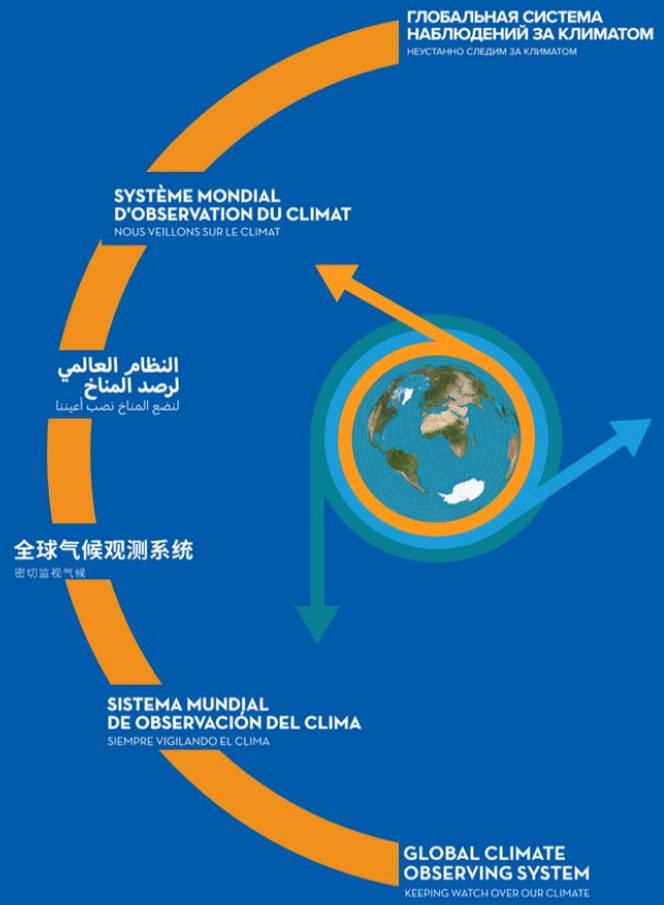

TOPC
Terrestrial Observation Panel for Climate

31st Session of the GCOS Steering Committee

Geneva, 2-5/07/2024

Martin Herold, TOPC Chair

GLOBAL CLIMATE OBSERVING SYSTEM
KEEPING WATCH OVER OUR CLIMATE

WMO

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Intergovernmental Oceanographic Commission

International Science Council

UN environment programme

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TOPC Membership

	Role		Name	Institution	Country	Expertise / ECVs
1	TOPC Co-chair	Mr	Martin HEROLD	Helmholtz-Centre Potsdam, German Research Centre for Geosciences (GFZ Potsdam)	Germany	AFOLU, IPCC / Biomass, Land Cover
2	TOPC Member	Mr	Andreas GÜNTNER	Helmholtz-Centre Potsdam, German Research Centre for Geosciences (GFZ Potsdam)	Germany	Hydrology, water storage, soil moisture, gravimetry / Groundwater, TWS
3	TOPC Member	Ms	Claudia RUZ VARGAS	IGRAC - International Groundwater Resources Assessment Centre	The Netherlands	Characterisation and management of water resources / Groundwater
4	TOPC Member	Mr	Diego MIRALLES	Ghent University	Belgium	Water and heat fluxes and biosphere-atmosphere interactions / Evaporation from Land
5	TOPC Member	Mr	Emilio CHUVIECO	Universidad de Alcala	Spain	Burned area mapping and fire risk assessment / Fire
6	TOPC Member	Mr	Matieu HENRY	FAO - Food and Agriculture Organization of the United Nations	Italy (International)	GIS, Carbon Cycle, Forestry / Land Cover, Biomass
7	TOPC Member	Ms	Nadine GOBRON	JRC - European Commission Joint Research Center, Directorate D - Sustainable Resources	Italy (International)	Terrestrial ECVs from in-situ and space / Albedo, FAPAR, LAI
8	TOPC Member	Ms	Nyambilila Abdallah AMURI	Sokoine University of Agriculture (SUA)	Tanzania	Soil chemistry and fertility, soil organic matter, carbon and nitrogen dynamics in soil especially for agriculture / Soil Carbon
9	TOPC Member	Mr	Simon MISCHEL	Global Runoff Data Centre (GRDC), Federal Institute of Hydrology (BfG)	Germany	Geography, paleoclimatology, groundwater-surface water interactions / River
10	TOPC Member	Mr	Wouter DORIGO	TU WIEN - Vienna University of Technology	Austria	Irrigation and vegetation observations from satellites and ground stations / Soil Moisture
11	interim - planning replacement	Mr	Hiroyuki ENOMOTO	National Institute of Polar Research	Japan	Snow and ice cover and cryospheric components / Ice Sheets and Ice Shelves
12	interim - planning replacement	Mr	Jean-François CRETAUX	CNES / Legos	France	Satellite altimetry and imagery for Lake water level, extent and volume database under the ESA-CCI / Lakes
13	ex officio GCW	Ms	Colleen MORTIMER	Environment Climate Change Canada, Climate Research Division	Canada	Glaciology, Remote Sensing / Snow
14	ex officio WGC	Mr	Darren John GHENT	University of Leicester, Department of Physics and Astronomy	United Kingdom	Satellite observations and modelling of land surface-atmosphere interactions in terms of energy balance, carbon and water cycles / Land Surface Temperature
15	ex officio GTN-G	Ms	Isabelle GÄRTNER-ROER	University of Zurich, World Glacier Monitoring Service (WGMS)	Switzerland	Cryosphere, glaciers and permafrost / Glaciers

