GCOS

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WCRP JSC 2025

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WMO

unesco
Intergovernmental Oceanographic Commission

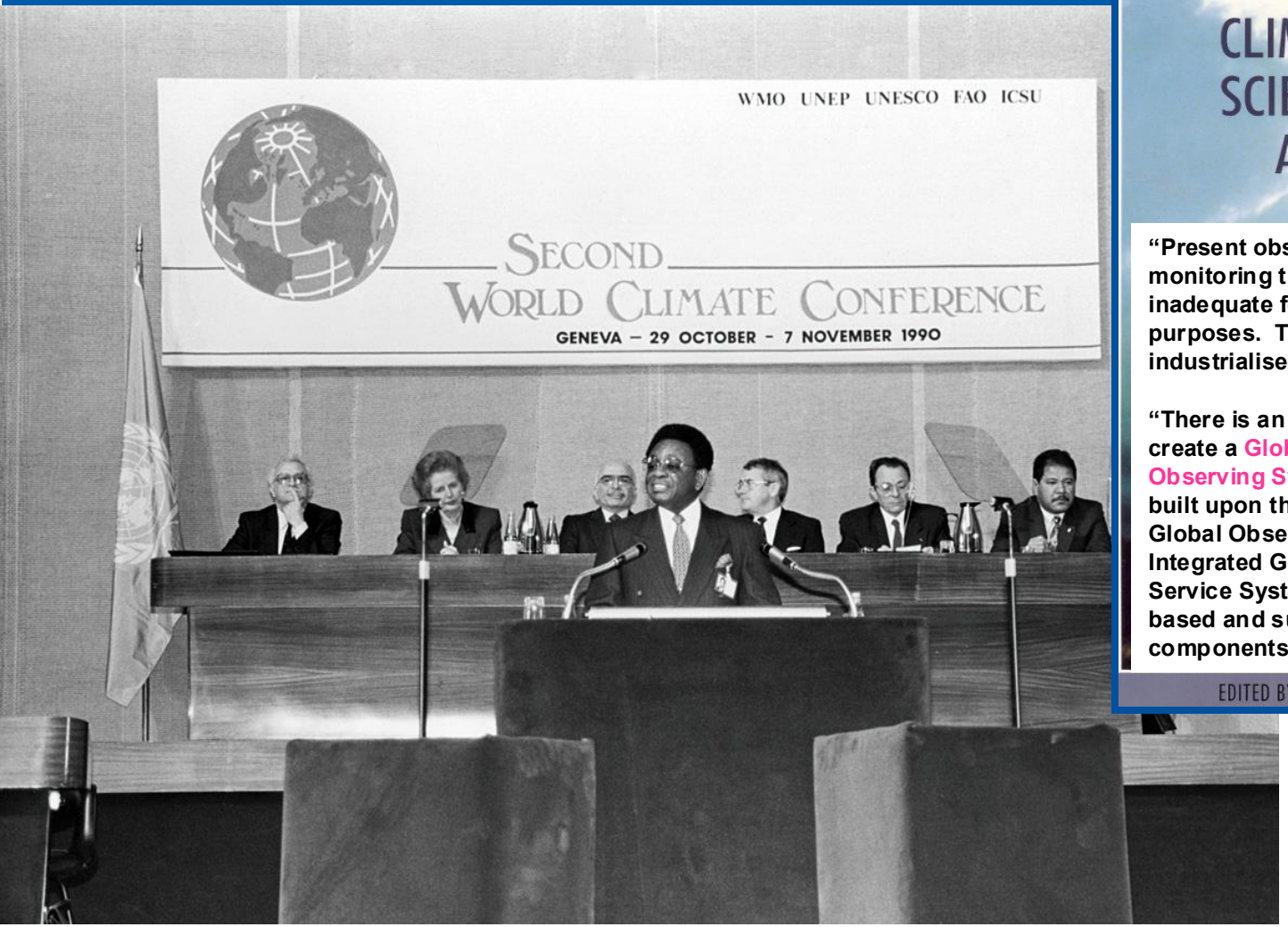
International Science Council

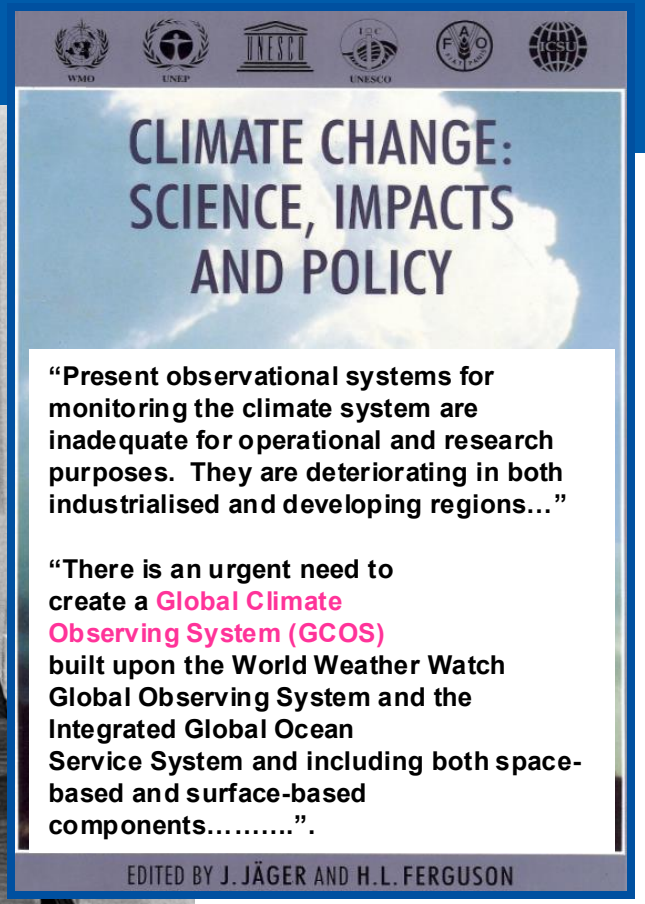
UN environment programme

Supported by the European Union

opernicus
Europe's eyes on Earth

Second World Climate Conference (WCC-2) Ministerial Session





WMO of UNESCO UNEP ICSU

WMO, IOC, UNEP and ICSU

- Noting 1-6
- Recognizing.....
- Considering...
- Agree 1-5
- Agree further....
- Approve:
  - Annex A
  - Annex B
  - Annex C
- Agree....
- Agree....
- Agree....

Annex A Concept of the Global Climate Observing System

