GCOS and Adaptation: GATT the GCOS Adaptation Task Team

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13th ESA CCI colocation - CMUG Integration meeting

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GLOBAL CLIMATE OBSERVING SYSTEM

KEEPING WATCH OVER OUR CLIMATE

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PPT Outline

1- (short) intro to GCOS

2- GCOS IP and Space Agencies

3. GCOS and Adaptation

GCOS – Global Climate Observing System

GLOBAL CLIMATE OBSERVING SYSTEM

KEEPING WATCH OVER OUR CLIMATE

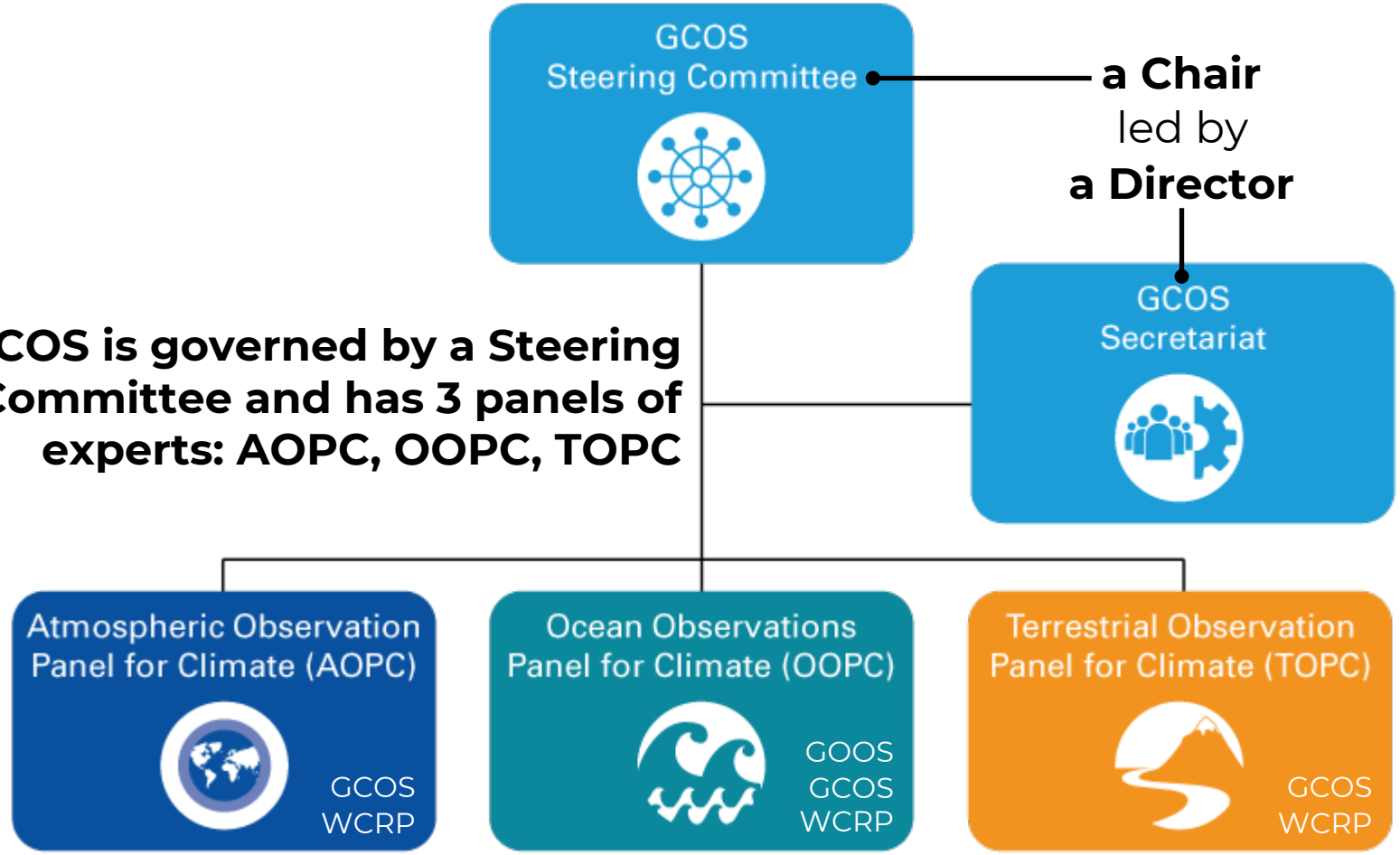
GCOS is a Co-Sponsored Programme:

- **WMO**
- **IOC - UNESCO**
- **UNEP**
- **ISC**

Additional contributors:
EU Commission, US State Dept., NOAA, Germany, EUMETSAT

GCOS was established in 1992 to address the UNFCCC systematic observation agenda

GCOS is governed by a Steering Committee and has 3 panels of experts: AOPC, OOPC, TOPC



GCOS – New Leadership

New Director of the GCOS Secretariat:
Mr Nir Stav
Previous Executive Director of the
Israeli Meteorological Service

New Chair of GCOS Steering Committee:
Ms Thelma Krug
INPE, National Institute for Space Research of Brazil
Previous vice-chair of IPCC

GCOS – Global Climate Observing System

VISION: a world where users have free access to the climate-related information they need

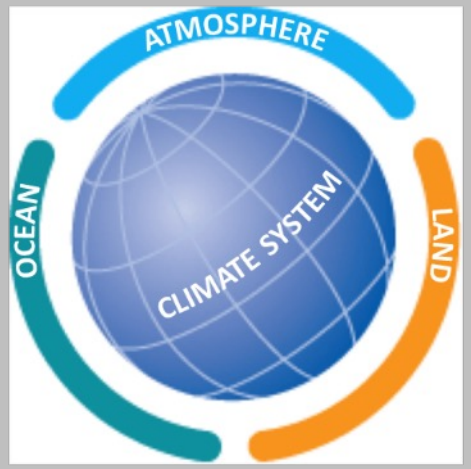
MISSION: GCOS is the authoritative global source of information and advice for planning and developing the global observing system for climate, its networks and data management; and a reference for formulating requirements for space and in situ climate observations

ACTIVITIES

Identify user needs for climate monitoring, adaptation, mitigation, sustainable development, UNFCCC and other MEAs

Ensure that climate **observations are enhanced and continued** into the future

Advocate for **free and open access** to relevant climate data



GCOS: an integrated system of systems

GCOS does not make observations itself, is a system of systems cooperating with a wide range of organizations: National Meteorological and Hydrological Services, Satellite Agencies, in situ networks, National and regional bodies, Research centres, etc.

Other Global Organizations and Networks for specific terrestrial ECV

Satellite observations are coordinated by the Joint CEOS/CGMS Working Group on Climate

