Submission from the Global Climate Observing System (GCOS) to SBSTA 41 on agenda item 8 (b) Research and systematic observation

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The Concept of the GCOS Programme

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 Session of the Subsidiary Body for Scientific and Technical Advice (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.

The Review of the GCOS Programme

At its 19th session from 20 to 23 September 2011 in Reading, UK, the Steering Committee had welcomed an independent review of the GCOS programme, requested by its four sponsoring organizations WMO, IOC of UNESCO, UNEP and ICSU, and appreciated the willingness of WMO to take the lead.

New developments in the Earth observing programme community have required a review of the GCOS programme objectives and mandate. The new developments include the establishment of the GEOSS, and the increased attention countries are now giving to adaptation. The GCOS programme will also be affected by the development and implementation of the Global Framework for Climate Services (GFCS), WMO Integrated Global Observing System (WIGOS), and the findings of the IPCC AR5. The recent changes in the climate observation landscape have led to an evolving framework for climate services also for the other sponsoring organizations programmes including Future Earth, Blue Planet, and PROVIA. Also, SBSTA has considered the timing of future contributions of GCOS to SBSTA that will assess the adequacy of climate observing systems, evaluate progress, and update implementation planning.

In January 2012, a letter from WMO Secretary-General was circulated to the Heads of the sponsoring organizations to ask for collaboration in the conduct of the review process. The solicitation process for the review board members and its chairman and the negotiations regarding the necessary budget to financially support the work of the board continued over the summer months in 2012. In October 2012 the sponsors agreed that the Review Board should be chaired by the former President of the Deutscher Wetterdienst, DWD, and each sponsor appointed an individual expert to serve at the Review Board.

A kick-off meeting with a small planning group for the first Review Board meeting led by WMO was held on 15 February 2013, at WMO. The first meeting of the entire GCOS Review Board was held from 26 to 27 March 2013, at WMO. The Review Board members agreed on the following elements for the review: (a) a survey from a questionnaire being sent out to the broader climate observations community; (b) personal interviews of key persons; and (c) recommendations of the Review Board. The survey based on an online questionnaire had been closed at the end of July 2013. The survey questionnaire was developed through a process of discussion and amendment with Review Board Members. The final questionnaire was structured around five main thematic sections and comprised of 34 ‘check-box’ style questions with opportunities to provide further comment:

- Section 1 – Balance and relevance of GCOS MoU;
- Section 2 – GCOS Programme Achievements;
- Section 3 – The relation of GCOS and international and national organizations;
- Section 4 – GCOS programme functions and mechanisms;
- Section 5 – Vision and future plans.

The review focused on assessing the added value the GCOS programme is giving to the Members of its sponsors and to the closely affiliated Earth Observation Community with respect to climate science research and climate politics. The programme review provided the basis for eventually revising the GCOS Memorandum of Understanding and updating the GCOS strategic plan. Interviews of key experts to the GCOS programme of the sponsoring organizations and partner programmes finished in the middle of September 2013. A first version of the review report served as basis for the Second GCOS Review Board meeting, which took place 28 to 31 October 2013, at the WMO headquarters, Geneva. The draft report was reviewed by sponsors until end of February 2014, and a final full report and a synthesis report was prepared in March 2014 for publication. The report was prepared by the GCOS Programme Review Board under the chairmanship of Mr Wolfgang Kusch.

Key Outcomes of the Review:

The major outcome of the review is the general recognition of the normative work of GCOS in defining guidelines and setting principles. The review showed that a clear vision of the GCOS programme will be of key importance for its future activities and success.

The review showed clearly the significance of the programme. A quote from the Synthesis Report: "There is no doubt that the GCOS programme should be continued. It is indispensable. If it ceased to exist it would need to be re-created."

Based on the full report, the board prepared 18 recommendations to assist the sponsors in their considerations of further action to support the GCOS programme.

The Memorandum of Understanding and the GCOS Strategic Plan need to be revised and up-dated to better meet future requirements for climate observations. The sponsors will need to assess the recommendations given in the report and discuss how best to put into practice. WMO has indicated to lead this process of discussing the level of implementation of the recommendations given in the report.

Plans for 2014 to 2016: GCOS Status Report and a new Implementation Plan

At the 37th Session of SBSTA in November 2012, GCOS was invited to submit a report on the assessment of the adequacy of the global observing systems for climate. At the end of 2013, GCOS started its third assessment cycle. A Status Report will be prepared for submission to GCOS' sponsoring organizations and Parties to the UNFCCC, in 2015. It will review the overall status of each Essential Climate Variable, assess progress against the 2010 GCOS Implementation Plan and identify gaps. This report will be submitted to SBSTA 43/COP21, to be held in December 2015, in Paris.

