
GCOS Statement to SBSTA 49, COP24

2 – 8 December, 2018

Extended version (20 November 2018)

This is our extended report to SBSTA on progress, with regard to Decision 19 of COP22 and to the conclusions of SBSTA45, on the Implementation of the Global Climate Observing System (GCOS)¹, a co-sponsored programme led by WMO.

GCOS is continuing in implementing the actions as recommended in its implementation plan², published in 2016.

The GCOS Steering Committee developed a strategy in 2018 that will provide additional clarity about the purpose of GCOS. The draft strategy will be endorsed by the executive heads of all sponsoring organizations and provided to the WMO Congress in May 2019.

The draft strategy is promoting three strategic goals:

I. Identify user needs. In particular, identify observations that more fully meet the needs of adaptation and mitigation to climate change, support sustainable development, the requirements of the UNFCCC and other multilateral environmental agreements (MEA).

II. In order to meet these needs, GCOS aims to ensure that climate observations are enhanced and continued into the future to provide the empirical evidence needed to understand and predict the evolution of the

¹ See homepage: <https://gcos.wmo.int/en/home>

² Available from: <https://gcos.wmo.int/en/gcos-implementation-plan>

climate, to guide mitigation and adaptation measures, to assess risks and enable attribution of climatic events to underlying causes, and to underpin climate services. GCOS will need to support integrated observations of the physical, chemical and biological properties and processes across the atmospheric, oceanic and terrestrial domains, in order to fully monitor the Earth's water and carbon cycles and energy.

III. Advocate for free and open access to relevant data.

GCOS was established in 1992. However, it is now facing new challenges. With the UNFCCC Paris Agreement of 2015, there is a wide consensus that supporting climate policy to address adaptation and mitigation is vital. The science has improved dramatically: the existence of anthropogenic climate change is clear and warming of the climate system is unequivocal.

This consensus on the need to act to mitigate and adapt to climate change together with improving and expanding observational technologies leads to more demands on the global climate observing system.

GCOS will consider how best to support users beyond its traditional role of supporting the science and understanding of climate change to include the global climate related observation needs of adaptation, mitigation, sustainable development, disasters and emergency response, and in responding overall to the Paris Agreement.

In order for climate observations to support an improved understanding of the climate system, a better attribution of events, and more reliable forecasts and projections, GCOS will need to ask for the whole climate system to be monitored. GCOS will incorporate the Earth's water and carbon cycles and energy balance in their entirety and aim to explain the changing conditions of the biosphere.

Observation technology is evolving. An example has been in the oceans with new autonomous equipment collecting data. New and higher resolution satellite data is becoming available. Other developments that use lower levels of technology but are likely to grow must be considered by GCOS.

A clear trend over the past decades has been a migration of individuals into cities, with over 50% of the world's population now living in urban areas. Observations are needed where people live, especially in the new urban megacities, to support adaptation, sustainable development and disasters as well as emergency response and resilience. GCOS will develop plans to address this.

Finally, to ensure high quality data is available, GCOS will need to improve its monitoring of the performance of ECV observations and implementation of the GCOS plans. This should be a central part of the work of its Expert Panels. Recent activities emerging from the GCOS Implementation Plan:

1. Promoting Global Climate Indicators³

The GCOS implementation plan asks for the development of an agreed set of global climate indicators that can be used to communicate to the widest community the scope and rate of changes to the climate in a widely accessible manner. The current list of climate indicators is being promoted: Global Surface Temperature, Ocean Heat, Atmosphere Carbon Dioxide, Sea Level, Ocean Acidification, Sea Ice Extent in the Arctic and Antarctic and Glacier Change.

2. Task Team on Paris Agreement

The GCOS Task Team on the Paris Agreement has identified where existing and future observations for climate can support the ambitions of the Paris Agreement and subsequent COP decisions in relation to global stocktake. The report⁴ of the Task Team is listing 16 activities which will improve the observing system with regard to improving the scientific understanding, supporting emissions an mitigation, supporting adaptation and monitoring the state of environment.

Effective support for these actions will be delivered through climate services which, themselves, require access to extensive, reliable and accurate observational data on the past and current evolution of essential climate variables.

³ <https://gcos.wmo.int/en/global-climate-indicators>

⁴ Available from: https://library.wmo.int/index.php?lvl=notice_display&id=20689

3. Using Radar to compliment precipitation climatology

The GCOS/WMO Radar Task Team⁵ is responsible for identifying requirements for the use of radar data for climate studies, including specifying adequate metadata and guidance on how to facilitate user access and preservation of data and to handle historical data. The first meeting was held at the Finnish Meteorological Institute in Helsinki in August 2017.