Examples of national and regional networks

Meteorological related networks, like: WIGOS, GSN, GUAN, GRUAN, GBON

a number of different ocean climate-related networks, in collaboration with GOOS

Examples of global networks associated with GCOS

and a wide range of other partners who support GCOS, host data centres, etc

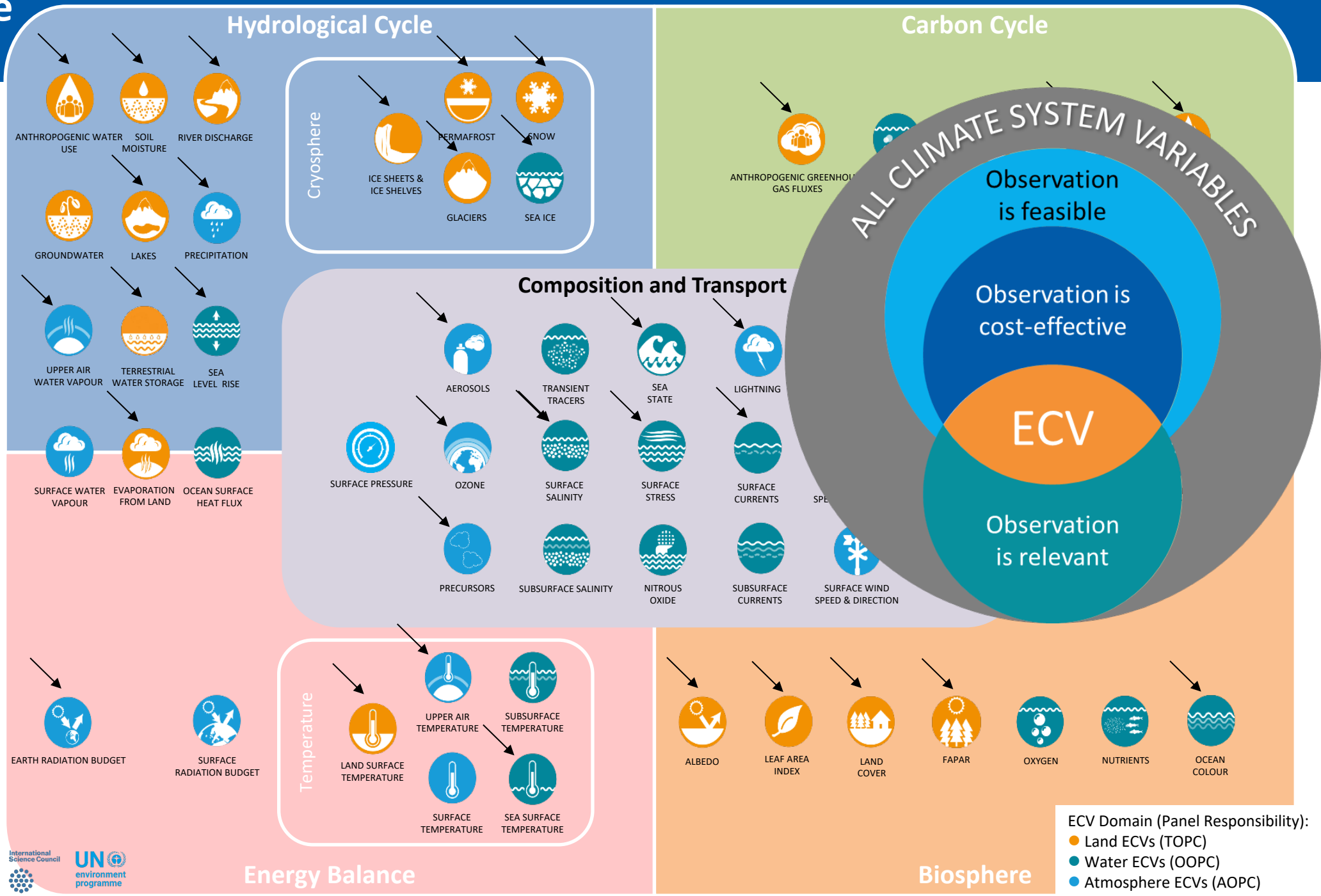
Essential Climate Variables - ECVs

55 ECVs - 37 can be measured from space

ECVs aim to monitor the climate system as a whole, covering the interlinked Earth's energy balance and the carbon and water cycles.

ECVs observations need to be:

