Satellite Data Requirements in Operational Hydrology
A WMO Perspective

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

World Meteorological Organization

WMO is the UN specialized agency in the domains of weather, climate and water (hydrology):

To promote activities in operational hydrology and to further close cooperation between Meteorological and Hydrological Services;

- Worldwide cooperation (observing networks and data centres)
- Data and information exchange
- Standardization
- Application and services
- Hydro – Meteo cooperation
- Research and training

World Meteorological Organization
Weather • Climate • Water

WMO HQ in Geneva, Switzerland

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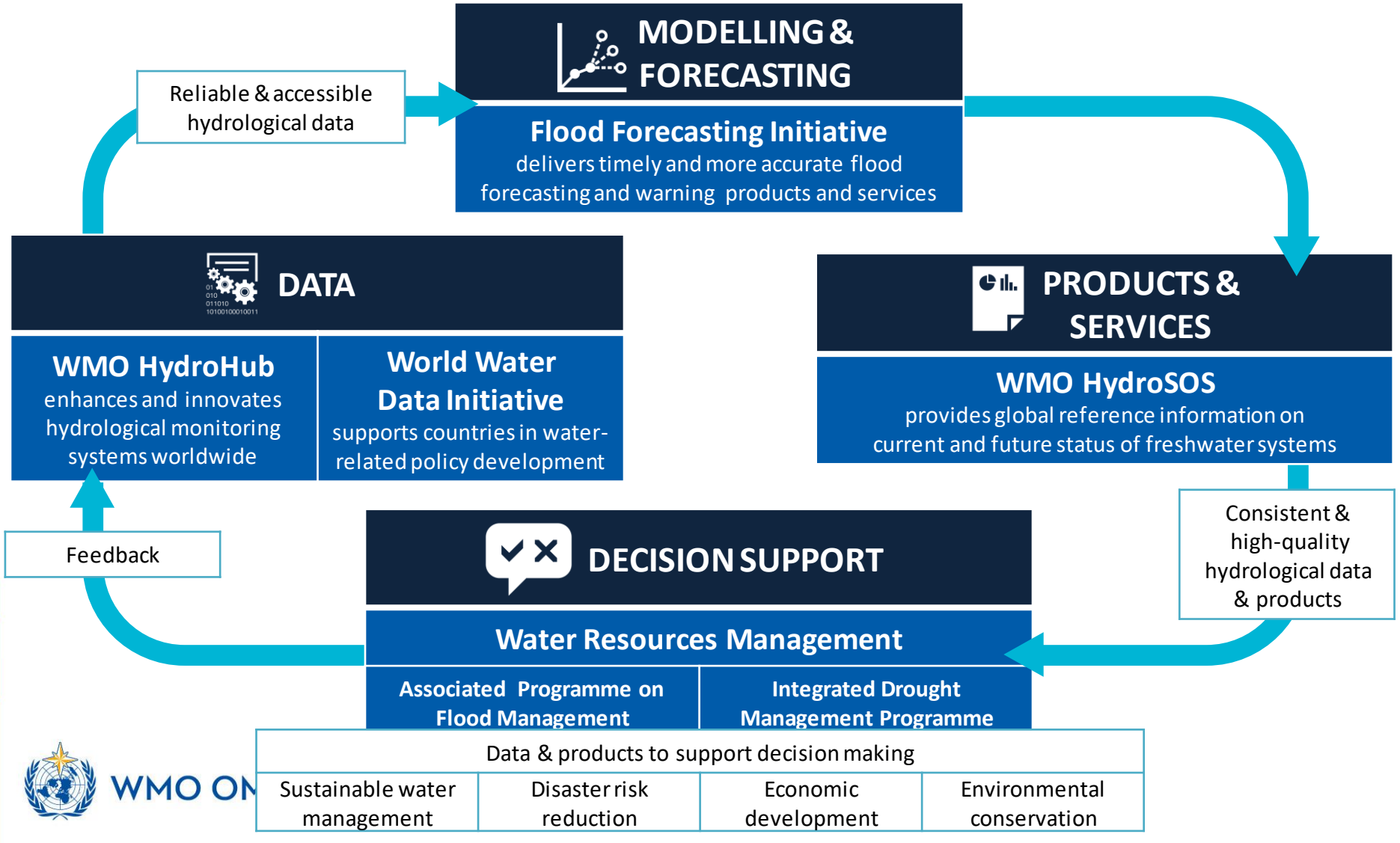
Operational Hydrology: WMO's long term ambitions

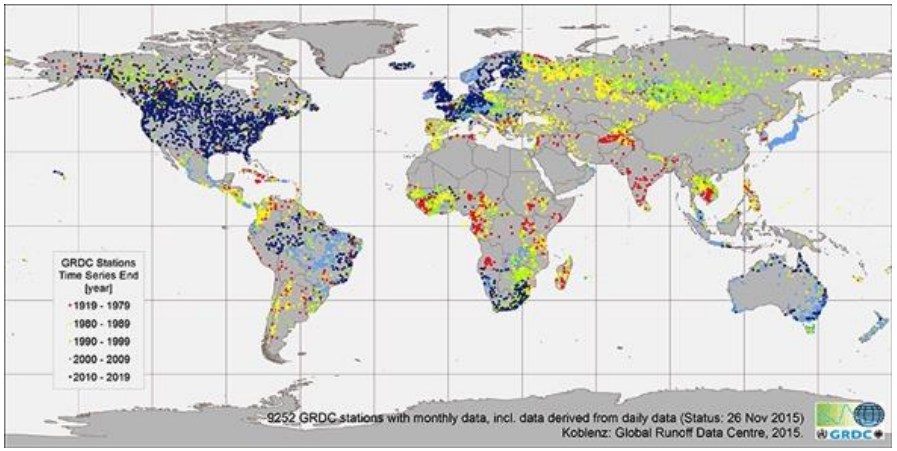
1. No one is surprised by a flood
2. Everyone is prepared for drought
3. Hydro-climate and meteorological data support the food security agenda
4. High-quality data supports science
5. Science provides a sound basis for operational hydrology
6. We have a thorough knowledge of the water resources of our world
7. Sustainable development is supported by information covering the full hydrological cycle
8. Water quality is known.