In parallel with the Status Report, GCOS will have to start drafting a new Implementation Plan which requires that GCOS will consider new developments, systems and frameworks, such as the Global Framework for Climate Services and the Global Earth Observation System of Systems. We will also need to take into account the findings of the Intergovernmental Panel on Climate Change Fifth Assessment Report, the ICSU-led initiative Future Earth, the IOC-led initiative Blue Planet, and the UNEP-led Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA), which is part of the World Climate Programme, like its sibling programmes GCOS and the World Climate Research Programme, WCRP.

The new GCOS Implementation Plan, to be published at the end of 2016, will be a milestone that will influence the agenda for climate observations on a global and regional scale. GCOS is planning to submit the Implementation Plan to SBSTA 45/COP22, as a follow-up document to the Status Report.

Addressing the need for observation requirements for climate change and mitigation

The Global Climate Observing System (GCOS) and the Global Observations for Forest Cover and Land Dynamics (GOFC-GOLD) held a joint workshop on Observations for Climate Change Mitigation at the Headquarters of the World Meteorological Organization (WMO) in Geneva, Switzerland, from 5-7 May 2014. The report is online available here: http://www.wmo.int/pages/prog/gcos/Publications/gcos-185.pdf.

This workshop contributed to a better understanding of the observations requirements for mitigation and suggested some revision to ECVs for serving needs of IPCC inventory guidelines.

The goals of the workshop were: (1) develop a statement on the general adequacy of the observations coordinated by the GCOS to support climate change mitigation and identify of further work that may need to be undertaken in preparation for the next GCOS status report on the Global Observing Systems for Climate, (2) identify requirements needed for observations and their use in monitoring to support climate services addressing mitigation needs (especially in regard to the Agriculture, Forestry and

other Land Uses (AFOLU) sector), (3) discuss strategic guidance on what steps both GCOS and GOFC-GOLD should take, and (4) provide guidance for technical communities, data producers and data users.

The following mitigation issues were highlighted that are likely to require the attention of the GCOS in future:

- review existing and consider new Essential Climate Variables (ECVs) that are related to climate change mitigation;
- identify and address gaps and requirements for observations to support their use in monitoring to support research into mitigation;
- provide guidance for technical communities to advise data producers (e.g., space agencies, observation networks) and data users (those involved in mitigation, and climate science community).

The meeting considered that GCOS and GOFC-GOLD should:

Action 1: consider the relationship between ECVs (especially those related to biomass, land cover, fire, and soil carbon) and the IPCC greenhouse gas inventory guidance AFOLU, and suggest any revision to the ECV list in time for the next Implementation Plan.

Action 2: consider how ECVs relate to the remote sensing product list identified by the Space Data Coordination Group to support the Global Forest Observations Initiative (GFOI), and make any suggestions to revise the ECV list.

Action 3: investigate the possibility of generating a full global map of land use changes, tracking reported emissions data under the IPCC land use categories. The first step could focus on forest land and forest land changes.

Action 4: better coordinate with information important for mitigation (not covered within the current ECV context) on:

(i) land management within the land use categories of IPCC, especially forest, agriculture, and livestock.

(ii) drivers and agents of change.

(iii) economic indicators (e.g., infrastructure, settlements, GDP).

Workshop by GCOS in collaboration with IPCC and UNFCCC, February 2015

GCOS is organising a workshop, in collaboration with IPCC and UNFCCC on "Enhancing observation to support preparedness and adaptation in a changing climate – Learning from the IPCC 5th Assessment Report". The workshop will be held from 10-12 February 2015, and hosted at the premises of the UNFCCC Secretariat in Bonn, Germany.

The 3-day workshop will consider the observational and research needs for adaptation to climate variability and change. It aims to enhance systematic observations and related capacity, especially in developing countries, in light of the detection of observed impacts, exposure and vulnerability to climate change, and in support of assessing the risks of climate change and adaptation planning. It therefore aims to further support the work on research and systematic observation under SBSTA, and that of adaptation under the UNFCCC at large. The workshop will build on the findings of the WG II report to the IPCC AR5, and of identified strategic technical guidance from the GCOS Workshop on 'Observations for Adaptation to Climate Variability and Change'. The event will address observational needs in a number of sectors, currently in the focus of

evolving climate services, such as on analysis needs for water, agriculture and food security, disaster risk reduction, and health.