Annex B Terms of Reference, Structure and Functions of the JSTC and JPO

Annex C Financial Arrangements

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GCOS – Global Climate Observing System

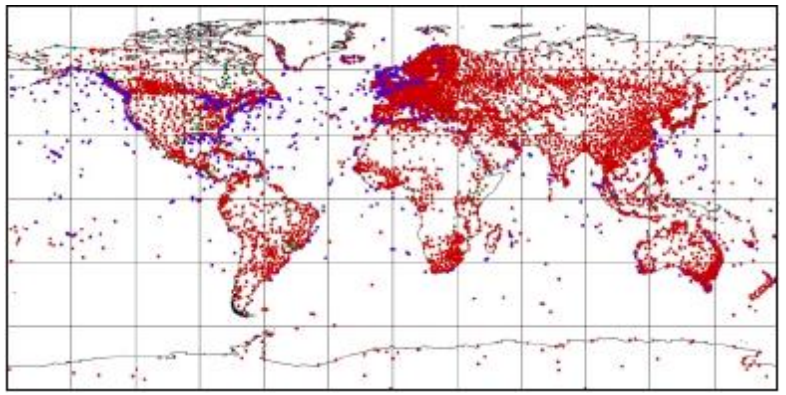
GCOS works towards climate observations being **enhanced** and **sustained** into the future, to provide the evidence needed to understand and predict the evolution of the climate, to guide mitigation and adaptation measures, to assess risks and enable attribution of climatic events to underlie causes, and to underpin climate services.

GCOS = Climate observations enabling climate science and services

GCOS is concerned with …

The observations:

- what is measured, how is it measured, where is it measured, how is the measurement sustained, etc.



