the Global Framework for Climate Services and the UNFCCC

A strengthened GCOS will be important for the successful implementation of the Global Framework for Climate Services (GFCS), recognizing that observations and monitoring constitute one of the essential pillars of the GFCS. The implementation of improvements to the climate observing system will also support assessment and development of policy related to climate change. Currently, there are 138 actions identified in the 2010 GCOS Implementation Plan in support of the UNFCCC, which address many of the needs for climate observations that apply also to the GFCS.



At the 37th Session of the Subsidiary Body for Scientific and Technical Advice (SBSTA) of the UNFCCC in November 2012, GCOS was invited to submit a report on the assessment of the adequacy of global observations for climate to SBSTA in 2015, followed by a new Implementation Plan in 2016. The GCOS programme has started on the process of developing a report on the progress and status of climate observations. The report will be followed by the implementation plan, which will identify:

- continuing and new requirements, including a restatement of the rationale for the list of ECVs and possible amendment of the list;
- the adequacy of present arrangements for meeting the requirements;
- the additional actions needed, with indicative costs, performance indicators and potential agents for implementation.

The plan should actively support not only the UNFCCC, but also the GFCS and the new research programmes PROVIA and Future Earth discussed below. The content will draw on input from a review of the actions set out in the 2010 Implementation Plan, the 2014 National Communication reports under the UNFCCC, the 5th IPCC Assessment process (through one or two workshops that will include amongst others the participation of several lead authors from Working Groups I and II), and results and identified recommendations from the workshop on observations for adaptation discussed in the following section. The three GCOS scientific panels on atmospheric, terrestrial, and oceanic observations for climate will contribute to the work, and the process will also call on one or several writing-team meetings, consultations, and a public review.

Addressing the need for observation requirements for climate change adaptation

From 26-28 February 2013, GCOS, in cooperation with UNEP, the IOC of UNESCO and the Department of Energy and Climate Change (DECC) of the United Kingdom, brought together about 45 participants for a 'Workshop on Observations Adaptation to Climate Variability and Change' at the headquarters of the German Meteorological Service (DWD) in Offenbach, Germany. Participants included representatives of the GCOS community and representatives of sectors in which adaptation to climate change and variability is, or is likely to become, an important concern. The goals of the workshop were to produce statements on the adequacy of observations, to identify requirements for observations to support climate services and research, and to provide strategic guidance on steps the GCOS programme should take in the coming years to address the needs for observations for adaptation to climate variability and change. To meet these goals, focus was set on cross-cutting issues, including risk management, early warning systems, research, modeling and assessment, and data rescue. The workshop further considered perspectives from various different fields that will be strongly impacted by climate change adaptation, including water resource management, coastal zone management, health, forestry, agriculture, energy, and transport sectors.

The workshop identified common themes regarding observation requirements. The need is to focus on observations with higher spatial and temporal resolution, specifically in regions where climate change will have significant effects on key sectors and where there are vulnerable populations. Infrastructure and governance to support sustained data rescue will need to be developed, and close links to climate change adaptation research initiatives such as the Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) and ICSU's Future Earth. Furthermore, existing information will need to be presented in forms of relevance to the users, which includes developing information and products in close consultation with those users, to invest in the ground-based network of primary hydro-meteorological observations, and to establish and improve mechanisms to provide data access and data descriptions. There is a strong necessity to further discuss the topic of observation requirements for climate change adaptation, which also will need to be linked to potential workshops on observational needs for the GFCS. As most of the adaptation actions will take place at a local and/or sub-national level, climate information used to support development, implementation and monitoring of such activities will be needed at the same level, though possibly with different requirements for each sector for which adaptation is a concern.

The enabling of globally coordinated space-based observations for climate monitoring

The CEOS Response to the 2011 update to the Satellite Supplement to the GCOS Implementation Plan, coordinated with CGMS and other bodies, reinforces the needs called out by the GCOS Satellite Supplement and provides more detail on the deliverables, coordination, activities, and who within CEOS will lead the effort. The Response, considered by the 37th session of the SBSTA in Doha (26 November-7 December 2012) provided a view of what can be achieved with current funding and additional funding with respect to some 48 satellite-related actions in the GCOS Implementation Plan. Atmosphere, ocean, and terrestrial domain leads are specified for follow-up. These coordinate with CEOS working groups, CEOS virtual constellations, climate-related external groups (e.g., SCOPE-CM, GSICS, WCRP, CGMS), and experts to develop plans responding to the actions in the GCOS Implementation Plan via templates. It is expected that this new CEOS Response will help space agencies plan their climate change programmes.

The CEOS, CGMS and the WMO Space Programme invited GCOS in January 2013 to attend a meeting on the development of the architecture for climate monitoring from space, the third meeting of the CEOS Working Group on Climate and a meeting of the SCOPE-CM Executive Panel. These meetings discussed several issues, including the architecture for climate monitoring, an inventory of ECV datasets, identification of the maturity of datasets, and in-depth ECV assessment. The desirability of developing the ECV inventory to include datasets based on *in situ* as well as space-based observation was recognised, and steps to be taken towards achieving this were identified.

