WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

GCOS STEERING COMMITTEE
TWENTY-EIGHTH SESSION GCOS SC-28

Virtual Session
24–26 November 2020

GCOS-236

UNITED NATIONS ENVIRONMENT PROGRAMME

INTERNATIONAL SCIENCE COUNCIL

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Note the presentations and documents are available on the GCOS web page:
https://gcos.wmo.int/en/28th-steering-committee-meeting-2020

1. INTRODUCTION AND WELCOME

The Steering Committee Chair welcomed the participants and asked all the participants to introduce themselves. As this was a virtual meeting, unfortunately, the timing could not be good for everyone.

There were no comments on the agenda.

Wenjian Zhang (WMO Assistant Secretary-General) welcomed the participants to the meeting. Many of the important activities associated with the Word Meteorological Organization (WMO) reform are completed or underway. GCOS will be a key contribution to many important WMO developments. Planning the Global Basic Observing Network (GBON) is underway and will underpin WMO observing system. The WMO data conference took place the previous week and was a major component in WMO's efforts to improvement its data policy. WMO is now focussing on the Earth System approach and sees observations to services as the future of WMO.

Following the WMO reorganization GCOS sits within the Infrastructure Department (previously it was Climate and Water Department) with a new director, Anthony Rea. Han Dolman was appointed the new chair of the steering committee at the beginning of this year. A Joint Study Group on GCOS was created by the four co-sponsors of GCOS to review the governance, structure and outputs of GCOS and will report to the co-sponsors in 2021. Its work is separate from the Steering Committee that continues to operate within its existing mandate.

The GCOS director noted that COVID-19 has had a significant impact on GCOS. There have been no in-person meetings and none are expected in the first half of 2021 at least. There has been a commensurate increase in virtual meetings that have enabled GCOS to progress with its work well but the need for in person meetings is increasing with many of the more detailed discussions being postponed. A decision on the format of the 2nd GCOS-WCRP Climate Observations Conference will be taken, in consultation with the host EUMETSAT, in May 2021. The United Nations Framework Convention on Climate Change (UNFCCC) meetings in 2020 were postponed as well.

2. COMMENTS FROM GCOS SPONSORS

2.1 WMO

GCOS is important to WMO as it ensures that climate needs are addressed in WMO requirements and regulations, ensuring WMO can play a leading role in climate observations. GCOS helps coordinate across a broad range of organizations and across both in situ and space-based observations. The development of reference networks is important for both weather and climate needs.

WMO supports GCOS by implementing observing systems so they satisfy Essential Climate Variable (ECV) requirements. WMO makes its technical systems (e.g. the WMO Integrated Global Observing System (WIGOS) Data Quality Monitoring System (WDQMS), Observing Systems Capability Analysis and Review Tool (OSCAR), Rolling Review of Requirements (RRR) and the WMO Information System (WIS)) available to GCOS. Finally, WMO supports the Director and assistant, provides office space and support and some funding to the GCOS Trust Fund.

WMO would like to see more guidance and support from Sponsors for GCOS.

WMO looks forward to GCOS assistance in Earth System approaches and closer integration of needs and requirements of GCOS into WMO's regulations and guidelines. GCOS is a platform for collaboration across multiple domains. GCOS should continue to support the future development of GBON and the Systematic Observations Financing Facility (SOFF) to cover climate needs (the initial idea for these networks came from the GCOS/WIGOS Fiji Regional Workshop). GBON is a major development in monitoring networks and with the implementation of the SOFF funding mechanism should lead to significant improvements.

WMO anticipates that the Joint Study Group should address some of these issues.

WMO also supports the development of reference networks and use of their results in meteorological networks as well as meeting climate need for high-quality data sets.

2.2 The Intergovernmental Oceanographic Commission (IOC)

IOC sees GCOS as a direct and authoritative voice with UNFCCC on systematic observations and an engagement point with satellite agencies for long-term planning on (ocean) ECVs. It provides a consistent framework to evaluate requirements for climate observations across domains.

Through its engagement with relevant scientific communities (e.g. World Climate Research Programme (WCRP), climate impacts and Intergovernmental Panel on Climate Change (IPCC) Working Group 1&2) it leads to improved delivery and evaluation of priorities.

GCOS could do more to identify how an implemented GCOS will also underpin delivery of climate services.

A contribution from National Oceanic and Atmospheric Administration (NOAA) supports one scientific officer to support the Ocean Observations Physics and Climate Panel (OOPC), shared between GCOS and the Global Ocean Observing System (GOOS). OOPC's activity is funded 75% form IOC (about US$30/year). IOC is the main support for GOOS.

In the future IOC would like to see GCOS to contribute to a more sustained climate observing system. GCOS outputs need to have greater impact on the ocean related work of IOC Member States.

IOC expects a transformation of GOOS in the coming decade with new technological innovations partnerships.