Data transmission: what is transmitted, with what time delay, in what code

Data management (including data rescue): archiving and access to raw data, metadata, and data products; recovery and rehabilitation of past data

Data and products: Fundamental records, including recalibration and homogenisation

GCOS – Global Climate Observing System

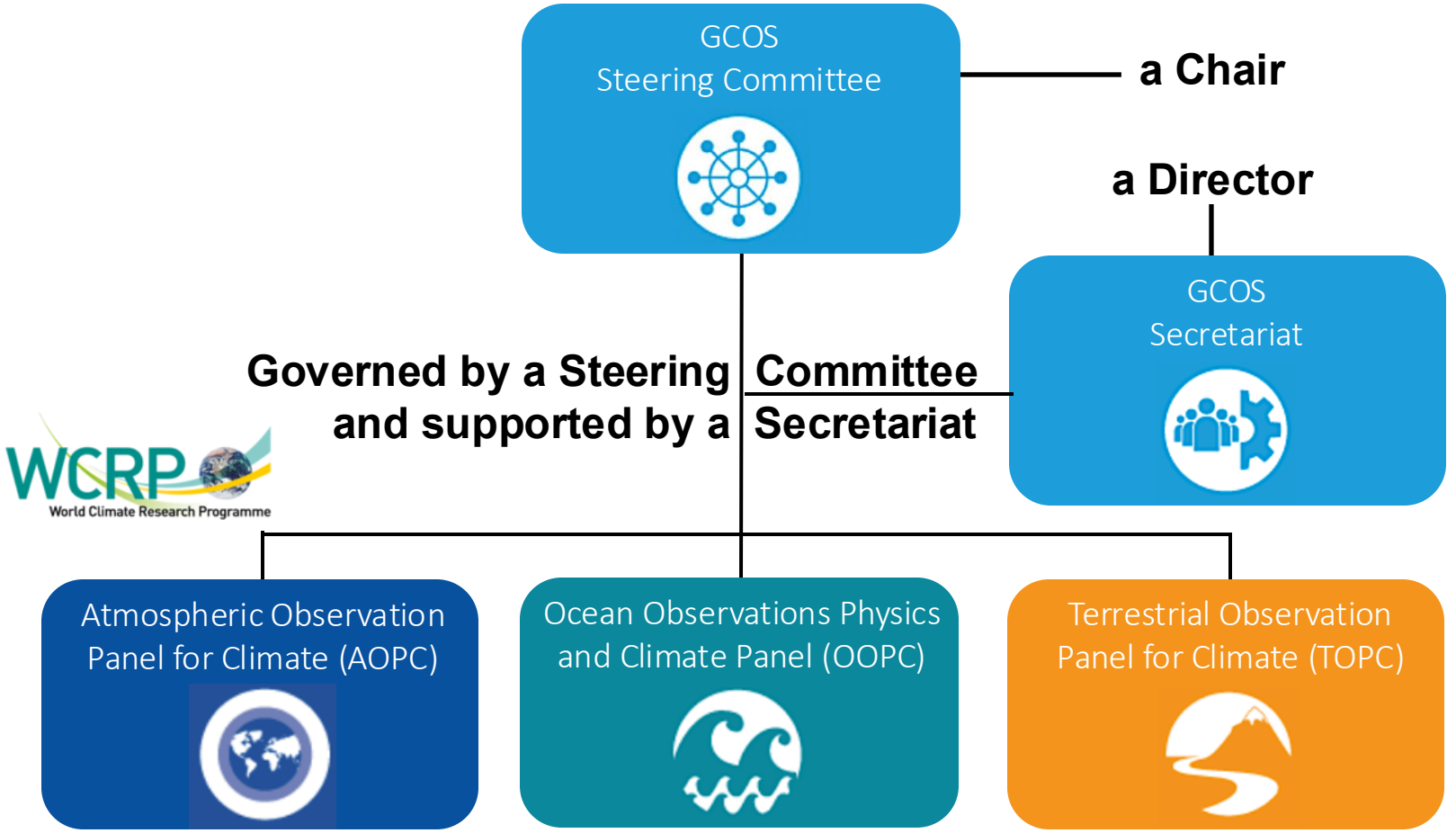
GLOBAL CLIMATE OBSERVING SYSTEM

KEEPING WATCH OVER OUR CLIMATE

Established in 1992
to address the UNFCCC
systematic observation agenda

GCOS is a joint programme of:

