Status and plans of WMO key initiatives

Presented to CGMS-53 Plenary session, agenda item 2

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Saving Life & Property

Adaptation

Mitigation

Modernization of NMHSs

Adoption of new technologies

Building and enhancing partnerships

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Executive summary

- Early Warning For All (EW4All) *
- WIS 2.0 Implementation
- AI/ML revolution
- WIGOS Vision update *
- Global Greenhouse Watch (G3W) *
- Global Cryosphere Watch (GCW)

* Will be further elaborated in other presentations

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WIS 2.0 Implementation

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Evolution of WMO data exchange

1963 World Weather Watch

1970s Global Telecommunication System (GTS)

2007 WMO Information System (WIS)

2019 WMO Reform (Earth System Approach)

2021 WMO Unified Data Policy (Core, Recommended)

Resolution 34 (EC-76)
Implementation plan update of the WMO Information System 2.0
[WMO-No. 1314, pg. 1147]

Resolution 25 (Cg-19)
Technical Regulations of the WMO Information System 2.0
[WMO-No. 1326, pg. 209]

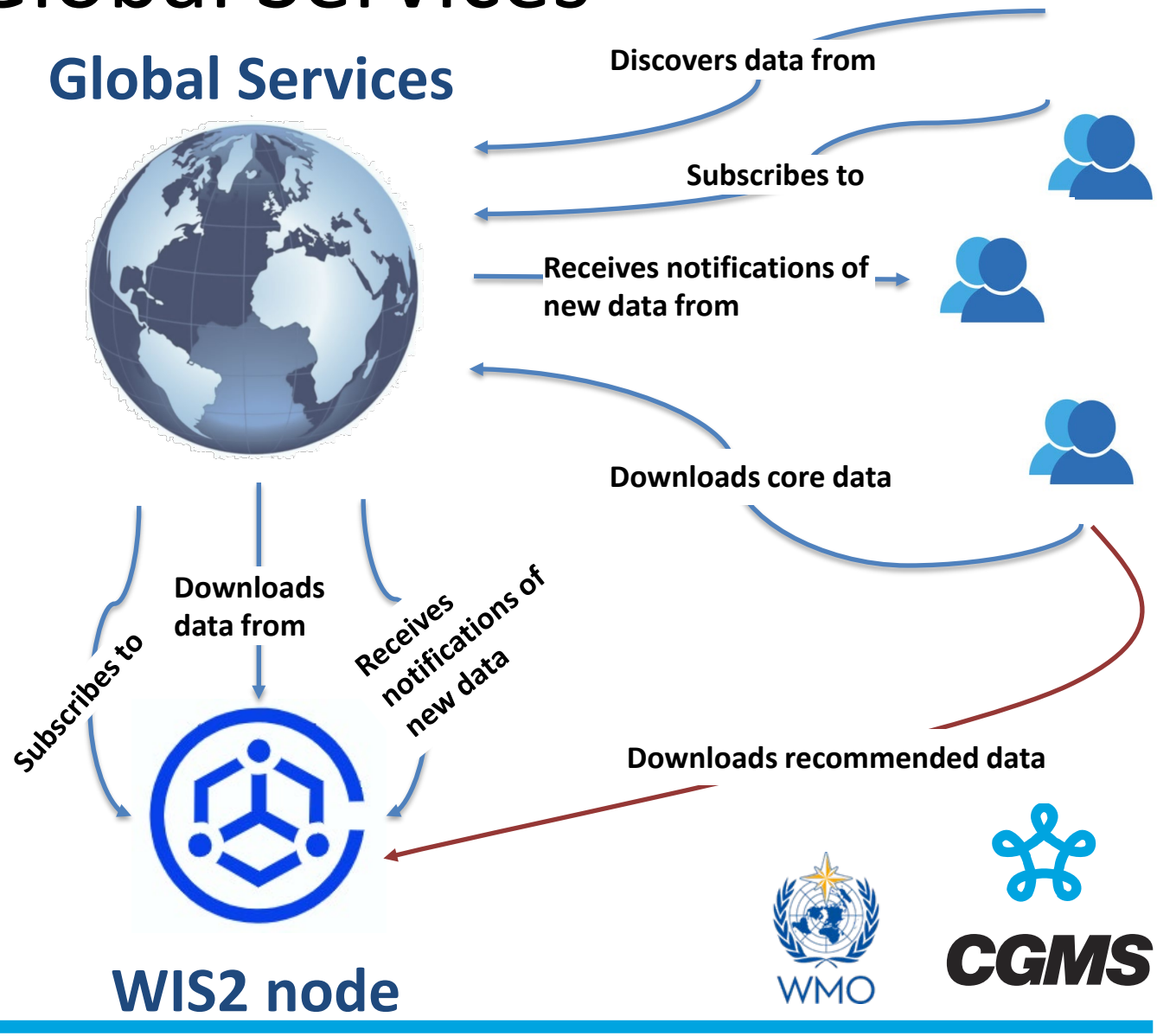
WIS 2.0