- Feasible
- Cost-effective
- Relevant



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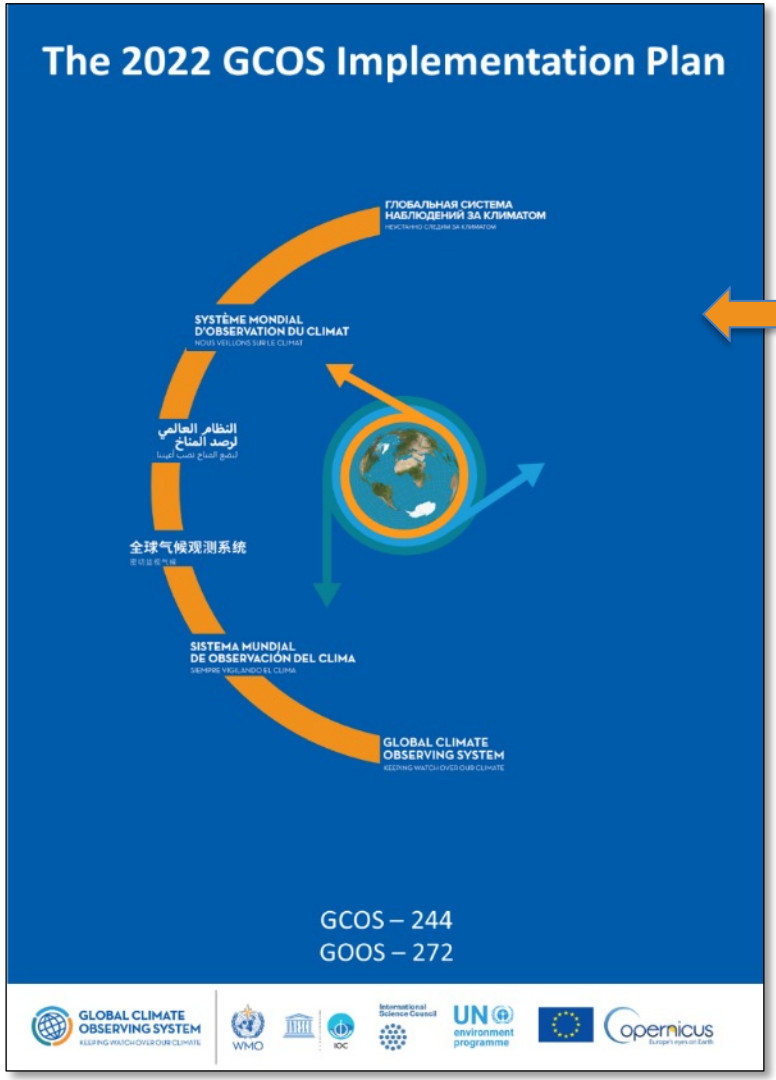
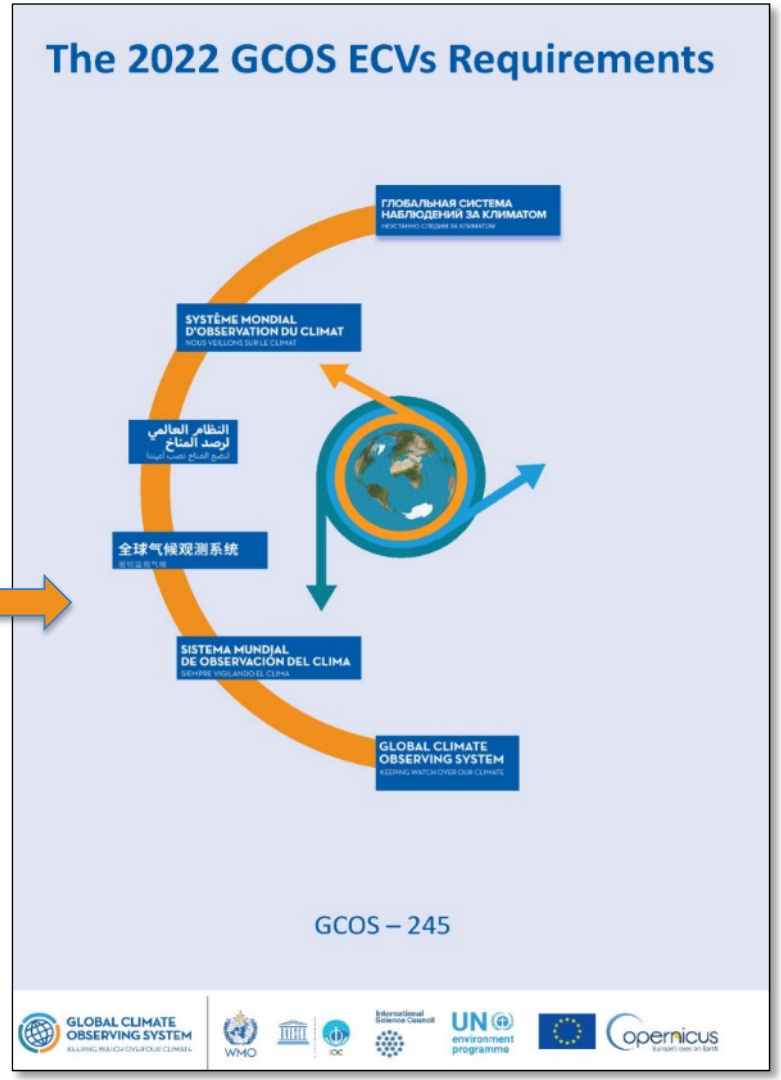
The GCOS Implementation Plan and ECVs REquirements



- **Published every ≅ 5 years**
- **Submitted to UNFCCC**

- **Actions for addressing gaps and improvements of a fit for purpose Global Climate Observing System**

- **Published jointly with the 2022 GCOS IP**
- **Provides the observational requirements for 55 ECVs (and more ECV products)**



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GCOS IP and Space Agencies

31 actions

16 (>50%) relevant to Space Agencies

Theme	Actions	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

GCOS IP Actions with relevance for Space Agencies

Theme A: Ensuring Sustainability

Action A2: Address gaps in satellite observations likely to occur in the near future

Action A3: Prepare follow-on plans for critical satellite missions

Action B1: Development of reference networks (in situ and satellite Fiducial Reference Measurement (FRM) programs)

Action B3: New Earth observing satellite missions to fill gaps in the observing systems

Action B5: Implementing global hydrological networks

Action B6: Expand and build a fully integrated global ocean observing system

Action B9: Improve estimates of latent and sensible heat fluxes and wind stress

Theme B: Filling Data Gaps

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GCOS IP Actions with relevance for Space Agencies

