



# GCOS

KEEPING WATCH OVER OUR CLIMATE



International  
Science Council



WORLD METEOROLOGICAL  
ORGANIZATION

INTERGOVERNMENTAL  
OCEANOGRAPHIC  
COMMISSION

## **30th Session of the GCOS Steering Committee**

**Virtual Session  
7-8 December 2022**

**GCOS-252**

UNITED NATIONS  
ENVIRONMENT PROGRAMME

INTERNATIONAL  
SCIENCE COUNCIL

© **World Meteorological Organization, 2023**

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.	DAY 1: 7 December 2022 .....	4
1.1	Welcome and opening of the meeting .....	4
1.2	Approval of the Agenda.....	4
1.3	Review of actions and decisions .....	4
1.4	WMO Updates .....	4
1.5	Sponsors vision on GCOS .....	5
1.6	Updates from SC Chair.....	6
1.7	GCOS and GCW .....	7
1.8	Updates and output of the Climate Conference.....	8
1.9	Panel reports .....	8
1.10	Report on GATT .....	9
2.	DAY 2: 8 December 2022 .....	10
2.1	GCOS Workplan .....	10
2.2	ECVs Rationalization .....	11
2.3	Climate Indicators .....	12
2.4	Earth Cycles .....	13
2.5	GCOS Joint Panel Meeting .....	13
2.6	GCOS panels Terms of Reference and Membership .....	14
2.7	GCOS Cooperation Mechanism (GCM) .....	15
2.8	GCOS Budget.....	15
2.9	Next meeting and any other business .....	16
	ANNEX 1: LIST OF DECISIONS AND ACTIONS.....	17
	ANNEX 2: AGENDA .....	20
	ANNEX 3: LIST OF PARTICIPANTS .....	22

## **1. DAY 1: 7 December 2022**

### **1.1 Welcome and opening of the meeting**

Anthony Rea, GCOS Director, welcomed the participants to this virtual meeting thanking in particular the ones joining at an inconvenient time. Anthony Rea acknowledged that 2022 had been a successful year for GCOS, with several notable achievements; recognition in the latest UNFCCC COP27 meeting, the publication of the GCOS Implementation Plan (GCOS IP), the finalization of the work of the Joint Study Group on GCOS (JSG) and the GCOS 2<sup>nd</sup> Climate Observation Conference. In 2023 the GCOS work will concentrate on addressing the actions from the Implementation Plan and continuing the JSG-GCOS work, with the renewal of the MoU with the sponsors expected to be complete by the end of 2023.

### **1.2 Approval of the Agenda**

Han Dolman, GCOS Steering Committee Chairperson, introduced the agenda that was subsequently approved. The agenda can be found in Annex 2.

### **1.3 Review of actions and decisions**

#### **Information Document**

Han Dolman reviewed the list of actions and decisions from the previous SC meeting in December 2022 (GCOS SC-29). This list, including the status of each action, can be found in [Annex 1 of GCOS SC-29 report](#).

### **1.4 WMO Updates**

#### **PRESENTATION**

Anthony Rea, on behalf of WMO, provided the latest updates from WMO.

#### **WMO INFCOM**

Two recommendations and one decision were adopted at the second session of the Commission for Observation, Infrastructure and Information Systems (INFCOM-2) that was held in Geneva (WMO HQ) from 24 to 28 October 2022.

INFCOM concurred with the 2022 GCOS Implementation plan and the 2022 GCOS ECVs requirements and requested its Management Group to review the actions relevant to the WMO and the National Meteorological and Hydrological Services (NMHS). The president of INFCOM will present a draft Recommendation for the next Executive Council (EC) whereby INFCOM will take into account the findings of GCOS in its workplan and the EC will recommend that the next WMO Congress urge Members to address those actions and encourage them to collaborate with national partners to address the full set of actions in the GCOS IP.

The report on the JSG was also presented at INFCOM-2. INFCOM decided that the GCOS Chair will be a member of the INFCOM Management Group. This will facilitate a better collaboration between GCOS and WMO. The president of INFCOM will present a draft Resolution whereby the EC will request the WMO Secretary-General to prepare a revised GCOS Memorandum of Understanding with the other GCOS sponsors for approval by the EC and will urge members to support the GCOS programme, either financially or with in-kind contributions.

The GCOS Surface Reference Network (GSRN) Implementation Plan was also endorsed.

## **WMO GHG Initiative**

In June 2022, the WMO Executive Council decided to develop a framework for a global Greenhouse Gas Monitoring Infrastructure, under the WMO leadership. However, WMO does not have the mandate to monitor all the needed variables, while GCOS and GOOS can cover part of the missing pieces of the system, focusing in particular, on the ocean and terrestrial domains. A Study Group was established to work on a concept document, to prepare a potential decision for the next WMO Congress.

This new initiative is very relevant to GCOS, that will be able to ensure the needed connections to the communities providing ocean and terrestrial variables. Nevertheless, its specific role still needs to be defined.

## **GBON and SOFF**

The WMO Systematic Observations Financing Facility (SOFF) started on the 1<sup>st</sup> of July 2022, with the mandate of supporting the implementation of the WMO Global Basic Observing Network (GBON).

## **1.5 Sponsors vision on GCOS**

### ***International Science Council (ISC)***

#### **PRESENTATION**

Katsia Paulavets, Senior Science Officer of the International Science Council (ISC), presented the vision, mission and governance of ISC. Its focus is on global sustainability and ISC is a Lead Coordinator of the UN Major Group for Science and Technology, which involves other GCOS co-sponsors, like UNESCO, UNEP and WMO. Through GCOS, the collaboration with other co-sponsored initiatives can be promoted. In that direction, ISC is planning to engage, working with the other GCOS co-sponsors, in the GCOS IP and its recommendations.

The value of GCOS is high. For the international scientific community and for countries working in the frame of the Paris Agreement, having access to climate observation is key. ISC proposed to collaborate with GCOS in exploring the possibility of expanding the ECVs to include social variables. However, regular discussions are needed, to establish a more effective relationships with GCOS and to identify areas for strategic collaborations.

ISC can support GCOS by, for example, providing scientific experts, engaging the GCOS scientific community in the production of knowledge products and advice for informing the international policy processes, organizing joint events around science and observations, and fostering relationships with international data centers.

