



International  
Science Council



WORLD METEOROLOGICAL  
ORGANIZATION

INTERGOVERNMENTAL  
OCEANOGRAPHIC  
COMMISSION

**27th Session of the GCOS/WCRP  
Atmospheric Observation Panel for Climate  
(AOPC-27)**

**Dublin, Ireland  
27-30 June 2022**

**GCOS-248**

UNITED NATIONS  
ENVIRONMENT PROGRAMME

INTERNATIONAL  
SCIENCE COUNCIL

© **World Meteorological Organization, 2022**

The right of publication in print, electronic and any other form and in any language is reserved by WMO. Short extracts from WMO publications may be reproduced without authorization, provided that the complete source is clearly indicated. Editorial correspondence and requests to publish, reproduce or translate this publication in part or in whole should be addressed to:

Chair, Publications Board

World Meteorological Organization (WMO)

7 bis, avenue de la Paix

P.O. Box 2300

CH-1211 Geneva 2, Switzerland

Tel.: +41 (0) 22 730 84 03

Fax: +41 (0) 22 730 80 40

E-mail: [Publications@wmo.int](mailto:Publications@wmo.int)

**NOTE**

The designations employed in WMO publications and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of WMO concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or products does not imply that they are endorsed or recommended by WMO in preference to others of a similar nature which are not mentioned or advertised.

The findings, interpretations and conclusions expressed in WMO publications with named authors are those of the authors alone and do not necessarily reflect those of WMO or its Members.

This publication has been issued without formal editing.

## Table of Contents

|     |   |    |
|-----|---|----|
| 1.  | Opening session .....   | 1  |
| 1.1 | Welcome – Peter Thorne .....                                      | 1  |
| 1.2 | Ireland National GCOS – Sarah Gallagher .....                     | 1  |
| 2.  | Panel updates .....   | 1  |
| 2.1 | Updates on WMO – Anthony Rea .....                                | 1  |
| 2.2 | Updates on GCOS .....   | 2  |
| 2.3 | WMO Activities of relevance to GCOS .....                         | 2  |
| 2.4 | GHG Initiative .....  | 3  |
| 2.5 | Copernicus.....   | 4  |
| 3.  | Solicitation of inputs .....                                      | 4  |
| 3.1 | Round Table Discussions .....                                     | 4  |
|     | Stephan Bojinski .....  | 4  |
|     | Chiara Cagnazzo .....   | 4  |
|     | Imke Durre.....   | 5  |
|     | Maria Hakuba.....   | 5  |
|     | Rainer Hollman .....  | 6  |
|     | Dale Hurst .....  | 6  |
|     | Liz Kent.....   | 6  |
|     | Shinya Kobayashi .....  | 7  |
|     | Paolo Laj .....   | 7  |
|     | Johanna Tamminen.....   | 8  |
|     | Blair Trewin .....  | 8  |
| 3.2 | Review and revision of GCOS documents .....                       | 9  |
| 4.  | GCOS Implementation Plan (Public Review Comments) .....           | 9  |
| 5.  | Networks .....  | 9  |
| 5.1 | GRUAN.....  | 9  |
| 5.2 | GSN and GUAN .....  | 10 |
| 5.3 | GBON .....  | 10 |
| 5.4 | Role of GCOS Network Manager .....                                | 11 |
| 5.5 | BSRN (Network Application).....                                   | 11 |
| 5.6 | TT-GSRN .....   | 11 |
| 6.  | Task Teams updates .....  | 12 |
| 6.1 | GCOS Adaptation Task Team .....                                   | 12 |
| 6.2 | Discussion on atmospheric ECVs for adaptation and extremes.....   | 12 |
| 6.3 | TT-Lightning Observations for Climate Applications (TT-LOCA)..... | 13 |
| 7.  | Work Plan and Other items for discussion: .....                   | 14 |
| 8.  | Place and Date of Next Meeting .....                              | 17 |
|     | ANNEX 1: LIST OF PARTICIPANTS .....                               | 18 |
|     | ANNEX 2: AGENDA .....   | 19 |
|     | ANNEX 3: LIST OF ACTIONS AND DECISIONS .....                      | 22 |

## 1. OPENING SESSION

### 1.1 Welcome – Peter Thorne

AOPC-27 was held at Clane, Ireland, hosted by Maynooth University. The meeting opened with a welcome to all participants from the AOPC Chairman, Peter Thorne. The meeting was hybrid. All the participants introduced themselves and explained their role within AOPC. Peter Thorne welcomed the two new members of AOPC, Stephan Bojinski (EUMETSAT) and Blair Trewin (BOM).

The list of participants can be found in Annex 1.

The agenda in Annex 2 was adopted with no changes.

The goal of the meeting was to update the panel on relevant WMO and GCOS activities, present to the panel the progress of the two task teams reporting to AOPC and address the comments received during the public review of the GCOS Implementation Plan that will be published in the autumn of 2022 and presented to COP-27.

### 1.2 Ireland National GCOS – Sarah Gallagher

Sarah Gallagher (Chair GCOS-Ireland) gave an overview of the GCOS Ireland National Committee. Established in 2018, GCOS-Ireland works to ensure the sustained provision of reliable physical, chemical and biological observations and data records for the total climate system – across the atmospheric, oceanic and terrestrial domains, including hydrological and carbon cycles, for Ireland.

The role of the National Committee is to coordinate and promote the GCOS observing principles relating to Essential Climate Variables (ECVs) of relevance to Ireland. The committee consists of participants from Met Éireann (GCOS National Coordinator), the Marine Institute and the Environmental Protection Agency, complimented by Teagasc as well as remote sensing expertise.

In 2021, the Committee published a report on “The Status of Ireland’s Climate”, a comprehensive analysis of “essential” climate data collected in Ireland: [Research\\_Report\\_386.pdf \(epa.ie\)](https://www.epa.ie/research/reports/Research_Report_386.pdf).

Follow-up discussion related to the lack of visibility of such national activities to GCOS Secretariat and the panels. The lists of GCOS National Coordinators and Focal Points are accessible from the GCOS website. However, the lists are outdated and access to the National Focal Points is not open to everyone.

|                       |  |
|-----------------------|--|
| <b>AOPC Action 1:</b> | AOPC requests that the list of the GCOS National Coordinators and Focal Points are reviewed, updated and made openly available, accepting that this also depend on WMO Members (GCOS Secretariat). |
|-----------------------|--|

## 2. PANEL UPDATES

### 2.1 Updates on WMO – Anthony Rea

Anthony Rea, Director of WMO Infrastructure and of GCOS Secretariat gave a presentation on updates of WMO activities relevant to AOPC. At the extraordinary session of Congress in 2021, WMO passed 3 linked policies: the WMO Unified Data policy, the GBON and the SOFF, all of which will be integral to AOPC work over coming years.

The new Data Policy introduces the concept of core data, that members *shall* exchange, and recommended data, that members *should* provide<sup>1</sup>. It covers weather, climate, hydrological, ocean and space weather data and includes exchange of data of all parties including the private sector. Core observational data for climate include measurements provided by GUAN and GSN and ECVs as defined by GCOS in the Manual on WIGOS, including historical data and climate reanalysis fields provided by GDPS centres.

GBON regulates what minimum set of meteorological observations members need to provide, recognizing persistent gaps in data coverage and inconsistency in recording. Requirements for the observations from GBON are defined through the Rolling Review of Requirements.

SOFF is the funding mechanism that contributes resources for the implementation of GBON. SOFF is governed by a Steering Committee and the funds are held in an UN multiparty trust fund. First projects are expected to be funded at the end of 2022.

At the moment, an implementation plan for the data policy has been prepared. There is a lot of work going on the GBON implementation. There is also ongoing discussion on the expansion of GBON. However, it is crucial to first implement what has been approved.