TOPC - Terrestrial Observation Panel for Climate

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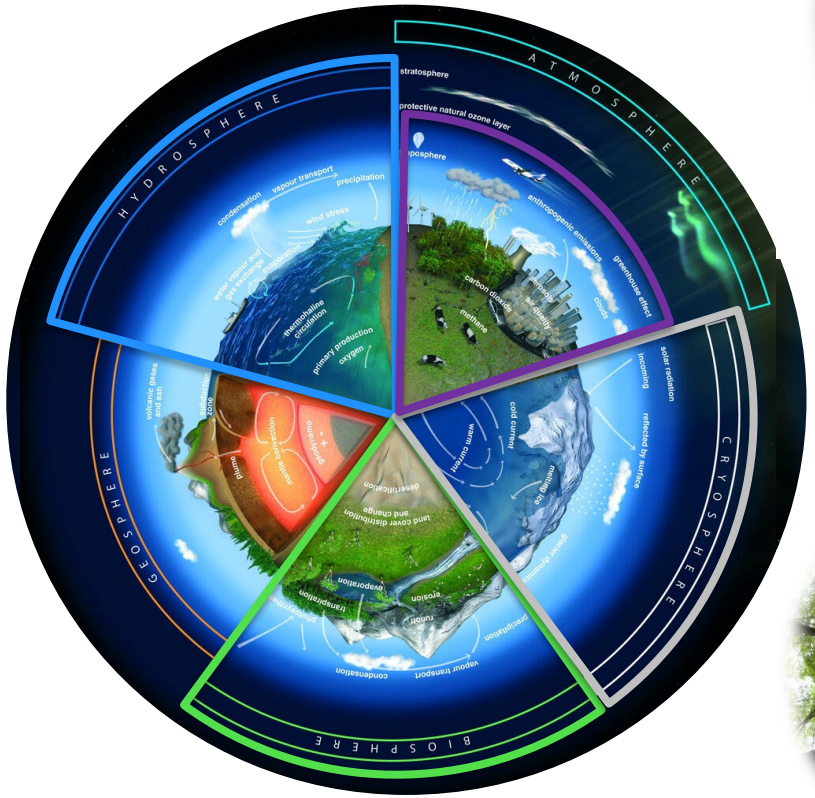
Terrestrial observations

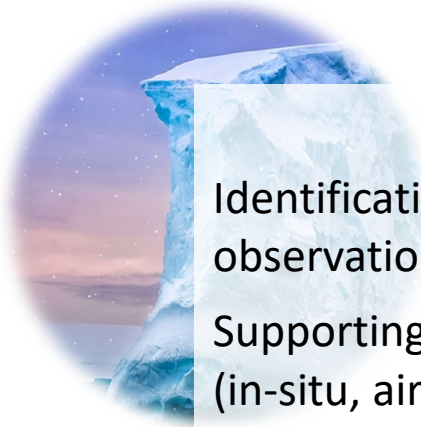
- Biosphere
- Cryosphere
- Hydrosphere
- Anthroposphere

In-situ and space-based observations of the terrestrial ecosystems for long-term monitoring of land properties and attributes which:

i) control the physical, biological and chemical processes affecting climate

ii) are themselves affected by climate change, are indicators of climate change and provide information on impacts of climate change.