… collaborative system of systems using Web-architecture and open standards to provide simple, timely and seamless sharing of trusted data and information …

- Open Standards (OGC, W3C, IETF, …)
- Free and Open Source tooling
- Data sharing through Web and real-time notifications with publication/subscription (pub/sub) protocols
- Cloud ready (turn-key solutions)
- Web services and APIs (Application Programming Interface)

WIS2 node and Global Services

- Each WMO Member shall implement at least one WIS2 node to share data in WIS2
- A WIS2 node replaces the GTS Message Switching System
- Data and metadata are shared through a WIS2 node
- A WIS2 Node shares data via an HTTPS service and sends notifications to MQTT subscribers
- A WIS2 node shares data only with Global Services



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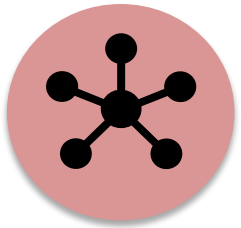
WIS2 Global Service instances

Global Broker



Brazil
France
China
USA

Global Discovery Catalogue

Canada
China
Germany

Global Cache

China
Germany
Japan
Korea
Saudi Arabia
USA/UK

Global Monitoring

China
Morocco

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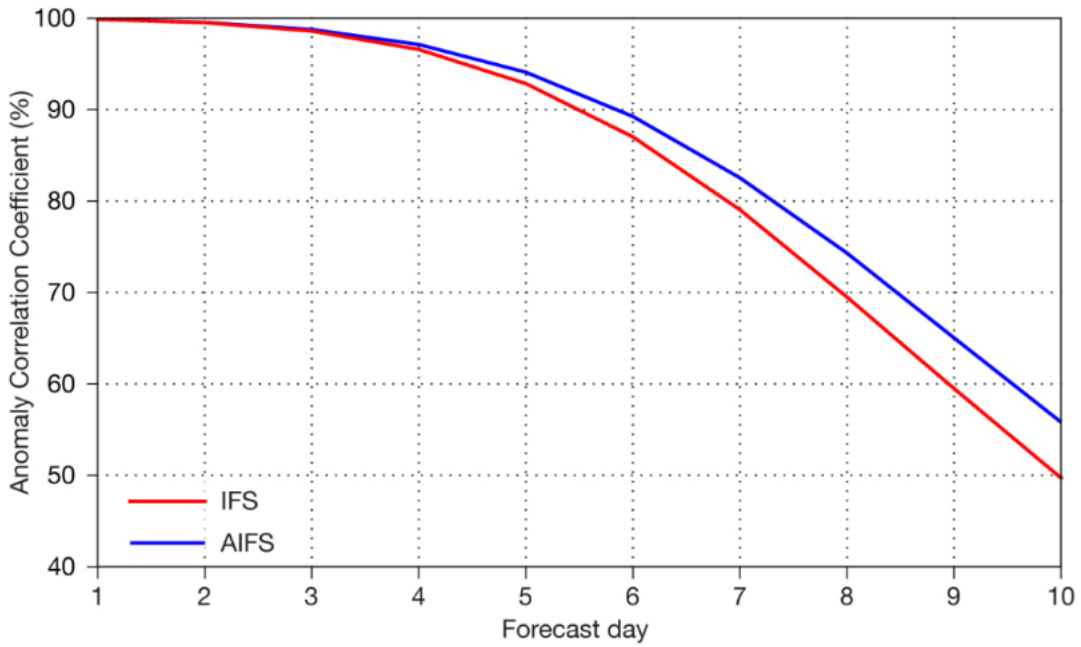
WIS2 Implementation plan