4. Lightning Observations for Climate Applications

Lightning is a new ECV in the atmospheric domain, and an assigned task team, the joint GCOS/WMO Task Team on Lightning Observations⁶ for Climate Applications is working on developing requirements and guidelines on the use of lightning data for climate, including the review and update of current lightning ECV requirements and the definition of standards and requirements for data management and data exchange of lightning monitoring for climate applications.

5. Regional Workshops in light of importance of climate adaptation

As called for in the implementation plan and mandated by SBSTA45, GCOS is holding regional workshops, particularly in light of the importance of adaptation, to identify needs and potential regional cooperation. The regional work programme envisaged would be an ideal forum to discuss adaption needs, promote guidance and best practice and design projects to improve observational networks.

These workshops will result in regional plans that will highlight the greatest needs and benefits of the proposed observational improvements. Donors would be encouraged to address these needs, either through the GCOS Coordination Mechanism, other actors or directly.

The workshops are held jointly with other interested stakeholders. One potential preparation in future would be to cooperate with WMO Regional Climate Centres to design and run specific regional small projects to assess existent capabilities needs in each country, identify potential opportunities of

⁵ <https://gcos.wmo.int/en/task-team-radar-observations-climate-applications-ttroca>

⁶ <https://gcos.wmo.int/en/task-team-lightning-observations-climate-applications-ttloca>

south-south cooperation, ongoing cooperation programmes and possible involvement of governments and the private sector.

These regional workshops will include representatives of countries in the region, potential donors and technical experts.

As a first step, GCOS, jointly with WIGOS, has organized a workshop in Nadi, in Fiji⁷, on from 9 to 12 October 2017, which developed an outline for a *Pacific region observing network plan in support of the GCOS Implementation Plan and the Implementation Plan for the Evolution of Global Observing Systems (EGOS IP)* to:

- Strengthen regional and national meteorological networks to support adaptation actions and avert loss and damage;
- Identify capacity building needs to ensure the sustainability of the networks;
- Support requests for finance from the operating entities of the financial mechanism under the Convention, the GCOS Cooperation Mechanism and other relevant funding sources.

The draft plan is being developed by GCOS and WIGOS in collaboration with the Secretariat of the Pacific Regional Environmental Programme (SPREP), the Pacific Islands Communication and Infrastructure Panel (PICI), and Pacific Meteorological Council, until December 2018.

A joint GCOS / Copernicus / WIGOS / GFCS workshop in collaboration with UNFCCC was held in Entebbe, Uganda, 31 October – 2 November 2018 on improving the value chain from observations to climate services to support climate policy, adaptation and mitigation in East Africa. The workshop outcomes will include a report and a regional plan to improve the value chain from observations to climate services in East Africa. The key messages are available⁸.

⁷ <https://gcos.wmo.int/en/regional-workshops/pacific-workshop>

⁸ <https://gcos.wmo.int/en/regional-workshops/east-africa-workshop>

6. Observations for Adaptation

The GCOS Terrestrial Observation Panel for Climate, TOPC, has decided to establish a task team⁹ to look at observations to monitor or support adaptation. Adaptation planning requires observations of the current state and assessment of risks of impacts and information on how these are changing. Some of this information comes from global observational systems and so GCOS is including these global monitoring needs in future observational requirements. In addition, some adaptation actions can be remotely sensed, and TOPC will consider how the observations needed to do this to support reporting to the UNFCCC Global Stocktake.

7. Progress in providing access to ECVs¹⁰

The GCOS science panels have started the process of reviewing progress on the new implementation plan and ensuring mechanisms are in place to monitor the observation, maintenance and free and open accessibility of all the ECVs. In this context, the work of the Joint CEOS-CGMS Working Group on Climate needs to be highlighted which is tasked with responding on the monitoring of climate from space. This working group has built an inventory for ECVs, which is accessible through a website. The ECV inventory¹¹ is the backbone of the architecture for climate monitoring from space and provides a comprehensive view as to what Climate Data Records are currently planned or available.

8. Continued commitment of space agencies

The Working Group on Climate has coordinated and compiled the space agencies' response¹² to the GCOS Implementation Plan. This document reiterates the commitment of space agencies worldwide to address actions required for implementation of the Global Climate Observing system and its specific contribution to climate change adaptation efforts around the world.

⁹ <https://gcos.wmo.int/en/terrestrial-observation-panel-climate/ttcao>

¹⁰ <https://gcos.wmo.int/en/essential-climate-variables>

¹¹ <http://climatemonitoring.info/ecvinventory>

¹² [WGClimate IP Response](#)

9. GCOS Network Management¹³

Many actions in the Implementation Plan are related to the operation and monitoring of the GCOS Upper-Air Network (GUAN). A Task Team was created to review the network requirements, assess and document the benefits of meeting stated requirements and to review how it contributes as a baseline network in the tiered network framework with GRUAN and the comprehensive network. A first meeting of the Task Team took place at the DWD Meteorological Observatory in Lindenberg, Germany from 5 to 6 December 2017. The key message from this meeting was a need to refocus the requirements of the GUAN in provided 'guaranteed' high-quality observations and the benefits of its designation as a baseline network. It was also decided that the original data should be retained and archived, and a common format for the raw data should be defined.