TOPC activities

Identification of terrestrial observation requirements

Supporting observing networks (in-situ, airborne, space-based)

Guidance on observation standards and norms

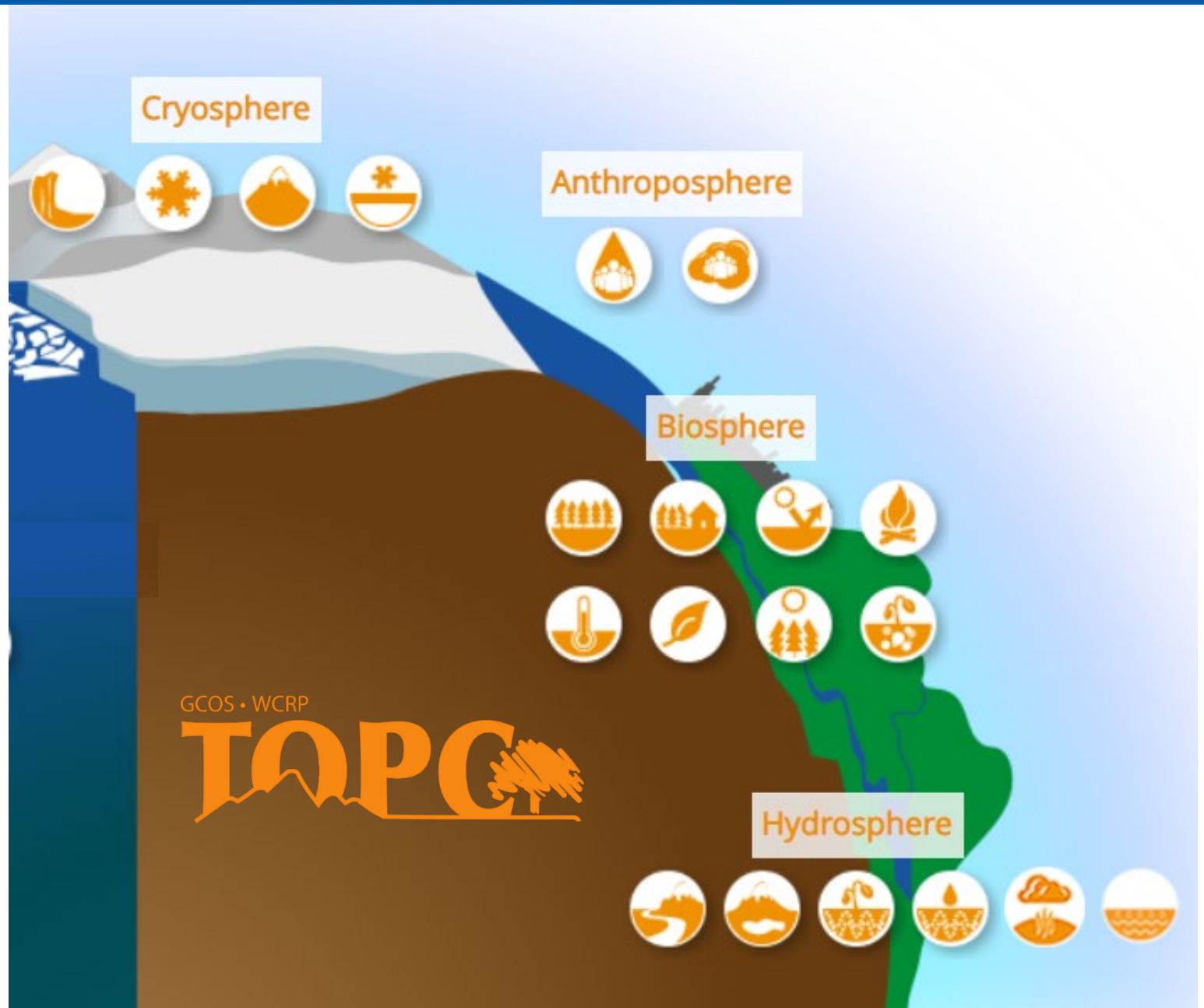
Facilitating access to data and information and its assimilation

Encouraging the use of best practices

Promoting climate studies and assessments.