WMO, IOC/UNESCO, UNEP, ISC



Guided by 3 panels of experts: AOPC, OOPC, TOPC

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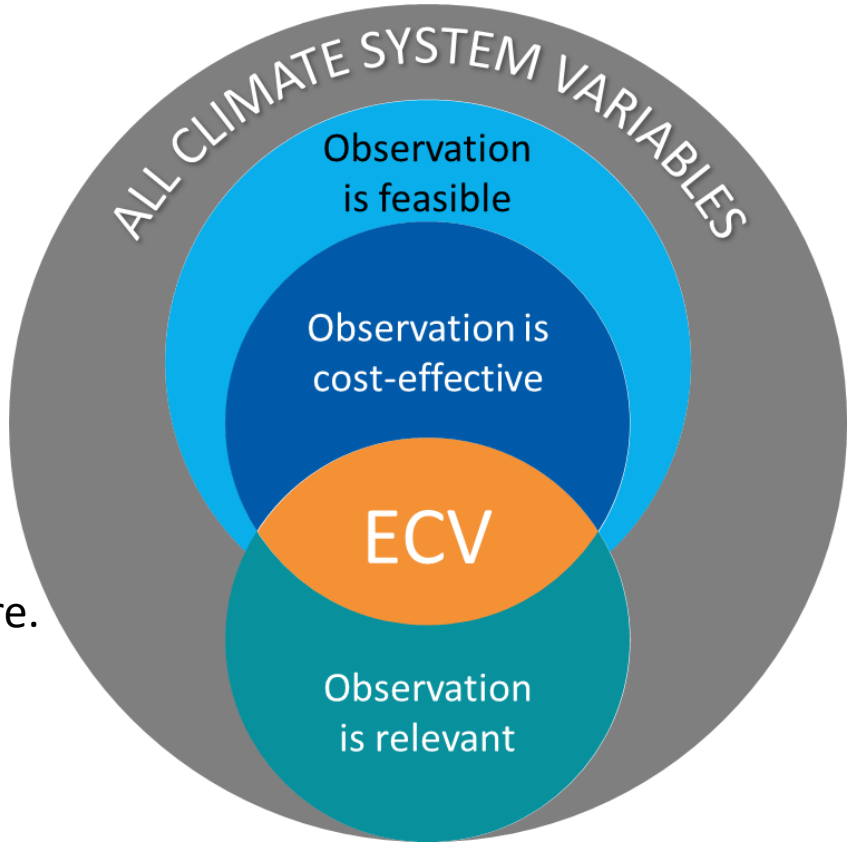
ECVs - Essential Climate Variables

GCOS developed and implemented the concept of Essential Climate Variables (ECVs) which are widely endorsed by the community and scientific programs.



Essential Climate Variables (ECVs)

- are physical, chemical or biological variables that critically contribute to the characterization of Earth's climate.
- are not stand-alone variables; they are part of a wider concept.
- are founded on climate science and observational capability and infrastructure.

ECV datasets provide the empirical evidence

- to understand and predict the evolution of climate,
- to guide mitigation and adaptation measures,
- to assess risks,
- to enable attribution of climatic events to underlying causes,
- to underpin climate services.

SOURCE: Bojinski et al. 2014

GCOS is acknowledged as the leading independent reference in defining requirements for climate observations.