The GCOS Secretariat is reporting regularly on the GUAN, the GCOS Surface Network (GSN), and the GCOS Cooperation Mechanism, including the station list update, monitoring statistics for past and current years and current and recent observations projects undertaken by the GCOS network management. A key component to report, update and encourage the work and responsibilities of the Lead Centres is the biannual meeting between the Lead Centre Representatives, WMO and GCOS. The last meeting was held in Asheville, USA, in September 2018.

Since January 2016 additional monitoring of the GSN stations has been provided through the EUMETNET Quality Monitoring Portal¹⁴ (QMP). This enhanced QMP not only provides real-time availability and timeliness statistics for surface and upper-air messages received at the German Meteorological Service, DWD in Offenbach, but also measurement quality as compared with NWP background fields (ECMWF). Members are encouraged to monitor the performance of their GSN stations through this portal, and report any issues with the appropriate WMO/GCOS Secretariat.

¹³ <https://gcos.wmo.int/en/networks>

¹⁴ <https://eucos.dwd.de/ravi/>

I would like to remind Parties that you helped to establish the GCOS Cooperation Mechanism¹⁵, which has enabled donor funds to support continued operation of key climatological stations that were at risk of failing. This now needs to be reinvigorated to avert decline in essential climate observations – for the atmosphere, oceans and land. Following decision 19/CP.22 we encourage Parties to consider participating in the GCOS Cooperation Mechanism.

The GCOS Cooperation Mechanism is the system improvement and resource mobilization activity of the GCOS programme. It has been established following a decision by the UNFCCC SBSTA in 2004 (UNFCCC Decision 5/CP.5) in order “to enable developing countries to collect, exchange, and utilize data on a continuing basis in pursuance of the UNFCCC”. Since then, more than 3 million USD have been raised over the years to accomplish projects dedicated to improve climate observation systems.

New funds to the GCOS Cooperation Mechanism have reduced significantly. Currently, the GCOS Cooperation Mechanism is only able to offer low cost emergency support or projects with an explicit request from the donor (i.e. Kenya and Swiss funding).

Several actions in the Implementation Plan are related to the operation of the GCOS Reference Upper-Air Network (GRUAN). GRUAN is an international reference observing network of sites measuring ECVs above the Earth's surface. It is the response to the need of WMO and GCOS for the highest accuracy data possible and is also part of WIGOS. GRUAN measurements provide long-term, high-quality climate data records from the surface, through the troposphere, and into the stratosphere that are being used to determine trends, constrain and calibrate data from more spatially-comprehensive observing systems (including satellites and current radiosonde networks), as well as providing appropriate data for studying atmospheric processes. GRUAN has currently 26 sites, with the aim to expand to 30 to 40 sites.

¹⁵ <https://gcos.wmo.int/en/cooperation-mechanism>

GCOS has established a task team to work on the development of a GCOS Surface Reference Network¹⁶ (GSRN TT). A position paper, developed by members of the community “Towards a global land surface climate fiducial reference measurements network” and published in the International Journal of Climatology in 2018¹⁷, includes the rationale of the existence of a global surface reference network. Basing their work on this paper, the GSRN Task Team is asked to move forward the concept of a global surface reference network towards the practical implementation of such a network and to provide a concrete roadmap for consideration of the key stakeholders. During the meeting, held at Maynooth University in Ireland, from 1 to 3 November 2017, it was decided to produce a document that will include benefits, requirements, network design, governance and management proposals. This document will be part of the material used to assess the interest in the GSRN from stakeholders and to investigate about possible resources.

10. Developing the ocean observing system for climate¹⁸

The GOOS/GCOS Ocean Observations Panel for Physics and Climate, OOPC, coordinates focussed reviews and evaluations to develop and improve the ocean observing system for climate. In recent years, two have spun off into finite lifetime projects (TPOS 2020 and the Deep Ocean Observing System). The current work plan is focussed on:

Ocean Heat and Freshwater storage

OOPC has initiated a review of the observing system for tracking changes in Ocean Heat and Freshwater Storage, and a workshop is anticipated in 2019. This review will be an important contribution to improved tracking of changes ocean heat and freshwater content. The review framework has been proposed as an OceanObs’19 Community Whitepaper.

