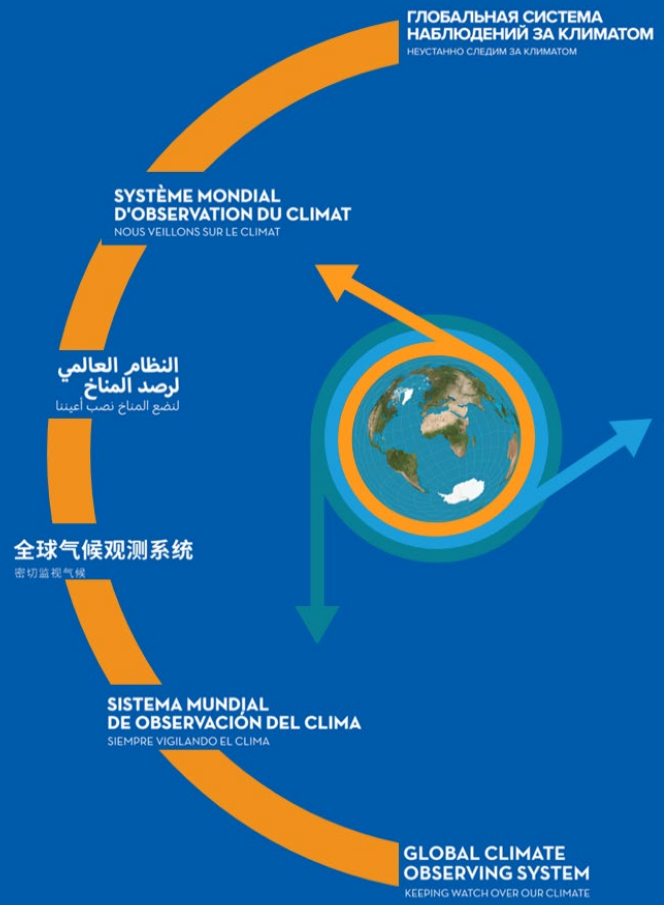

GCOS IP Action A1.1 – Sustainability of in situ networks

Caterina Tassone

GLOBAL CLIMATE OBSERVING SYSTEM
KEEPING WATCH OVER OUR CLIMATE

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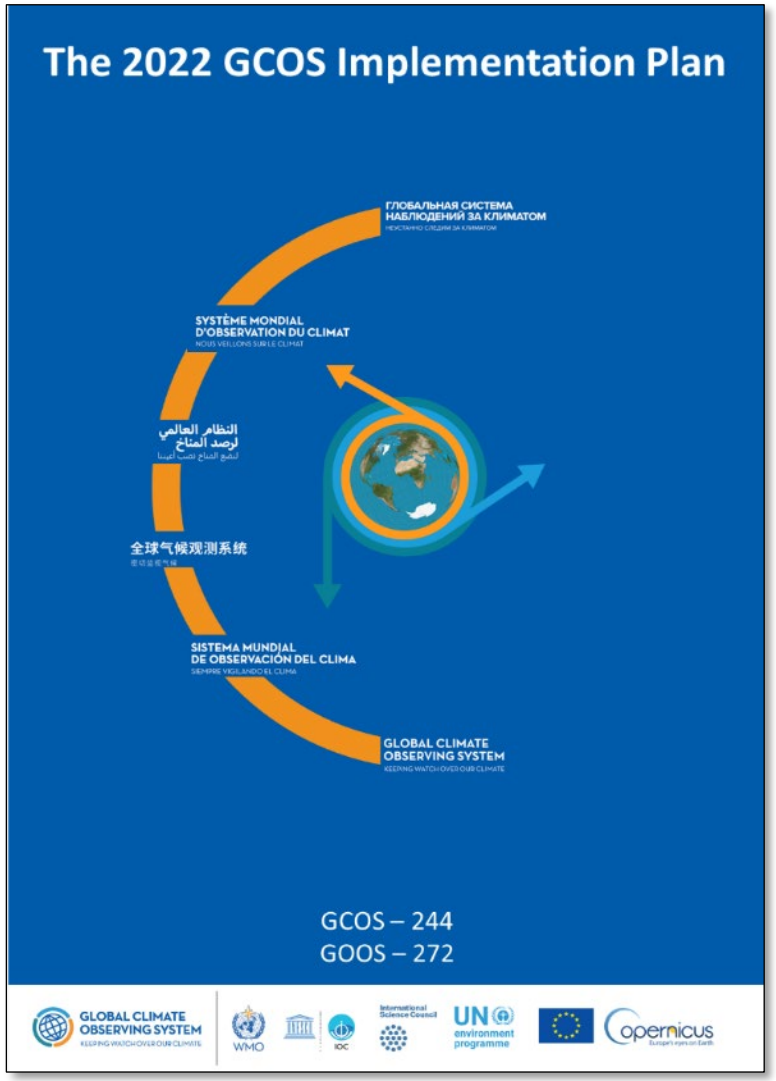
The exercise in GCOS IP Action A1.1