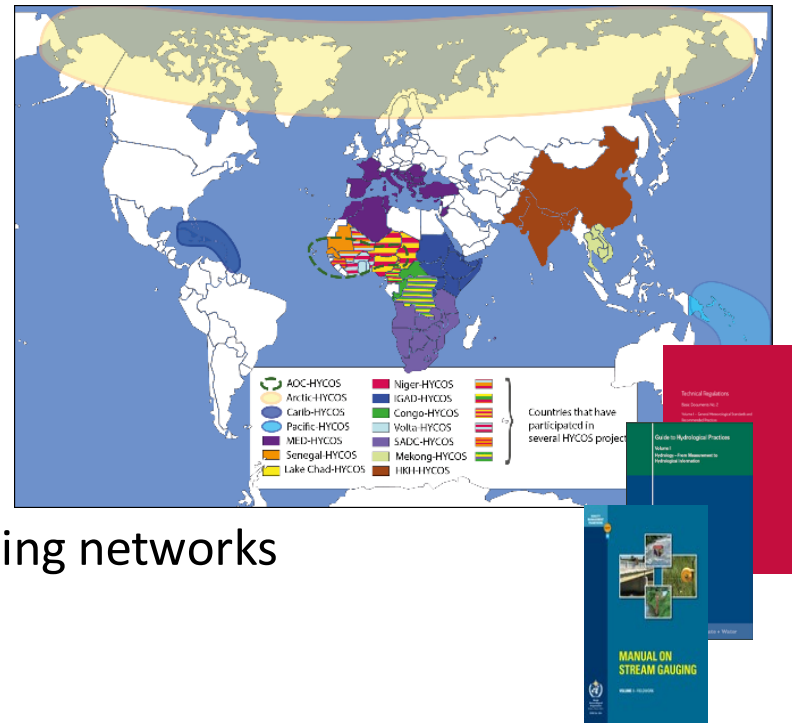
The WMO Hydrological Value Chain Initiatives



WMO ON

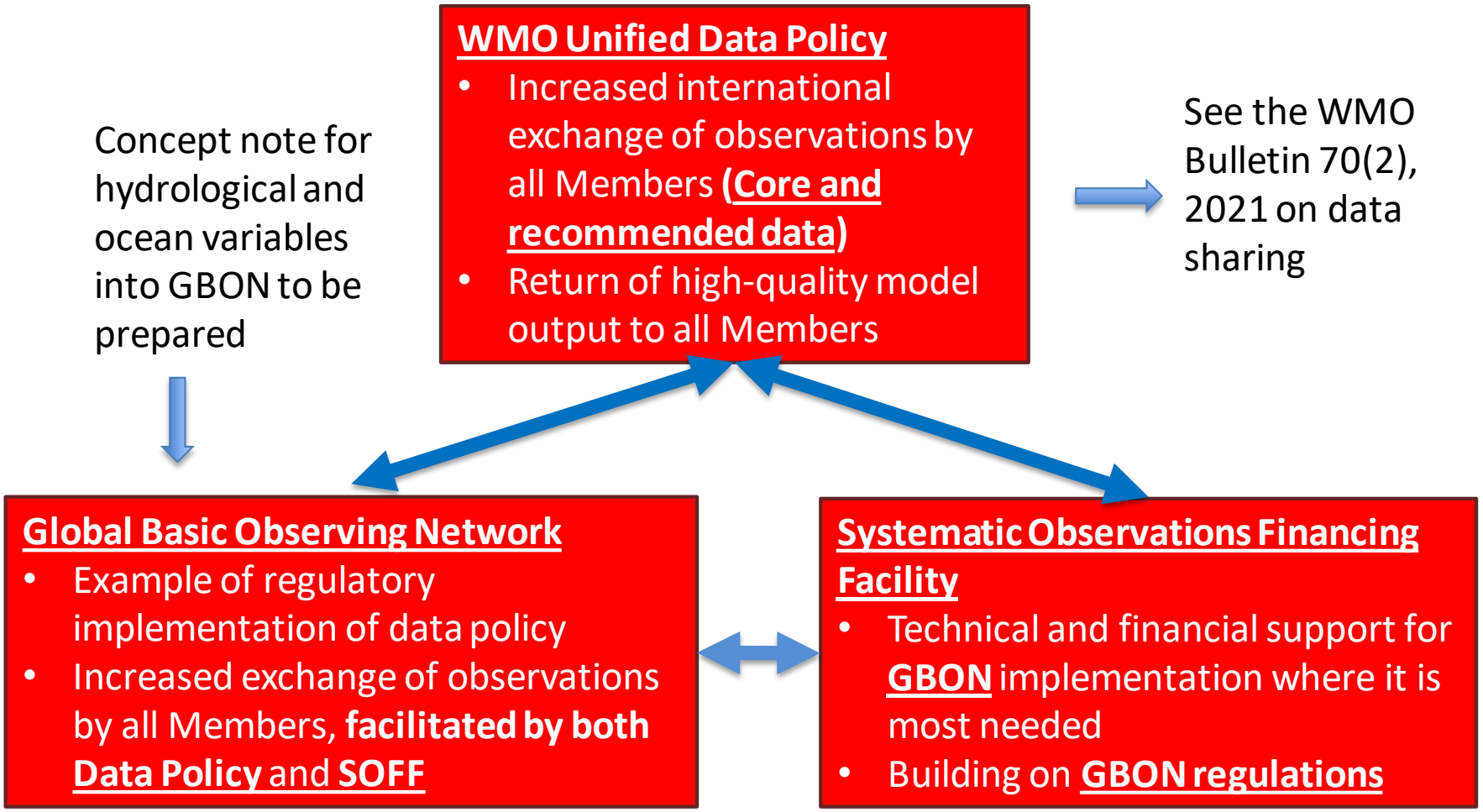
Water challenges require solutions based on sound facts, information and data, but:





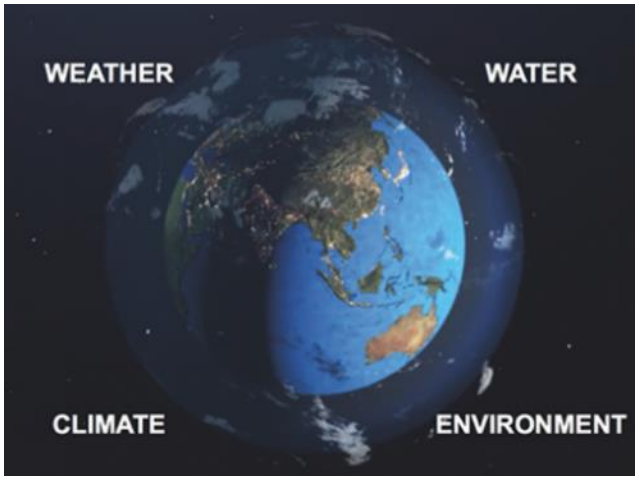
- Insufficient coverage of current monitoring networks
- Quality of data not always known
- Many data not shared
- Low visibility and recognition of Hydrological Services
- Need for an innovative approach
- Integrating various sources of data
- Quality and technical standards

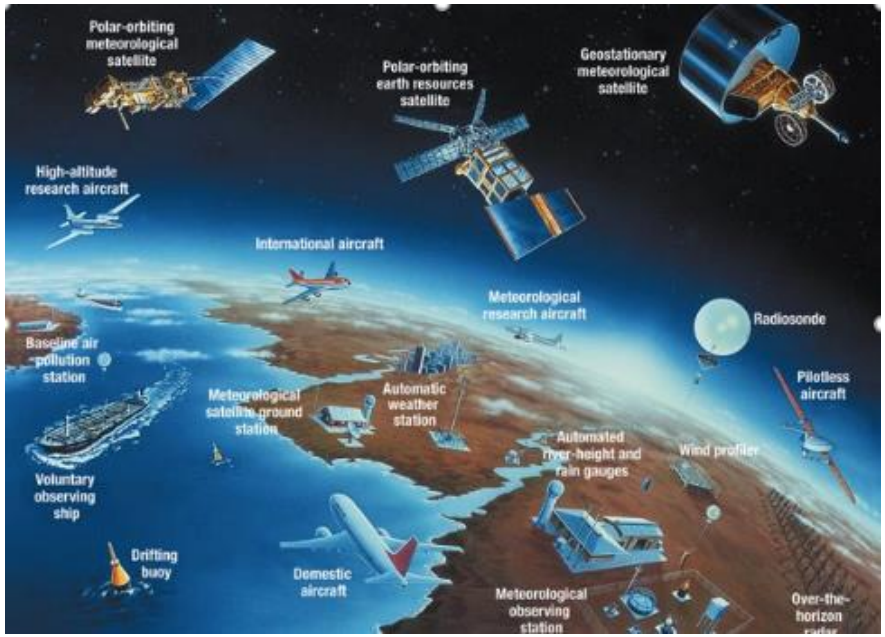
Policy basis for Earth System approach: historical decisions from WMO Congress in October 2021



Towards a holistic approach to Earth monitoring

- Integrated information for better understanding and modeling of Earth processes
- Interoperability of observing systems
- Integration of multi-source data
- Common basic tools for data management
  - Quality assessment
  - Make providers and users life easier





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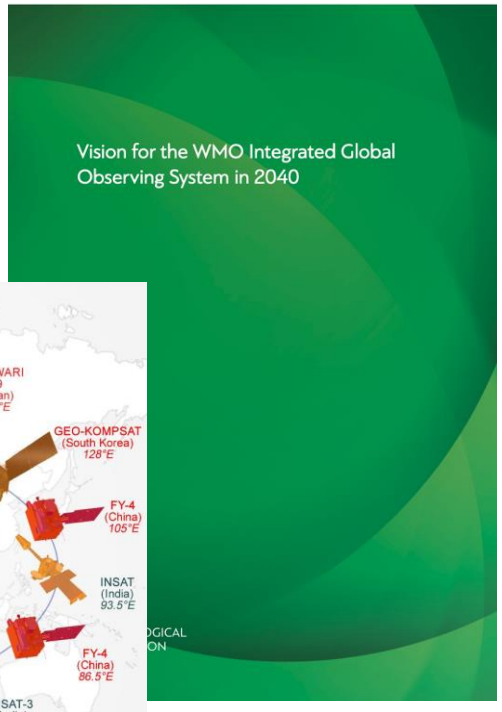
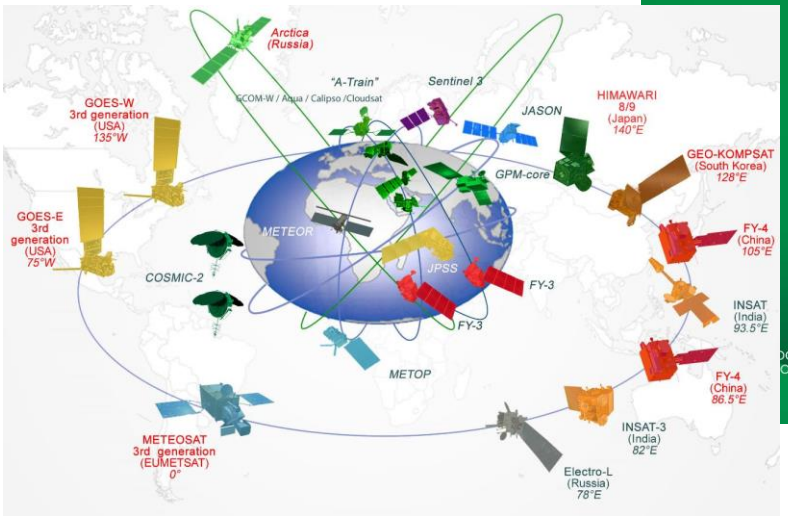
INNOVATIVE MEASUREMENT

