Global Cryosphere Watch (GCW) and Linkages to GCOS

GCOS Steering Committee Meeting
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Global Cryosphere Watch (GCW)

- **The WMO's Global Cryosphere Watch (GCW)** fosters international coordination and partnerships between scientific and operational communities with the goal of meeting the cryosphere data and information need of members and partners, in support of Earth system monitoring, modeling and prediction.

- **GCW operates under the remit of the Infrastructure Commission (INFCOM).**

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Global Cryosphere Watch (GCW)

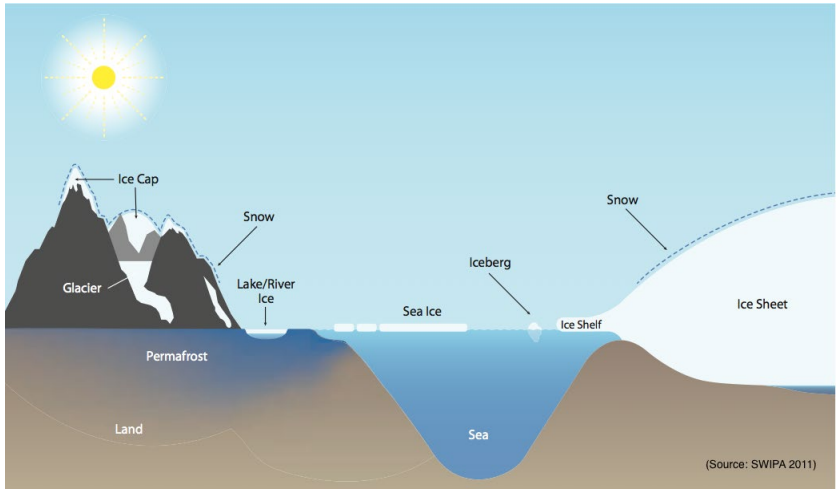
- The World Meteorological Organization's Global Cryosphere Watch is an international mechanism for supporting all key cryospheric in-situ and remote sensing observations.

- To meet the needs of WMO Members and partners in delivering services to users, the media, public, decision and policy makers, ***GCW provides authoritative, clear, and useable data, information, and analyses on the past, current and future state of the cryosphere***.

- GCW includes observation, monitoring, assessment, product development, prediction, and research.

- It provides the framework for reliable, comprehensive, sustained observing of the cryosphere through a coordinated and integrated approach on national to global scales to deliver quality-assured global and regional products and services.

- GCW organizes analyses and assessments of the cryosphere to support science, decision-making and environmental policy.



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GCW Global Cryosphere Watch

Global Cryosphere Watch (GCW)

- To meet these objectives, GCW implementation encompasses:
  - **Requirements**: Meet evolving cryospheric observing requirements of WMO Members, partners, and the scientific community, by contributing to the WMO Rolling Review of Requirements (RRR) process;
  - **Integration**: Provide a framework to assess the state of the cryosphere and its interactions within the Earth System;
  - **Standardization**: Enhance the quality of observational data by improving observing standards and best practices for the measurement of essential cryospheric variables;
  - **Access**: Improve exchange of, access to, and utilization of observations and products from WMO observing systems and those of its partners;
  - **Coordination**: Foster research and development activities and coherent planning for future observing systems and global observing network optimization.

- The observing component of GCW is a component of the WMO Integrated Global Observing System (WIGOS).
  - Through WIGOS and the WMO Information System (WIS), GCW will provide a fundamental contribution to the Global Earth Observation System of Systems (GEOSS).
  - GCW will organize analyses and assessments of the cryosphere to support science, decision-making, environmental policy and services through, inter alia, its foundational support to the Global Framework for Climate Services (GFCS).

From the 2022 GCOS Implementation Plan

- 2.4.1 Monitoring the Earth Energy Budget Von Schuckmann et al. (2020)13 and (2022)14 identified some key requirements for improving future assessments:
  - **Sustained remote sensing**, and the **acquisition of further in situ measurements** for validation **for all the cryosphere components** are key to quantifying future changes.
  - The continuation of **satellite altimeter missions with high inclination, polar focused** orbits is critical in our ability to monitor sea ice thickness in particular (see Action F2).
  - Observations of **snow thickness with multi-frequency altimeters** are essential for further constraining sea ice thickness estimates.
  - For **ice sheets and glaciers, reliable gravimetric, geodetic, and ice velocity measurements, knowledge of ice thickness and extent, snow/firm thickness and density**, and the continuation of the now 3-decade long satellite altimeter record are essential to quantify changes in mass balance of grounded and floating ice.
  - The **estimate of glacier heat uptake** is particularly affected by lack of knowledge of ice melt below sea level and to a lesser degree, lacking knowledge of firn and ice temperatures. This gap introduces a systematic bias in the estimate of cryospheric energy uptake.