These three policies are relevant to GCOS, which could benefit in terms of increase coverage of ECVs. GBON does not include any regulation on long occupancy of stations, and this should possibly be included in the regulatory material. SOFF will also have implications for the GCOS Cooperation Mechanism.

WMO is now moving from the GTS to the WIS 2 which will include a component of cloud services for data. It was noted that marine observations are not adequately included in GBON. Marine data is recognized as important and fragile and WMO is planning to send a strong message about the importance of marine data at next COP.

## 2.2 Updates on GCOS

Peter Thorne gave an update on the Joint Study Group on GCOS: the process is almost completed. The report is in the final stage and will be finalized shortly. It will be presented as an information document at INFCOM-2. There is not envisaged to be any substantial direct impact for AOPC.

Rainer Hollmann gave an update on the 2<sup>nd</sup> Climate Observation Conference, which will take place on the 17-19<sup>th</sup> October in Darmstadt, Germany.

More than 200 abstracts have been submitted and the scientific committee is now in the process of reviewing them and preparing the programme for the conference that will be published at the end of August. It has not been decided yet whether the format of the conference will be a series of presentations or more a mixture between keynotes and panel discussions. It is not clear yet if the conference will be completely hybrid or whether there will only be streaming facilities.

## 2.3 WMO Activities of relevance to GCOS

Peter Thorne presented a summary of the WMO activities of relevance to GCOS.

### **Climate Data Management:**

---

<sup>1</sup> In WMO regulations shall and should have specific meaning. Activities denoted shall are mandatory whereas activities denoted should are encouraged / recommended

A new group has been established aiming to advance aspects of exchange of historical data and metadata through the creation of a common data model exchange. It aims to help advance the historical data sharing aspects of the new unified data policy and build capacity within members.

**JET-EOSDE:**

The team produced a guidance to members on how to evolve their observing system to meet the WIGOS Vision 2030. It will be adopted at INFCOM-2. It refers members to the GCOS IP for high-level guidance on climate.

**Tiered Network:**

WMO regulatory materials refer to tiered network design, but there is no guidance given in how to assign a network to a tier nor are the tiers defined. The proposal from the SC-ON task team relies on previous work of GCOS and GAIA-CLIM. It is the proposal of the possible approach that can be taken in future work to prepare the guidance to the tiered networks. It defines four tiers, that will initially be applied at the level of networks but could eventually in the future be used for stations or instruments. The approach will initially be for in-situ but can be extended to space observations. It will be presented at INFCOM-2 and, if endorsed, the timeline for the continuation of this work will depend on the priorities.

**Station Set:**

The SC-ON task team addressed the question of how to treat distributed multi-functional sites in OSCAR Surface and WIGOS metadata. The suggestion is to ensure that linked assets are visible as a single collection. The document with a proposal will be submitted at INFCOM-2.

**2.4 GHG Initiative**

Han Dolman, Chair of the GCOS Steering Committee, presented the WMO GHG initiative. GHG monitoring systems can be used to detect hot spots, monitor the emissions of hot spots, assess emission changes against local reduction targets, assess the national emissions and changes. Depending on the questions asked, different systems are needed. The GCOS IP has an action, to develop an integrated operational global GHG, that is linking the surface-based observations to the satellite ones using models that can assimilate these types of observations. A workshop on this topic was held at WMO in May 2022. Recommendations from the workshop show that there is consensus on the need for a fully integrated, globally coordinated Greenhouse Gas system but close coordination with entities outside WMO is needed. WMO will call for a round table discussion with relevant parties to establish the need for a high-level coordination mechanism among all data providers. It is critical that the other organizations are on board from the beginning. GCOS plays a role as it has many contacts in different domains beyond the classical meteorological ones. GCOS has individual ECVs that have specific requirements set, but not necessarily set to a framework of an operational assimilation system. The panels should work together to see whether the requirements are adequate for this purpose.

|                              |   |
|------------------------------|---|
| <p><b>AOPC Action 2:</b></p> | <p>AOPC notes the GHG (WMO Carbon Initiative) document (presentation and report from WMO workshop) and must now consider how to build-on the recommendations. In particular, we need to ensure that relevant observations related specialist research institutes and networks are aware and involved (All).</p> |
|------------------------------|---|

## 2.5 Copernicus

Chiara Cagnazzo presented highlights of the Copernicus programme. Copernicus serves different requests from all over the world and delivers several terabytes of data a day. Registered users are over 120,000, but there are many more users that use the data in downstream activities. Many reanalysis data are used as well as products for activities related to climate adaptation. The CDS and toolbox is going to evolve into the Climate Atmospheric Data Store (CADS) which will be a more usable and interoperable infrastructure. As of today, 33 ECV products are delivered, spanning atmospheric physics and composition, ocean, hydrology and cryosphere and land biosphere, with a plan to add a further 5 products by the end of 2022. Together with the data documentation and application cases are delivered.

In situ observations play an important role in C3S as input to the reanalysis and for verification of ECV products. C3S focuses on improvement of historical records through data rescue activities. Another important activity for Copernicus is reanalysis (ERA5). Compared to the previous ERA-Interim, ERA5 has much higher resolution, uncertainty estimates, and datasets are available at hourly resolution, which opens many applications. The next reanalysis will be ERA6, with higher resolution, improvements in the model, coupling atmosphere, land and ocean, improved treatment of biases, and estimation of mean-state uncertainties. C3S seasonal predictions datasets are also available in the datastore, in particular CMIP6 projections are published and updated in the CDS. Plans for climate projections are to enhance the existing CMIP5, CMIP6 and CORDEX interfaces with the CDS with additional functionalities.

Finally, Chiara briefly presented CAMS (Copernicus Atmosphere Monitoring Service). Within CAMS there is ongoing work to deliver Copernicus CO<sub>2</sub> emission monitoring by combining satellite and in-situ observations with Earth system models. This will support countries and regions with observation-based policy relevant information.

## 3. SOLICITATION OF INPUTS

### 3.1 Round Table Discussions

AOPC members were asked to provide their view on activities related to their fields of expertise and relevant for AOPC. These may help to inform both immediate and longer-term workplans for the panel. Below are the summaries that AOPC members provided.

#### Stephan Bojinski

Stephan commented on the need for the panel to consider the following:

- Questions of scale: global vs regional/local, and data for describing extremes;
- Traceability and background of requirements;
- Application-specific requirements;
- Phenomena as ECVs? (e.g., storm tracks);
- Satellite data, upcoming missions.

#### Chiara Cagnazzo

AOPC to create a link across institutions for key activities such as data rescue, uncertainty quantification of new types of observations, data management, evaluation and quality control and across reanalysis centers (including all new aspects such as coupling components, new atmospheric composition reanalysis etc.) to share lessons learned, also on aspects associated to operationalization.

AOPC a place/hub where to facilitate an exchange of the analysis & collection of requirements done by Climate Services and by observational centers for a fully integrated uptake.