IMOMO

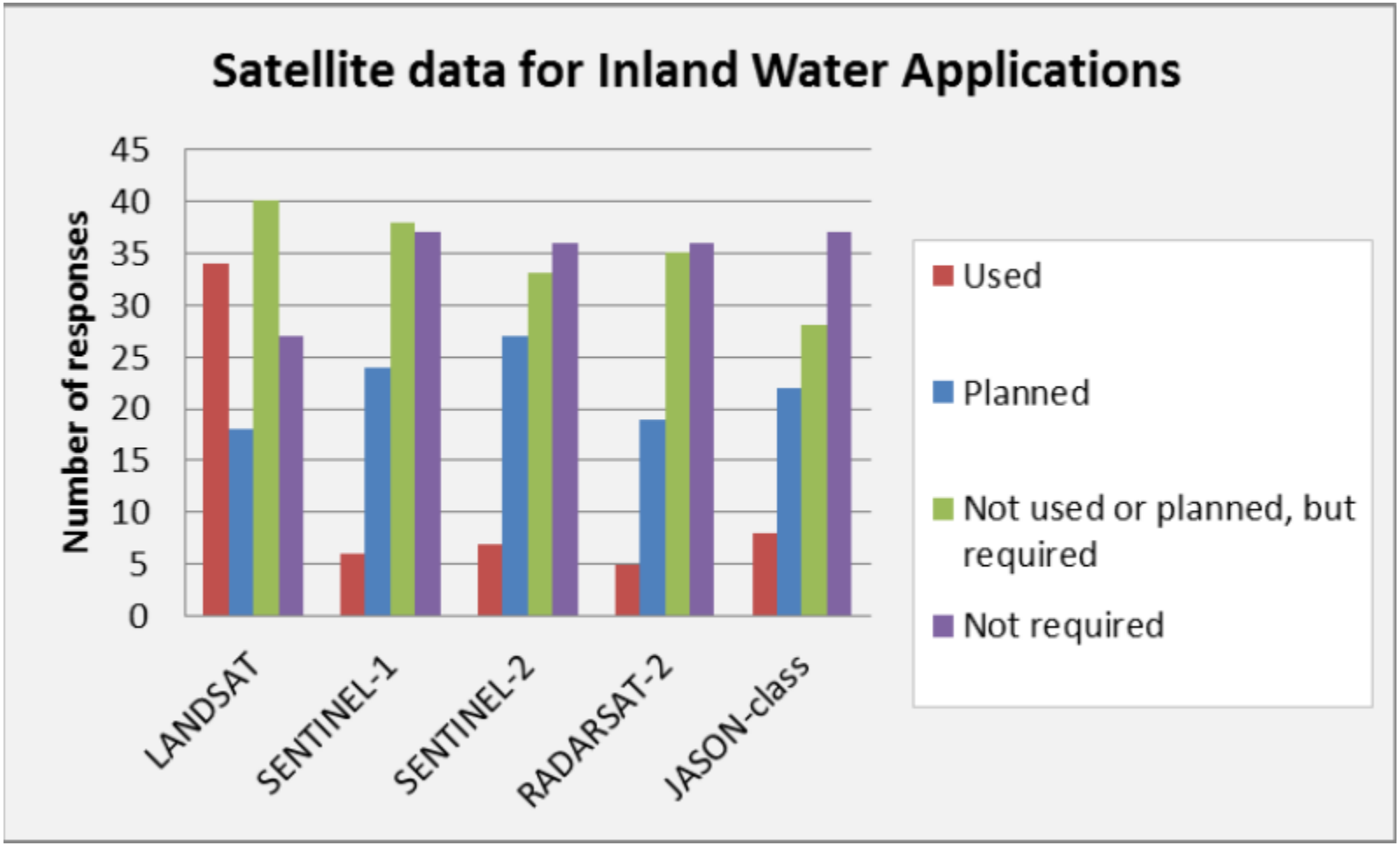
WMO space programme

- **Since 2003**
- **Promote availability and utilization of satellite data and products for weather, climate, water and related applications**
  - **Promote observation**
  - **Use of data and products**
  - **Capacity Building**
  - **Space weather**