Action A1: Ensure necessary levels of long-term funding support for in situ networks, from observations to data delivery	
Activities	1. Undertake an assessment of current levels of funding support for global in situ networks delivering relevant in situ ECV data, including cal/val measurements, and identify those in situ networks with immediate or short-term problems around adequacy and sustainability of funding - by end of 2023. 2. Identify entities that can provide support for the networks identified as at risk in Activity 1. 3. Advocate with funding agencies to support identified networks.

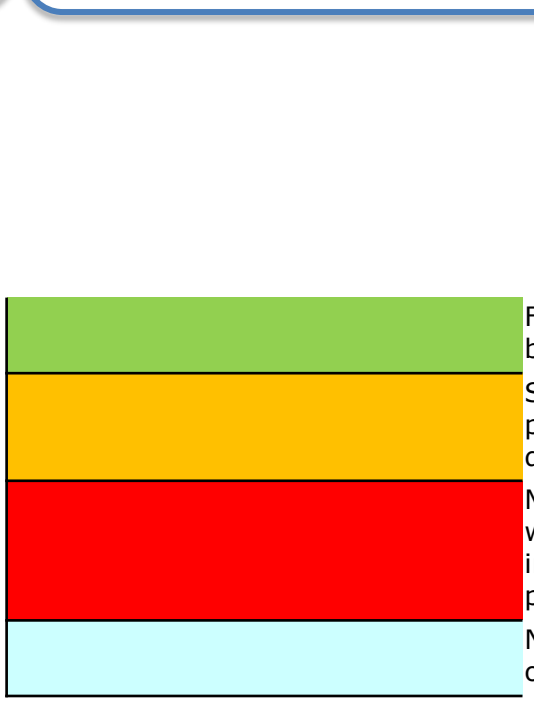
Means of Assessing Progress	1. Initial inventory of the funding profile for identified in situ networks that provide ECVs, considering adequacy and sustainability of funding support. Findings are to be prepared by all GCOS panels and consolidated in the [illegible] report by the end of 2023. The report should provide a current health snapshot of financial support for the networks. 2. Regularly reassess and report in future GCOS Status Reports progress towards sustainable funding for those networks designated in the initial report as inadequate or at risk. 3. Number of in situ networks for which funding support as a whole has been improved.
Additional Details	GCOS panels should inventory key current in situ networks and ascertain their levels of support, and barriers to their full implementation, and highlight examples of existing sustainable solutions. NMHSs, research performing organizations and other public and private funders should then take the outcomes of these assessments and attempt to remedy issues raised. A final assessment will then be made at the end of the IP / Status report cycle.



The exercise

Name of the in situ network	provided ECVs	Monitoring Platform	Type of funding	Funding cycle/horizon	Projected change in density/coverage (5y)	Meeting ECVs Spatial Requirements	Global/Regional coverage (specify)	Current Status (colour code)