## Imke Durre

### **Recent and Upcoming Releases:**

- GHCN Hourly later this year: Dataset of global hourly observations developed in collaboration with a related Copernicus project
- Version 2.2 of the Integrated Global Radiosonde Archive (IGRA) later this year: Includes low-resolution versions of BUFR radiosonde observations in IGRA
- 5-km-resolution daily gridded fields for the Contiguous U.S. later this year: Back to 1951 and updated daily
- Monthly and daily gridded normals for the Contiguous U.S. this year
- Normals from WMO Member Countries within the next year
- Fundamental HIRS-based CDRs extended with IASI and CRIS within the next 1-2 years

### **New Drivers:**

- Increased interest in climate adaptation
- Increased funding for specific efforts from the U.S. Congress and within NOAA
- Planned migration to the cloud
- Increased interest in artificial intelligence
- Increased emphasis on enhancing and broadening access to data and information

### **Examples of Projects being initiated and to be completed in 20223-2027:**

- Extension of the Normalized Difference Vegetation Index (NDVI), Leaf Area Index (LAI), and related CDRs
- Transition the production of the snow cover CDR from Rutgers University to NCEI
- Development of a snow water equivalent CDR
- Establishment of a mechanism for annual flood assessments at NCEI
- Development of datasets and web portals that integrate meteorological observations, land cover data, and paleoclimatic proxy records necessary for improving wildfire prediction.
- Development of a spatially complete, temporally homogeneous humidity dataset that utilizes in-situ and remotely-sensed data
- Cloud-based dashboard for developing and visualizing CDRs

## Maria Hakuba

Maria Hakuba introduced a national (grassroots) effort to Develop a Continuity Framework for Satellite Observations of Climate in the U.S.

This effort kicks off with a workshop of the same name to be held in August and organized and hosted by the Keck Institute for Space studies at Caltech.

The goal of this study program is to help accelerate discussions and plans for a greater and more impactful U.S. contribution to the global climate observing system, and to provide guidance on the GCOS framework, including roles and contributions towards an actual architecture

implementation. The study team will work toward identifying and filling gaps in the program of record and addressing Continuity for Earth Observations. Non-exhaustive considerations for the U.S. Programmatic Model would be to either contribute to expanding the Copernicus program while retaining current mandates or to develop a Copernicus-like national entity that is co-developed and managed (e.g. by NASA, NOAA, USGS).

### Rainer Hollman

Rainer Hollman noted that he realized that the requirements sometimes do not match in a consistent way. Therefore, we have to undertake the following tasks (or to stimulate someone to do it):

- 1) Assessment to investigate the consistency (of uncertainties, spatial, temporal resolution etc.);
- 2) Develop a methodology to establish requirements in a more consistent way.

He also noted the need to discuss more about radar networks following on from the prior work of the task team on radars.

### Dale Hurst

Dale Hurst pointed out that more than 98% of stratospheric water vapor (SWV) profile measurements are currently being made by the *Aura* Microwave Limb Sounder (MLS), and the 18 year-old MLS is being scheduled for power down in 2023. At this time the only in-progress limb sounder program is the Atmospheric Limb Tracker for the Investigation of the Upcoming Stratosphere (ALTIUS), but it will not be deployed until 2025, inevitably creating a > 1-year "gap" in high-density global SWV profile measurements. This significant impending loss of critical satellite-based SWV observations will likely occur simultaneously with a reduction in balloon-based in situ measurements of SWV profiles by frost point hygrometers (FPHs). Most FPHs rely on cryogenic cooling by HCFC-23, a potent greenhouse gas that is rapidly being phased out. Some FPH launch sites are now unable to purchase HCFC-23 and are therefore extremely limited in their ability to perform SWV soundings. The combination of these two reductions in SWV profile measurements will leave the upper atmospheric science community without the high-density data that have been available for research since 2004.

He also gave a quick overview of NOAA's new Earth's Radiation Budget program that is supporting studies of the impacts of human-induced changes in clouds and stratospheric aerosols (i.e., geoengineering). One focus is to thoroughly characterize the background composition of the global stratosphere through increased balloon-borne measurements of stratospheric aerosols, water vapor and ozone. Another is to measure the impacts of natural perturbations of stratospheric composition by volcanic eruptions and extremely powerful wildfires.

### Liz Kent

More work is required to better define the requirements for surface observations of temperature, humidity, winds and pressure, linking the requirements firmly to a range of user requirements, such as stable long-term large-scale averages. The definition of requirements at the regional and local scales also requires additional work.

The availability of tools (reminiscent of OSSEs or FOI used in NWP) to estimate the effects of network changes on adequacy for different user requirements would be tremendously useful and facilitate efforts to ensure that the requirements were consistent between variables and among different applications. Such tools would help translate requirements presented as resolution-accuracy-stability values into information that can be used for network design, particularly for mobile marine platforms.

Requirements that have more complex interactions are hard to capture in the current framework. An example is air-sea interaction where accurate and co-incident measurements of several different variables are required. The interaction between these variables needs to be understood in a range of different regimes, similar to process studies, which will feed into reanalysis evaluation and improved user requirements.

There is a requirement for ongoing quantification of real-world uncertainties for new platform and instrument types and for historical observations. This will be particularly important if 3rd party data are to be incorporated into climate records.

Marine data systems for delayed mode data need to be updated to meet current standards for both data and metadata. Marine data transmitted in near time needs to be securely archived. Resources are required for data rescue, integrated storage of data, metadata, code and images, and to ingest the rescued data into archives to become available for climate applications. Integrated libraries of metadata and documentation would also be valuable. New systems need to be modular to widen participation, provide a hub to focus community activity and provide tools for data translation, visualization, evaluation and code for fixing known problems with particular sources.

It was noted that ICOADS has recently released an updated NRT data release incorporating data transmitted in BUFR. However, it was also noted that key ICOADS staff have left NCEI and delayed mode data post 2014 has not been incorporated as a "full release". Key staff have also been lost from the Met Office and National Oceanography Centre, highlighting the reliance on small numbers of expert staff in this area globally. Capacity development in this area is urgently required to assure the long-term marine data record and its preservation.

[Shinya Kobayashi](#)

**Exchange information between observation providers and reanalysis centres regarding their respective plans:**

Reanalysis is one of the important components in the value chain for climate services. With its wide user base, the number of users who indirectly use climate observations is significantly amplified. A typical cycle of upgrading reanalysis is 5~10 years. In order to make the most of this opportunity of improvement, preparation of input observations needs to be carefully planned. This would be facilitated if observation providers and reanalysis centres regularly exchange information regarding their respective plans.

**Follow carefully the latest development in data assimilation techniques for NWP:**

Development in operational NWP systems is a major driving force for the improvement of reanalysis systems. Currently, some major NWP centres have been developing a coupled data assimilation technique. Once this technique becomes mature enough for operational NWP, that would eventually be used to produce coupled reanalyses. With a coupled data assimilation technique, observations near the interface between different Earth System components, e.g., SST, could be assimilated in a better way, which would improve consistency across multiple Earth System components. Requirements for such observations need to be reviewed as the data assimilation techniques evolve.

[Paolo Laj](#)

GAW is establishing its next implementation plan, with an in-person SSC meeting scheduled early October in Geneva and a series of virtual meetings scheduled over this summer. Some actions in the GCOS plan rely on a well-functioning GAW (Obviously B4 but also A1, C1, C3, Data

centers issues in D1, D2, D3 and D4, and urban hot spots in F4). It would make sense to clearly refer to the GCOS IP in this process.

With a European-centric view, the EU commission will issue a number of calls in the autumn that can serve GCOS activities not only in Europe but with many partner countries in the World. I am well-aware of the programs (INFRA and mission Climate and Health/Environment) if needed.

Referring to Tim's presentation on GSRN, The European Metrology Network (EMN) for Climate and Ocean Observation for <https://www.euramet.org/climate-and-ocean-observation/> has been established by EURAMET. There will be a BIPM/WMO conference in September (BIPM-WMO Metrology for Climate Action Workshop (BIPM-WMO-WS-2022)). I have submitted a proposal to present metrology activities of the European Research Infrastructure I am leading (ACTRIS) for short-lived climate species integrating many GCOS ECVs (Clouds/Precipitation, Aerosol, Ozone and aerosol Precursors).