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

20 Terrestrial ECVs (...at present!)



	ECV
	Hydrosphere
1	River Discharge
2	Lakes
3	Soil Moisture
4	Groundwater
5	Terrestrial Water Storage (TWS)
	Cryosphere
6	Snow
7	Glaciers
8	Ice Sheets and Ice Shelves
9	Permafrost
	Biosphere
10	Fraction of FAPAR
11	Leaf Area Index
12	Albedo
13	Above-Ground Biomass
14	Land Cover
15	Soil Carbon
16	Fire
17	Land-Surface Temperature
18	Evaporation from Land
	Anthroposphere
19	Anthropogenic Greenhouse-Gas Fluxes
20	Anthropogenic Water Use

20 Terrestrial ECVs – 57 quantities

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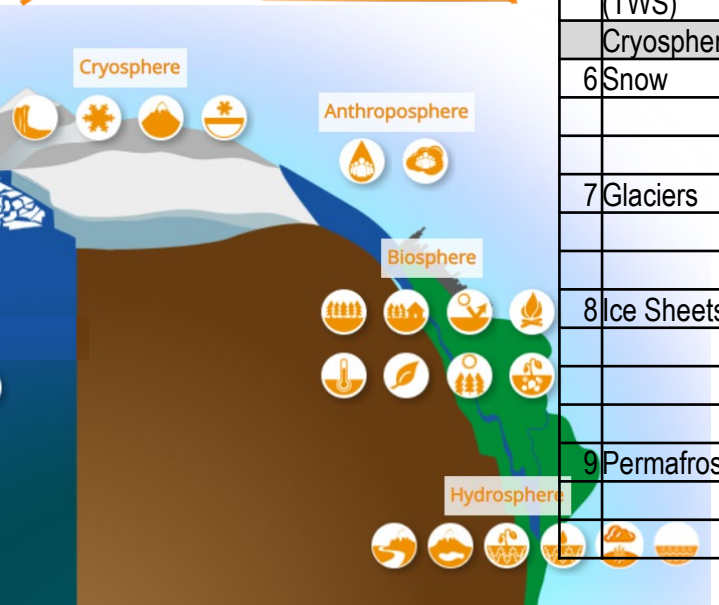

	ECV	ECV Product
	Hydrosphere	5 ECVs / 15 Products
1	River Discharge	River Discharge
		Water Level
2	Lakes	Lake Water Level (LWL)
		Lake Water Extent (LWE)
		Lake Surface Water Temperature (LSWT)
		Lake Ice Cover (LIC)
		Lake Ice Thickness (LIT)
		Lake Water-Leaving Reflectance
3	Soil Moisture	Surface Soil Moisture
		Freeze/Thaw
		Surface Inundation
		Root Zone Soil Moisture
4	Groundwater	Groundwater Storage Change
		Groundwater Level
5	Terrestrial Water Storage (TWS)	Terrestrial Water Storage Anomaly
	Cryosphere	4 ECVs / 13 Products
6	Snow	Area Covered by Snow
		Snow Depth
		Snow-Water Equivalent
7	Glaciers	Glacier Area
		Glacier Elevation Change
		Glacier Mass Change
8	Ice Sheets and Ice Shelves	Surface Elevation Change
		Ice Velocity
		Ice Volume Change
		Grounding Line Location and Thickness
9	Permafrost	Permafrost Temperature (PT)
		Active Layer Thickness (ALT)
		Rock Glacier Velocity (RGV)

	ECV	ECV Product
	Biosphere	9 ECVs / 20 Products
10	Fraction of FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
11	Leaf Area Index	Leaf Area Index (LAI)
12	Albedo	Spectral and Broadband (Visible, Near Infrared and Shortwave) DHR & BHR with Associated Spectral Bidirectional Reflectance Distribution Function (BRDF) Parameters
13	Above-Ground Biomass	Above-Ground Biomass (AGB)
14	Land Cover	Land Cover
		Maps of High-Resolution Land Cover
		Maps of Key IPCC Land Classes, Related Changes and Land Management Types
15	Soil Carbon	Carbon in Soil
		Mineral Soil Bulk Density
		Peatlands
16	Fire	Burned Area
		Active Fires
		Fire Radiative Power (FRP)
17	Land-Surface Temperature	Land Surface Temperature (LST)
		Soil Temperature
18	Evaporation from Land	Sensible Heat Flux
		Latent Heat Flux
		Bare Soil Evaporation
		Interception Loss
		Transpiration
	Anthroposphere	2 ECVs / 9 Products
19	Anthropogenic Greenhouse-Gas Fluxes	8 products on Anthropogenic CO2, CH4, N2O and F-Gas Emissions + Fluxes (National and Continental level) + CO2 Emissions/Removals by Land Categories + High-Resolution Footprint Around Point Sources
20	Anthropogenic Water Use	Anthropogenic Water Use