WMO user survey 2017
Satellite data for inland water-related applications



Example of possible collaboration with satellite community

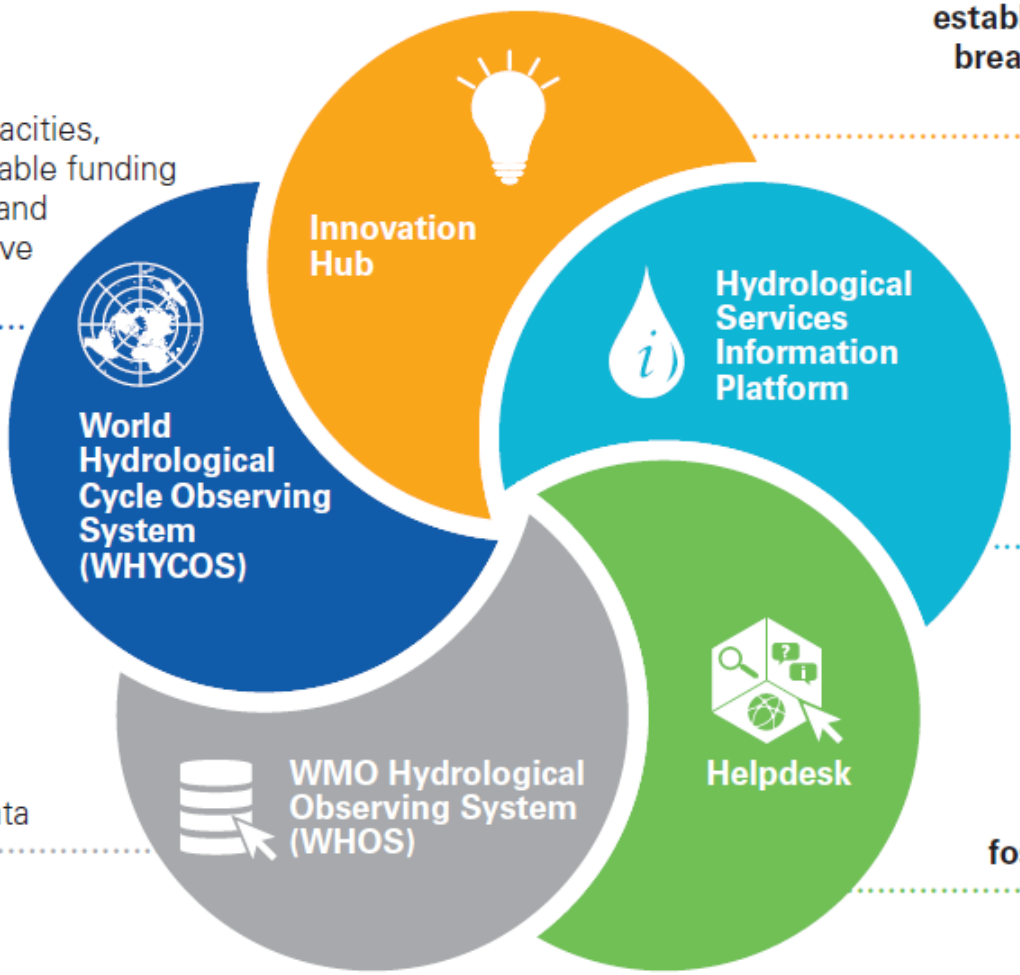
- Data Collection: water level (e.g., Congo, Niger), soil moisture (SWOT, SMOS), Groundwater (GRACE)
- Data platform and centers:
  - WHOS will be contributing to UNOOSA – Space4Water
  - HYDROLARE (WMO data center for Lake and Reservoirs) is supported by LEGOS for combining in situ and satellite data
- Projects: HydroSOS (global, regional and national hydrological situation – Today and in the Future), will combine in situ and satellite information. Collaboration foreseen with ECMWF, NCAR, …
- Other collaborations: COPERNICUS (exploratory discussions), CEOS-Water, International Network of Basin Organization, …
- Private sector (e.g., e-Ray)

WMO HydroHub

A new paradigm for Hydrometry

We drive innovation, **establish** partnerships, **break** boundaries and **unlock** funding

We develop capacities, **catalyze** sustainable funding and monitoring, and **support** innovative approaches



We share information and **identify** opportunities

We promote free and open data

We share knowledge and **foster** collaboration

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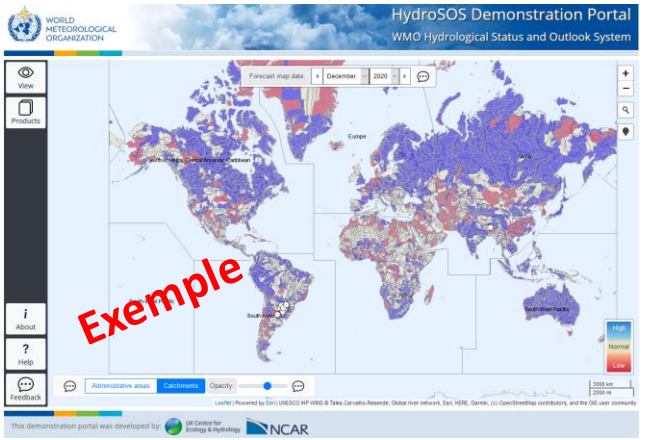
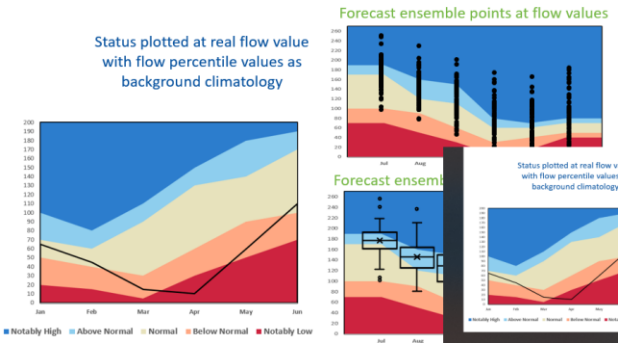
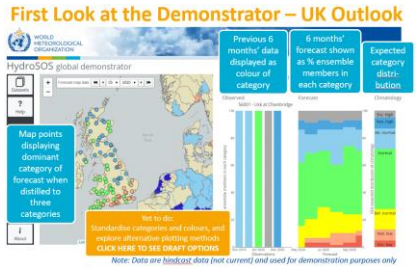
HydroSOS: Status and Outlook of the Hydrological Cycle





- By and for NHS, according to their needs
- Satellite and in situ products
- Regional and global models