2.3 United Nations Environment Programme (UNEP)

ECVs are the backbone of the Global Environment Monitoring Activities in UNEP: atmospheric, hydrological and ocean variables are most relevant. It is important to ensure harmonized high standard observations with the SDGs especially those related to SDG 6 (water), 13 (climate) and 14 (oceans). This directly links to the UNEP's key assessments such as the Emission Gap Report (EGR) made in partnerships with organisations such as the IPCC, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the intergovernmental Group on Earth Observations (GEO) The ECV are also relevant for the science policy interface at various scales i.e. Regional Seas and MEAs.

Underrepresented in GCOS so far is a focus on adaptation to global trends namely climate and its effects and how to measure adaptation and how to inform steps towards adaptation. Therefore, UNEP has actively contributed to the Task Team on Observations for Adaptation – the outcomes of which would be very welcome by UNEP and its sub-programmes particularly on observations for adaptation progress, results and co-benefits. This links to the World Adaptation Science Programme, the Adaptation Futures Conference, and will help identify urgent and future needs in research, policy, and action, with a focus on the developing countries.

UNEP is actively involved in the Steering Committee of GCOS and the Study Group through its Chief Scientist and this engagement will continue.

The United Nations Environment Assembly provides the global environment focused science policy interface advocating for the relevance of high-quality standardized observations and linking them to the Data Strategy Development requested by the Governments by 2025. UNEP promotes the concept and science of the ECV and Essential Ocean Variables (EOVs) in its work at regional scale including capacity building in the Regional Seas.

UNEP though its analytical and assessment work investigates and provides context for climate and earth system observations, their interlinkages with health, ecosystems, natural capital at large and their relevance in informing societal transformation.

Key reports such as the Emissions Gap and Adaptations Gap Reports will draw on observations and close relations will evolve around UNEP's partnership based (alliance/consortium) approaches around Air Quality, Water Quality (WWQA) and Oceans (incl. coastal zones). Also worth considering are the co-benefits of links between the GCOS based observations and the world environment situation room (partially this is happening already e.g. on atmospheric variables).

2.4 The International Science Council (ISC)

The ISC benefits from GCOS' global networks of experts and from the observing system capabilities, that provide our community of scientists with data and information they need to develop new insights and synthesis work.

GCOS and the other co-sponsored programmes also help build the ISC's ambition to be an international and credible global voice for science. Through its networks and partnerships, the ISC has the capacity to convene critical debates for the future of global science and the articulate the public value of science.

ISC supporting good scientific practice. It engages the academic community (national academies and research funders as well as international scientific unions) in GCOS activities. ISC promotes the free and responsible conduct of science globally.

ISC amplifying the reach of GCOS by involving its community in ISC's communications and outreach activities (blogs, interviews, Global Science TV, etc.). It works with GCOS to help disseminate publications and messages through our international network of members and partners.

ISC would like to explore further ways of amplifying the reach and entrainment of experts to GCOS via ISC communication channels. ISC should engage with GCOS and other programmes (WCRP, GOOS, Future Earth, etc.) to create momentum around COP 26.

3. REPORTS TO THE STEERING COMMITTEE

3.1 Secretariat

The secretariat reported on the progress of the next GCOS Status Report. Drafting is well underway with a draft to be reviewed by the panels available before Christmas and the public review starting in February 2021. The publication is expected to be in mid-2021 following approval by the Steering Committee.

The Second CGOS-WCRP Climate Observation Conference hosted by, EUMETSAT is planned for 12–14 October 2021, in Darmstadt, Germany. A final decision on the format of this meeting will be taken in May 2021. The Organizing Committee will start to discuss the content, structure and invitation for abstracts of the meeting in January. The meeting will be arranged to include substantial time for discussions.

The outputs will provide inputs into the next GCOS implementation plan (2022).

3.2 Atmospheric Observation Panel for Climate (AOPC)

The main activities this year have included:

- Establishing the GCOS Surface Reference Network (GSRN), working with WMO Standing Committees on Earth Observing Systems and Monitoring Networks (SC-ON) and on Measurements, Instrumentation and Traceability (SC-MINT) to ensure GSRN is integrated into WMO;
- Contributions to the planning for GBON;
- The Task Team on Lightning has been refreshed and will continue to its work with in-situ and satellite observations;
- Contributions to the Status Report; and
- Preparation of ECV requirements.

AOPC will continue to support of GSRN Task Team during its development and to respond to requirements arising from WMO SC-ON. It will also collaborate with data centres to establish data repositories, in particular for GNSS-PW and Thunderdays data.

If GBON and the SOFF are adopted and successfully implemented the future of GCOS Surface Network (GSN) and the GCOS Upper Air Network (GUAN) will need to be discussed.

AOPC will continue to support the Status Report, Implementation Plan and GCOS Climate conference.

The Panel needs to spend time with an in-person meeting given the new membership and as it last met as a panel for only a day and a half in 2019. AOPC feels that at this time cross-panel issues are a secondary concern compared to actually being able to meet as a panel at this juncture for long-enough to actually discuss and agree the priorities.