Air-Sea Fluxes and Wind Stress

A task team has been established to oversee the development of a strategy for observations of Air Sea Fluxes, and an ambitious forward strategy has been

¹⁶ <https://gcos.wmo.int/en/task-team-proposed-gcos-surface-reference-network-ttgsrn>

¹⁷ DOI: 10.1002/joc.5458

¹⁸ <https://gcos.wmo.int/en/ocean-observations-physics-and-climate-panel>

proposed as a Community Whitepaper in OceanObs'19. Improvements in Air Sea Fluxes and the diurnal cycle are essential in underpinning seamless prediction systems, and coupled forecasts down to shorter timescales. Improvements in air sea fluxes are critically dependant on ocean surface stress observations, and so OOPC has a focussed effort to improve ocean surface stress products also.

Boundary Currents and their interactions with the shelf

An international task team is being formed to develop requirements sustained observations of Boundary Currents and their interaction with the shelf. Boundary currents are dynamic features in the ocean, focus the regional distribution of heat and properties, and are regions of strong air-sea interaction, and the source of large errors in climate models. In addition, how boundary currents interact with the continental shelf can moderate the cross shelf exchange of properties, particularly carbon, and nutrients, and can therefore impact on ocean productivity and the carbon cycle. The dynamic nature of boundary currents makes them a challenge to measure, and a portfolio of observing platforms are needed. The group aims to develop best practices for boundary current observations, and a development strategy for key boundary current regimes.

11. Regional Ocean Observing System reviews and development projects

OOPC monitors progress of regional projects and reviews. In particular, OOPC identifies synergies and issues or advances which need to be raised to the global level, or can be used to advance the global observing effort.

The TPOS 2020 project was formed out of a review supported by OOPC, and is tasked with redesigning and re-energising the Tropical Pacific Observing System. The project noted in particular the need for further work on refining requirements, observing system design for Ocean Surface Stress and Air Sea Fluxes. As these issues are broader than the Tropical Pacific, TPOS 2020 will collaborate closely with OOPC. The First report was published in 2016, following external review.

Following the approval of the TPOS 2020 First Report by the sponsors, the tropical Pacific was recognised as a WIGOS Pre-Operational Pilot at WMO executive Council Session (EC-69), acknowledging the recommendations of the

first report, with the implementation and governance transition coordinated through a JCOMM Transition and Implementation Task Team.

Re-energising the western tropical Pacific observing system is the priority, and pilot project has been established to oversee regional implementation. The project is now working towards a second report which will be available for review and published ahead of the WMO Congress in May 2019. The report will have greater focus particularly on shorter (weather and extreme events) timescale requirements, and on the status of sub-seasonal to inter-annual forecast systems.

Similar regional efforts to evolve, integrate and enhance regional, basin scale observing systems, such as the European funded AtlantOS project and follow up Blueprint for an Atlantic Ocean Observing System, the Southern Ocean Observing System (SOOS) programme, and the Deep Ocean Observing Strategy to extend sustained observations into the full depth of the ocean. Regional reviews are also underway in the Tropical Atlantic and Indian Ocean. The need for ongoing regional, basin scale coordination is expected to be discussed at the OceanObs'19 conference.

12. Observing System implementation and performance tracking

OOPC works closely with the joint WMO/IOC of UNESCO commission on marine meteorology (JCOMM Observations Coordination Group), the membership of which comprises globally coordinated sustained oceanographic and marine meteorological observing networks, to set targets for the observing networks which in combination meet ECV requirements. Improved targets and Key Performance Indicators have been identified to improve tracking of the observing system performance for level of effort, coverage, and data delivery. OOPC ensured that these reflect targets identified as actions in the GCOS Implementation Plan. The JCOMMOPS technical coordination platform routinely tracks the performance of the observing networks, against targets, so the status of the observing system for climate can now be summarized on demand.

13. OceanObs'19 Decadal Conference

OceanObs'19 represents the culmination of a major planning effort to set agenda for the next decade of sustained ocean observing, with a focus on 'connecting observations to users'. It is hoped that operational services delivery will therefore be strongly represented. As with previous conferences, OOPC is playing a lead organising role. Further information can be found at www.oceanobs19.net.

OceanObs'19 builds on two previous OceanObs conferences. OceanObs'99 set the basis for what we know now as the sustained ocean observing system for climate, building on the major international experiments conducted in the 1980s and 1990s; and OceanObs'09 set the framework for expanding and evolving the ocean observing system to meet a broader range of requirements, through the Framework for Ocean Observing which has been heavily leaning on the framework of the Global Climate Observing System, as systems of climate observing systems.

14. Planning cycle for the GCOS towards the Global Stocktake

GCOS recognizes the need for coordination between its planning cycle and the scheduled global stocktake in 2023, and will aim to revise its status report in 2020/2021, plan for a second science conference eventually in 2021 and update its implementation plan in 2022.

Lastly, we consider the Earth Information Day initiative as an important opportunity to optimize engagement and connect information and requirements among the observation and science communities.

GCOS hopes to contribute to the successor of the very successful Marrakech event, and offers to assist the UNFCCC Secretariat in organizing it.

Thank you