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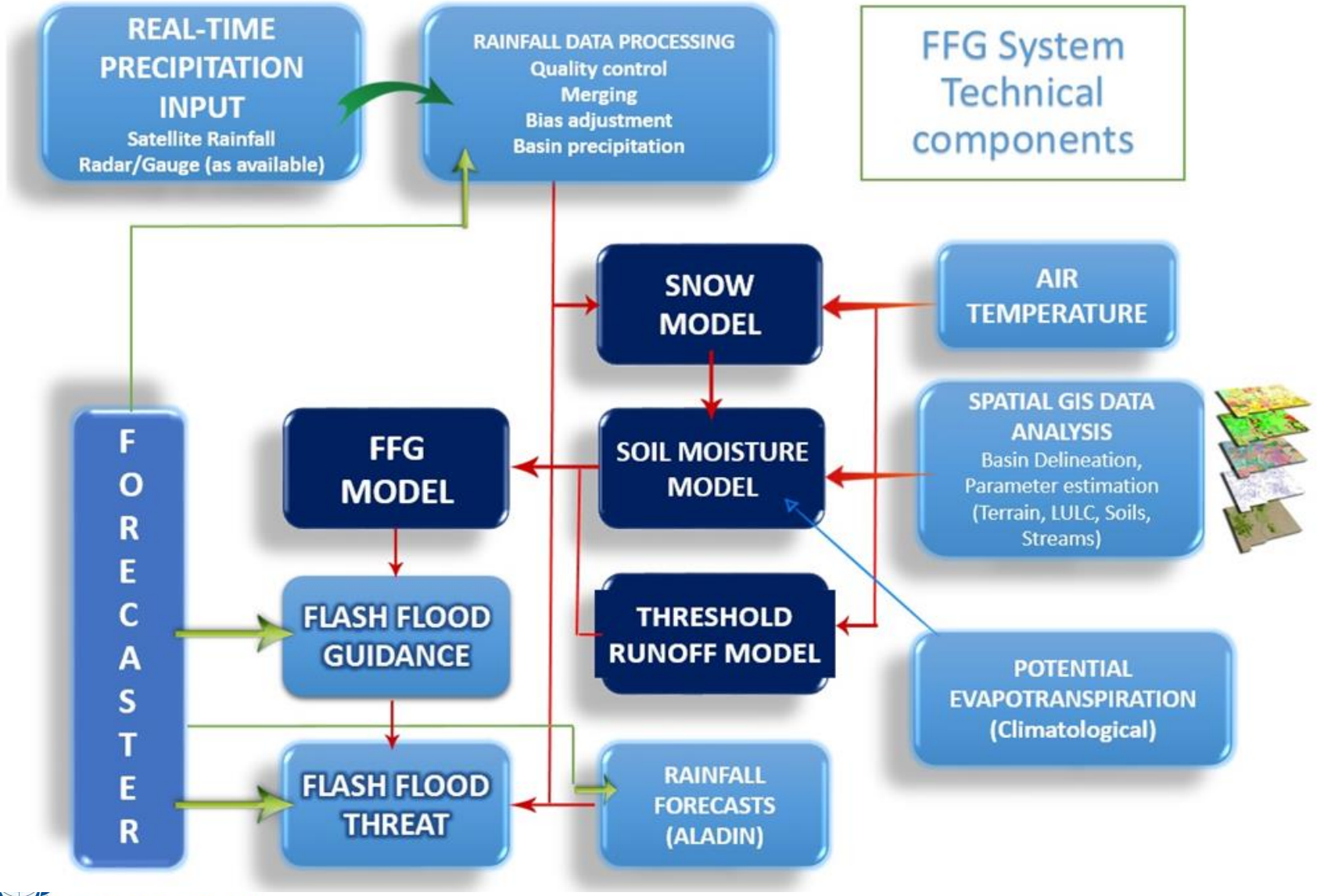
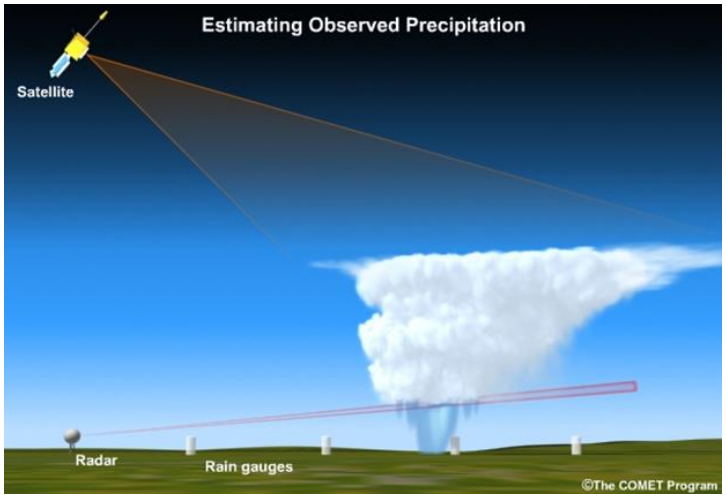
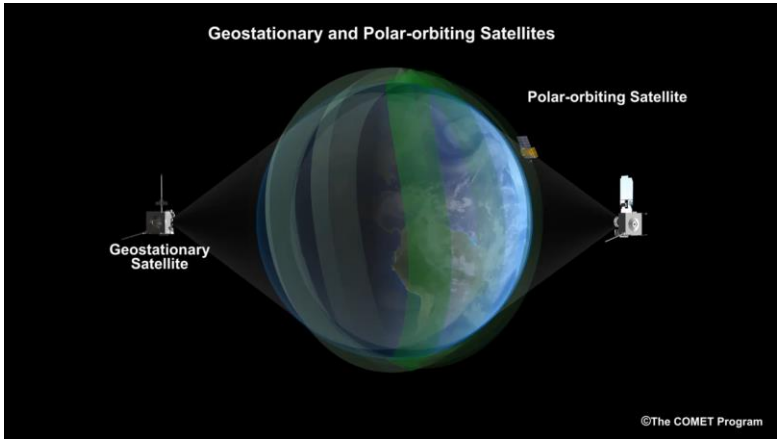
FFGS Components



Satellite Precipitation Estimates in FFGS





- Satellite data provider: **NOAA**
- The big advantage of the meteorological satellites is that they are **covering the entire globe**, which is very important in regions with sparse coverage by traditional gauge or radar networks.
- The relatively **high spatial and temporal resolution** is critical since heavy rain often covers a relatively small area and can change very quickly.