3.3 Ocean Observations Physics and Climate Pane (OOPC)

The main activities of OOPC include

- OceanObs19 Conference (134 Articles in Frontiers) & Action plan;
- Energy imbalance assessment (von Schuckmann et al. 2020) - the Energy Cycle paper;
- Air-sea fluxes OASIS proposal - funded Scientific Committee on Oceanic Research (SCOR) working group;
- Biogeochemical Argo (BGC-Argo) (5 years plan: US funded $53 million; awaiting decision in Europe, Asia, Australia);
- Evaluations of parts of the observing system with design recommendations for the future;
- Tropical Pacific Observing System-TPOS 2020 completion this year;
- Tropical Atlantic Observing System (TAOS) Review almost completed (will be published January 2021);
- Indian Ocean Observing System-IndOOS-2 (published in BAMS in Nov. 2020).

Main areas of OOPC (holistically with GOOS) work in the next 1-5 years are:

- Improving the ocean observing through observations strategy analyses:
  - Ocean heat and freshwater storage
  - Ocean-Atmosphere fluxes
  - Boundary systems
  - Appropriate ocean and climate indicators
  - Engagement with Ocean Predict and operational services
- GOOS Implementation Planning process with synthesis across components.

OOPC plans to use the UN Decade of Ocean Sciences to focus on integration, system design, connection across value chain with better links to modelling.

Connections to cross-panel work

- UN Ocean Decade programme "Into the coasts": connection to terrestrial observations;
- BioEco panel interested in engaging for maturation of ECVs in a common way across biological realm;
- Developing an Observing Air-Sea Interactions Strategy (OASIS);
- Global and regional cycles as a focus;
- Development of an integrated GCOS Extremes and Adaptation observing and assessment strategy.

3.4 Terrestrial Observation Panel for Climate (TOPC)

Major tasks in the previous year included:

- Contributions to Status Report;
- Preparations for public consultation of ECV requirements Consideration of responses postponed initially until an in-person meeting, now will be done remotely;
- Adaptation Task Team. While their work was delayed due to COVID, they were able to report to TOPC in October: the Task Team needs revitalizing and GCOS-wide inputs;
- Development of Biosphere indicator continuing with a focus on phenology in temperate and boreal zones;
- Agreement on the development of a new list of major lakes to be observed Integrating different existing lists;
- Carbon and Biosphere cycles papers continuing: Water paper submitted to BAMS.

Plans for 2021 include:

- Revitalize the TOPC Task Team on adaptation with 1st meeting in early 2021. TOPC will ensure engagement of SC & the 3 panels and inputs from relevant users (e.g. Copernicus, GEO) . Aim to prepare a report for SC 2021;
- Finalize lists of major lakes to be observed and do the same for rivers;
- Progress biosphere indicator including a community discussion (led by Nadine Gobron, Martin Herold)
  - Designed by early 2021;
  - Approved by SC 2021;
  - Potential production by Jan 2022;
- Agree revised ECV requirements including considering needs of users especially adaptation and mitigation;
- Consider rock glaciers as potentially part of permafrost;
- Improving collaboration between/with Global Terrestrial Networks (GTN);
- Continue to work on the Status Report, Implementation plan and GCOS Conference.

Areas for cross-panel collaboration include:

- Coastal Areas where issues include land Use/Land Use Change, lack of river discharge data and potential overlaps such as mangroves that are part of forest reporting to the UNFCCC;
- GSRN where TOPC contribute to its planning will continue to cover the terrestrial component;
- Identify Suitable ECV (e.g. Soil Moisture) and contribute to its development;
- The Climate Cycle Work – contribute to SC task team;
- With AOPC consider adequacy of flux (energy & water) measurements.

4. BUDGET AND FUNDRAISING

Doc. 4.0

Presentation

GCOS Budget and Funding. Table 1 shows the overall financial situation of GCOS and the GCOS Cooperation Mechanism. Table 2 gives some detail of the income and expenditure.

Table 1. Summary of GCOS Financial Situation (in CHF) - 2020 and forecast, for the GCOS Trust Fund and below for the GCOS Cooperation Mechanism.

The income is the amount that are certain, additional funds are expected but not enough to cover the short-fall.

Overall Balance - GCOS (CHF) (including COVID-19 Impacts in 2020-21)				
	2020	2021	2022	2023
Income	729,503	446,632	425,220	0
Balance from previous year carried forward	522,095	579,451	271,776	0
Expenditure	672,147	754,306	949,902	905,227
Balance	579,451	271,776	-252,907	-905,227

Note: this includes deductions of 342,000 CHF in 2020 and 268,770 CHF in 2021 due to the impacts of COVID-19 restricting travel and meetings. This assumes no travel in the first half of 2021.