### ***Intergovernmental Oceanographic Commission of UNESCO (IOC)***

Vladimir Ryabinin (Executive Secretary, IOC), jointly with Albert Fischer (Head, Ocean Science and Services Section, IOC), gave a presentation on behalf of the Intergovernmental Oceanographic Commission.

The recent GCOS IP is a good example of GCOS importance and usefulness because it integrates inputs from experts from several organizations, including UN and is not limited to GCOS sponsors. The countries and negotiators may have different positions according to their legitimate interests. Science provides objective information and is therefore critically important for making decisions. It is therefore important to increase the investments in communication, working with GCOS and other partners to speak with one voice.

Vladimir Ryabinin listed several examples about the importance of GCOS for IOC. The GCOS recognition in the UNFCCC frame is very important. GCOS helped in giving visibility to ocean observations and oceans were mentioned in the preamble of the Paris Agreement. GCOS is also helpful to IOC, together with WMO, for speaking with satellite agencies. GCOS plays an important role in providing requirements and statements to UNFCCC Parties and advocating for the

continuation of emissions reductions and monitoring. However, the loss and damage theme is becoming more prominent within UNFCCC and we need to jointly think about how we can support it.

GCOS and GOOS have very effective relationships, what is missing is something similar for the Global Terrestrial Observing System (GTOS).

Despite its name, GOOS is not only about observations but is about the whole value chain. Similarly, GCOS needs to think how to implement not only observations but all set of actions that stands from observations.

GOOS, jointly with WCRP and OOPC, significantly contributed to the GCOS IP and there are several actions relevant to oceans.

IOC is committed to continue sponsoring GCOS, sometimes there can be financial limitations, but the intellectual contribution will always be ensured.

Vladimir Ryabinin concluded saying that too often in the past observations of different sectors (e.g. climate, biodiversity, ocean, etc.) were divided, like in silos. However, from the ocean perspective the research and observations work cannot be divided. Observations needed for ocean management can also be needed for the climate, biodiversity, pollution, economy, social and other domains. That is why we need to work together in a coordinated manner.

Vladimir Ryabinin and Albert Fisher confirmed that GCOS can play an important role in the UN Ocean Decade, that started in 2021. The Ocean Decade has 45 programmes and 203 projects and GOOS is already contributing to these programmes. GCOS can effectively support IOC and the Ocean Decade, for example working with GOOS in the Ocean Observing Co-Design Programme. The aim of this programme is to focus on the outputs of the observing systems and their impacts and how to prioritize investments for building the needed observing and modelling infrastructure. One of the other areas where GCOS and WMO can provide their contribution is carbon cycle, relevant also for the WMO GHG initiative.

The fact that GCOS and IOC-GOOS, have in common the 3 main cycles (energy, water and carbon), and thus can support each other was welcome by the SC members. This connectivity encompasses the whole Earth system and is important, in particular, for addressing the challenge of codesigning the observing system.

The importance of the Loss and Damage theme and its link with adaptation was stressed. In this respect, GCOS is beginning to develop a better understanding of how global observations can help in supporting adaptation and that this can be also useful for improving the understanding about loss and damage, including the social dimension.

Anthony Rea recognized the need to work more on the terrestrial observation domain, considering the lack of GTOS. In that direction, GCOS has already started to reinforce the relationships with the Global Terrestrial Networks (in particular GTN-H) and Food and Agriculture Organization of the United Nations (FAO), to understand if there can be the opportunity to work on a new GTOS concept or some of its components.

## **1.6 Updates from SC Chair**

### **UNFCCC COP27**

#### **Information Document**

GCOS and its Implementation Plan (IP) were presented at Earth Information Day 2022 (09/11/2022) and at a specific side event held in the WMO-IPCC-MERI Pavilion on the 11/11/2022. The GCOS IP was well received, along with a high-level statement on the gaps to be addressed in order to achieve an effective global observing system. The outcome was that

the concept of systematic observation is better recognized at high level in COP, as well as the GCOS role in addressing the related issues.

Anthony Rea underlined that the GCOS IP was instrumental to frame the dialogue at the Earth Information Day, and to send a consistent message to the Parties on the need for filling the gaps and sustained funding for global systematic observations. It helped to obtain a high-level statement on systematic observations in the [Sharm el-Sheikh Implementation Plan \(Chapter VII\)](#).

Albert Fisher stressed the fact that the discussion around the GCOS IP was more political than in the past, showing the increasing importance of science in the policy process. The Global Goal on Observations was not endorsed, as there were different sensitivities and concerns by countries about the language used, and the need to have differentiated responsibilities in terms of the needed financial support from developed countries. It is worthwhile to try to submit the global goal proposal again, because it has the potential to raise the visibility of systematic observations both at the international and more importantly at the national level.

### ***World Climate Research Programme (WCRP)***

At the last GCOS SC (SC-29) it was decided to organize a joint WCRP-GCOS workshop on Earth cycles. There was a preliminary exchange of information between the programme's chairs and the secretariats. Detlef Stammer, chair of WCRP, recognized that the interaction between GCOS and WCRP has significantly improved, but we should work to further progress it at level of both chairs and secretariat. The two programmes have complementary roles, WCRP does not deal with the observing systems but can define the scientific questions that an optimal global climate observing system needs to answer. In the future the different responsibilities of WCRP and GCOS need to be clearly defined.

### ***GCOS SC Membership renewal***

#### ***Information Document***

Han Dolman communicated the need to renew the membership of the GCOS Steering Committee as some of the members have reached the 6-years limit established in the GCOS MoU while some others have expressed their wish to step down. The GCOS Secretariat will be in contact with GCOS SC members to clarify their membership, and the SC renewal will be done progressively, in order to ensure continuity.

He also announced his resignation from GCOS chair, from the 1<sup>st</sup> of January 2023, due to the need to dedicate more time to other commitments. Han Dolman has devoted more than one decade to GCOS, starting from chairing its Terrestrial Observation Panel for Climate (TOPC). He closed expressing his gratefulness and appreciation for the work of the GCOS Secretariat. GCOS Director, Anthony Rea, thanked Professor Dolman for having provided leadership to GCOS in this difficult transition period, in particular considering the Covid pandemic.