Name of the in situ network	provided ECVs	Monitoring Platform	Type of funding	Funding cycle/horizon	Projected change in density/coverage (5y)	Meeting ECVs Spatial Requirements	Global/Regional coverage (specify)	Current Status (colour code)
International Soil Moisture Network	Moisture, Freeze/Thaw, Surface Inundation, Root Zone Soil Moisture)	in situ (network of networks)	A (for ISMN), A-C for original data provider	ongoing, operational	increased and formalised data acquisition efforts		yes, but significant data gaps	
USCRN	Land surface temperature	in situ (radiometers)	B			20%	Regional, US	
SURFRAD	Land surface temperature	in situ (radiometers)	B			20%	Regional, US	
GTN-R (Global Terrestrial	River Discharge	in situ river gauging	B both for GRDC and	ongoing, operational	dependent on national	yes	Global, but sparse	
Global Runoff Database at	River Discharge	in situ river gauging	B both for GRDC and	ongoing, operational	dependent on national	yes	Global, but sparse	
GTN-L	**Lakes:** lake lewel, lake surface temperature	in situ lake gauging stations	B	ongoing, operational	dependent on national policy	no data	Regional, mostly Europe and North America	
FLUXNET (and contributing networks) - ICOS ??	Evaporation from land (transpiration, bare soil	in situ (eddy covariance)	Mix of A and B, depending on the	Depending on the station and regional		20%	Global but tropical regions heavily	
Global Groundwater Monitoring Network (GGMN) at the International	Groundwater	In-situ (network of networks)	B for GGMN, but the national monitoring networks are	ongoing, operational	dependent on national policy		Global, but sparse station density in Central America and	
GTN-L (Global Terrestrial Network for Lakes)	Lakes: lake level, lake surface temperature	in situ lake gauging stations	B	ongoing, operational	dependent on national policy	no data	Regional, mostly Europe and North	
WGMS	Glacier Mass Change	in situ (network of	**B**	4 years	dependent on national	80%	global, some regions	
FAO/AQUASTAT	irrigation water use							
GEOTREES	Biomass	In-situ, terrestrial	A mix of B and C,	Next 5 years	Priority sites have	50-100%	Global	
GTN-G	Glaciers	in situ and remote sensing	Mix of A and C					
BSRN	Surface albedo (only broadband)	in-situ	B and C		10%	yes	Global	
Copernicus GBOV	FAPAR; Albedo; LAI; Soil Moisture	in situ (radiometers) and DHP	A	4 years (Copernicus)	50%	70%	Global (with some missing regions)	Depend on EU MMF
Copernicus LAW	Land surface temperature	in situ (radiometers)	A	3 years (Copernicus)		20%	Regional, mostly Europe	
SAPFLUXNET	Evaporation from land (transpiration)	in situ (sapflow meters)	A. Fixed-duration funding. Funding	Next 4 years (not recurrent)	Expected doubling of the number of sites,	10%	Global but measurements are	
GTN-P	Permafrost	glacier velocity (RGV); partly remote sensing (RGV only)	Mix of A and C	4 years project cycles. Presently		Difficult to achieve in very remote	global, some regions underrepresented	



Funding available, observations can be maintained for the next 3-5 years

Significant funding uncertainty or problems with data quality. Sustained quality conservations at risk

Major funding risk, funding ended or will do so within <3 year, instruments lost or not deployed, no prospect of redeployment

Not applicable, not making these observations is sustained mode

GCOS WMO unesco Intergovernmental Oceanographic Commission International Science Council UN environment programme

Synthesis

WHAT THE EXERCISE DOES NOT DO

- The exercise **was not an assessment of whether the network is actually meeting the observational requirements**. A network considered fully operational (green) may nevertheless be insufficient in aspects like geographical coverage, data management or data quality (covered in other Actions of GCOS IP)

- The exercise **was not an evaluation of the level of funding invested in each network/ECV.** Two networks scored as “green” may have very different levels of total funding, and one network scored as “red” may have a greater funding, but still be precarious in that the funding is not guaranteed in the mid-term.

- The exercise **was undertaken using the networks** (not the individual ECVs). A single ECV can be measured by several networks (and a network can measure several ECVs) and this can lead to some nuances in the interpretation of the results.

The results

AOPC

National synoptic observation networks (land based)	Pressure, air temperature, surface wind, surface water vapour, precipitation, cloud (some products)
National synoptic observation networks (ocean)	Pressure, air temperature, surface wind, surface water vapour, precipitation
Global observing system (radiosondes)	UA T, UA WV, UA windspeed and direction
AMDAR	UA T, UA WV, UA windspeed and direction
Pilot balloons	UA windspeed and direction
GNSS-PW	UA WV
Wind profilers	UA windspeed and direction
Dual-pol radar	Precipitation, boundary and tropo winds
VOS / ASAP sondes	UA T, UA WV, UA windspeed and direction
Ozonesondes (NOAA, NASA, EU)	UA T, UA WV, UA windspeed and direction, ozone (concentrations and columns)
Baseline Surface Radiation Network (BSRN)	Downward Short-Wave Irradiance at Earth Surface, Downward Long-Wave Irr. at Earth Surface, Upward Long-Wave Irr. at Earth Surface
Atmospheric Composition	Atmospheric Composition (GHG, Ozone, Aerosols)
LIGHTNING	Lightning