Overall Balance GCOS Cooperation Mechanism (CHF)				
	2020	2021	2022	2023
Income	50,000	50,000	50,000	50,000
Balance from previous year carried forward	92,888	57,045	57,045	57,045
Expenditure	85,843	50,000	50,000	50,000
Balance	57,045	57,045	57,045	57,045

Note: this does not include the spending on HIGHWAY as this is net zero in 2020.

GCOS needs about 1 million CHF a year to operate: the major expenses are the secretariat staff and hosting meetings (mainly participant travel). GCOS income is now significantly less than 1 million with the main funding in 2020 a grant from Copernicus and a contribution from the US. This is significantly less than the normal (non-COVID-19) rate of expenditure.

The trust fund has been diminishing over recent years.

The ability of the secretariat to reduce its costs is limited and meetings are mainly on-line, even before the COVID-19 crisis.

While there will be a significant carry-over of funds (due to reduced expenditure in 2020) this will not continue if GCOS wishes to remain effective with a wide range of contributions.

The GCOS Cooperation Mechanism has limited funds for the next 1-2 years for specific activities (assuming if the Japanese contribution continues) without additional fund-raising its benefit and impact will be small, so a long-term plan is needed, and this was discussed under item 6.5.

It is not clear what are the sponsors doing about the Trust Fund or their responsibility for the core funding.

The EU sees GCOS as providing added value for implantation of Copernicus. UNFCCC sees GCOS as key requirements setting body for convention and for process. The on-going process

of updating requirements helps with talks internationally. GCOS is a template for intentional collaboration.

UNEP mandate is to engage in global environmental agenda to support member states on the basis of MEA. Therefore, it relies on GCOS for requirements. Financially they are struggling.

There is a structural issue: there is support for observations, but it is more difficult to fund coordination and planning which would make more efficient use of funding for observations.

Number	Action	Responsibility
SC-28/1 Action	It was agreed to establish a Task Team to look at what the steering committee can do to support the raising of additional funds for the GCOS Trust Fund.	Initial volunteers: Sue Barrell and Youba Sokona

5. STEERING COMMITTEE WORKING ARRANGEMENTS

The Chair explained that he believed that the steering committee should have a more active role in steering the programme of GCOS. Attending an annual meeting was not enough. The committee agreed.
As there was no in-person meeting in 2020, it is hoped one can take place in 2021.

Number	Action	Responsibility
SC-28/2 Action	SC agreed to take a more proactive approach to GCOS: e.g. involvement in task forces, virtual meetings and decisions by email.	SC
SC-28/3 Action	It was agreed that the Steering Committee should meet at least every six months, virtually or in person, with some decisions made by email exchanges in the interim periods. Steering Committee members will also participate in task groups as needed.	SC

The status of members of the Steering Committee was discussed with some members reaching the end of their 3-year term. However, due to the disruptions caused by the COVID-19, and that the Joint Study Group may revise the Terms of Reference of the GCOS Steering Committee, it was agreed that all members should serve for at least another year.

Number	Action	Responsibility
SC-28/4 Action	Agree SC members reaching the end of their term shall continue to serve until the Joint Study Group Finishes. The Secretariat to check the procedure for doing this.	GCOS Secretariat

6. REVIEW IMPACT OF GCOS

Doc. 6.0

Presentation

The SC reviewed impact of GCOS including the ECV Requirements; its last Status Report and Implementation Plan; networks; support for UNFCCC, other MEA, adaptation and mitigation. For WMO, there is a clear route into their regulatory material, to influence the development of climate monitoring which is being developed by the secretariat. In other areas the impact of GCOS could be improved. Links to other multilateral environmental agreements (MEA) have not been developed. The SC emphasized the need to improve integration with WMO – i.e. need to integrate requirements more with WIGOS.

Number	Action	Responsibility
SC-28/5 Action	Secretariat to prepare a note on improving the integration of GCOS ECV and climate needs into the WMO regulatory system and WIGOS for discussion by the SC.	GCOS Secretariat

GCOS needs to define requirements and set priorities by looking at successes and thinking of users and their needs. There will also need to be a consideration of adaptation and extremes in the Status Report and Implementation Plan.

Number	Action	Responsibility
SC-28/6 Action	The SC will hold an off-line discussion on how to be more proactive on adaptation, and relevant links to IPCC and other organizations.	SC
SC-28/7 Action	Secretariat to contact Copernicus and GEO over user requirements.	GCOS Secretariat

6.1 Review of ECV Requirements

Doc. 6.1a

Presentation

The SC discussed the way that the panels developed ECV and ECV product requirements. They agreed that GCOS should review the current list of ECV to identify exactly which ECV are really needed to monitor the climate with a focus on supporting policy development, planning and monitoring implementation of adaptation and mitigation noting this requires more detailed information on extremes: i.e. focus on activities with direct benefits to human health, livelihoods and well-being. This should indicate why they are needed beyond improving scientific understanding of certain phenomena.