AI/ML revolution



AIFS forecast skill. We show the northern hemisphere Anomaly Correlation Coefficient (ACC) for geopotential height at 500 hPa of IFS forecasts (red, dashed) and AIFS forecasts (blue) for 2022. Higher values indicate better skill.

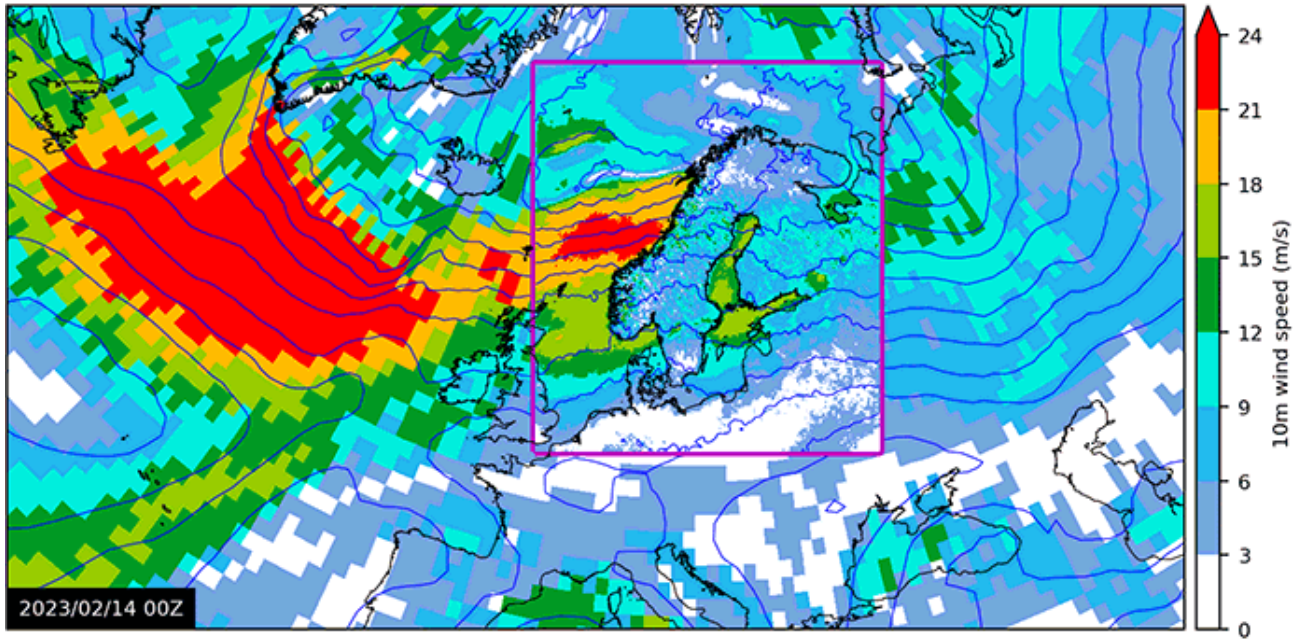


Illustration of the promising results for a 7-day forecast of 10 m wind speed (shading) and sea-level pressure (contours), obtained with the regionally high-resolution AI-based model Bris, developed by MET Norway and partners, making use of the Anemoi framework. The model has learned to forecast at high resolution (here about 2.5 km) inside the Nordic region, and at low resolution (here about 30 km) outside of this domain. The model successfully creates a higher-resolution structure over the Nordics.