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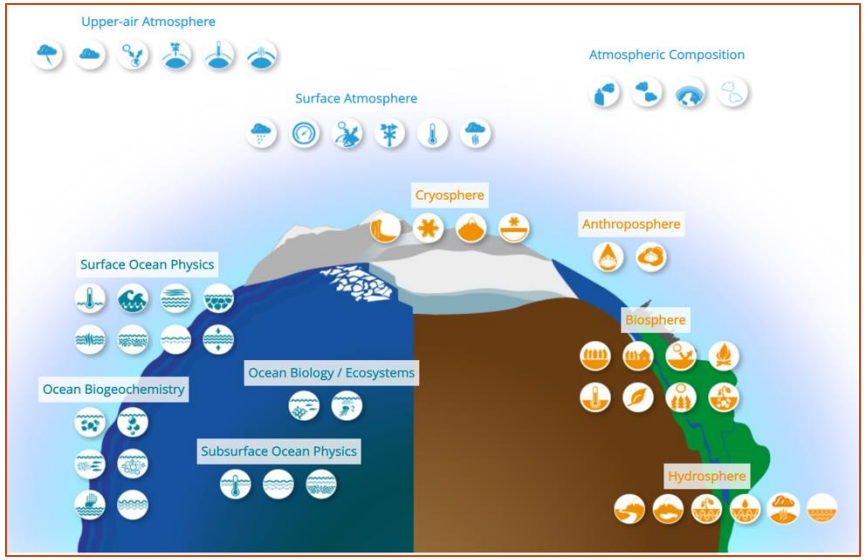
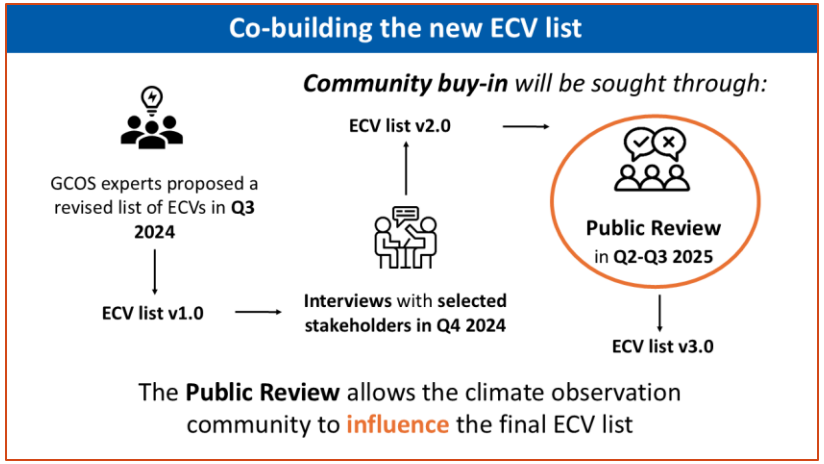
The GCOS ECV Rationalization process

GCOS and ECVs - GCOS defines the Essential Climate Variables (ECVs), which represent a minimum set of observed variables that are needed to monitor the Earth's changing climate.

Why is a review happening? – The ECV list has evolved with time and key questions have emerged:

- *Are all the 55 ECVs still **essential**?*
- *Is the current **categorization** of ECVs optimal?*
- *Are the ECVs **consistent** across the different domains?*
- *Are the processes for adding ECVs **transparent** and **coherent**?*





Where are we in the process? A Task Team has conducted a comprehensive review of ECVs and their governance and in Q3 presented a proposal for a new ECV list to 9 key stakeholders and collected their feedback. WCPR was one of them. Now, an updated set of ECVs has been developed and will be open to Public Review

https://apps.ipcc.ch/comments/ECV_rationalization/index.php

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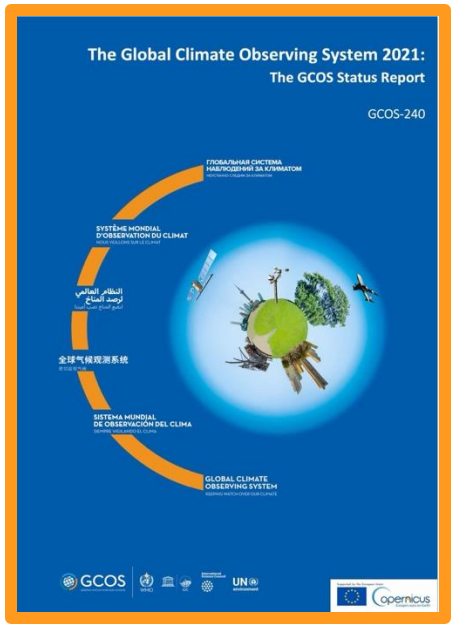
GCOS Reporting to UNFCCC