TOPC & GCOS IP Actions – an overview

IP Action	Activity / ECVs	Relevant Terrestrial Network
A1: Ensure necessary levels of long-term funding support for in situ networks, from observations to data delivery		GTN-H, GTN-G, GTN-P, GTN-L, GTN-R, ISMN, others
A2: Address gaps in satellite observations likely to occur in the near future	Altimetry in the polar regions (Ice sheets); Gravimetry missions (TWS, Groundwater); Biomass; Global scale ice surface elevation (Glaciers)	GTN-G, other
B1: Development of reference networks (in situ and satellite Fiducial Reference Measurement (FRM) programs)	Albedo, Biomass, FAPAR, Fire, LAI	
B2: Development and implementation of the Global Basic Observing Network (GBON)	Groundwater, Lake, River, Soil Moisture	GTN-H, GTN-L, HYDROLARE, GTN-R, ISMN? others?
B3: New Earth observing satellite missions to fill gaps in the observing systems	Develop operational techniques to estimate permafrost extent	GTN-P
B5: Implementing global hydrological networks	Improve the collection of hydrological observations (Groundwater, Lake, River, Soil Moisture, TWS). Report on the Anthropogenic Water Use.	GTN-H, GRDC/GTN-R, GTN-L, HYDROLARE, GGMN, ISMN, (AQUASTAT)
B9: Improve estimates of latent and sensible heat fluxes and wind stress	Evaporation from Land	
B10: Identify gaps in the climate observing system to monitor the global energy, water and carbon cycles	several trrestrial ECVs	
C1: Develop monitoring standards, guidance and best practices for each ECV	several ECVs	
C3: General improvements to in situ data products for all ECVs	several ECVs	
C5: ECV-specific satellite data processing method improvements	Permafrost, Land Cover, Fire, Biomass, Albedo, LAI, FAPAR	GTN-P
D1: Define governance and requirements for Global Climate Data Centres		GTN-H, other
D2: Ensure Global Climate Data Centres exist for all in situ observations of ECVs		FLUXNET, GRDC, GTN-G, GTN-P, GTN-R, HYDROLARE, ISMN, SAPFLUXNET, WGMS
D3: Improving discovery and access to data and metadata in Global Climate Data Centres		FLUXNET, GRDC, GTN-G, GTN-P, GTN-R, HYDROLARE, ISMN, SAPFLUXNET, WGMS
D4. Create a facility to access co-located in situ cal/val observations and satellite data for quality assurance of satellite products		
D5: Undertake additional in situ data rescue activities		
F2: Improved ECV satellite observations in polar regions	Land surface temperatures, Albedo	
F4: Improve climate monitoring in urban areas	terrestrial ECVs that are urban-relevant	
F5: Develop an Integrated Operational Global GHG Monitoring System	Anthropogenic Greenhouse-Gas Fluxes	

TOPC & WMO

TOPC has a unique position under the WMO Earth System Approach:

- Monitoring of climate change and impacts on land
- Land contribution to the Global Greenhouse Gas Watch (G3W)
- Biosphere: no counterparts in WMO
- Cryosphere: GCW is ex-officio member
- Hydrology: TT EarthHydroNet Task Team, INFCOM-3 Decision on Hydrological Data Centers (see following slide)
- GBON expansion to hydrological variables for climate applications

TOPC Responsible for RRR - Rolling Review of Requirements:

- AA 4.2 Hydrological and Terrestrial Climate Monitoring
- AA 5.3 Cryospheric Climate Monitoring

WMO - INFCOM decisions on hydrological data centers

INFCOM-3 Decision on the WMO Global Hydrological Data Centers

The following data centers/networks (linked to GCOS/TOPC) were recognized as supporting WMO efforts in hydrological cycle observations.