DECISION 28-1

The Steering Committee decides that:

a) When the GCOS expert panels review the ECV products they should ensure that they are relevant for GCOS mandate and produce a clear justification for the need of each product based on its relevance for climate monitoring and clear user-defined needs.
b) The GCOS Secretariat involve the user community in reviewing the relevance of the ECV products for the needs of their communities.
c) The GCOS Secretariat produce a list of essential ECV products, identified through a) and b) to be approved by the Steering Committee.
d) Requirements for the agreed ECV products will be included in the update of the GCOS Implementation Plan and in the WMO OSCAR/Requirements.

Furthermore, the Steering Committee reaffirms that an ECV and its products should:

- Be feasible and sustainable to measure;
- Have a clearly specified user need going beyond scientific curiosity;
- Number of ECV and products should be the minimum needed to meet user needs;
- Measure a significant part of the climate system.

The Steering Committee also decided that, where possible, requirements should be aligned with existing observing systems (e.g. for Numerical Weather Prediction NWP) while noting the specific climate needs (e.g. accuracy, stability and historic time series). The Steering Committee also notes that differing requirements for different uses may be needed for a specific ECV.

6.2 Consider TOPC proposal for an ECV "Total Water Storage"

Doc. 6.1b

Presentation

TOPC proposed that Total Water Storage (TWS) become an ECV. Strong representations were made by a group of about 20 scientists from Germany, U.S., France, Switzerland and Austria representing a large user community from geodesy, hydrology, oceanography and glaciology. A completed proposal agreed at the TOPC-22 on 20 March 2020.

TWS comprises all the water storage on the Earth's continental areas in frozen and liquid state, including ice caps, glaciers, snow cover, soil moisture, groundwater and surface water bodies such as lakes, man-made reservoirs, rivers, wetlands, and flooded areas. TWS change is the only variable that allows for comprehensively closing the terrestrial water budget, balancing precipitation, runoff and evapotranspiration.

TWS can be observed through satellite observations of the temporal and spatial changes in the Earth's gravity field. Gravity data have been provided by the GRACE satellite mission (2002-2017) and are continued by the GRACE-Follow-On mission (GRACE-FO, launched in 05/2018).

TWS change has many uses including:

- Quantifying the net effect of changes in the climate, human water use and other hydrological effects on the continental water budget;
- Closing the terrestrial water balance;
- Identifying hot spots of changes in the water cycle assessing the severity of droughts, contributing to flood prediction by measuring the wetness status of river basins, monitoring the ice mass loss of glaciers and ice caps, quantifying the contribution of TWS to sea level rise;
- Improving the predictive skill of Earth system models through validation and calibration.

The requirements for the proposed ECV are given in Table 2. and 3.

Table 2. ECV product requirements for proposed new ECV - Thresholds*

ECV	Product	Temporal resolution	Latency	Spatial resolution	Required measurement uncertainty	Stability (per decade)
Terrestrial Water Storage (TWS)	TWS anomaly	monthly	monthly	300 km	10-20 mm, Trend 10 mm/a	No drift

*GCOS ECV guidelines: The threshold defines the minimum requirement, i.e., the value that has to be met to ensure that data are useful.

Table 3. ECV product requirements for proposed new ECV – Goals*

ECV	Product	Temporal resolution	Latency	Spatial resolution	Required measurement uncertainty	Stability (per decade)
Terrestrial Water Storage (TWS)	TWS anomaly	daily	2-3 days	50 km	10-20 mm, Trend 10 mm/a	No drift

*GCOS ECV guidelines: The goals define the ideal requirements above which further improvements are not necessary. This is likely to evolve as applications and technologies progress.

DECISION 28-2

The Steering Committee decides that Total Water Storage (TWS) should be an ECV and asks TOPC to include it, and its requirements, in the next revision of the GCOS Implementation Plan.

Number	Action	Responsibility
SC-28/8 Action	TOPC should look at definition of other hydrological ECV as TWS is included to ensure consistency and reduce duplication.	TOPC

6.3 Climate Cycles

Doc. 6.2

Of the four papers produced on the climate "cycle" the ENERGY paper has been published, the Water paper has been submitted and work is continuing to finalize the carbon and biosphere papers.

It was noted that looking at the climate cycles (energy, carbon, water) and biosphere, in an integrated way across the 3 domains provides an opportunity for the panels to work together and provides an integrated look at the observing system.

It was decided to establish a task team with the modelling communities and WCRP (one for energy/water and the other carbon) to consider what observations they really need to improve their climate understanding (if any) and to plan a way forward.

Number	Action	Responsibility
SC-28/9 Action	Panel Chairs to suggest possible members of cycles task team.	3 Panels Chairs

DECISION 28-3

The Steering Committee decides to:

a) Establish a task force to oversee the cycle work in the future and to make sure that recommendations feed into the next IP.
b) This work is not necessarily limited to energy, water and carbon but may also extend to other cross-domain efforts such as for instance sea ice for which ECVs from different domain are needed.
c) The Steering Committee also decides that, where possible, requirements should be aligned with existing ECVs. The Steering Committee also notes that differing requirements for different uses may be needed for a specific cycle.