OOPC

Core Argo	SST, Subsurface T, SSS, Subsurface S, Subsurface current
SOT	SST, Subsurface T
GO-SHIP	ALL EOVs, all depths
Sea level	Sea Level
OceanSITES	SST, Subsurface S, Surface Currents, Subsurface Currents, Sea State, Surface Stress, Ocean Surface Heat Flux, O2
DBCP - Moored	SST, Subsurface S, S and Subs Currents, Sea State, Surface Stress, Ocean Surface Heat Flux
HF Radars	Surface Currents
DBCP drogued	SST, Surface Currents, Surface Pressure
DBCP – drifting wave	Sea State, Surface Pressure
Biogeochemical Argo	Oxygen, Ocean Inorganic Carbon, Nutrients, Ocean nitrous oxide N2O
Deep Argo	Subsurface Temperature, Subsurface Salinity, Subsurface Currents
OceanGliders (UAV)	SST, Subsurface T, SSS, Subsurface S, pH, O2, subsurface current
USV	SST, SSS, S and Subs Currents,, Sea State, Surface Stress, Ocean Surface Heat Flux
AniBOS	SST Subsurface Temperature, SSS, Subsurface Salinity

TOPC

International Soil Moisture Network	Soil moisture (Surface Soil Moisture, Freeze/Thaw, Surface Inundation, Root Zone Soil Moisture)
USCRN	Land surface temperature
SURFRAD	Land surface temperature
GTN-R	River Discharge
Global Runoff Database at GRDC	River Discharge
GTN-L	Lakes: lake lewel, lake surface temperature
FLUXNET	Evaporation from land
GGMN	Groundwater
WGMS	Glacier Mass Change
FAO/AQUASTAT	irrigation water use
Copernicus GBOV	Land surface temperature; (not only as for validation); FAPAR; Albedo; LAI; Soil Moisture
GTN-G	Glaciers
BSRN	Surface albedo (only broadband)
GEOTREES	Biomass
Copernicus LAW	Land surface temperature
SAPFLUXNET	Evaporation from land (transpiration)
GTN-P	Permafrost

Synthesis per panel

ATMOSPHERE

- A vast majority of ECVs are measured with systems that are operational, inserted in long term programmes .
- The clearest exception are the ECVs related to **atmospheric composition**, whose measurements depend to a great extent on research funds and are not part of permanent monitoring programmes. (This does not mean that the density of the atmospheric networks is always sufficient and, in fact, this feature has not ceased to worsen in the last years (hence the creation of GBON), with significant regional variations.)

OCEAN

- Unlike the atmosphere, **the majority of the networks** are scored as yellow, meaning that they **are not supported by institutional, long-term funding**, but on cycles of less than 5 years.
- The situation is **particularly fragile for biogeochemical variables and subsurface variables**, while variables measured at surface and near the coast are generally better supported.
- **ECVs at the subsurface cannot be monitored with satellites.** This ncreases the importance of sustained in-situ networks.

TERRESTRIAL

- Approximately half of the in-situ networks and variables have sustained funding (those related to hydrology), **while the other half are supported mostly on research funding (biomass, soil moisture)**. Many terrestrial ECVs rely mostly in remote sensing (exclusively for Fire, or TWS), and the role of the in-situ measurements is less critical.
- The situation is **particularly worrisome for permafrost**.

Main message

ECVs at greater risk from the point of view of sustainability of the measurements are:

- Atmospheric composition ECVs.
- Most of the ocean ECVs in general, and in particular the subsurface and biogeochemical.
- Terrestrial ECVs related to biomass and permafrost.

Recommendation from GCOS Steering Committee

Steering Committee Recommendation:

- Avoid communicating all the details of this analysis but communicate the implications clearly, making strong points about the need to support the identified networks. In bringing this message to COP, it is important to add specifics on why the identified networks are important and what kind of remedy action we expect, actionable recommendations easily implemented by the Parties.
- Sustainability of the observing system – GCOS Secretariat to propose to present at the upcoming Earth Information Day (EID) at COP29 on the lack of sustainability of certain observing systems identified in the GCOS IP action A1, including the situation of the declining performance of GSN and GUAN.

Thank you!

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