### Johanna Tamminen

#### **UV-radiation missing from ECVs:**

UV-radiation is strongly related to aerosol and ozone precursors, but also more generally to gas chemistry, including chemistry involving GHGs. UV-radiation is probably the most important factor determining secondary aerosol formation (see e.g. Kerminen et al, 2018, Baranizadeh et al, 2014). UV-radiation photolysis rates control the chemistry from precursor gases to ozone.

However, so far UV-radiation has not been defined as an ECV (one reason could be that it falls between the two panels, AOPC and TOPC). I think it would be important to consider this. Also, what is important is that both in-situ surface observations and satellite derived global daily gridded estimates of UV-radiation exist (including spectral UV-radiation, actinic flux, photolysis rates).

I note also, that in TOPC, there is FAPAR defined as ECV, which describes (visible wavelengths) radiation effects on vegetation (plant level), but the atmospheric chemistry effects (UV-wavelengths) are not covered with this parameter. In AOPC there is Ozone and Aerosol precursor gases that are defined as ECVs. The component lacking from here is the UV-radiation which determines the reactions related to ozone and aerosol precursors.

There are also several other use cases for UV-radiation related to, e.g., biosphere, health and material sciences. All these application areas are also affected by the climate effects on UV-radiation due to changes in cloudiness, aerosols, ozone and albedo.

Would it still be possible to include UV-radiation as a new ECV product (in atmosphere context it could be added to Precursors, in terrestrial together with FAPAR)? If this is not possible, it could be at least mentioned in the Implementation plan to study and characterize further?

### Blair Trewin

Implementation of new WMO data policy will be important for AOPC over the next few years - if implementation is successful then available data sets for some ECVs are likely to expand substantially.

GCOS and most associated activities fall under INFCOM but most of WMO's climate services/climate change work falls under SERCOM (partly a historical legacy). We will need good communication between the two parts of WMO (as someone closely involved with SERCOM activities I'm potentially in a good position to do that).

From my experience on State of the Climate reports etc., a significant data gap is for climate extremes, which rely on data for various ECVs at daily (or shorter) timescales. Making full use of the opportunities provided by the new WMO data policy will be important here.

Given that AOPC's membership is predominantly in Europe and North America, I see myself as providing a perspective from other regions, particularly in the southern hemisphere. (Although I didn't mention it at the meeting, if the new global baseline network manages a reasonable level of implementation, that will open opportunities for us too).

### 3.2 Review and revision of GCOS documents

Peter Thorne raised the topic that there are several GCOS documents in the WMO library that have not been reviewed for many years, and more concerning is that AOPC has no process to regularly review documents which are guidance information, rather than just a report. Following on discussion was centered around: the need to better highlight documents containing guidance e.g. on the GCOS frontpage; the metadata tags included with the document on the WMO library; how they were being used/referred to; overlap between the documents; and then need to review the existing document before we implement any new process to publish their availability.

|                       |  |
|-----------------------|--|
| <b>AOPC Action 3:</b> | AOPC requests that there is an audit of the current GCOS published documents (AOPC) which are 'guidance' related, the result of which is provided to AOPC for comments. The review of these documents and the need for an ongoing review process, and the visibility of the documents, will be added to the panels workplan. (GCOS Secretariat). |
|-----------------------|--|

## 4. GCOS IMPLEMENTATION PLAN (PUBLIC REVIEW COMMENTS)

All AOPC relevant comments were reviewed and marked as: Rejected; Noted; Taken into Account; and Accepted, along with clarifying comments. Changes to actions and requirements text were made and submitted to Secretariat for inclusion in the final IP. Panel members were thanked for their active engagement over a number of years on the requirements tables and actions. It was noted that once published it will be necessary for AOPC to take ownership of (subsets of) relevant actions and track progress.

## 5. NETWORKS

This session considered solely those networks that directly report to AOPC.

### 5.1 GRUAN

Peter Thorne presented a status report on behalf of GRUAN. The key points were: the issue with the use of R23 in the reference observation for UTLS water vapour as outlined by Dale Hurst; the upcoming WMO Radiosonde Intercomparison which is a major focus of the GRUAN Lead Centre and for the first time will utilise a range of GRUAN processed sondes on each payload; status of GDPs; the impact of a complete lack of in-person meetings for 3 years; and a request to consider the use of Pangaea for the GRUAN data archive.

The follow up discussion was mainly around the use of Pangaea for the GRUAN archive and the limitations of the current facility which is undertaken by NCEI. The issue is associated with the accessibility of the GRUAN data (i.e. visibility, use of DOI's) rather than the archiving of the data.

|                       |  |
|-----------------------|--|
| <b>AOPC Action 4:</b> | AOPC requests that the GRUAN LC arrange a discussion with NCEI on the matter of archiving and accessibility. AOPC also requests that GRUAN (WG & LC) consider including a NCEI representative on WG-GRUAN, noting that this was the case in the past. (GCOS Secretariat to send this request to GRUAN LC). |
|-----------------------|--|

|                       |  |
|-----------------------|--|
| <b>AOPC Action 5:</b> | AOPC request that GCOS Secretariat investigate the possibility for a GCOS memorandum of understanding (MOU) with Pangea in the first instance to serve GRUAN data. (GCOS Secretariat). |
|-----------------------|--|

## 5.2 GSN and GUAN

Tim Oakley presented the 2021 network report for GSN and GUAN, which includes the 2022 station list update, 2021 network statistics and recent work for the GCOS Cooperation Mechanism (GCM).

Peter Thorne asked about the availability of the parallel measurements associated with the GSN station list change request received from Australia.

Post meeting request - New Zealand would like to nominate Whenuapai (WSI 0-20000-0-93112) to join the GCOS Upper Air Network (GUAN) programme. Its location in the upper North Island fills a gap from a regional perspective, particularly with Raoul Island (WSI 0-2000-0-93997) being silent. Whenuapai operates to GUAN reporting standards (at least 25 daily soundings to 30hPa per month), using the same high quality equipment, procedures, and reporting standards. This site is a key location in our national observing programme, producing high quality observations important for both the weather and climate communities. The data generated at the station is readily shared with the WMO community through the GTS/WIS, providing a valuable input into global numerical weather prediction and climate studies.

|                         |   |
|-------------------------|---|
| <b>AOPC Decision 1:</b> | Approves the 2022 GSN & GUAN station list as presented to the meeting and the post meeting addition of Whenuapai (New Zealand). |
|-------------------------|---|

|                       |  |
|-----------------------|--|
| <b>AOPC Action 6:</b> | AOPC requests that the GCOS Network manager, asks BOM about the availability of the parallel measurements, and if available, makes further considerations as to where they should be archived. (GCOS Network Manager and Blair). |
|-----------------------|--|

## 5.3 GBON

The background and plans for GBON (and SOFF) were presented by Anthony Rea under agenda item 2.1. Tim Oakley showed a table of GBON requirements, as agreed by WMO and approved by Members, along with draft criteria for compliance. The initial implementation will focus on the availability of land-surface pressure and upper-air profiles.

This information confirmed the need for GCOS/AOPC/Climate representation at the GBON/SOFF management forum as the focus is very much being driven by Global NWP. There are currently no plans to discontinue GUAN and GSN once GBON is fully implemented as GBON requirements do not include commitment to maintain long-term stations which is a key requirement of GSN/GUAN. However, this may be rectified in future and then, as directed by GCOS-SC, it would be germane to reconsider the desirability of retaining GUAN and GSN as separate entities.

|                       |  |
|-----------------------|--|
| <b>AOPC Action 7:</b> | AOPC requests that GCOS/AOPC have representation within the management teams who are implementing GBON and SOFF, to advocate the Climate requirements. GCOS Secretariat to raise this request with WMO Director of Infrastructure. (GCOS Secretariat). |
|-----------------------|--|

#### 5.4 Role of GCOS Network Manager

Tim Oakley briefed AOPC on his role as GCOS Network Manager and the tasks that he undertakes according to the agreed job description. Whilst this was more for information to the panel members, he also requested feedback as to whether anything was missing or was not required.