6.4 Format of Implementation Plan

Doc. 6.3

Presentation

In order for the next implementation plan to have a greater impact, the next update to the implementation plan should be more focused on the major implementable actions and needs for each part of the observing system.

Inputs into this report will include:

- the GCOS Status Report;
- the GCOS Climate Observations Conference;
- the IPCC findings; and
- the outcomes of the revisions of the ECV requirements.

The draft outline has been prepared in consultation with the Steering Committee Chair. It aims to focus more on key actions needed by the various actors active in climate observations. Actions in this plan will be broader than before, encompassing a number of separate activities.

The first step is the establishment of a writing team which will, in January, refine and agree the draft outline, presented below. They will work with the panels in writing this report.

Number	Action	Responsibility
SC-28/10 Action	SC to volunteer and/or make proposals for coordinator and members of IP writing team to GCOS Secretariat by end 2020.	SC
SC-28/11 Action	Secretariat to ensure GCOS IP is incorporated into WMO processes.	GCOS Secretariat

Draft Outline of GCOS Implementation Plan

1. Executive Summary
2. Introduction
3. ECV (Describe ECV, Significant changes (if any), stewardship, satellite & in situ, accuracy…)
4. Main findings on Status of the Global Climate Observing System (Brief summary based on: GCOS Status Report, GCOS Science Conference, IPCC Assessments, Consideration of the climate cycles)
5. Improving the Global Climate Observing System
   - 5.1. Observations made by/for National Meteorological and Hydrological Services (NMHS), NWP, Cryosphere and Hydrology)
   - 5.2. Other ocean physics and geochemistry observations
   - 5.3. Observations of the Biosphere
   - 5.4. Observations of Anthropogenic ECV
   - 5.5. Satellite Observations
   - 5.6. Global Climate Data Centres
   - 5.7. How GCOS will support these improvements
6. Summary

DECISION 28-4

The Steering Committee decides that:

a) A writing team be established to draft the updated Implementation Plan. Its first meeting should be in January 2021. The Steering Committee Chair, in consultation with the Steering Committee members, should select members of the writing team.
b) The writing team should have about 10 members. The selection of the members shall consider geographical and gender balance as well as experience in the different domains and user communities.
c) The writing team shall include the SC Chair and one chair from each panel.
d) The SC agrees that the attached outline shall be used as a starting point for the Plan. Steering Committee members should make specific comments and proposals for the first meeting of the writing team.
e) The writing team is asked to report a revised outline to the first Steering Committee teleconference after to their initial meeting and to report progress to subsequent Steering Committee meetings.
f) The timeline for this plan is for an initial internal review in November/December 2021; a public review of at least 6 weeks in January/February 2022; followed by publication in mid-2022. (This timeline was agreed previously).

6.5 GCOS contributions to the UNFCCC and its Global Stocktake (GST).

Presentation

Jo Post (UNFCCC) introduced the UNFCCC Global Stocktake (GST) and discussed how GCOS can contribute to the GST, the Paris Agreement and the UNFCCC more broadly.

The GST is an ambitious agreement to limit global temperature rise, to increase adaptation and climate finance, and every 5 years assess progress towards the targets of the Paris Agreement. The first GST is in 2023. The Paris Agreement covers, mitigation, adaptation, finance, technology, capacity building and transparency.

Each GST is followed by communications describing parties (future) individual efforts. Parties then need to increase their ambition and report on their individual efforts (i.e. look backwards, biennial transparency reports) every 2 years starting in 2024. These reports then feed into the next GST and the cycle continues.

Information used in the GST should not identify an individual or group of Parties but be more aggregated. Information for the GST can come from Parties, IPCC, UNFCCC Constituted Bodies and forums, UN agencies, UNFCCC observers, regional groups and institutions. The systematic observation community will contribute to the GST. The UNFCCC is constructing a science-based policy process from observation through research and assessment to policy making. The Paris Agreement and subsequent discussions in the UNFCCC have described the process and information needed in some detail.

The UNFCCC is proposing to establish an ad-hoc coordination group (supported by the UNFCCC secretariat) on systematic observation and monitoring of the progress the Parties are making towards their collective targets. This group should both provide input to the GST at the global level and support to countries making their individual contributions to GST. The consolidated contribution of the systematic observation community will be presented in a synthesis report to the GST, that will be produced in 3 parts corresponding to GST themes (i.e. Climate Action, Climate Support, Impact of Climate Action).

This work will need to collect aggregate information, identify indicators of progress and baselines (focused on the outcomes in terms of mitigation of and adapting to climate change) and should identify information gaps and good practices and lessons learned.