## **1.7 GCOS and GCW**

### **PRESENTATION**

#### ***Information Document***

Shawn Marshall, GCW vice-Chair, presented the Global Cryosphere Watch (GCW) programme and its linkages to GCOS. GCW operates under the remit of WMO-INFCOM and is an international mechanism for supporting all key cryospheric in-situ and remote sensing observation. The observing component of GCW is also a component of the WMO Integrated Global Observing System (WIGOS). The GCW Study Group on WMO Cryosphere Crosscutting Functions (SG-CRYO)

recently released a report with 14 recommendations to INFCOM. Recommendation 9 “Cryosphere in the Global Climate Observing System (GCOS)”, focused on the collaboration with GCOS and the GCW activities aligned with GCOS IP 2022 actions were underlined. The Global Cryosphere Watch Advisory Group (GCW-AG) recommended to convene a dialogue with the GCOS SC on the evolution of cryosphere monitoring in the GCOS framework. The GCW and GCOS collaboration is already in place, with GCW members co-custodians of Sea Ice (ongoing) and Snow (planned) Essential Climate Variables (ECVs). Another area of collaboration could be on the definition of the Shared Arctic Variables, and the consideration of Mountain ECVs. The GCOS chair appreciated the GCW presentation and underlined that the ECVs rationalization process (see item 2.2) should also include the cryospheric variables.

## **1.8 Updates and output of the Climate Conference**

### **PRESENTATION**

#### **Information Document**

Han Dolman gave a presentation about the GCOS 2<sup>nd</sup> Climate Observation Conference, held in Darmstadt, Germany, 17-19 October 2022, on behalf of Sabrina Speich, chair of the Conference Organizing Committee.

The Conference was a great success, thanks also to the support of EUMETSAT, and brought together more than 140 participants in person from 29 countries, with 200 submissions accepted, more than 100 talks, including keynotes, and 100 posters.

The conference fostered international dialogue amongst climate scientists, observations experts, operational services, United Nations agencies, intergovernmental organizations, and policy makers. A conference statement was produced, calling for sustained long-term funding; addressing key gaps in observations; improving data quality, availability, accessibility and utility; creating and maintaining climate data repositories; addressing emerging needs; engaging with nations; improving regional and national climate change information; integrating and collocating observations. The conference participants also called for the establishment of a Global Goal on Observations (GGO) under the UNFCCC, which however was not included in the UNFCCC COP27 statement.

## **1.9 Panel reports**

### ***Terrestrial Observation Panel for Climate (TOPC)***

#### **PRESENTATION**

Thelma Krug, Chair of the TOPC Panel, presented the TOPC activities in 2022. Most efforts were dedicated to finalizing the IP and the ECVs requirements. Other activities started in 2022 and that will be key for the next years are:

- Adaptation. TOPC contributed to the GCOS Adaptation Task Team, especially the case studies on wildfire and pluvial flood in urban areas. Adaptation is an area of increasing interest for the terrestrial domain;
- The WMO GHG Monitoring Initiative;
- Collaboration with FAO, GEO, GCW, GTNs (already started with GTN-H).

A survey was conducted to review the panel’s membership and expertise, to identify gaps, collect suggestions, and plan future activities to be aligned with the GCOS IP actions.

### ***Atmospheric Observation Panel for Climate (AOPC)***

The AOPC 27<sup>th</sup> meeting was held as a hybrid meeting, in Ireland, 27-30 June 2022. Peter Thorne, Chair of the AOPC, presented the key achievements. The GCOS Surface Reference Network (GSRN) is entering in its pilot phase. The GCOS Reference Upper-Air Network (GRUAN) meeting



was held in November 2022 in La Réunion. Significant progresses within GRUAN include new data products from radiosondes. Thanks to laboratory testing a massive increase in the quality of the radiosondes outcomes is expected.

There is a major issue in terms of water vapour measurements in the troposphere and stratosphere. NASA decided to switch off the Microwave Limb Sounder (MLS) instrument sensor, with the risk of significant gaps in the atmospheric composition measurements. GCOS and WMO are jointly advocating with NASA for the MLS continuation.

The long-standing advocacy by GCOS on the importance of tiered networks produced an agreed mechanism at WMO level. This is a major step, but further work (in terms of regulatory materials, agreements, protocols, etc.) is still needed to implement it.

A letter was sent by the Secretary General to all WMO members asking them to submit historical data, to recognize international repositories. This should increase sharing of historical data in line with the WMO unified data policy.

As for the other panels, AOPC needs to renew its membership, several applications were received responding to an open call.

The work of AOPC in 2023 will focus on addressing the GCOS IP relevant actions.

## ***Ocean Observations Physics and Climate Panel (OOPC)***

### **PRESENTATION**

Weidong Yu, OOPC co-chair, presented the OOPC key activities of the last year. A series of webinars was held promoting the dialogue between the modelling and observing communities in 6 boundary systems; a paper is in preparation. A multidisciplinary group worked on the ocean indicator framework: a initial set of indicator is being proposed in a baseline paper. The OASIS (Observing Air-Sea Interactions Strategy) programme, which was conceived at the last GCOS joint panel meeting in 2019, is a UN Ocean Decade programme now. It is considered a cross GCOS action because it is about interactions between ocean, atmosphere and land. Several meetings were held to work on the GCOS IP and the ECV requirements. OOPC and CLIVAR co-hosted the Workshop from Global to Coastal Ocean, responding to the adaptation emerging requirements. Right after the GCOS 2<sup>nd</sup> climate observation conference the 25th Session of the OOPC was held in person in Darmstadt, 20-21 October 2022. Also OOPC is renewing its membership through a call for applications. OOPC is working on a new workplan for 2024-27 aligned both to the GCOS and GOOS implementation plans. OOPC members are involved in supporting the WMO Rolling Review of Requirements (RRR). The connection with WCRP is mainly based on the CLIVAR project but OOPC envisages further improvements. OOPC co-chair highlighted that due to its intermediary role, increased coordination resources are needed to support the panel activities.