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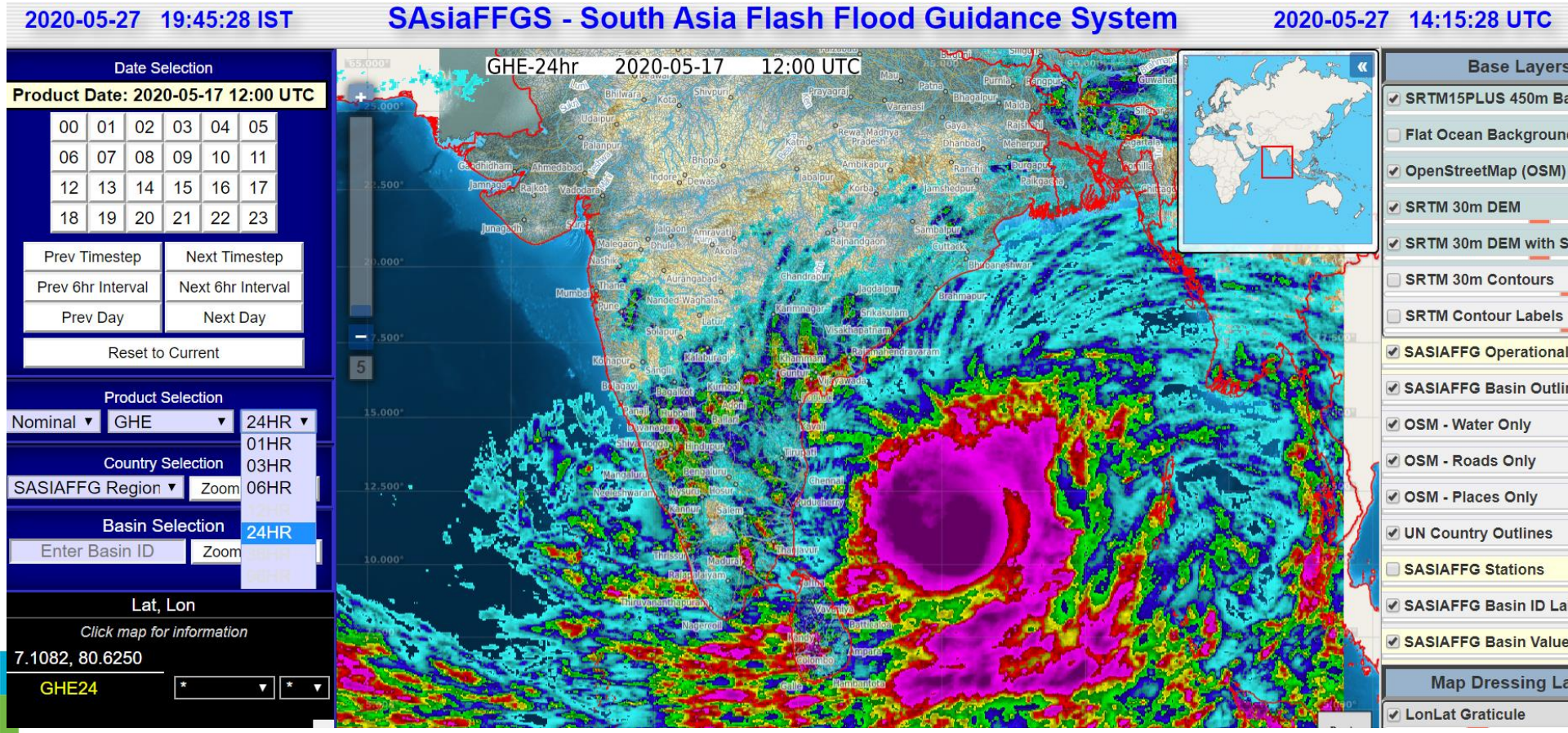
Global HydroEstimator Satellite Precipitation Estimates



- **Latency: 15-20 min**
- **Spatial resolution: 4 km**

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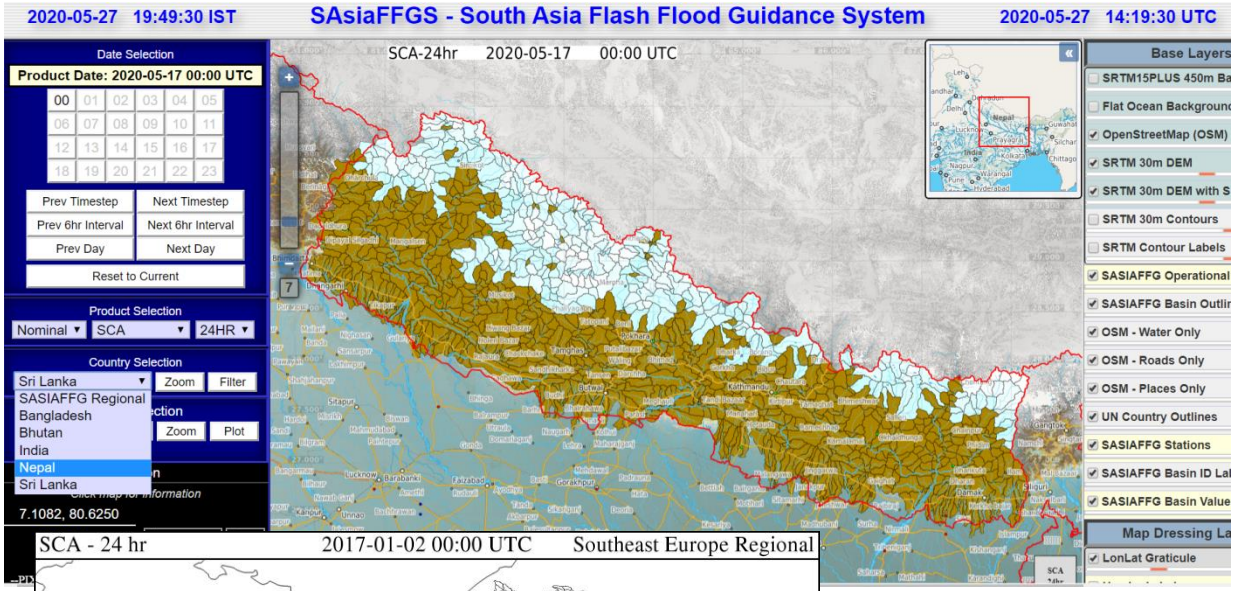
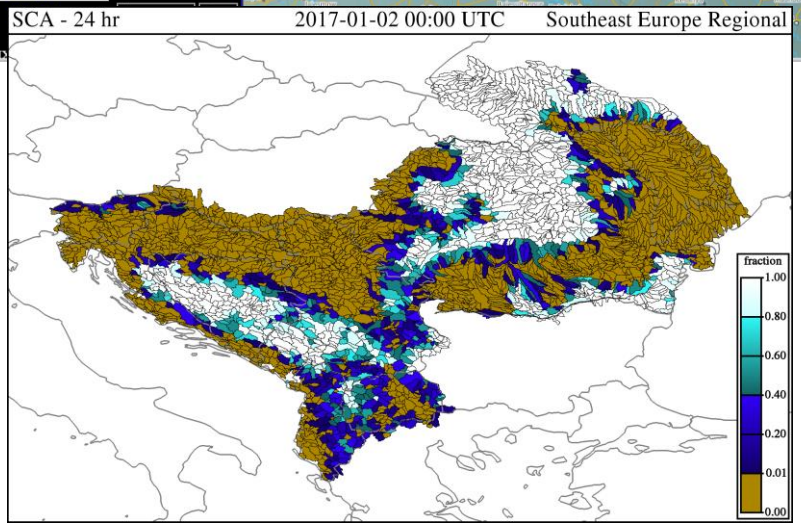
Snow Coverage Area in FFGS