The ESA Climate Change Initiative (CCI) is pursuing its work on 14 ECVs started in 2010/11 for a first three-year phase, and will continue in a second phase running for another three years until end of 2016. Its main objective is to improve quality to meet climate needs and to ensure free open access to CCI data products, to promote wide exploitation of CCI data sets, to maximize scientific impact and to evolve from prototype to sustainable systems. The GCOS programme is considered as a high-level user and the Chairman of the GCOS Steering Committee is actively involved in giving guidance and advice through membership of the ESA CCI science advisory body.

The GCOS Cooperation Mechanism to support climate observations in developing countries

Managing the impacts of climate change have and will present major challenges for developing countries. The information needed to design effective policies for mitigating the effects of – and adapting to – climate change and facilitating sustainable development fundamentally depends on the availability of climate observations. However, such observations must be of a high quality, have a long period of operations and be incorporated in a network of sufficient density to be useful in decision-making. Meeting these challenging requirements will be difficult for many developing countries unless they are provided with some, and often sustained, assistance. The GCOS Cooperation Mechanism directly contributes to fulfilling the repeated requests of the UNFCCC to provide financial and technical support developing countries to improve their climate observing systems, which will also contribute to meeting the countries' needs for improved global networks.

The GCOS Cooperation Mechanism was established to identify and make the most efficient use of resources available for improving climate observing systems in developing countries, particularly to enable them to collect exchange and utilize data on a continuing basis in pursuance of the UNFCCC. In recent years, several countries have provided funds and participated on the GCOS Cooperation Mechanism Donor Board. The GCOS sponsors are constantly seeking additional countries that are willing to participate towards the goal of improved climate observing networks in developing countries. Since 2005, the GCOS Cooperation Mechanism has received and distributed over 3 Million USD in support of the GCOS networks, primarily for the atmospheric domain through the GCOS Surface Network (GSN) and the GCOS Upper-Air Network (GUAN). The support provided has been wide-ranging and covers all aspects of the observing system life-cycle.

Successful GCOS Cooperation Mechanism implementation projects include the renovation of surface stations, the implementation of new upper-air systems, replacing and installing hydrogen generators, improved telecommunication and hosting technical workshops. In the 2012/2013 timeframe, the GCOS Cooperation Mechanism focused primarily on the GCOS upper-air and surface networks, working to improve the overall performance of these important baseline networks through direct renovation projects, the recent activities of the WMO Commission for Basic Systems (CBS) Lead Centres for GCOS, and various training workshops. Of particular relevance have been:

- the supply of radiosondes and balloons (to Gan, Maldives; Yevevan, Armenia; and Khartoum, Sudan), which was made possible through funding from Japan, Switzerland and the UK;
- the upgrade of eight GSN stations in Angola, which was funded by the Royal Netherlands Meteorological Institute (KNMI);
- the renovation of eleven stations in Madagascar (with funding from the UK Met Office), which are now using a local mobile phone SIM connection;
- organizing the bi-annual CBS Lead Centre Meeting for GCOS from 8-10 October 2013 in Chile, Santiago (and kindly hosted by the Dirección Meteorológica de Chile), which focused on Quality Management service provided by these Lead Centres in terms of monitoring the network, diagnosing any issues and the methods of communication, etc.;
- the update of minimum requirements for all GUAN stations, which includes the reporting of temperature and wind to 30 hPa and humidity to the tropopause (on at least 25 days each month).

GCOS Programme Review

The GCOS programme has had substantial success in the past 20 years, but several new developments and some emerging issues have given rise to the need to re-examine the mandate and terms of reference of GCOS. The GCOS Steering Committee at its 19th session in 2011 welcomed an independent review of GCOS and appreciated the willingness of WMO to take the lead in seeking to carry this out in 2013. The review board had held its first meeting from 26 to 27 March 2013, and its second meeting from 28 to 30 October 2013. The board is chaired by Mr Wolfgang Kusch, former president of the Deutscher Wetterdienst (DWD), Germany, and is comprised out of individual experts nominated by each of the sponsoring organizations. The deliberations of the board and the report will be available to the public in the middle of 2014.

Key Accomplishments

The GCOS programme has had substantial success in the past 20 years, including the designation of atmospheric observing networks, facilitating the expansion of the terrestrial networks, establishing important links to the UNFCCC, defining the GCOS Climate Monitoring Principles, implementing the concept of Essential Climate Variables (ECVs), producing Adequacy and Progress Reports of and Implementation Plans for the global climate observing system, promoting the development of Satellite Observing Systems for Climate, and implementing a GCOS Regional Workshop Programme. The GCOS programme appreciates the support it has received from Parties to the UNFCCC, and looks forward to continued support in the future, especially in assisting the programme in its assessments of the progress in climate observation and the adequacy of the current and foreseen provisions, in its identification of implementation actions, and in continuing to generate fundamental climate data records and ECV products, including from reprocessing of past data records.

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