### **1.10 Report on GATT**

#### **PRESENTATION**

##### **Information Document**

Chiara Cagnazzo, member of AOPC, presented the report of the GCOS Adaptation Task Team (GATT). After the Paris Agreement, further emphasis is required to address the issues of impacts and adaptation, also through the provision of earth observations and exploiting the value of existing ECVs. In 2019, small scoping-groups were established within GCOS-TOPC and GCOS-SC. In 2021, the GATT was established to include members also from the other two GCOS panels. Preliminary findings from the GATT report are that many ECVs, and their datasets, support climate models and reanalysis and therefore are vital for adaptation, providing the global and regional information to complete local information. However, many challenges are still in place: information for adaptation is often local in nature and higher-resolution observations in time and space are needed to observe climate extremes.

The importance of reanalysis as an integrator of observations, providing consistent dataset for many adaptation applications was also highlighted

Three case studies were conducted addressing three different sectors critical for adaptation: i) forest wildfire management; ii) pluvial flood risk assessment in urban areas; and iii) ocean extremes.

The work is still incomplete and further activities are needed to achieve more valuable results, therefore the GATT team requested guidance from the GCOS SC on the way forward.

Decision Number	Description
Dec. 30/1	<ol style="list-style-type: none"> <li>1. The GATT is asked to complete its work on the case studies for presentation at the Joint Panel Meeting in June 2023.</li> <li>2. GCOS should hold an Adaptation workshop in 2023/4 (or a set of workshops around key adaptation concerns) with major implementers and supporters of adaptation as well as thematic experts. The aim of this workshop will be to identify, from their point of view, what are the most important datasets and climate information they need, what are the major gaps, and whether the existing GCOS ECVs/products including their spatial and temporal specifications are adequate for adaptation.</li> </ol> <p>The Steering committee will consider the report of the Case Studies of the GCOS Adaptation Task Team and the outcomes of the Workshop and then decide on a way forward.</p>
Additional recommendations to Dec. 30/1	<p>The Steering Committee recommends that:</p> <ul style="list-style-type: none"> <li>• The GCOS Secretariat should hold the consultations for this workshop as described in the <a href="#">Information Document 1.10</a>.</li> <li>• The GCOS Expert Panels should aim to ensure that at least two members of each panel can support work on adaptation.</li> <li>• GCOS should put more emphasis on supporting improvements to reanalysis and global climate modelling. The panels are asked to consider how their work can improve reanalysis and climate modelling and how existing ECV that are not currently used in reanalysis or climate modelling can contribute.</li> </ul>

## 2. DAY 2: 8 December 2022

Han Dolman welcomed the participants to the Second Day of meeting and the Secretariat suggested a change of order in the Agenda, so that the Workplan was discussed at the end of the first block of presentations. Nevertheless, for the sake of the report, the initial order will be followed (as described in the Agenda).

### 2.1 GCOS Workplan

#### PRESENTATION

#### [Information Document](#)

The GCOS Secretariat presented the GCOS Workplan, which was heavily based on the need to accomplish the Actions in the GCOS Implementation Plan, but also included other activities, such as, the update of the ECV specification sheets, linking with WMO/IOC bodies, communication and outreach, the organization of the Joint Panel Meeting in Bonn in 2023, and support to GCOS chair and GCOS SC. The presentation focused exclusively on those actions that are common to

the three officers, i.e. of a cross-panel nature. Each officer has an additional set of activities that connect with the respective work plans of each of the panels.

The Secretariat highlighted the need to give priority to making progress on the Actions in GCOS IP.

The SC agreed on the activities presented on the Work Plan, acknowledged its ambition and suggested being very realistic on the resources available to undertake them. Activities should be prioritized, quality vs quantity, by doing a clear assessment of the time requested and by, if needed, postponing or putting on hold some of the activities. The GCOS Secretariat indicated that they had already done a first assessment of time resources, and after approval of the draft Workplan by the SC, they will work on detailing better a timeline and milestones for each of the activities proposed, and inform the SC should major changes in the Workplan occur.

Decision Number	Description
Dec. 30/2	<p>The Steering Committee decides that the main activities of GCOS secretariat in 2023 should be:</p> <ol style="list-style-type: none"> <li>1. Addressing the GCOS IP actions that have GCOS as an implementer.</li> <li>2. Update OSCAR/RRR with the ECV requirements from IP and the ECV fact sheets</li> <li>3. ECV Rationalization</li> <li>4. Support task team on Adaptation, the Earth’s cycles, the implementation of the GSRN</li> <li>5. Organize Joint Panel Meeting 2023 (26 – 30 June)</li> <li>6. Support to GCOS panels and GCOS SC</li> <li>7. Support to WMO and participate in relevant Standing Committees and Expert Teams on behalf of GCOS</li> <li>8. Support responses to relevant recommendations to the JSG-GCOS</li> <li>9. Communications, Liaise with Partners</li> <li>10. Preparation and presentation of input at the meetings of UNFCCC, WMO and IOC Governing bodies</li> </ol>

## 2.2 ECVs Rationalization

### PRESENTATION

This item follows up from the previous GCOS SC-29, which agreed to attempt the rationalization of the ECVs, meaning a grouping of ECVs that would lead to a simplification of the list and to a clearer and more transparent framework, and improved consistency.

The main argument is that there are several ECVs that in fact refer to the measurement of the same property, but in different parts of the Earth System (e.g. temperature or albedo).

The request is to setup a task team composed of 2 members per panel, and the panel co-chairs, who will work on a first proposal. Besides this, it is proposed that the panel co-chairs work on defining a process that clarifies and formalizes the inclusion of new ECVs and new ECVs products.

The GCOS SC welcome the proposal stressing the importance of socializing it and performing a broad consultation with stakeholders and users of the ECVs to make sure that it is well understood and accepted. The process should not be rushed, so it is suggested that the results are presented in 2-3 years time.

