

Global Climate Observing System (GCOS)

GCOS Submission to SBSTA 57, 2022

The Earth's climate is changing as a result of human activities. Observations of our climate show widespread, rapid, and intense changes that are unprecedented over many thousands of years. These changes affect all components of the climate system and every region on Earth. They have led to more frequent and more extreme events, such as heat waves, storms, floods, and droughts, that strongly impact our society, our infrastructures and all living things. Climate observations have been fundamental in the development of scientific assessments and policies, including IPCC reports and the 2015 Paris Agreement. They are the foundation of our understanding of the climate and how to mitigate climate change, adapt to future conditions, and reduce and address future loss and damage.

In October 2022, GCOS published its latest Implementation Plan for the global observing system for climate and the revised observational requirements for Essential Climate Variables. The Implementation Plan was produced by the GCOS panels experts and a writing team following extensive consultations across scientific communities spanning observations, end users, and an open public review.

Based on an analysis of the status of the global observing system, and the requirements for the Essential Climate Variables, the 2022 Implementation Plan identifies the major practical actions to be undertaken in the next 5-10 years. These are categorized across six themes:

- Ensuring the sustainability of key existing observation programs and identifying areas of immediate concern;
- Filling data gaps in current observing capabilities, addressing areas where observations are consistently deficient, most notably parts of Africa, South America, Southeast Asia, in the deep ocean and polar regions;
- Improving data quality, availability and utility, including reprocessing to ensuring climate information is available in the form and quality needed by users;
- Improving data management to ensuring the free and unrestricted access to climate data and its long-term data curation;
- Improving engagement with countries and stakeholders, identifying needs and sources of support; and
- Addressing other emerging needs such as more detailed information for adaptation and mitigation.

These actions urgently require adequate support and long-term investment from governments, operational agencies, funders and research organizations.

GCOS has also published in parallel an updated set of requirements for the Essential Climate Variables to provide the scientific basis necessary to understand and predict the changing climate, and to support policies and decision making for mitigation and adaptation. Building on the Implementation Plan, GCOS recently organized its 2nd Climate Observation Conference in Darmstadt, Germany (17-19 October 2022) that fostered an international dialogue between climate scientists, observations experts, operational services, United Nations agencies, intergovernmental organisations, and policy makers.

The conference agreed a formal statement that reinforces and complements the actions identified in the Implementation Plan and goes a step further, calling for the establishment of a global goal on observations under the UNFCCC. This global goal on observations should guide the “action-oriented framework for observation” necessary to provide a sustainably funded long-term global observing system to underpin mitigation and adaptation action and reporting, and assist recognition, understanding and coordination of activities by international, regional and national stakeholders.

Observations remain fundamental to the value chain of scientific knowledge and activities that support our understanding of our current and future environment and decisions on sustainable development.

The Global Climate Observing System (GCOS) was established in 1992 by the World Meteorological Organization (WMO), the Intergovernmental Oceanographic Commission of UNESCO (IOC), the United Nations Environment Programme (UNEP) and the International Science Council (ISC) to coordinate global climate observations and facilitate their development and improvement.

GCOS Climate Observation Conference Statement

Darmstadt, Germany, 17-19 October 2022

Ref.: Z6384/2022-11/ES

The Earth's climate is changing as a result of human activities. Observations of our climate show widespread, rapid, and intense changes that are unprecedented over many thousands of years. These changes affect all components of the climate system and every region on Earth. They have led to more frequent and more extreme events, such as heat waves, storms, floods, and droughts, that strongly impact our society, our infrastructures and all living things. Climate observations have been fundamental in the development of scientific assessments and policies, including IPCC reports and the 2015 Paris Agreement. They are the foundation of our understanding of the climate and how to mitigate climate change, adapt to future conditions, and reduce and address future loss and damage.

"Observations underpin all weather, climate, water, and ecosystems services and products. Without the collection and sharing of these observations, the ability to understand, predict, mitigate, and adapt to changes in the climate system is limited," Sabrina Speich, Chair of the GCOS Climate Observation Conference, said.

The newly released 2022 Implementation Plan of the Global Climate Observing System (GCOS) specifies the climate observations required to inform science, services and society. The report was requested by the United Nations Framework Convention on Climate Change (UNFCCC). The GCOS Implementation Plan identifies existing gaps in Earth observations and areas in need of improvement. These needs must be urgently addressed to progress towards a comprehensive and sustainable global climate observing system.

Building on the GCOS Implementation Plan, the GCOS Climate Observation Conference (Darmstadt, Germany, 17-19 October 2022) fostered international dialogue amongst climate scientists, observations experts, operational services, United Nations agencies, intergovernmental organisations, and policy makers.

In particular, the conference participants unanimously call for UN Member States, and relevant agencies for:

- **Sustained, long-term funding**, which is essential to ensure the continuity and expansion of observations to monitor the Essential Climate Variables. The provision of many observations is still supported through limited-term funding, and the climate observing system remains fragile.
- **Addressing the key gaps in observations**, that have been identified in different components of the observing system in, the atmosphere, the ocean, the cryosphere, the biosphere, the mountains, and lakes and rivers. Priority areas for improvement are parts of, Africa, South America, South-East Asia, the deep ocean, and the polar regions.
- **The improvement of data quality, availability, accessibility and utility**. Many climate observations are underexploited because of the lack of consistency, and clarity, in their processing, interoperability and usability. The conference has provided concrete pathways to improvements, identifying that increased effort is required to

ensure that the data can be readily used in reanalysis and are fit for purpose. It also recognized the importance of reference quality observations, with full traceability, and defined and quantified uncertainties.

- **The creation and maintenance of climate data repositories.** To address and understand climate change, the longest possible time series need to be preserved and made available. Climate data must be made available through global data repositories, and their access must be free and unrestricted. The conference also identified the need for increased funding to ensure data can be rescued from hard-copy, or archaic digital formats, to extend existing data time series.
- **Addressing the emerging needs.** Climate information needs are changing. As an example, the increased frequency of observations for adaptation and mitigation measures are needed urgently. The global climate observing system must evolve in response to such needs.
- **The engagement with nations.** Many climate observations are made by national agencies. These agencies need to be supported by their governing bodies and they need to be coordinated transnationally, at regional and global level. The benefits of climate observations need to be widely understood and the contributions of national observations to global datasets require enhancement.
- **The improvement of regional and national climate change information.** Improved understanding of the local decision-making context and associated observational requirements, will help address the gap between the "top-down", global, production of observations and climate information, and the "bottom-up" local-scale decision making.
- **Integrated and collocated observations** of the physical, chemical, and biological components of the climate system, which will enhance our understanding on climate variability, trends and impacts, particularly on fragile ecosystems.

The conference participants call for the establishment of a global goal on observations under the UNFCCC. This should guide the needed "action-oriented framework for observation" to assist recognition, understanding and coordination of activities by international, regional and national stakeholders to deliver climate information on the impacts of climate change and for mitigation and adaptation action and reporting. Observations remain fundamental to the value chain of scientific knowledge and activities that support our understanding of our current and future environment and decisions on sustainable development.