GCOS Status Report



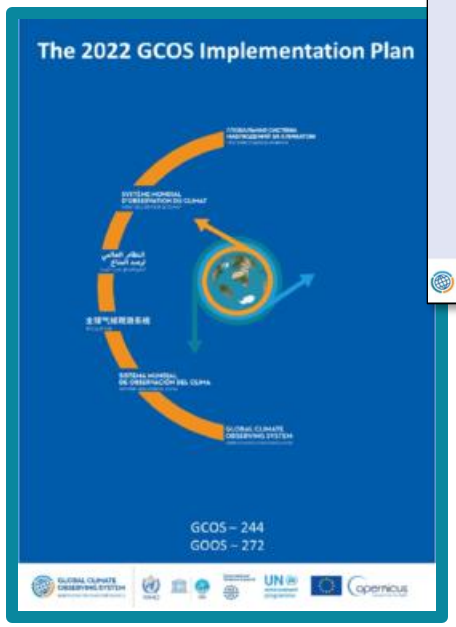
Assess if the status of the observing system for climate meets those requirements

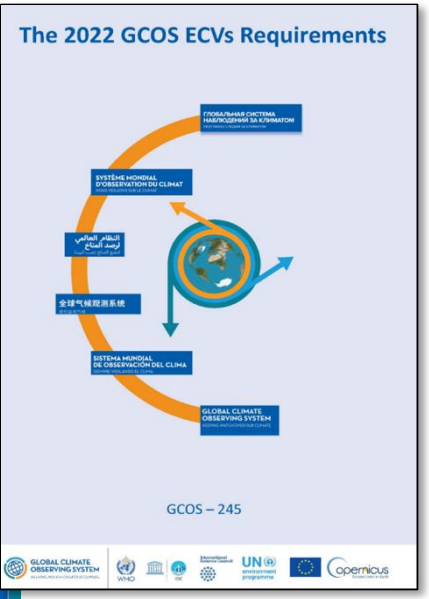
≃ 5 years cycle

UNFCCC

Identify what we need to measure

GCOS ECVs Requirements and Implementation Plan





ECV product requirements for climate monitoring
For all ECV products

Propose actions to address gaps and improve the observing system for climate

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GCOS IP

Theme	Actions	GCOS workplan is defined by the IP actions	Implementing Bodies											
			WMO	NMHS	Space agencies	GOOS	Reanalysis Centers	Global Data Centers	Research organizations	National Agencies	Parties to UNFCCC	Academia	Funding Agencies	GCOS
A: ENSURING SUSTAINABILITY	A1. Ensure necessary levels of long-term funding support for in situ networks, from observations to data delivery		x	x					x			x	x	x
	A2. Address gaps in satellite observations likely to occur in the near future				x									
	A3. Prepare follow-on plans for critical satellite missions				x									
B: FILLING DATA GAPS	B1. Development of reference networks (in situ and satellite Fiducial Reference Measurement (FRM) programs)		x	x	x				x				x	x
	B2. Development and implementation of the Global Basic Observing Network (GBON)		x	x		x								x
	B3. New Earth observing satellite missions to fill gaps in the observing systems				x									
	B4. Expand surface and in situ monitoring of trace gas composition and aerosol properties			x					x	x			x	
	B5. Implementing global hydrological networks		x	x	x			x						
	B6. Expand and build a fully integrated global ocean observing system			x	x	x			x	x		x		
	B7. Augmenting ship-based hydrography and fixed-point observations with biological and biogeochemical parameters					x			x					
	B8. Coordinate observations and data product development for ocean CO_2 and N_2O		x			x			x	x				
	B9. Improve estimates of latent and sensible heat fluxes and wind stress			x	x	x			x			x		
	B10. Identify gaps in the climate observing system to monitor the global energy, water and carbon cycles								x				x	x
C: IMPROVING DATA QUALITY, AVAILABILITY AND UTILITY, INCLUDING REPROCESSING	C1. Develop monitoring standards, guidance and best practices for each ECV		x		x	x								x
	C2. General improvements to satellite data processing methods				x				x			x		
	C3. General improvements to in situ data products for all ECVs			x					x			x		
	C4. New and improved reanalysis products				x		x					x		
	C5. ECV-specific satellite data processing method improvements				x		x							
D: MANAGING DATA	D1. Define governance and requirements for Global Climate Data Centres		x					x						x
	D2. Ensure Global Data Centres exist for all in situ observations of ECVs		x	x		x				x			x	x
	D3. Improving discovery and access to data and metadata in Global Data Centres							x					x	x
	D4. Create a facility to access co-located in situ cal/val observations and satellite data for quality assurance of satellite products		x	x	x				x					
	D5. Undertake additional in situ data rescue activities		x	x							x		x	x
E: ENGAGING WITH COUNTRIES	E1. Foster regional engagement in GCOS		x			x					x			x
	E2. Promote national engagement in GCOS			x							x	x		x
	E3. Enhance support to national climate observations										x		x	x
F: OTHER EMERGING NEEDS	F1. Responding to user needs for higher resolution, real time data		x	x	x				x			x		x
	F2. Improved ECV satellite observations in polar regions				x				x			x		
	F3. Improve monitoring of coastal and Exclusive Economic Zones			x	x	x			x			x		
	F4. Improve climate monitoring of urban areas		x	x					x	x		x		x
	F5. Develop an Integrated Operational Global GHG Monitoring System		x		x				x	x		x		x