Decision Number	Description
Dec. 30/3	<p>The Steering Committee decides that GCOS should implement the workplan on ECV rationalization described below:</p> <ol style="list-style-type: none"> <li>1. A team with 2 representatives from each panel, appointed by the panel chairs, shall identify how sets of ECV products should best be grouped and make preliminary proposals by June 2023, to be presented at the Joint Panel meeting. Following this: <ul style="list-style-type: none"> <li>• The relevant panel members should refine each ECV group to be presented for approval at SC 32 or 33. To do this, a workshop with stakeholders (both users and producers of ECVs) will be organized to explain the process and get input from them.</li> <li>• The panel chairs shall ensure that a document describing the rationale and process is prepared and distributed among GCOS users.</li> </ul> </li> <li>2. The secretariat should propose to SC 32 or 33 a publicity plan around these proposals.</li> <li>3. The panel chairs should propose a group to write a paper, to be published in BAMS, on updating the first paper on ECVs (Bojinski et al. 2014).</li> <li>4. The panel chairs, with the assistance of the GCOS secretariat, should propose a formal process for the adoption of new ECV and ECV products in future, following current practice as far as possible. This should include: <ol style="list-style-type: none"> <li>a. A justification on how each new ECV and ECV product is significant for climate studies.</li> <li>b. A consideration if this ECV or ECV product already exists within the other two domains.</li> <li>c. A justification why new ECV products are assigned to a certain ECV. A demonstration that they meet the criteria in Bojinski et al. (2014).</li> <li>d. Following agreement by all the panel chairs each proposal should be forwarded to the SC for final approval.</li> </ol> </li> </ol>

## 2.3 Climate Indicators

### PRESENTATION Information Document

Karina von Schuckmann introduced this item and presented a newly developed indicator: the "Earth Energy Imbalance" (EEI). EEI is the difference between the incoming solar radiation and the outgoing radiation. Karina von Schuckmann explained the different methods available to estimate the EEI. The Earth Heat Inventory is currently the most reliable one, and its monitoring, through an internationally concerted effort, would allow us to understand how much heat surplus is available for melting and warming, and would improve climate predictions and projections. This indicator meets all the criteria: relevance, representativeness, traceability, timeliness and data adequacy. It is very integrative, and one single Decision Number and its evolution, provides a lot of information on the state of the energy cycle and what can happen in the future. The GCOS SC were convinced of the interest of the EEI indicator but posed some questions about its "friendliness", given that indicators are used as a communication tool and they must be understandable by a lay audience.

The Director of GCOS indicated that the Climate Indicators are not owned exclusively by GCOS. As WMO relies on the Climate Indicators for its annual State of Climate Reports (Climate Services), he suggested consulting with the WMO's Director of Climate Services beforehand. As far as other Indicators are concerned (biosphere, adaptation, water and carbon cycles), the proposal was to investigate them in connection with the discussion around Earth Cycles. It was also pointed out, that IPCC has already defined indicators in their AR 6 report and it would be worth taking them into account.

([https://www.ipcc.ch/report/ar6/wg1/downloads/figures/IPCC\\_AR6\\_WGI\\_FAQ\\_2\\_2\\_Figure\\_1.png](https://www.ipcc.ch/report/ar6/wg1/downloads/figures/IPCC_AR6_WGI_FAQ_2_2_Figure_1.png))

## 2.4 Earth Cycles

Han Dolman presented this item and reminded the SC that it was in 2016 when it was decided to look at the GCOS programme from the perspective of cycles. Since then, significant progress has happened: three papers published in peer reviewed journals, actions in the 2022 GCOS IP, as well as visibility at the Earth Information Day in COP27. It is important to link up with WCRP, where projects such as GEWEX (water and energy cycles) and the Global Carbon project are already working on this topic. In fact, WCRP has a task team on cycles and budgets where GCOS is represented. This task team has undertaken a survey amongst their experts to take stock of the current state of the art, and to organise a joint GCOS/WCRP workshop in spring 2023 to report back at the next GCOS SC.

A joint decision encompassing Items 2.3 and 2.4 was taken as follows:

Decision Number	Description
Dec. 30/4	<ol style="list-style-type: none"> <li>1. GCOS Secretariat works with WMO/Climate Services to explore the adoption of additional climate indicators, such as the earth energy imbalance or covering new domains (e.g. biosphere).</li> <li>2. GCOS Secretariat organizes a workshop on Earth Cycles jointly with WCRP and asks Han Dolman, Karina von Schuckmann and Wouter Dorigo to develop the aims and objectives of this workshop from a GCOS perspective.</li> <li>3. The workshop on Earth Cycles should consider how the current set of Climate Indicators reflect the changing earth cycles and whether any additional indicators are needed.</li> </ol>

## 2.5 GCOS Joint Panel Meeting

### PRESENTATION

In view of the current on-going cross-panel work as reflected in the GCOS Implementation Plan Actions and including, amongst others, the work on Earth Cycles, Adaptation and Indicators, as well as the ECVs Rationalization, it was proposed to hold a Joint Panel Meeting (JPM) on 26-30 June 2023 at ECMWF headquarters, in Bonn (Germany). To optimize resources and mitigate CO<sub>2</sub> emissions due to travel, the JPM will be back-to-back with the GCOS panels' annual meetings. A preliminary agenda including plenary, cross-panel break-out sessions and panel meetings was presented.

Jean Noël Thépaut (representing ECMWF) confirmed they are ready to host the meeting, but there is a limitation of 50 participants. The JPM would provide an opportunity for TOPC to meet in person for the first time in several years.

The GCOS SC members supported the proposal, stressing the need to protect the three days of panel time and keeping it focused around GCOS IP actions. Discussing extremes in relation to

Earth Cycles was also suggested as a theme for the JPM. WGClimate suggested to use the occasion to do a back-to-back meeting with GCOS Secretariat.

A discussion followed where SC members expressed some concern that too many meetings were held in Europe, and they emphasized the importance of choosing venues in less developed countries.

Hence, the SC requested that all efforts are done to ensure an even geographical distribution of venues and to promote the organization of meetings in low-income countries.