Number	Action	Responsibility
SC-28/12 Action	The SC agreed to support this activity and that this should be led by the SC Chair supported by the GCOS secretariat, with technical contributions from the panels as needed.	SC Chair

6.6 A more proactive approach to networks

Doc. 6.5

Presentation

There are a number of GCOS networks ranging from the GCOS reference networks (GCOS Reference Upper Air Network (GRUAN) and GSRN that is currently being established), and baseline (GSN and GUAN), the joint GCOS-WCRP Baseline Surface Reference Network (BSRN), and, with a looser arrangement, the global terrestrial networks (GTN) that report to TOPC.

WMO is establishing the Global Basic Observing Network (GBON). This will provide the minimum requirements needed for numerical weather prediction and reanalysis in support of climate monitoring. The GBON stations will largely overlap with GSN and GUAN and so the future of the GSN and GUAN need to be considered. A better alignment of the GCOS reference networks with WMO would be mutually beneficial. Despite BSRN being a GCOS network for surface radiation, it has very little practical link to GCOS, so it is very hard to influence its evolution. The formal relationship with the various Global Terrestrial Networks to GCOS is unclear.

The GCOS Cooperation Mechanism (GCM) was established in response to a request from the UNFCCC and provides practical support to networks. This includes equipment, repairs, communication and training. However, in recent years contributions to the fund have been falling.

The Steering Committee agreed that:

a) GCOS Reference Networks are recognized by WMO, IOC, and network operators as the highest quality observing networks with robust metrological traceability and uncertainty quantification leading to improvements in quality and stability of long-term climate records;
b) GCOS Baseline networks are integrated into GBON, over the next 5 years, as the minimum set of observations needed to globally monitor the climate;
c) The role of all the networks, and GCOS' contribution to them, is clarified. It was noted that the GTN may benefit form a stronger more formal link to GCOS;
d) Sustained climate networks require sustained funding for the poorest countries, through a managed financing mechanism.

Number	Action	Responsibility
SC-28/13 Action	SC to form a task team to work with Secretariat how to broaden GCM activities and funding for SC-29.	SC and GCOS Secretariat

DECISION 28-5

The Steering Committee decides that the GCOS Secretariat will:

a) Collect, define and monitor deliverables and milestones for the GCOS reference networks.
b) As GBON and SOFF develop, establish an expert group to review how GSN and GUAN can be integrated into the GBON and what are the relevant requirements that must be maintained.
c) Through the development of GSRN ensure that the extension of GSRN to all domains is considered.

DECISION 28-6

The Steering Committee decides to jointly with WCRP, review and, if necessary, make proposals about the relationship between BSRN and GCOS.

DECISION 28-7

The Steering Committee decides that TOPC will review and, if necessary, make proposals about the relationship between the Global Terrestrial Networks and GCOS, reporting back at the next Steering Committee meeting.

DECISION 28-8

The Steering Committee decides to ask the GCOS Secretariat to present options regarding the future of the GCM and report back to the next SC meeting.

7. AOB

7.1 Time and place of next meeting.

It was agreed to meet virtually in May 2021 and to see if an in-person meeting is possible in October/November 2021 (it will be 2 years since the Steering Committee met face-to-face).

7.2 Summary of actions and decisions

Number	Action	Responsibility
SC-28/1 Action	It was agreed to establish a Task Team to look at what the steering committee can do to support the raising of additional funds for the GCOS Trust Fund.	Initial volunteers: Sue Barrell and Youba Sokona
SC-28/2 Action	SC agreed to take a more proactive approach to GCOS: e.g. involvement in task forces, virtual meetings and decisions by email.	SC
SC-28/3 Action	It was agreed that the Steering Committee should meet at least every six months, virtually or in person, with some decisions made by email exchanges in the interim periods. Steering Committee members will also participate in task groups as needed.	SC
SC-28/4 Action	Agree SC members reaching the end of their term shall continue to serve until the Joint Study Group Finishes. The Secretariat to check the procedure for doing this.	GCOS Secretariat
SC-28/5 Action	Secretariat to prepare a note on improving the integration of GCOS ECV and climate needs into the WMO regulatory system and WIGOS for discussion by the SC.	GCOS Secretariat
SC-28/6 Action	The SC will hold an off-line discussion on how to be more proactive on adaptation, and relevant links to IPCC and other organizations.	SC
SC-28/7 Action	Secretariat to contact Copernicus and GEO over user requirements.	GCOS Secretariat
SC-28/8 Action	TOPC should look at definition of other hydrological ECV as TWS is included to ensure consistency and reduce duplication.	TOPC
SC-28/9 Action	Panel Chairs to suggest possible members of cycles task team.	3 Panels Chairs
SC-28/10 Action	SC to volunteer and/or make proposals for coordinator and members of IP writing team to GCOS Secretariat by end 2020.	SC
SC-28/11 Action	Secretariat to ensure GCOS IP is incorporated into WMO processes.	GCOS Secretariat
SC-28/12 Action	The SC agreed to support this activity and that this should be led by the SC Chair supported by the GCOS secretariat, with technical contributions from the panels as needed.	SC Chair
SC-28/13 Action	SC to form a task team to work with Secretariat how to broaden GCM activities and funding for SC-29.	SC and GCOS Secretariat