Following discussions were around: a continuation on the need for representation for the work on GBON/SOFF (see 5.3); increased support for GRUAN; and more cross-panel collaboration. At this time, it was considered that changes to the job description were not required.

#### 5.5 BSRN (Network Application)

Tim Oakley presented the application from the Baseline Surface Radiation Network (BSRN) to become a GCOS Recognized Network, along with some background information on the network nomination process which was agreed by GCOS in 2021.

The discussions that followed were about: sustainability of the network and any commitment to GCOS; the oversight of BSRN; and the network coverage.

|                         |   |
|-------------------------|---|
| <b>AOPC Decision 2:</b> | AOPC approves the application from BSRN to become a GCOS Recognized Network. AOPC requests GCOS Secretariat to undertake the necessary steps for this to be approved by GCOS. (GCOS Secretariat). |
|-------------------------|---|

#### 5.6 TT-GSRN

Sarah Gallagher briefed the meeting on the history, status and plans for the Implementation of the GCOS Surface Reference Network being led by an AOPC Task Team. This included an update of the team members, the agreed 10 years goals and how the team had structured the work across 6 subgroups. The main achievements of the team since its first meeting in March 2021 were the nomination of the GSRN Lead Centre to the China Meteorological Agency (CMA) and agreed Terms of Reference, and a documented process for the Implementation of a Pilot phase of the network. This later document includes an Annex on the measurement and siting requirements, which for the Pilot phase will only require reference Surface Temperature and Precipitation measurements.

Tim Oakley presented two documents: the partially approved GSRN governance and the approved GSRN Pilot Network Implementation.

The discussions that followed were about: how global coverage and addressing all climate zones were being addressed; the level of engagement and commitment from the LC; how we might enforce an ISO standard; the number of stations in the Pilot phase; and whether the GSRN is applicable to the other panels.

AOPC thanked Sarah as the representative of TT-GSRN for the efforts of the team and the excellent progress to date.

|                         |   |
|-------------------------|---|
| <b>AOPC Decision 3:</b> | AOPC 'In principle' approves of the Pilot Network document, allowing AOPC members additional time (until 11th July) to respond with comments/edits after which the document will be 'Approved'. |
|-------------------------|---|

|                       |   |
|-----------------------|---|
| <b>AOPC Action 8:</b> | AOPC requests that the GSRN Pilot network document is circulated to the other panels and GCOS-SC for information and comments. (GCOS Secretariat) |
|-----------------------|---|

## 6. TASK TEAMS UPDATES

### 6.1 GCOS Adaptation Task Team

Chiara Cagnazzo (ECMWF) presented an update to the meeting on GCOS Adaptation Task Team (GATT).

The team is co-chaired by Chiara (AOPC) and Nigel Tapper (TOPC). While this was initially a TOPC task team with no members from AOPC, AOPC is now involved in the GCOS Adaptation Task Team (key role on extremes) with 4 members, so it contributes to develop the pathway forward for a GCOS role in the Global Stocktake process. That should continue and evolve. Within existing capabilities, GCOS can contribute to the improved understanding of climate change impacts through the provision of geospatial data inputs relevant to bio-geophysical modelling and to the improved assessment of climate-related risks through provision of relevant geospatial data inputs (observations for adaptation); and use of existing ECVs to extract information on the spatiotemporal development of adaptation for a limited number of examples (observations of adaptation). The GATT is working on evaluating which existing ECVs in their current specification could inform adaptation, assessing whether the current requirements are sufficient; and considering whether new ECVs not in current GCOS suite are needed and for which purpose.

A report of this task team will be delivered to next GCOS Steering Committee to get its feedback.

AOPC could also lead a specific activity on climate attribution, to define new actions on how to provide systematic and sustained observations for the future new climate attribution services (among key variables are air temperature and precipitation).

|                       |  |
|-----------------------|--|
| <b>AOPC Action 9:</b> | AOPC recommends a review of the GATT team membership is undertaken by the GCOS SC when the current team produces its report to ensure balance across domains and all relevant expertise is represented. (GCOS Secretariat) |
|-----------------------|--|

### 6.2 Discussion on atmospheric ECVs for adaptation and extremes

The discussion made the following points:

- It is important to make the distinction between needing new ECVs or new ECVs products.
- GCOS covers the global aspects of the observations. However, adaptation requires information from local observations, While GCOS cannot provide requirements for those, it needs to identify and provide a connection between the global and the regional/local aspect.
- Identifying and including ECVs (or similar) that are not the traditional physical ECVs but are socioeconomics ones, is also very relevant for adaptation. However, the expertise of

the panels lies with the geophysical ECVs and such a decision would require a high-level decision regarding the mandate of GCOS.

- Having consistent requirements or standards for local observations can help develop continental scale information and products. Many adaptation systems require consideration of specific events in the context of long-term consistent and homogenous information in the past.
- Data needed for supporting adaptation comes from models, with global observations having a role via either assimilation in the case of NWP/reanalysis or verification. Thus, expertise in modelling and reanalysis is needed within the GATT.
- Physical atmospheric phenomena can be described by the existing ECVs by introducing additional ECV products and multi ECV products. Many ECVs products are missing: For example, for precipitation there is only accumulated precipitation while intensity and duration play an important role for adaptation. Temperature would require daily max and min.
- In terms of these multi ECV products, an example is human comfort that requires heat stress measurements, based on temperature and humidity or in the more complex form also on wind and radiation. The trends of the occurrence of severe weather can also be tracked through crosscutting multiple ECVs.

|                         |  |
|-------------------------|--|
| <b>AOPC Decision 4:</b> | AOPC recommends that rather than adding ECVs, we should consider ECV products and integrated products across ECVs. |
|-------------------------|--|

### 6.3 TT-Lightning Observations for Climate Applications (TT-LOCA)

Steve Goodman gave a presentation as the chair of TT-LOCA. The team has established a partnership with the NASA GHRC and NOAA NCEI for reprocessing, archive and stewardship of the Lightning ECV data sets. Further details for the metadata are needed and will be addressed including the creation of a cloud service “landing page” for portal access to the ECV products. A summary report will be developed on the progress of the TT since the previous GCOS-227 report discussing the work plan, activities, progress, achievements and recommendations.

He discussed the many important connections between Lightning and other ECVs such as fire, precipitation, clouds, nitrous oxide, temperature and aerosols. He showed an example of possible connections between a decrease in global lightning in the 20+ year space-based Lightning time series observed in 2019-2020 that might be related to the decrease of industrial activity and pollution due to the Covid pandemic. From the ground-based World Wide Lightning Location Network (RF) he showed a plot of the increase in high latitude lightning which may be related to a warming Arctic. Such connections between lightning and the other ECVs should be good themes for future investigation.