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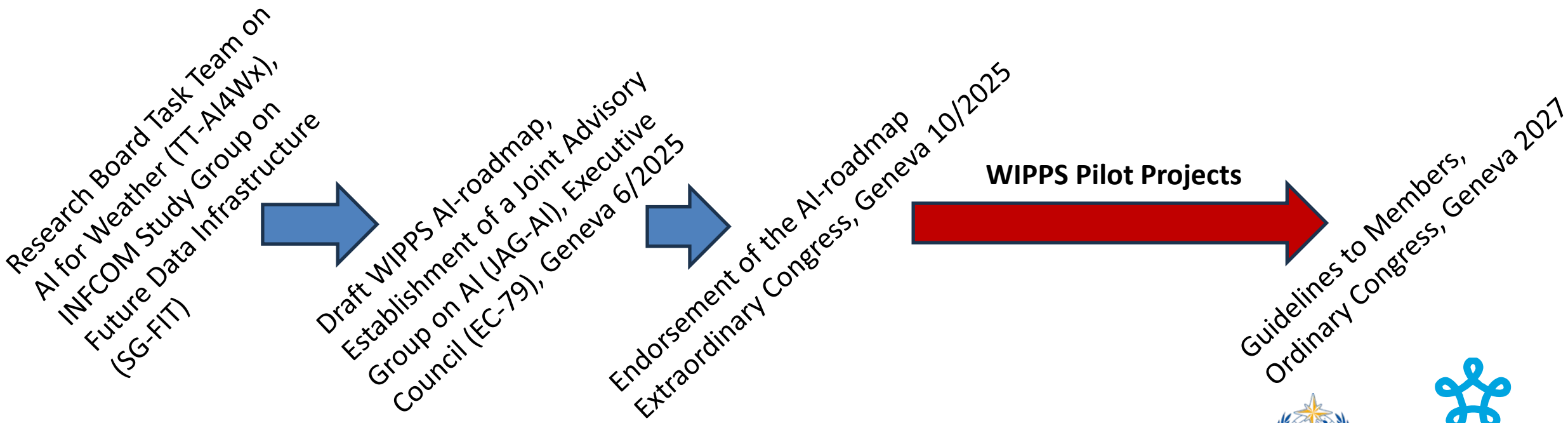
Issues and Challenges for AI use

- Data Availability and Quality
  - Provision of long-term observation/analysis dataset for AI training and verification
  - Observation requirements for high-impact forecasting
  - Quality control of observations
- Prediction and post-processing
  - Benefit and applicability of AI-ESP for nowcasting and forecasting
  - High-resolution AI-based forecasts for local area
  - Compatibility between initial fields and training dataset
  - High-resolution data-driven models
  - Benefit and necessity of post-processing
- Verification
  - WIPPS standard verification of AI-ESP model outputs
  - Verification of AI-ESP model outputs for local weather elements and extremes
  - Verification of meteorological consistency between variables of AI-ESP model outputs
  - Verification of forecast scenarios

Issues and Challenges for AI use (Cont.)