DECISION 28-1

The Steering Committee decides that:

a) When the GCOS expert panels review the ECV products they should ensure that they are relevant for GCOS mandate and produce a clear justification for the need of each product based on its relevance for climate monitoring and clear user-defined needs.
b) The GCOS Secretariat involve the user community in reviewing the relevance of the ECV products for the needs of their communities.
c) The GCOS Secretariat produce a list of essential ECV products, identified through a) and b) to be approved by the Steering Committee.
d) Requirements for the agreed ECV products will be included in the update of the GCOS IP and in the WMO OSCAR/Requirements.

Furthermore, the Steering Committee reaffirms that an ECV and its products should:

- Be feasible and sustainable to measure;
- Have a clearly specified user need going beyond scientific curiosity;
- Number of ECV and products should be the minimum needed to meet user needs;
- Measure a significant part of the climate system.

The Steering Committee also decided that, where possible, requirements should be aligned with existing observing systems (e.g. for NWP) while noting the specific climate needs (e.g. accuracy, stability and historic time series). The Steering Committee also notes that differing requirements for different uses may be needed for a specific ECV.

DECISION 28-2

The Steering Committee decides that Total Water Storage (TWS) should be an ECV and asks TOPC to include it, and its requirements, in the next revision of the GCOS Implementation Plan.

DECISION 28-3

The Steering Committee decides to:

a) Establish a task force to oversee the cycle work in the future and to make sure that recommendations feed into the next IP.
b) This work is not necessarily limited to energy, water and carbon but may also extend to other cross-domain efforts such as for instance sea ice for which ECVs from different domain are needed.
c) The Steering Committee also decides that, where possible, requirements should be aligned with existing ECVs. The Steering Committee also notes that differing requirements for different uses may be needed for a specific cycle.

DECISION 28-4

The Steering Committee decides that:

a) A writing team be established to draft the updated Implementation Plan. Its first meeting should be in January 2021. The Steering Committee Chair, in consultation with the Steering Committee members, should select members of the writing team.
b) The writing team should have about 10 members. The selection of the members shall consider geographical and gender balance as well as experience in the different domains and user communities.
c) The writing team shall include the SC Chair and one chair from each panel.
d) The SC agrees that the attached outline shall be used as a starting point for the Plan. Steering Committee members should make specific comments and proposals for the first meeting of the writing team.
e) The writing team is asked to report a revised outline to the first Steering Committee teleconference after to their initial meeting and to report progress to subsequent Steering Committee meetings.
f) The timeline for this plan is for an initial internal review in November/December 2020; a public review of at least 6 weeks in January/February 2022; followed by publication in mid-2022. (This timeline was agreed previously).

DECISION 28-5

The Steering Committee decides that the GCOS Secretariat will:

a) Collect, define and monitor deliverables and milestones for the GCOS reference networks.
b) As GBON and SOFF develop, establish an expert group to review how GSN and GUAN can be integrated into the GBON and what are the relevant requirements that must be maintained.
c) Through the development of GSRN ensure that the extension of GSRN to all domains is considered.

DECISION 28-6

The Steering Committee decides to jointly with WCRP, review and, if necessary, make proposals about the relationship between BSRN and GCOS.

DECISION 28-7

The Steering Committee decides that TOPC will review and, if necessary, make proposals about the relationship between the Global Terrestrial Networks and GCOS, reporting back at the next Steering Committee meeting.

DECISION 28-8

The Steering Committee decides to ask the GCOS Secretariat to present options regarding the future of the GCM and report back to the next SC meeting.

ANNEX 1: LIST OF PARTICIPANTS

Members of the GCOS Steering Committee	
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ANNEX 2: AGENDA

1. **Introductions and welcome**
   - 1.1. Welcome and tour de table.
2. **Comments from GCOS Sponsors**
3. **Reports to the Steering Committee**
   - 3.1. GCOS developments and future
   - 3.2. On-going activities
     - 3.2.a. Progress on the GCOS Status Report
     - 3.2.b. GCOS Climate Observations Conference
     - 3.2.c. Panels reports
4. **Budget and fundraising (Role of sponsors and steering committee in fund raising)**
5. **Steering Committee Working Arrangements**
6. **Review Impact of GCOS**
   - 6.1. Review of ECV Requirements
     - 6.1.a. Agree that GCOS should review the current list of ECV
     - 6.1.b. Consider TOPC proposal for an ECV "Total Water Storage"
   - 6.2. Climate Cycles
   - 6.3. Format of Implementation Plan
   - 6.4. GCOS contributions to the UNFCCC and its Global Stocktake (GST).
   - 6.5. A more proactive approach to networks
7. **AOB**

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