- **GRDC – Global Runoff Data Center**
- **IGRAC** – International Groundwater Resources Assessment Center
- **HYDROLARE** – International Data Center on Hydrology of Lakes and Reservoirs
- **ISMN** – International Soil Moisture Network
- **GTN-H** – Global Terrestrial Network Hydrology

Workplan to be developed for registering them as WMO centers.
Relevance to:

- Possible GCOS recognition process for global climate data centers
- Action D1 - Define governance and requirements for Global Climate Data Centres (see Item 7.3)
- Action D2 - Ensure Global Data Centres exist for all in-situ observations of ECVs

TOPC & Hydrology

GBON expansion to hydrological observations

Developing a rationale – in the frame of the TT EarthHydroNet – for expanding GBON to hydrological ECVs for climate application, starting with soil moisture, evaporation, precipitation, and river discharge (other variables can be considered).

This will contribute to the GCOS-IP actions:

- B2: development and implementation of the global basic observing network (GBON)
- B5 - implementing global hydrological networks

Gcos cooperation mechanism to support hydrological observations

Considering the soff support to atmospheric observations, gcos sc-30 suggested to use the gcm in support to hydrological observations. TOPC is planning, with the support of germany, a pilot project to support hydrological field stations (e.G. River discharge) and related capacity building in underrepresented regions (probably central asia, i.E. Uzbekistan).

This will contribute to the gcos-ip actions:

- B5 - implementing global hydrological networks
- E3 - enhance support for national climate observations

TOPC Related Networks

GTNs – Global Terrestrial Networks
(born of two parents organizations: GCOS & GTOS) ⟶ legacy to TOPC

- **GTN-H** – Global Terrestrial Network for Hydrology
- **GTN-R** – Global Terrestrial Network for River
- **GTN-L** – Global Terrestrial Network for Lakes (i.e. Hydrolare)
- **GTN-G** – Global Terrestrial Network for Glaciers
- **GTN-P** – Global Terrestrial Network for Permafrost

TOPC contribution to GCOS IP Action: A1 - Ensure necessary levels of long-term funding support for in-situ networks, from observations to data delivery (see Item 7.2).

TOPC Related Networks

GTNs – Global Terrestrial Networks - Application for GCOS Network Accreditation

- **GTN-H** – Global Terrestrial Network for Hydrology
- **GTN-R** – Global Terrestrial Network for River

Planning to apply as GCOS Affiliated Network

Part of the GLOBAL CLIMATE OBSERVING SYSTEM a GCOS Affiliated Network

	Network Oversight	Reporting
GCOS Network	GCOS, oversight by GCOS Network Manager or GCOS panels	Annually to GCOS, represented at GCOS Meetings
GCOS Affiliated Network	Oversight exists but is not GCOS e.g. OCG for ocean networks or this is part of the network as in the GTN	Annual report available but no direct reporting to GCOS
GCOS Recognized Network		

TOPC and GCOS Sponsors

WMO

- Hydrology and Cryosphere
- Biosphere missing: TOPC (almost) unique contribution to the WMO Earth System approach

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OOPC
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- Not only ocean!
- UNESCO was GTOS sponsor for the land component
- Hydrology: UNESCO Intergovernmental Hydrological Programme

UN environment programme

- CH_4 Emissions Observations
- Climate impacts on Health?
- Hydrology and Cryosphere
- Adaptation

International Science Council

- Data Centers
- …

WCRP
World Climate Research Programme

- Hydrology
- Cycles
- Fluxes

TOPC external relations

- Natural link with FAO (previous TOPC co-sponsor at the time of GTOS) for land cover, biomass, forestry, agriculture, soil, fire, Aquastat, etc.
- GEO – Group on Earth Observations: for land-related observations, GFOI, GEOTREES, GEOGLAM
- CEOS: AFOLU roadmap
- ESA-CCI (14 terrestrial ECVs), Copernicus services (climate, land)
- Countries: global terrestrial earth observations to support national level monitoring and adaptation

TOPC – Conclusions and Challenges

- Unique position: establishment of integrated observing networks (in-situ, satellite, …) in the terrestrial domain (Biosphere, Hydrosphere …)
- Key partnerships for space observations: observation/monitoring programs (cal/val networks, Copernicus, ESA, NASA …)
- Support the terrestrial networks (ideally for all terrestrial ECVs)
- Climate change adaptation (to be decided at this SC) and Mitigation (G3W, i.e terrestrial/biosphere/land use component)
- Climate indicators / ECV Rationalization / Data Centers
- Working on global and national level: adaptation, national GHG inventories, GFOI,
- Engagement with countries on linking ground and space-based climate observations

Thank you!

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