Participants will be also informed on the next steps in the assessment cycle of the GCOS programme which comprises a report on the status of the global observing systems for climate and a new implementation plan.

The GCOS would welcome contributions from Parties to the identification of emerging needs on observations, both in the context of the workshop and by contributing to third assessment cycle of the GCOS in taking part in the review process of the Status Report and Implementation Plan.

Reporting on global observing systems for climate

Regarding reporting on global climate observing systems, GCOS had contributed to the preparation of the revised UNFCCC reporting guidelines on global climate change observing systems for the provision of detailed technical reports on systematic observation in conjunction with the national communications by Annex I Parties, which were adopted by decision 11/CP.13, and updating and revising earlier guidelines from 1999 (FCCC/CP/1999/7, chapter III).

Previously, the SBSTA had in several occasions provided guidance concerning national communications and GCOS reports, such as in FCCC/SBSTA/2005/10, FCCC/SBSTA/2006/11 and FCCC/SBSTA/2007/16. In light of the on-going revision of the UNFCCC reporting guidelines on national communications by Annex I Parties under the SBI, GCOS would like to offer to assist Parties in revision of relevant chapters of those guidelines with regard to observations, and taking into account the effort of Parties when submitting their National Communication, while also being aware of the need to prepare their GCOS reports. These GCOS reports should take into account any developments on ECVs and outcomes of earlier GCOS reports and 2010 implementation plan (as requested by SBSTA 33 conclusions). Further guidance may assist in enhancing synergies between both efforts.

Developing and improving the sustained observing system in the Tropical Pacific: The Tropical Pacific Observing System, 2020 Project.

A Tropical Pacific Observing System 2020 (TPOS 2020) Project has been established during 2014, to transition the Tropical Pacific Observing System to be more robust, integrated and sustainable, by 2020.

The Tropical Pacific Observing System, developed during the Tropical Ocean Global Atmosphere (TOGA) project (1984-94), is a core component of the Global Climate Observing System, underpinning climate services, including the delivery of seasonal forecasts. Recent challenges in sustaining the current TPOS, as well as advances in science requirements, modelling and forecasting systems and observing technology meant it was timely for a systems based review of the requirements for the Tropical Pacific Observing System. The review culminated in a workshop held in La Jolla, USA in January 2014. The formation of the TPOS 2020 Project was the main recommendation to come out of a review of the TPOS, which culminated in a workshop held in La Jolla in January 2014.

The TPOS 2020 Project will be led by a Steering Committee, supported by a Resources Forum, and a distributed project office. The project will report to the Global Ocean Observing System (GOOS) Steering Committee. Progress has been swift in forming the project; a Steering Committee has been established, and their first meeting was held in October 2014 in Ansan, Korea. A Resources Forum teleconference was held immediately after the Steering Committee meeting, Task teams to coordinate much of the design work are in the process of being established. Further information can be found on the project website at www.tpos2020.org

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

In November 2013, the Committee on Earth Observation Satellites (CEOS) and the Coordination Group for Meteorological Satellites (CGMS) agreed to combine their international coordination efforts for climate monitoring through the creation of the CEOS-CGMS Working Group on Climate, taking heritage from the predecessor CEOS Working Group on Climate. This group blends the capabilities and capacities of both operational as well as research and development space agencies. This joint working group, as a direct response to the ECV observational needs identified by GCOS, has three over-arching objectives: i) providing a comprehensive and accessible view as to what Climate Data Records are currently available, or planned to be available; ii) Delivering further Climate Data Records, including multi-mission Climate Data records through best use of available data; and iii) Optimising the planning of future satellite missions and constellations to expand existing and planned Climate Data Records. It is envisaged that the first tangible deliverables from this new working group will be available at the end of 2015.

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 2013/2014 timeframe, the GCOS Cooperation Mechanism continued to focus 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 and Yeveran, Armenia), which was made possible through funding from Japan and the UK;

- the renovation of surface climate stations in Madagascar, including the comprehensive training of local technicians in the support and maintenance of these systems;
- the repair and service of the hydrogen generator in support of the upper-air observations at Harare, Zimbabwe, which was made possible through funding from Germany;
- the provision of a consultant, based in Africa, to focus on improving the data availability from the GSN & GUAN stations in the region and working on high priority projects.

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