Decision Number	Description
Dec. 30/6	<ol style="list-style-type: none"> <li>1. The Steering Committee decides to hold a Second GCOS Joint Panel Meeting in June 2023 in Bonn and approves the budget for it.</li> <li>2. The Steering Committee asks the GCOS Secretariat to:               <ol style="list-style-type: none"> <li>a. Work with ECMWF to identify the venue in Bonn and prepare the logistics;</li> <li>b. In consultation with the GCOS Panels' chairs, organize the content and a provisional agenda for the meeting to cover the topics presented in the Concept Note (<a href="#">Annex A</a>) and present it to the Steering Committee by 15 March 2023.</li> </ol> </li> <li>3. The Steering Committee requests that all efforts are done to ensure an even geographical distribution of venues and to promote the organization of meetings in low-income countries.</li> </ol>

## 2.6 GCOS panels Terms of Reference and Membership

### PRESENTATION

An update of the Terms of Reference for GCOS panels (which had not been revised since 2010) was presented. This update was done by the Secretariat in consultation with the GCOS chair and GCOS panel co-chairs. The main changes comprise, an extended panel (up to 15 members), the formalization of the ex-officio member role, and the extension of the membership term (3+3+3) submitted to SC approval.

The SC approved the changes. Since the three panels are co-sponsored by WCRP (and by GOOS in the case of OOPC), it was agreed that the new ToR would be circulated to the co-chairs of those programmes for their approval.

Decision Number	Description
Dec. 30/7	<ol style="list-style-type: none"> <li>1. The Steering Committee approves the panel composition, the terms of reference of panel chairs and members, and the panels' term of reference contained in Annex A to <a href="#">Document 2.6 (amended)</a> and agrees that it should be implemented immediately.</li> <li>2. The Steering Committee approves the initial list of ex-officio members for the panels contained in Annex B to Doc.2.6, noting that the panel chairs may propose changes for approval by the Steering Committee in the future.</li> </ol>

Action Number	Description
SC-30/1	GCOS Secretariat to send the new Terms of Reference to the co-chairs of WCRP and GOOS for final approval.

## 2.7 GCOS Cooperation Mechanism (GCM)

### Information Document

Tim Oakley, seconded expert to GCOS Secretariat by the UK MetOffice, presented this item and recalled that the GCM is a resource mobilization activity under GCOS, established in 2004, which has raised approximated 4 million USD used to improve the climate observation systems, for any domain, normally in developing countries. It is in fact the only activity that implies field work, training etc, with direct benefit to Member States.

The UNFCCC at COP27 reiterated the need to address systematic observation gaps, meaning that the GCM is still very important.

He summarized the status of the GCM and stressed that after 2021, when three projects were completed, no new donations and no new projects have been run.

The WMO initiative GBON (Global Basic Observing Network) is funded by the SOFF (Systematics Observation Financing Facility) mechanism. SOFF could be providing a similar type of support than GCM did until now, however, GCM was specifically supporting stations that met the requirements to become a climate station, with a long-term perspective, while GBON/SOFF is more intending to improve the global NWP forecasts. Tim Oakley has been involved in the GBON Task Team and contributing his expertise to the project in the last year. He explained that GBON is now in a readiness phase, where information about the current status of the networks and compliance with GBON requirements is being assessed, and this may include information on historical records.

The possible way forward with GCM would be to re-orientate it so that it filled in some of the gaps that GBON will not cover, provided there are funds. The GCM could also be instrumental to take advantage of funding coming from organizations willing to invest on observations through specific projects, and the GCM could provide a network manager to support those.

Decision Number	Description
Dec. 30/8	The Steering Committee decides that GCOS should refocus the GCM on areas that are not supported by the SOFF. Initially TOPC should consider how the GCM can, in the future, support hydrological observations by identifying sources of support, identifying stations that are most in need of support and coordinating with relevant observing organizations and support agencies.

Some SC members were sceptical about the hydrological observations as this has been attempted repeatedly since many years, but there was agreement that it was worth trying.

Action Number	Description
SC-30/2	The Steering Committee suggests that the GCM and fund raising could be one of the items for the Joint Panel Meeting in June 2023

## 2.8 GCOS Budget

### PRESENTATION

Anthony Rea, GCOS Director, presented the item and explained how the expenditure in the years just before COVID19 had been slightly higher than the revenue. In 2022 the revenue is roughly 880,000 francs, the largest donors being the US State Department and EU Copernicus, followed by NOAA and WMO. The anticipated revenue in 2023 (not committed yet) is very similar and so is the distribution of funds against donors. The loss of any of those donors would be very problematic and Anthony Rea took the opportunity to thank them as well as the others like DWD.



The fluctuations in currency (Franc relatively stronger now, but funds are received either in dollars or in euros) and the increase in the price of travel have a significant impact too. The breakout of proposed expenses amounting 305000 CHF was then presented (excluding salaries), including items for meetings, travel, the cost of the building and ICT, and funds to support the Network Manager (Tim Oakley) and a consultancy. The budget allocated to travel has reduced by a 50% compared to pre-COVID19 levels. This expenditure would allow to keep the projected total expenditure approximately 70000 lower than the anticipated revenue, hence, counteracting the trend in pre-COVID19 time. This seems advisable given the risk associated with changes in the currency and give room in case of a donor not contributing. The main limitation concerns the organization of meetings. The Joint Panel Meeting will be feasible, while it would not be possible to organise regional workshops relying on GCOS funds exclusively. However, other sources of funds and collaborations (like with WIGOS) could be explored.

Decision Number	Description
Dec. 30/9	The Steering Committee approves the presented GCOS Budget and agrees on the provisional expenses proposed for 2023.

## 2.9 Next meeting and any other business

The list of Decisions was recalled, as well as the changes that were proposed to the list in the course of GCOS SC-30.

The next Steering Committee will be run online in March, mostly to present the agenda for the Joint Panel Meeting. The exact composition of the SC is unknown for now.

Action Number	Description
SC-30/3	The Steering Committee agrees to meet online in March 2023 to discuss, amongst others, the agenda for the Joint Panel Meeting.

Han Dolman concluded the meeting thanking the participants and expressing it had been a pleasure to serve in GCOS.



## ANNEX 1: LIST OF DECISIONS AND ACTIONS

Table 1. List of Actions approved by the GCOS SC-30.

Action Number	Description
SC-30/1	GCOS Secretariat to send the new Terms of Reference to the co-chairs of WCRP and GOOS for final approval.
SC-30/2	The Steering Committee suggests that the GCM and fund raising could be one of the items for the Joint Panel Meeting in June 2023.
SC-30/3	The Steering Committee agrees to meet online in March 2023 to discuss, amongst others, the agenda for the Joint Panel Meeting.