GCOS

Action B10: Identify gaps in the climate observing system to monitor the global energy, water and carbon cycles

WCRP-GCOS June 2023 Paris Workshop

PROCEDURES

A broad roadmap for GCOS-WCRP joint work coordinated by a joint GCOS-WCRP working group that will liaise with their respective expert groups (including the Global Carbon Project) and scientific communities.

1. **Formulate the global integrals corresponding to the 12 continuity equations**, encompassing land, ocean, cryosphere, atmosphere and the 3 distinct cycles + a rigorous quantification of the uncertainties + systematic and random errors.

2. **Describe in detail the procedures for submitting estimates** and the minimum requirements. These could be the first elements of a good practice guide.

3. **To reduce systematic errors** GCOS/WCRP will provide a reference ocean/land/cryosphere mask. All integrals will need to be calculated using a **reference ocean/land/cryosphere mask and averaged over the annual cycle.**

4. **Write a technical guide to define a common framework for how best to calculate the integral quantities and document the various types of errors.** Document known pitfalls. This should be part of a best practices guide.

5. **Building on existing community activities**, **establish a scientific community (including early career scientists and experts from the Global South)** to evaluate the global integrals needed for closing the continuity equations + identifying observational gaps & process understanding is needed.

6. Seek funding opportunities

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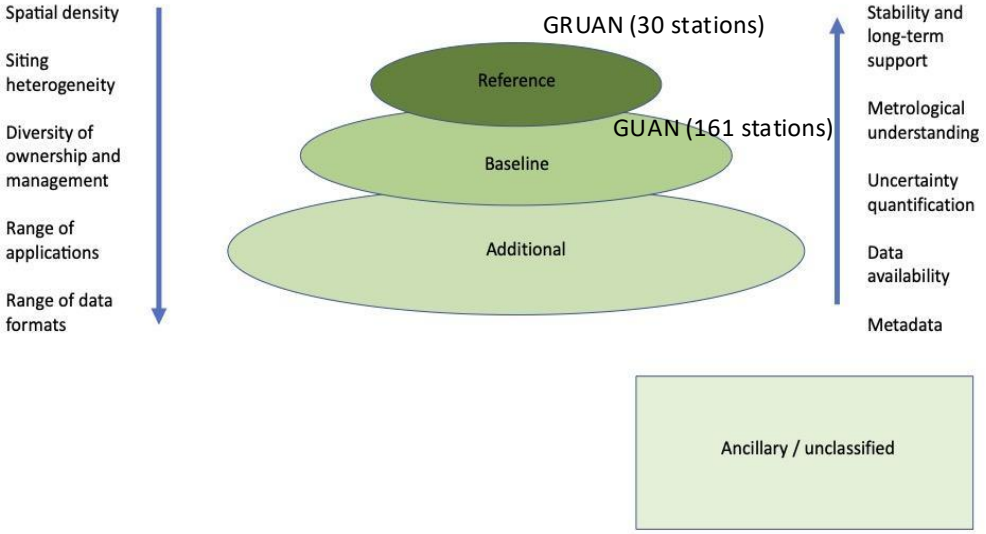
Reference Networks

Tiered Network approach



GCOS Reference Upper-Air Network

A reference network provides metrologically traceable observations, with quantified uncertainty, at a limited number of locations, or for a limited number of observing platforms.