The task team finds the collaboration with AOPC very useful and likewise AOPC recognize the progress achieved by the task team. AOPC thanks the task team for its work and it is decided to extend the task team for an additional two years at which point it will be disbanded in favor of a presence on the Panel of a lightning expert.

|                         |   |
|-------------------------|---|
| <b>AOPC Decision 5:</b> | AOPC approves that TT-LOCA is extended, for last time, for a further two years, looking at transitioning then to having lightning expertise on the panel. |
|-------------------------|---|

## 7. WORK PLAN AND OTHER ITEMS FOR DISCUSSION:

### **(1) ECV Rationalization**

Caterina provided a summary of what has been discussed/done so far with regards the rationalization of the list of ECVs. The GCOS Steering Committee at its 29<sup>th</sup> Session agreed to work towards presenting the ECVs in a rationalized form and asked the secretariat, in consultation with the panel co-chairs to propose a new grouping of ECVs which can be discussed in the panels and the next SC. There are currently 54 ECVs, however, many of these are for parameters differing only by where they are measured. For example, temperature has 5 ECVs in the three different domains that could be merged in a single ECV. Assigning ECVs to logical groups will simplify the ECV set and provide more clarity. The ECV products will remain the same but would be allocated differently. Many of the new ECVs will likely be cross-domain: i.e., ECV products from different domains be comprised in the new ECV, so this needs to be considered in a cross-panel manner. Some concerns were raised at the SC meeting. In particular, the simplification may hide certain (current) ECVs which are particularly relevant in a UNFCCC/Paris Agreement context such as the global surface temperature and GHG; there could be an impact on funding and agencies implementing requirements, who may be confused by the change. Therefore, traceability between the initial ECVs and new ones must be ensured, and the change must be communicated adequately to all interested parties.

There are several different ways the ECVs could be rationalized, and this has to be discussed among the three panels. A suggestion to a way forward is to form a task team comprising 2-3 members from each panel. It is key that stakeholders, particularly those who use the ECV framework to drive funding decisions ((e.g. ESA, Copernicus) are actively consulted.

|                         |  |
|-------------------------|--|
| <b>AOPC Decision 6:</b> | AOPC welcomes the initiative and the approach for the ECV rationalization.   |
| <b>AOPC Action 10:</b>  | AOPC requests that the topic of the ECV rationalization is raised with the GCOS SC, requesting a way forward (Stakeholder engagement, Timeline and Plan). (AOPC chair) |

### **(2) AOPC Terms of Reference and Membership**

Membership rules need to be updated. The main point of concern is about the length of the membership, that currently is set at 2 terms of three years each. This can be a problem in terms of institutional experience, it does not take into account that usually a member needs around 18 months to start efficiently contributing to AOPC and it is not in sync with the two main reports produced by GCOS, the Status Report and the Implementation Plan, with the result that experts in the panel find themselves working on an implementation plan that they have not contributed to. Current term limits can be exceptionally extended with the consent of the SC. Different options were discussed, with the favourite option being an initial term of three years followed by a second term of 5 years. This will give the opportunity to the member as well as to the chair of the panel, to check after three years if the expectations on both sides are met. Succession was also discussed. It is important to ensure that once a member is leaving, the successor to this member can be briefed and helped to ease in the role. Imke proposed to send a draft document on the succession to the Secretariat as a starting point. The number of members was

also discussed. While 12 members seem a small number given the several tasks AOPC takes on, there is also concern that membership should not exceed 15-16 members as it would make it more difficult to collaborate and it would significantly increase the work of the secretariat.

|                        |   |
|------------------------|---|
| <b>AOPC Action 11:</b> | AOPC requests a draft document with different options regarding the membership rules and this to be presented back to the panel, with an aim to propose a new 'process' to the GCOS SC. This needs to be done in consultation with the other panels. (GCOS Secretariat) |
|------------------------|---|

Current membership is revised, Johanna Tamminen and Shinya Kobayashi communicated to the panel that they will not continue after their current terms. Peter Thorne, on behalf of the other members and of the Secretariat, thanked the two members for their significant contributions to AOPC during their terms. After the meeting Dale Hurst also communicated that he will retire later in 2022 and thus needs to relinquish his membership. Dale is also thanked for his service and contributions accordingly. The GCOS Secretariat will initiate a process to identify new members for the panel, with a priority of replacing the expertise of the members who are leaving and taking also into account gender and geographical balance.

Peter Thorne invites the members of the panel to reflect upon their interest of becoming co-chair and eventually communicate their interest to him or to the Secretariat in the following weeks. express their interest in joining him as co-chairs.

|                        |   |
|------------------------|---|
| <b>AOPC Action 12:</b> | AOPC requests that the process for new members to join the panel is initiated, with a priority for those current members who are rotating off. (GCOS Secretariat) |
|------------------------|---|

### **(3) Workplan**

This discussion was aimed at identifying the panel activities for next couple of years. It was noted that when the new GCOS IP was published, the panel will review the IP actions, identify which ones are relevant to AOPC, and assign them to members. There might also be actions that will require collaboration with members from other panels.

|                        |  |
|------------------------|--|
| <b>AOPC Action 13:</b> | Once the GCOS IP has been published, review IP actions in reference to AOPC & assign members to act as an 'Action Steward(s)'. Cross-cutting actions should also be identified. (AOPC) |
|------------------------|--|

The following items were considered a priority for the AOPC workplan, and where there was a need for initial activities these have also been included as an action:

#### **(a) Continuity of UTLS in-situ and space vapour measurements**

|                        |   |
|------------------------|---|
| <b>AOPC Action 14:</b> | AOPC requests that the GCOS Director sends letters to NASA and ESA to recommend that gaps in satellite observations of UTLS should be avoided in the future. (GCOS Secretariat) |
|------------------------|---|

#### **(b) Weather Radar observations**

|                        |   |
|------------------------|---|
| <b>AOPC Action 15:</b> | Secretariat to identify whether there are ongoing activities in WMO on weather radars. Eventually member of AOPC to participate to WMO team, if appropriate. (GCOS Secretariat) |
|------------------------|---|

- (c) Earth Radiation Budget (ERB)** - Review of observation strategy/vision for Earth Radiation Budget (Submitted by Jörg Schulz, Deutscher Wetterdienst) April 2008.
- (d) Task Teams** - Improve link to the GATT team: AOPC has the role to provide some of the connections, for example for reanalysis, it connects to three relevant actions. Improve link to the task teams GSRN and TT-LOCA.TT on Earth Cycles, not active at the moment, but will soon be instigated. Members of AOPC will take part to this task team.
- (e) GBON** – Inclusion of other variables. Marine observations plus how these are represented in the WMO RRR
- (f) UV-radiation (missing as an ECV)** - To consider this for the next update on the ECV requirements. Consider UV radiation as an ECV product under an existing ECV (TOA Radiation, Precursor Gases).

|                        |  |
|------------------------|--|
| <b>AOPC Action 16:</b> | Scope out a draft of an ECV product for UV-radiation (Johanna, Paolo, Maria) |
|------------------------|--|

- (g) WV (GNSS)** – Review the work for the repository at ECMWF and the ongoing sustainability.

|                        |   |
|------------------------|---|
| <b>AOPC Action 17:</b> | Invite ECMWF to next AOPC meeting to report on the GNSS-PW repository. (GCOS Secretariat) |
|------------------------|---|

- (h) Data Management** - The 1st step is for Secretariat and chairs to agree on a methodology to assess for which ECV data centres do not exist and if a centre does exist whether the current arrangements are adequate. Panel members are asked to provide suggestions on how to undertake an audit of the existing data centres. Once the methodology is identified, ECV stewards will start reviewing the data centres. As a reminder, existing ECV fact sheets, which include data repository for each of the ECVs, will need to be updated but can serve as a starting point. FAIR needs to be referenced as well as sustainability.

|                        |  |
|------------------------|--|
| <b>AOPC Action 18:</b> | Provide a proforma to undertake an audit of data centres. (AOPC) |
|------------------------|--|

- (i) Precipitation** – Consistency of data products. Suggestion is to have a presentation at next AOPC meeting and do an assessment. The question is whether this is an observational issue, or it depends on how the products are derived. Blair was the responsible Lead Author for precipitation in the IPCC WG1 and could lead this. Data rescue is also important to inform products and reduce uncertainties in data sparse regions.
- (j) Satellite constellation** – Studies on possible future orbital constellation to address gaps. A small group of AOPC, should consider this and how this might be presented to the satellite community (WG-Climate). In order to ensure that there is no duplication, it is best to meet with WG-Climate at the beginning of this work.
- (k) Representation from AOPC on other teams** – i.e. HQ Climate Data Management.

|                        |  |
|------------------------|--|
| <b>AOPC Action 19:</b> | AOPC requests that the current list of WMO expert teams (INFCOM and SERCOM) is circulated to AOPC members to consider representation. (GCOS Secretariat) |
| <b>AOPC Action 20:</b> | Draft a new AOPC workplan and send it to all members for review (GCOS Secretariat)   |

All actions and decisions identified during this meeting are listed in Annex 3.