Theme C: Improving Data Utility

- Action C1: Develop monitoring standards, guidance and best practices for each ECV
- Action C2: General Improvements to Satellite Data Processing Methods
- Action C4: New and improved reanalysis products
- Action C5: ECV-specific Satellite Data Processing Method Improvements

Theme D: Managing Data

- Action D4: Create a database of co-located in situ cal/val observations and satellite data for quality assurance of satellite products

Theme F: Emerging Needs

- Action F1: Responding to user needs for higher resolution, near real time data
- Action F2: Improved ECV satellite observations in polar regions
- Action F3: Improve monitoring of coastal and Exclusive Economic Zones
- Action F5: Develop an Integrated Operational Global GHG Monitoring System

Space Agency Response to the GCOS IP

WGClimate* is coordinating the Space Agency Response to the GCOS IP

- A collaborative effort between WGC and GCOS experts
- Partially shared membership: WGC ex-officio members in GCOS Panels
- GCOS rapporteurs for each satellite actions have been identified
- Regular interactions between WGClimate chairs and GCOS Secretariat
- Regular reporting on progress on actions by WGC to GCOS, using an agreed template

* the Joint Committee on Earth Observation Satellites (CEOS) and Coordination Group for Meteorological Satellites (CGMS) Working Group on Climate.

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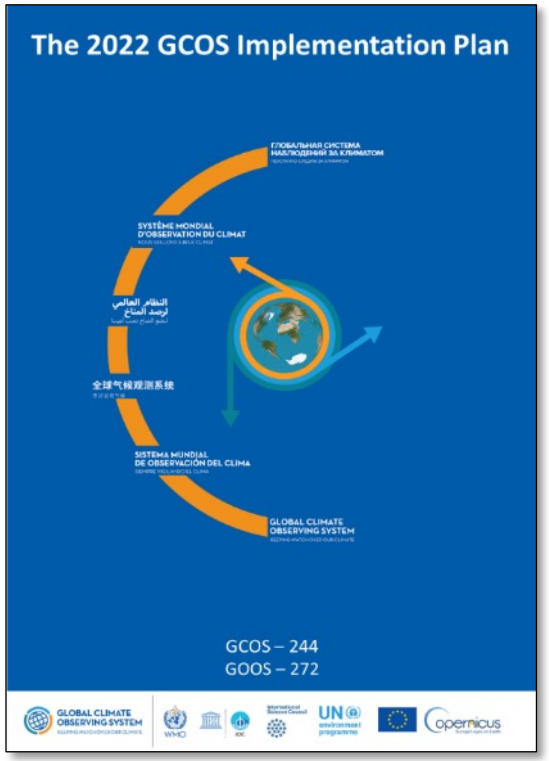
GCOS IP and Adaptation

The 2022 GCOS Implementation Plan has planned collective actions focusing on different aspects of adaptation and involving a wide range of stakeholders, including Space Agencies:

- **C4. New and improved reanalysis products**
- **E1. Foster regional engagement in GCOS**
- **F1. Responding to user needs for higher resolution, real time data**
- **F3. Improve monitoring of coastal and Exclusive Economic Zones**
- **F4. Improve climate monitoring of urban areas**



GATT - the GCOS Adaptation Task Team

Why GATT?

The GATT was established in 2021 as a GCOS response to the growing importance of adaptation in the frame of multilateral international agreements, especially the Paris Agreement.

From Global to Local

- **GCOS is intrinsically and traditionally focused on global or regional scale**
- **impacts of extremes and adaptation are primarily at the local scale**
- **the GATT initiated a study to assess how global climate observations can best support climate-resilient development through adaptation to climate change**

GATT – 3 Case Studies

Three Case Studies

The suitability, in terms of spatial and temporal resolution, of existing ECVs for adaptation application (observations for and of adaptation) was investigated across 3 case studies in 3 different critical sectors:

1) **forest wildfire management**
2) **pluvial flood risk assessment in urban areas**
3) **ocean extremes**

GATT results – Wildfire case study

17 atmospheric and terrestrial ECVs, and 27 ECV related products, were identified as relevant for forest wildfire adaptation.