GRUAN:

- Ground based network for reference upper air observations for climate under GCOS and integrated into WIGOS - **Priority 1: Water vapor, temperature; Currently 33 sites**
- Maintain consistent reference observations over decades
- Standardization and traceability
- Deliberate measurement redundancy
- Quality management and change management
- Validation of satellite systems

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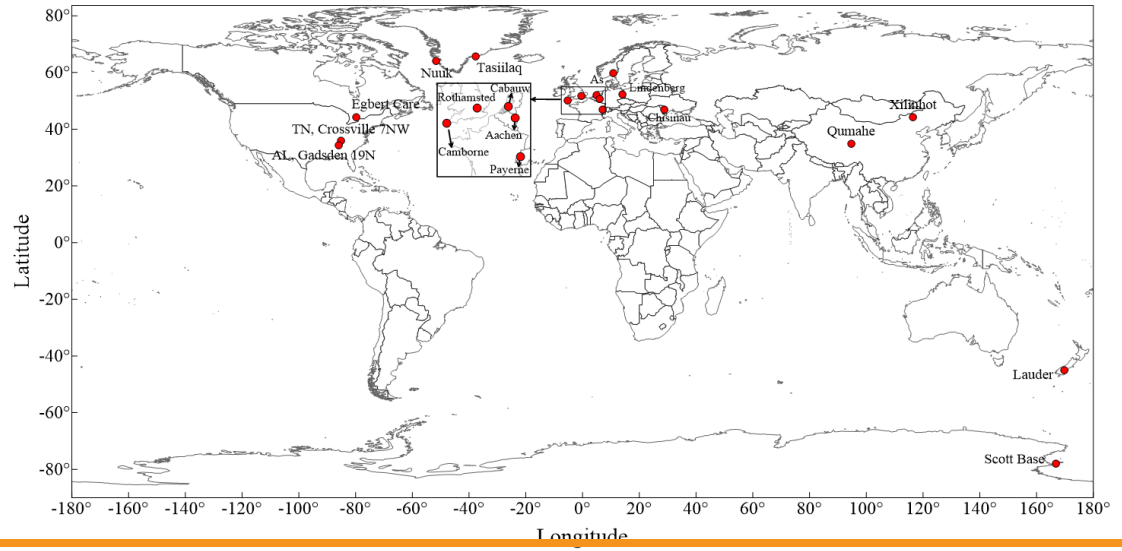
GSRN (Pilot)



GSRN Ref No.	Station Name	Country
01	Egbert CARE	CANADA
02	TN, Crossville 7NW	USA
03	AL, Gadsden 19N	USA
04	Cabauw	THE NETHERLANDS
05	Chisinau	Republic of Moldova
06	As	NORWAY
07	Aachen	Germany
08	Lindenberg	Germany
09	Camborne	UK
10	Rothamsted	UK
L1	Qumahe	China
L2	Xilinhot	China
L3	Payerne	Switzerland
L4	Scott Base	New Zealand
L5	Lauder	New Zealand
L6	Nuuk	Denmark
L7	Tasiilag	Denmark

Implementation of Pilot (GSRN)

- Mandatory variables: Temperature and Precipitation
- 17 pilot GSRN station across 11 countries: Canada, China, Denmark, Germany, Moldova, Netherlands, New Zealand, Switzerland, UK, USA
- LC/TT-GSRN working with station contact to ensure:

Station and measurement level metadata and data transfer (CSV, BUFR, WIS2.0)

Working together with SC-MINT ET-MU to calculate uncertainties for temperature

GCOS and WCRP

Strong “structural” similarities: long-standing programmes (> 30y), both hosted by WMO, both co-sponsored WMO, IOC, and ISC.

Several members are both members of GCOS Panels and of WCRP (GCOS panels are co-sponsored by WCRP). CLIVAR is an ex-officio member of OOPC.

- TOPC we have a new member (since October 2024) on Evaporation from Land: Li Jia (Chinese Academy of Sciences) member of GEWEX Scientific Steering Group (SSG)

- GCOS OOPC Chair ex-officio member of ESMO Group on Observations for Researching Climate (WGORC)

WCRP representative in WMO Climate infrastructure (led by GCOS Steering Committee deputy chair)

WCRP participates actively in the GCOS Steering Committee

GCOS and WCRP often lead activities jointly (e.g., activity in Earth Cycles)

Thank you

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