It was agreed that next teleconference will take place at the end of September.

## **8. PLACE AND DATE OF NEXT MEETING**

The proposal is for next meeting to take place in Bonn hosted by ECMWF (Copernicus). There is not a clear decision yet on whether this will be a joint panel meeting, either with the two other panels or with one of them. Date will be decided in the next weeks.

The GCOS Secretariat and the panel participants expressed their sincere gratitude to the host of the meeting, Peter Thorne. The AOPC benefited greatly from the provision of excellent meeting facilities and enjoyed thoroughly the generous hospitality of Maynooth University.

The meeting closed on 30 June 2022 at 15:00.

## **ANNEX 1: LIST OF PARTICIPANTS**

- Peter Thorne (Chair)
  - Stefan Bojinski
  - Chiara Cagnazzo
  - Imke Durre
  - Maria Hakuba
  - Rainer Hollmann
  - Dale Hurst
  - Elizabeth Kent
  - Shinya Kobayashi
  - Paolo Laj
  - Johanna Tamminen
  - Blair Trewin
- 
- Sarah Gallagher (GSRN co-chair)
  - Steve Goodman (TT-LOCA chair)
  - Anthony Rea (GCOS Director)
  - Caterina Tassone (GCOS Secretariat)
  - Tim Oakley (GCOS Secretariat)

## ANNEX 2: AGENDA

| Day 1: Monday 27 June 2022  |  |           |                                 |   |
|-----------------------------|--|-----------|---------------------------------|---|
| Time                        | Item   | N.        | Presenter                       | Outcome                                       |
|                             | <b>Opening of meeting</b>  | <b>1.</b> |                                 | Information                                   |
| 09:30-10:30                 | Welcome  | 1.1       | Peter Thorne                    |   |
|                             | Introduction of participants   | 1.2       | Peter Thorne                    |   |
|                             | National GCOS Ireland  | 1.3       | Sarah Gallagher                 |   |
|                             | Adoption of Agenda   | 1.4       | All                             |   |
| 10:30-11:00                 | Coffee Break   |           |                                 |   |
|                             | <b>General Information</b>   | <b>2.</b> |                                 | Information                                   |
| 11:00-11:20                 | Updates on WMO:<br>WMO INFCOM Updates  | 2.1       | Anthony Rea                     |   |
| 11:20-11:40                 | Updates on GCOS:<br>• JSG-GCOS<br>• Climate Conference   | 2.2       | Peter Thorne<br>Rainer Hollmann |   |
| 11:40-12:00                 | WMO activities of relevance for GCOS:<br>• Climate Data Management<br>• EOSDE activity<br>• Tiered networks<br>• Station sets          | 2.3       | Peter Thorne                    |   |
| 12:00-12:30                 | The GHG Initiative   | 2.4       | Han Dolman or<br>Lars Peter     |   |
| 12:30-13:30                 | Lunch Break  |           |                                 |   |
|                             | <b>General Information (cont.)</b>   | <b>2.</b> |                                 |   |
| 13:30-14:00                 | Copernicus   | 2.5       | TBD                             |   |
|                             | <b>Input from panel members</b>  | <b>3.</b> |                                 |   |
| 14:00-15:00                 | Round table: Relevant activities for discussion in AOPC - items relevant from perspective of panel members and that of their community | 3.1       | All                             | Identify further points of discussion for 8.1 |
| 15:00-15:30                 | Coffee Break   |           |                                 |   |
| 15:30-16:30                 | Round table continued  | 3.1       | All                             |   |
| 16:30-17:30                 | Update and revision of GCOS documents  | 3.2       | Caterina Tassone, all           | Proposal for a GCOS document review process   |
| 17:30                       | End of day 1   |           |                                 |   |
| Day 2: Tuesday 28 June 2022 |  |           |                                 |   |
| Time                        | Item   | N.        | Presenter                       | Outcome                                       |
|                             | <b>GCOS Implementation Plan</b>  | <b>4.</b> |                                 |   |
| 09:30-10:30                 | • Updates on process<br>• Presentation on comments on IP and ECV requirements:<br>• Assign comments and address general comments       |           | Caterina Tassone                | Review of IP comments                         |
| 10:30-11:00                 | Coffee Break   |           |                                 |   |
|                             | <b>GCOS Implementation Plan (cont.)</b>  | <b>4.</b> |                                 |   |
| 11:00-12:30                 | Address general comments (cont.)<br>Break out groups (if necessary)  |           |                                 |   |
| 12:30-13:30                 | Lunch Break  |           |                                 |   |
|                             | <b>Networks</b>  | <b>5.</b> |                                 |   |

|                                      |  |            |                                   |  |
|--------------------------------------|--|------------|-----------------------------------|--|
| 13:30-14:00                          | GRUAN  | 5.1        | Peter Thorne                      | Information  |
| 14:00-14:20                          | GSN-GUAN   | 5.2        | Tim Oakley                        | Approval of 2022 stations lists  |
| 14:20-15:00                          | GBON   | 5.3        | Tim Oakley                        | Information  |
| 15:00-15:30                          | Coffee Break   |            |                                   |  |
| 15:30-16:00                          | Role of GCOS Manager                                       | 5.4        | Tim Oakley                        | Recommendation for future activities of the role of GCOS Network Manager |
| 16:00-17:00                          | BSRN: Application to become a GSRN affiliated Network      | 5.5        | Tim Oakley/Caterina Tassone       | Decision   |
| 17:00                                | End of day 2   |            |                                   |  |
| <b>Day 3: Wednesday 29 June 2022</b> |  |            |                                   |  |
| Time                                 | Item   | N.         | Presenter                         | Outcome  |
|                                      | <b>TT-GSRN</b>   | <b>6.</b>  |                                   | <b>Information</b>   |
| 09:00-09:30                          | GSRN: General presentation on GSRN                         | 6.1        | Sarah Gallagher                   |  |
| 9:30-09:45                           | GSRN: Presentation on Governance                           | 6.2        | Tim Oakley                        |  |
| 09:45-10:00                          | GSRN: Presentation on Pilot stations                       | 6.3        | Tim Oakley                        |  |
| 10:00-10:30                          | Discussion   | 6.4        | All                               |  |
| 10:30-11:00                          | Coffee Break   |            |                                   |  |
|                                      | <b>Other GCOS Task Teams</b>                               | <b>7.</b>  |                                   |  |
| 11:00-11:30                          | GATT: Presentation   | 7.1        | Chiara Cagnazzo                   | Information/recommendation   |
| 11:30-12:30                          | Discussion on atmospheric ECVs for adaptation and extremes | 7.2        | All (Matilde Rusticucci, leading) | Recommendations  |
| 12:30-13:30                          | Lunch Break  |            |                                   |  |
|                                      | <b>GCOS Task Teams (cont.)</b>                             | <b>7.3</b> |                                   |  |
| 13:30-14:00                          | TT-LOCA: Presentation                                      | 7.4        | Steven Goodman                    | Information  |
| 14:00-15:00                          | Discussion on next steps for TT-LOCA                       |            | All                               | Decision of TT-LOCA next steps   |
| 15:00-15:30                          | Coffee Break   |            |                                   |  |
|                                      | <b>GCOS Implementation Plan</b>                            | <b>4.</b>  |                                   |  |
| 16:00-17:30                          | Report of BoG; finalize comments                           |            | All                               | Comments of IP addressed   |
| 17:30                                | End of day 3   |            |                                   |  |
| <b>Day 4: Thursday 30 June 2022</b>  |  |            |                                   |  |
| Time                                 | Item   | N.         | Presenter                         | Outcome  |
|                                      | <b>AOPC Workplan</b>                                       | <b>8.</b>  |                                   |  |
| 09:00-10:30                          | Selection of activities for next years                     | 8.1        | Peter Thorne, all                 | Most important things AOPC should be doing                               |