ECV	ECV product
Terrestrial ECVs	
Above-Ground Biomass	Above-Ground Biomass
Evaporation from Land	Transpiration
FAPAR	FAPAR, Fraction of Absorbed Photosynthetically Active Radiation
Fire	Active Fire
	Burned Area
	Fire Radiative Power
Precipitation	Accumulated Precipitation
Surface Water Vapour	Relative Humidity (near surface)
Surface Wind Speed and Direction	Wind Direction (near surface)
	Wind Speed (near surface)
Upper Air Wind Speed and Direction	Wind (horizontal) in the Boundary Layer
Upper-Air Temperature	Atmospheric Temperature in the Boundary Layer
Upper-Air Water Vapour	Relative Humidity in the Boundary Layer
	Specific Humidity in the Boundary Layer
	Water Vapour Mixing Ratio in the Upper Troposphere and Lower Stratosphere

An example of the exercise: Fire Danger Modelling

ECV	ECV Products	Spatial resolution requirements*	Temporal resolution requirements*
Land Surface Temperature	Land Surface Temperature	<1 km (G); <1 km (B); 1 km (T)	<1 h (G); 1 h (B); 6 h (T)
Precipitation	Accumulated Precipitation	50km (G); 125 km (B); 250 km (T) > resolution needed	1 day (G); 1 month (B); 1 year (T)
Soil Moisture	Surface Soil Moisture	1 km (G); 10 km (B); 50 km (T)	6 h (G); 24 h (B); 48 h (T)
Surface Wind Speed and Direction	Wind Direction (near surface)	10 km(G); 100 km(B); 500 km (T)	<1 h (G); 1 h (B); 3 h (T)
	Wind Speed (near surface)	10 km(G); 100 km(B); 500 km (T)	<1 h (G); 1 h (B); 3 h (T)

- **help evaluate whether wildfire risk and impacts have changed over time in response to adaptation actions.** **observations of adaptation**

GATT – results

Many ECVs are relevant for adaptation.

Long-term global datasets of ECVs can complement local information in a consistent framework, by feeding regional and global climate models as well as reanalysis.

However, to be more effective for local adaptation:

- **the quality of climate datasets, in terms of completeness, accuracy, resolution, interoperability and accessibility, has to be improved**
- **climate datasets should be integrated with non-climatic information, i.e. socio-economic, demographic, technological, environmental, etc.**


Photo by Michael Held (from https://unsplash.com)

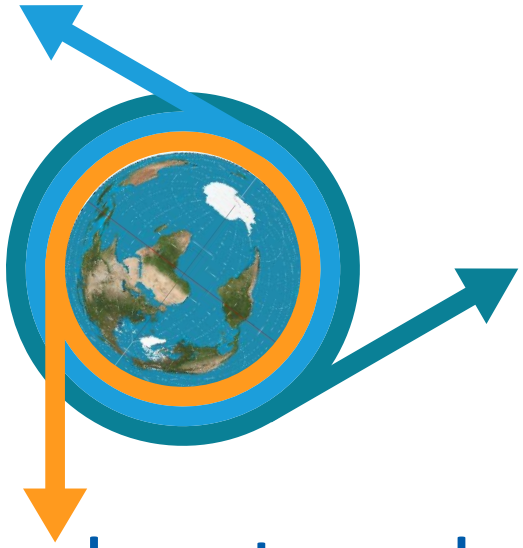

Photo by Sébastien Baille (France), WMO 2022 Calendar Competition


Photo by Muhammad Amdad Hossain (Bangladesh), WMO 2022 Calendar Competition

GCOS and Adaptation – Conclusions and Way Forward

Conclusions

- GCOS is a global system and cannot support all the various local needs that are better determined and responded to at a local level.
- A complete assessment cannot be done by GCOS alone: key adaption stakeholders and experts need to be involved.



Way Forward

- Workshop: GCOS to organize workshop(s) involving major adaptation implementers and thematic experts, to identify ECVs, global datasets and climate information, including spatial and temporal specifications, needed for adaptation.
- Paper: GCOS to lead the preparation of a paper on improving the accuracy and reliability of reanalysis and climate models to be used for tailoring adaptation to the expected regional and local changes.
- Satellites: promote the use of high-resolution space-based observations (≃10m) for monitoring changes at local level and planning adaptation measures.

The GATT Team

Bombelli A.[1], Cagnazzo C.[2], Desanker P.[3], Dolman A.J.[4], Eggleston S.[1], Fiorino C.[3], Herold M.[5], Hollmann R.[6], Kent E.[7], Koll R.M.[8], Kremer H.[9], Krug T.[10], Martín Míguez B.[1], Post J.[3], Rea A.[1], Rodrigues R.[11], Rusticucci M.[12], Seitzinger S.[13], Speich S.[14], Tapper N.[15], Tassone C.[1]

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