Table 2. List of Decisions approved by the GCOS SC-30.

Decision Number	Description
Dec. 30/1 (amended)	<ol style="list-style-type: none"> <li>1. The GATT is asked to complete its work on the case studies for presentation at the Joint Panel Meeting in June 2023.</li> <li>2. GCOS should hold an Adaptation workshop in 2023/4 (or a set of workshops around key adaptation concerns) with major implementers and supporters of adaptation as well as thematic experts. The aim of this workshop will be to identify, from their point of view, what are the most important datasets and climate information they need, what are the major gaps, and whether the existing GCOS ECVs/products including their spatial and temporal specifications are adequate for adaptation.</li> </ol> <p>The Steering committee will consider the report of the Case Studies of the GCOS Adaptation Task Team and the outcomes of the Workshop and then decide on a way forward.</p>
Dec. 30/2	<p>The Steering Committee decides that the main activities of GCOS secretariat in 2023 should be:</p> <ol style="list-style-type: none"> <li>1. Addressing the GCOS IP actions that have GCOS as an implementer.</li> <li>2. Update OSCAR/RRR with the ECV requirements from IP and the ECV fact sheets</li> <li>3. ECV Rationalization</li> <li>4. Support task team on Adaptation, the Earth's cycles, the implementation of the GSRN</li> <li>5. Organize Joint Panel Meeting 2023 (26 – 30 June)</li> <li>6. Support to GCOS panels and GCOS SC</li> <li>7. Support to WMO and participate in relevant Standing Committees and Expert Teams on behalf of GCOS</li> <li>8. Support responses to relevant recommendations to the JSG-GCOS</li> <li>9. Communications, Liaise with Partners</li> <li>10. Preparation and presentation of input at the meetings of UNFCCC, WMO and IOC Governing bodies</li> </ol>
Dec. 30/3	The Steering Committee decides that GCOS should implement the workplan on ECV rationalization described below:

	<ol style="list-style-type: none"> <li>1. A team with 2 representatives from each panel, appointed by the panel chairs, shall identify how sets of ECV products should best be grouped and make preliminary proposals by June 2023, to be presented at the Joint Panel meeting. Following this: <ul style="list-style-type: none"> <li>• The relevant panel members should refine each ECV group to be presented for approval at SC 32 or 33. To do this, a workshop with stakeholders (both users and producers of ECVs) will be organized to explain the process and get input from them.</li> <li>• The panel chairs shall ensure that a document describing the rationale and process is prepared and distributed among GCOS users.</li> </ul> </li> <li>2. The secretariat should propose to SC 32 or 33 a publicity plan around these proposals.</li> <li>3. The panel chairs should propose a group to write a paper, to be published in BAMS, on updating the first paper on ECVs (Bojinski et al. 2014).</li> <li>4. The panel chairs, with the assistance of the GCOS secretariat, should propose a formal process for the adoption of new ECV and ECV products in future, following current practice as far as possible. This should include: <ol style="list-style-type: none"> <li>a. A justification on how each new ECV and ECV product is significant for climate studies.</li> <li>b. A consideration if this ECV or ECV product already exists within the other two domains.</li> <li>c. A justification why new ECV products are assigned to a certain ECV. A demonstration that they meet the criteria in Bojinski et al. (2014).</li> <li>d. Following agreement by all the panel chairs each proposal should be forwarded to the SC for final approval.</li> </ol> </li> </ol>
<p>Dec. 30/4 amended (it replaces the initial Dec. 30/4 and Dec. 30/5)</p>	<ol style="list-style-type: none"> <li>1. GCOS Secretariat works with WMO/Climate Services to explore the adoption of additional climate indicators, such as the earth energy imbalance or covering new domains (e.g. biosphere).</li> <li>2. GCOS Secretariat organizes a workshop on Earth Cycles jointly with WCRP and asks Han Dolman, Karina von Schuckmann and Wouter Dorigo to develop the aims and objectives of this workshop from a GCOS perspective.</li> <li>3. The workshop on Earth Cycles should consider how the current set of Climate Indicators reflect the changing earth cycles and whether any additional indicators are needed.</li> </ol>
<p>Dec. 30/6</p>	<ol style="list-style-type: none"> <li>1. The Steering Committee decides to hold a Second GCOS Joint Panel Meeting in June 2023 in Bonn and approves the budget for it.</li> <li>2. The Steering Committee asks the GCOS Secretariat to: <ol style="list-style-type: none"> <li>a. Work with ECMWF to identify the venue in Bonn and prepare the logistics;</li> <li>b. In consultation with the GCOS Panels' chairs, organize the content and a provisional agenda for the meeting to cover the topics presented in the Concept Note (Annex A) and present it to the Steering Committee by 15 March 2023.</li> </ol> </li> </ol>

Dec. 30/7	<ol style="list-style-type: none"> <li>1. The Steering Committee approves the panel composition, the terms of reference of panel chairs and members, and the panels' term of reference contained in Annex A to Document 2.6 and agrees that it should be implemented immediately.</li> <li>2. The Steering Committee approves the initial list of ex-officio members for the panels contained in Annex B to Doc.2.6, noting that the panel chairs may propose changes for approval by the Steering Committee in the future.</li> </ol>
Dec. 30/8	The Steering Committee decides that GCOS should refocus the GCM on areas that are not supported by the SOFF. Initially TOPC should consider how the GCM can, in the future, support hydrological observations by identifying sources of support, identifying stations that are most in need of support and coordinating with relevant observing organizations and support agencies.
Dec. 30/9	The Steering Committee approves the presented GCOS Budget and agrees on the provisional expenses proposed for 2023.

Dec.30/4 and Dec. 30/5 were merged following the discussion at the GCOS SC-30.