|                 |  |     |              |  |
|-----------------|--|-----|--------------|--|
|                 | Development of workplan:<br>agree on activities and<br>experts   |     |              | in the next 4 years<br>(looking at IP actions<br>and at input from<br>roundtable)) |
| 10:30-<br>11:00 | Coffee Break   |     |              |  |
| 11:00-<br>12:30 | BoG on activities  | 8.2 |              |  |
| 12:30-<br>13:30 | Lunch Break  |     |              |  |
| 13:30-<br>15:00 | Presentation of BOG and next<br>steps  | 8.3 |              |  |
| 15:00-<br>16:00 | Discussion: <ul style="list-style-type: none"> <li>• Actions from AOPC27</li> <li>• Venue of next meeting</li> <li>• Date of next meeting</li> </ul> | 8.4 | Peter Thorne |  |
| 16:00           | End of day 4   |     |              |  |

## ANNEX 3: LIST OF ACTIONS AND DECISIONS

|                        |  |
|------------------------|--|
| <b>AOPC Action 2:</b>  | AOPC requests that the list of the GCOS National Coordinators and Focal Points are reviewed, updated and made openly available, accepting that this also depend on WMO Members (GCOS Secretariat).   |
| <b>AOPC Action 2:</b>  | AOPC notes the GHG (WMO Carbon Initiative) document (presentation and report from WMO workshop) and must now consider how to build-on the recommendations. In particular, we need to ensure that relevant observations related specialist research institutes and networks are aware and involved (All).   |
| <b>AOPC Action 3:</b>  | AOPC requests that there is an audit of the current GCOS published documents (AOPC) which are 'guidance' related, the result of which is provided to AOPC for comments. The review of these documents and the need for an ongoing review process, and the visibility of the documents, will be added to the panels workplan. (GCOS Secretariat). |
| <b>AOPC Action 4:</b>  | AOPC requests that the GRUAN LC arrange a discussion with NCEI on the matter of archiving and accessibility. AOPC also requests that GRUAN (WG & LC) consider including a NCEI representative on WG-GRUAN, noting that this was the case in the past. (GCOS Secretariat to send this request to GRUAN LC).                                       |
| <b>AOPC Action 5:</b>  | AOPC request that GCOS Secretariat investigate the possibility for a GCOS memorandum of understanding (MOU) with Pangea in the first instance to serve GRUAN data. (GCOS Secretariat).   |
| <b>AOPC Action 6:</b>  | AOPC requests that the GCOS Network manager, asks BOM about the availability of the parallel measurements, and if available, makes further considerations as to where they should be archived. (GCOS Network Manager and Blair).   |
| <b>AOPC Action 7:</b>  | AOPC requests that GCOS/AOPC have representation within the management teams who are implementing GBON and SOFF, to advocate the Climate requirements. GCOS Secretariat to raise this request with WMO Director of Infrastructure. (GCOS Secretariat).   |
| <b>AOPC Action 8:</b>  | AOPC requests that the GSRN Pilot network document is circulated to the other panels and GCOS-SC for information and comments. (GCOS Secretariat)  |
| <b>AOPC Action 9:</b>  | AOPC recommends a review of the GATT team membership is undertaken by the GCOS SC when the current team produces its report to ensure balance across domains and all relevant expertise is represented. (GCOS Secretariat)   |
| <b>AOPC Action 10:</b> | AOPC requests that the topic of the ECV rationalization is raised with the GCOS SC, requesting a way forward (Stakeholder engagement, Timeline and Plan). (AOPC chair)   |
| <b>AOPC Action 11:</b> | AOPC requests a draft document with different options regarding the membership rules and this to be presented back to the panel, with an aim to propose a new 'process' to the GCOS SC. This needs to be done in consultation with the other panels. (GCOS Secretariat)  |
| <b>AOPC Action 12:</b> | AOPC requests that the process for new members to join the panel is initiated, with a priority for those current members who are rotating off. (GCOS Secretariat)  |

|                        |  |
|------------------------|--|
| <b>AOPC Action 13:</b> | Once the GCOS IP has been published, review IP actions in reference to AOPC & assign members to act as an 'Action Steward(s)'. Cross-cutting actions should also be identified. (AOPC) |
| <b>AOPC Action 14:</b> | AOPC requests that the GCOS Director sends letters to NASA and ESA to recommend that gaps in satellite observations of UTLS should be avoided in the future. (GCOS Secretariat)        |
| <b>AOPC Action 15:</b> | Secretariat to identify whether there are ongoing activities in WMO on weather radars. Eventually member of AOPC to participate to WMO team, if appropriate. (GCOS Secretariat)        |
| <b>AOPC Action 16:</b> | Scope out a draft of an ECV product for UV-radiation (Johanna, Paolo, Maria)   |
| <b>AOPC Action 17:</b> | Invite ECMWF to next AOPC meeting to report on the GNSS-PW repository. (GCOS Secretariat)  |
| <b>AOPC Action 18:</b> | Provide a proforma to undertake an audit of data centres. (AOPC)   |
| <b>AOPC Action 19:</b> | AOPC requests that the current list of WMO expert teams (INFCOM and SERCOM) is circulated to AOPC members to consider representation. (GCOS Secretariat)                               |
| <b>AOPC Action 20:</b> | Draft a new AOPC workplan and send it to all members for review (GCOS Secretariat)   |

|                         |   |
|-------------------------|---|
| <b>AOPC Decision 1:</b> | Approves the 2022 GSN & GUAN station list as presented to the meeting and the post meeting addition of Whenuapai (New Zealand).   |
| <b>AOPC Decision 2:</b> | AOPC approves the application from BSRN to become a GCOS Recognized Network. AOPC requests GCOS Secretariat to undertake the necessary steps for this to be approved by GCOS. (GCOS Secretariat). |
| <b>AOPC Decision 3:</b> | AOPC 'In principle' approves of the Pilot Network document, allowing AOPC members additional time (until 11th July) to respond with comments/edits after which the document will be 'Approved'.   |
| <b>AOPC Decision 4:</b> | AOPC recommends that rather than adding ECVs, we should consider ECV products and integrated products across ECVs.  |
| <b>AOPC Decision 5:</b> | AOPC approves that TT-LOCA is extended, for last time, for a further two years, looking at transitioning then to having lightning expertise on the panel.   |
| <b>AOPC Decision 6:</b> | AOPC welcomes the initiative and the approach for the ECV rationalization.  |

**GCOS Secretariat**  
**Global Climate Observing System**  
**c/o World Meteorological Organization**  
**7 bis, Avenue de la Paix**  
**P.O. Box No. 2300**  
**CH-1211 Geneva 2, Switzerland**  
**Tel: +41 22 730 8067**  
**Fax: +41 22 730 8181**  
**Email: [gcos@wmo.int](mailto:gcos@wmo.int)**