- NMHS infrastructure and capacity requirements
  - Use of AI-ESP model outputs in operational forecasting and warning
  - Implementation and maintenance of AI-based systems
- Applications
  - Applicability of AI to calculate the impact-related indices for hazards
  - Limited predicable variables of AI-ESP models for user applications
  - Feasibility to use AI for automated forecasts and warnings
- Model Explainability and Transparency
  - Guidelines on the use and interpretation of AI-ESP model outputs
  - Guidelines on developing explainable AI-ESP
- WIPPS Framework and Technical Regulations
  - Expansion of WIPPS activities to accommodate AI-ESP model outputs
  - Impact of AI on the WIPPS cascading process
- PPE and Ethical Considerations

Integration of AI/ML in the WMO Integrated Processing & Prediction System (WIPPS)



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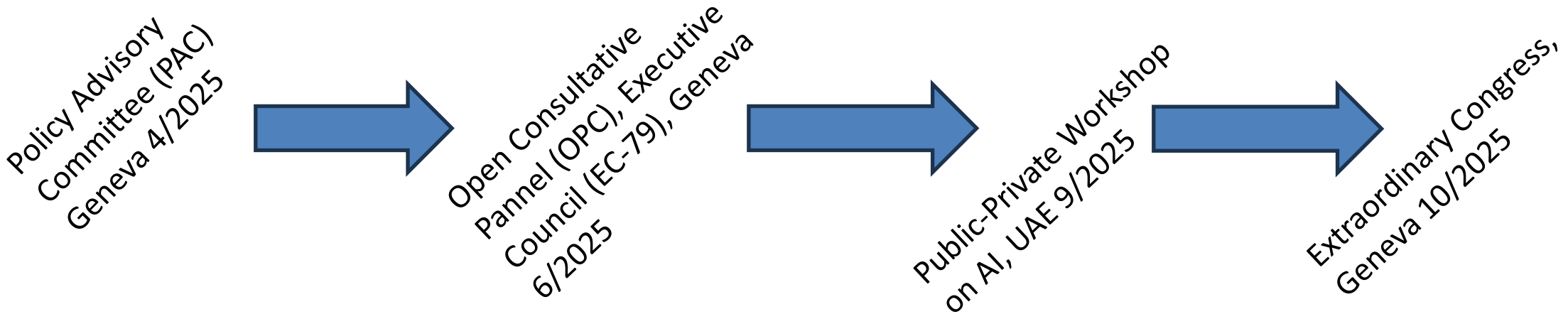
WIPPS Pilot Projects

- AI for Nowcasting Pilot Project (AINPP)
- Global to local data-driven predictions in a common framework
- ECMWF/WMO AI Weather Quest
- WGNE Models Intercomparison Project (WGNE-MIP)
- UNESCAP/WMO Typhoon Committee initiative on AI Applications in Tropical Cyclone Analysis and Prediction
- Pilot for global riverine flood prediction
- ...

Public-Private joint AI effort coordination



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Global Cryosphere Watch (GCW)

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EC-78 (2024) requested INFCOM to

- *work with the Research Board and the satellite community, especially through CGMS, for multi-satellite coordinated cryosphere monitoring products to improve the spatial and temporal resolution and coverage"*
- *organize consultations towards WMO pursuing closer links with the international satellite community on the monitoring of the cryosphere, such as through CGMS,*

EC-79 (2025) The 5th International Polar Year, 2032-33

- WMO to support "*the realization of benefits from the constellation of polar orbiting and other satellites monitoring the cryosphere by engaging interested Agencies.*"