- This product provides the latest estimate of the fraction of snow cover for each sub-basin.
- For FFGS, snow cover is retrieved daily from the Interactive Multi-sensor Snow and Ice Mapping System (IMS), made available as a global product through the National Snow and Ice Data Center, NOAA.





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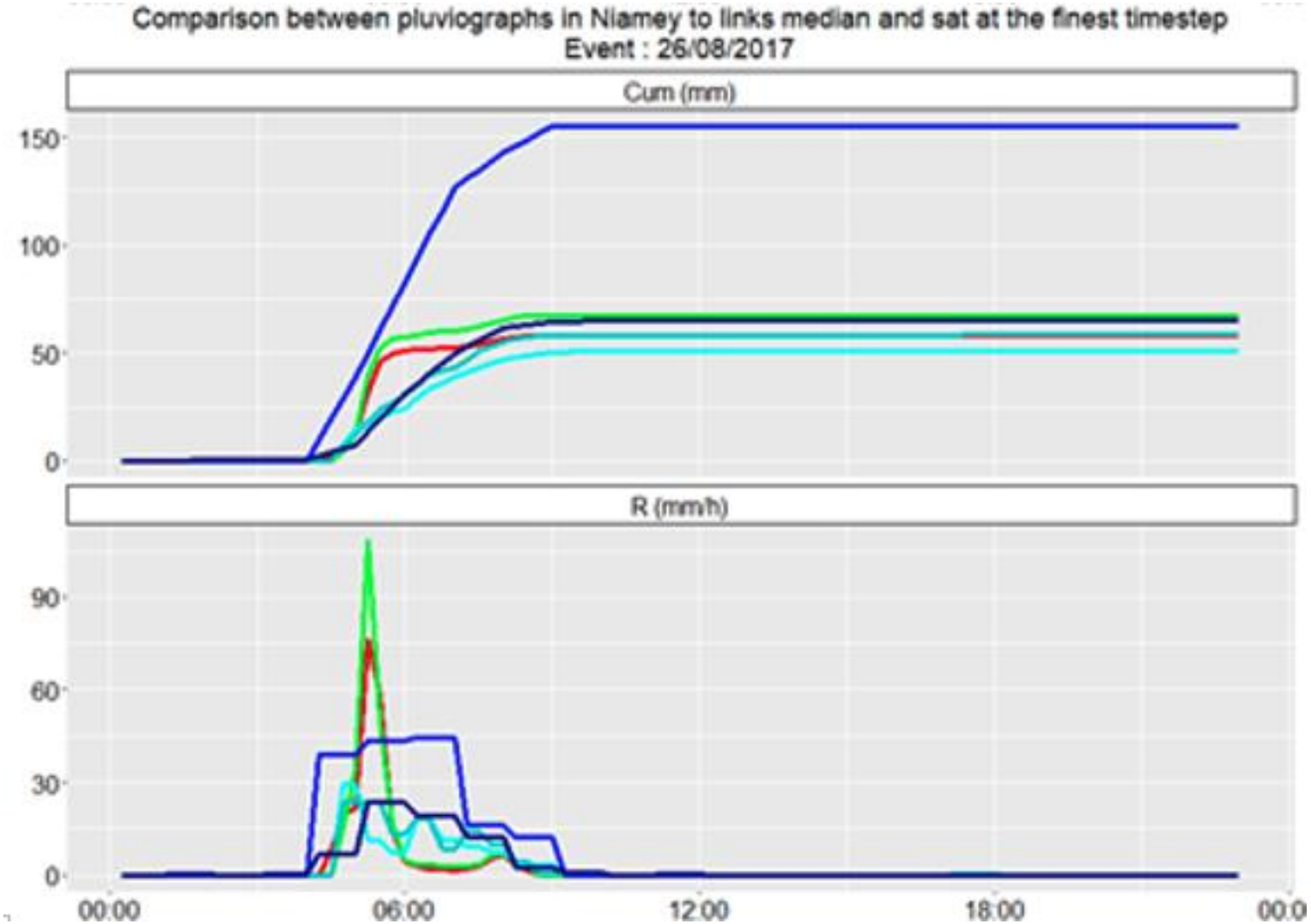
Integrating satellite and CML attenuation data



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Source: Rain Cell project

Conclusions

- Water is a complex system: no good decision without good information: data are central
- All data sources must be combined: In situ, citizen science, remote sensing: Cooperation a key
- Data quality must be ensured!
- WMO paves the way to innovative water monitoring (HydroHub) and to information on possible water related problems (HydroSOS)
- Needs for satellite information for water are growing
- Only a few NMHSs a effectively using satellite information
- Interactions between WMO hydrology and satellite community should be coordinated in a well-defined framework

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Thank you
Merci

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