## ANNEX 2: AGENDA

Day 1		7 December - 13:00-16:15 CET		
Item	Time	Subject	Presenter	Topic and Documents
1.1	13:00	Welcome and opening of the meeting	Anthony Rea	
1.2	13:00-13:05	Approval of the Agenda	Han Dolman	Agenda
1.3	13:05-13:15 (10 min)	Review of actions and decisions	Han Dolman	<a href="#">INF. 1.3</a> - SC-29 Actions and Decisions review
1.4	13:15-13:35 (20 min)	WMO Updates	Anthony Rea	INFCOM-2 ( <a href="#">GSRN Pilot</a> , <a href="#">GCOS IP</a> , <a href="#">JSG-GCOS</a> ) <a href="#">Presentation</a> WMO GHG Initiative GBON and SOFF (Act 29/1)
1.5	13:35-14:05 (30 min)	Sponsors vision on GCOS (IOC, UNEP, ISC)	Katsia Paulavets (ISC) Albert Fischer/Vladimir Ryabinin (IOC)	<a href="#">ISC Presentation</a> For information: benefits of GCOS for sponsors/support to GCOS from sponsors
1.6	14:05-14:30 (25 min)	Updates from SC Chair	Han Dolman	<a href="#">INF. 1.6a</a> - SBSTA 57 and COP 27 decisions WCRP (act 29/3) <a href="#">INF. 1.6b</a> - GCOS SC Membership renewal
<b>14:30 - 14:45 BREAK</b>				
1.7	14:45-15:00 (15 min)	GCOS and GCW	Shawn Marshall (GCW)	A GCW overview <a href="#">INF. 1.7 -Presentation</a> - A GCOS implementation in non-WMO areas
1.8	15:00-15:15 (15 min)	Updates and output of the Climate Conference	Han Dolman / Sabrina Speich	<a href="#">INF. 1.8 -Presentation</a> - Output from the Conference, Conference report and statement
1.9	15:15-15:45 (30 min)	Panel reports	Panel Chairs	Activities, future plans and issues <a href="#">OOPC Presentation</a> <a href="#">TOPC Presentation</a>
1.10	15:45-16:15 (30 min)	Report on GATT	Chiara Cagnazzo	<a href="#">Document 1.10</a> - Decision 1 <a href="#">INF. 1.10</a> <a href="#">Presentation</a> - How can GCOS best support Adaptation in the UNFCCC space?

Day 2		8 December - 13:00-16:15 CET		
Item	Time	Subject	Presenter	Topic and Documents
2.1	13:00-13:40 (40 min)	IP and GCOS Workplan	Caterina Tassone	<a href="#">Document 2.1</a> - Decision 2 - <a href="#">Presentation</a> <a href="#">INF. 2.1</a>
2.2	13:40-14:00 (20 min)	ECV Rationalization	Antonio Bombelli	<a href="#">Document 2.2</a> - Decision 3 <a href="#">Presentation</a>
2.3	14:00-14:20 (20 min)	Indicators - Are the indicators still adequate?	Karina von Schuckman/ Han Dolman	<a href="#">Document 2.3</a> - Decision 4* <a href="#">Presentation</a> <a href="#">INF. 2.3</a> <i>*(Decision 4 and 5 have been merged to <b>one</b> Decision 4)</i>
2.4	14:20-14:45 (25 min)	Earth's Cycles	Han Dolman	<a href="#">Document 2.4</a> - Decision 4* <i>*(Decision 4 and 5 have been merged to <b>one</b> Decision 4)</i>
2.5	14:45-15:00 (15 min)	GCOS Joint Panel Meeting	Belén Martín Míguez	<a href="#">Document 2.5</a> - Decision 6 <a href="#">Presentation</a>
<b>15:00 - 15:15 Break</b>				
2.6	15:15-15:25 (10 min)	Panel Membership formalization and ex-officio list	Caterina Tassone	<a href="#">Document 2.6</a> - Decision 7 <a href="#">Presentation</a>
2.7	15:25-15:40 (15 min)	GCM (Action SC 29/12) - Future of GCM	Tim Oakley	<a href="#">Document 2.7</a> - Decision 8
2.8	15:40-16:00 (20 min)	GCOS Budget	Anthony Rea	<a href="#">Document 2.8</a> - Decision 9 <a href="#">Presentation</a>
2.9	16:00-16:10 (10 min)	Review actions and decisions and final approval	Han Dolman	
2.10	16:10-16:15 (5 min)	Next SC meeting (online-March?) and membership	Han Dolman	

## ANNEX 3: LIST OF PARTICIPANTS

STEERING COMMITTEE MEMBERS				
Chair	The Netherlands	Prof.	Albertus Johannes Han	Dolman
Member	Australia	Dr	Sue	Barrell
Member	China	Dr	Qingchen	Chao
Member	Canada	Dr	Sybil	Seitzinger
Member	Switzerland	Dr	Youba	Sokona
Member	Japan	Mr	Kazuto	Suda
Member	Japan	Dr	Toshio	Suga
Member	Zürich	Dr	Michael	Zemp
EX-OFFICIO MEMBERS				
AOPC Co-chair	Ireland	Prof.	Peter	Thorne
OOPC Co-chair	France	Prof.	Sabrina	Speich
OOPC Co-chair	China	Dr	Weidong	Yu
TOPC Co-chair	Brazil	Dr	Thelma	Krug
TOPC Co-chair	Germany	Dr	Martin	Herold
SPONSORS				
IOC of UNESCO	France	Dr	Vladimir	Ryabinin
ISC	France	Ms	Katsia	Paulavets
UNEP	Not present			
WMO	Switzerland	Represented by Anthony Rea		
WCRP	Switzerland	Dr	Michael	Sparrow
WCRP	Switzerland	Dr	Detlef	Stammer
INVITED EXPERTS				
NOAA	US	Dr	David	Legler
NOAA	US	Dr	Ann-Christine	Zinkann
GOOS	France	Dr	Emma	Heslop
GOOS	France	Dr	Albert	Fischer
Copernicus	Germany	Dr	Jean-Noël	Thepaut
GCW	Canada	Dr	Shawn	Marshall
ECMWF	Germany	Dr	Chiara	Cagnazzo
Mercator Ocean	France	Dr	Karina	von Shuckmann
WMO Secretariat				
WCRP	Switzerland	Dr	Nico	Caltabiano
WCRP	Switzerland	Dr	Hindumathi	Kulaiappan Palanisamy
GCW	Switzerland	Dr	Rodica	Nitu

**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)**