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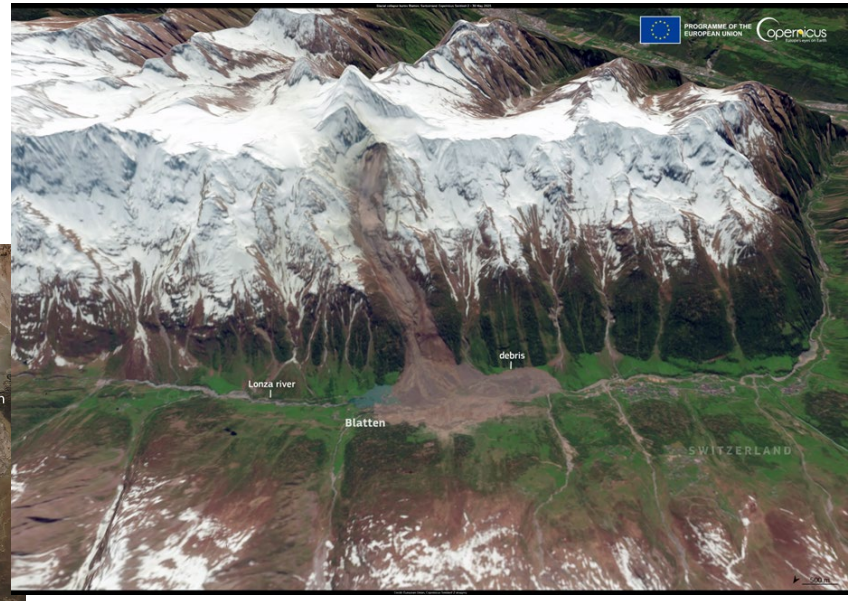
Task Team on Cryosphere and Polar Observation from Space (TT-CPOS)

- Presented at CGMS Plenary in 2023
- A substructure of AG-GCW (link to research and operations)
- Endorsed by INFCOM MG
- Working with ET-SSU
- ToRs developed based on broad consultations
- Building on the former Polar Space Task Group

Snow accumulation in the Andes is a crucial water resource for the region



Copernicus Sentinel-2 image (30.05.2025) - extent of the affected area following the high-alpine slope failures and collapse of Birch glaciers (Blatten, Switzerland)

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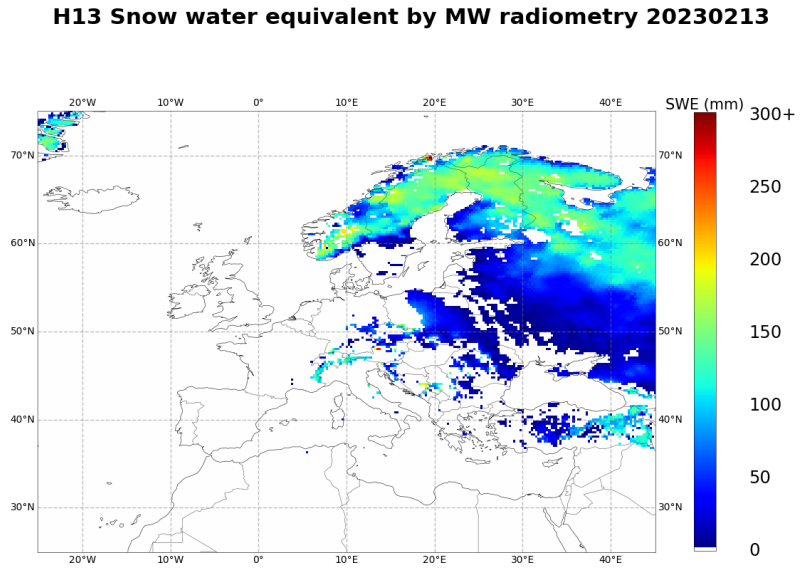
To be considered by CGMS:

➢ Sustained monitoring of hazards in polar and high mountain regions: e.g. rapidly forming glacier lakes, snow, ice and frozen ground dynamics, icesheets

- There is huge potential for integrating snowpack and glacier runoff modelling into hazard forecasts and EWS in mountain catchments
- Need:
  - *sustained satellite monitoring of the cryosphere (temporal & spatial coverage)*
    - ✓ high-alpine slopes and glacier changes
    - ✓ changes in snowpack
    - ✓ mountain precipitation
    - ✓ Icebergs and icesheets
  - *Improved retrievals of cryosphere-related products from existing satellite observations for mountain regions, e.g. snow cover*
  - *multisensory products for consistent snow and ice products*



EUMETSAT H SAF
SUPPORT TO OPERATIONAL HYDROLOGY AND WATER MANAGEMENT

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