GCW activities aligned with GCOS IP 2022 actions

GCOS Action	GCW activities
A2: Address gaps in satellite observations likely to occur in the near future	GCW-AG to re-establish Polar Space Task Group as a mechanism to engage with Space Agencies, to address requirements
A3: Prepare follow-on plans for critical satellite missions; 5. Sea ice and icebergs (or floating ice)	
B1. Development of reference networks (in situ and satellite Fiducial Reference Measurement (FRM) programs)	SnowPEx – snow cover and SWE – non- mountainous regions Planned Mountain snow intercomparison Joint Body on Status of Mountain Snow Cover (IACS, MRI, GCW) SIN'TX
C2: General improvements to satellite data processing methods	
C3: General improvements to in situ data products for all ECVs	
B2. Development and implementation of the Global Basic Observing Network (GBON)	GBON – Global NWP and climate reanalysis: - Snow depth – already included; - Additional parameters (e.g. sea ice) – action of GCW-AG
B3. New Earth observing satellite missions to fill gaps in the observing systems	GCW-AG to re-establish Polar Space Task Group as a mechanism to engage with Space Agencies, to address requirements
B5. Implementing global hydrological networks	Snow, glaciers, and permafrost observations are being registered in CryoNet (OSCAR/Surface) - as they related to hydrological cycle
C1: Develop monitoring standards, guidance and best practices for each ECV	Wmo No 8 – Part II – Measurement fo Cryosphere Variables: - **Ch 2 – Snow – published; revision to be approved by INFCOM3** - **Ch 3 – Glaciers – approved by INFCOM2** - **Ch 4 – Permafrost – for community review Q3 2023, to be approved by INFCOM3** - Ch 5 – Sea Ice – development under way into 2023; Ice sheets - IBD

GCW activities aligned with GCOS IP 2022 actions

GCOS Action	GCW activities
C4: New and improved reanalysis products	Snow Watch and Sea Ice Watch - actions
C5: ECV-specific satellite data processing method improvements	Contributions planned via Ets and PSTG
D2: Ensure Global Climate Data Centres exist for all in situ observations of ECVs	Cryosphere and Polar Data WIS2.0 DCPC established by Met Norway with engagements or other data sources and providers (TPE, etc) Apply FAIR principles; Strong link to research programmes
D3: Improving discovery and access to data and metadata in Global Climate Data Centres	
D5: Undertake additional in situ data rescue activities	
E1: Foster regional engagement in GCOS	Integration of cryosphere in-situ observations in WIGOS: - OSCAR/Surface: GCW WSIs, Metadata included in WMDR; - Active engagements with cryo observing programmes to identify and register new stations; - Development of open-source tools to enable the transformation of data into standard formats (NetCDF) with some QC, provided to CryoNet stations; - Inventories of cryosphere observations: Andes, Central Asia
E3: Enhance support for national climate observations	
F2. Improved ECV satellite observations in polar regions	PSTG; potential engagement support for a Arctic Observing Mission

Opportunities

- GCW-AG – 2024-2027 work plan;
- GCW Co-custodian of Sea Ice ECV – Thomas Lavergne
- Expert contributions for the custodian role: Snow? Others?
- SG-Cryo - ***Recommendation 9*** **- Cryosphere in the Global Climate Observing System (GCOS)**
  - GCW-AG welcomes the dialogue with GCOS SC on the evolution of cryosphere monitoring in GCOS;
    - SG-CRYO took note of the work undertaken on defining Shared Arctic Variables, as proposed by the Sustaining Arctic Observing Networks (SAON) Roadmap to Arctic Observing and Data Systems (ROADS) process, and the consideration of Mountain ECVs.
  - GCW acknowledges the needs of operational climate services for regional, shorter range climate products
  - A harmonized system that acknowledges the necessary complexity while remaining parsimonious, would be valuable to the global community.

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Thank you
Merci

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