2024 DRAGON SYMPOSIUM

DRAGON 5 FINAL RESULTS REPORTING

24-26 JUNE 2024

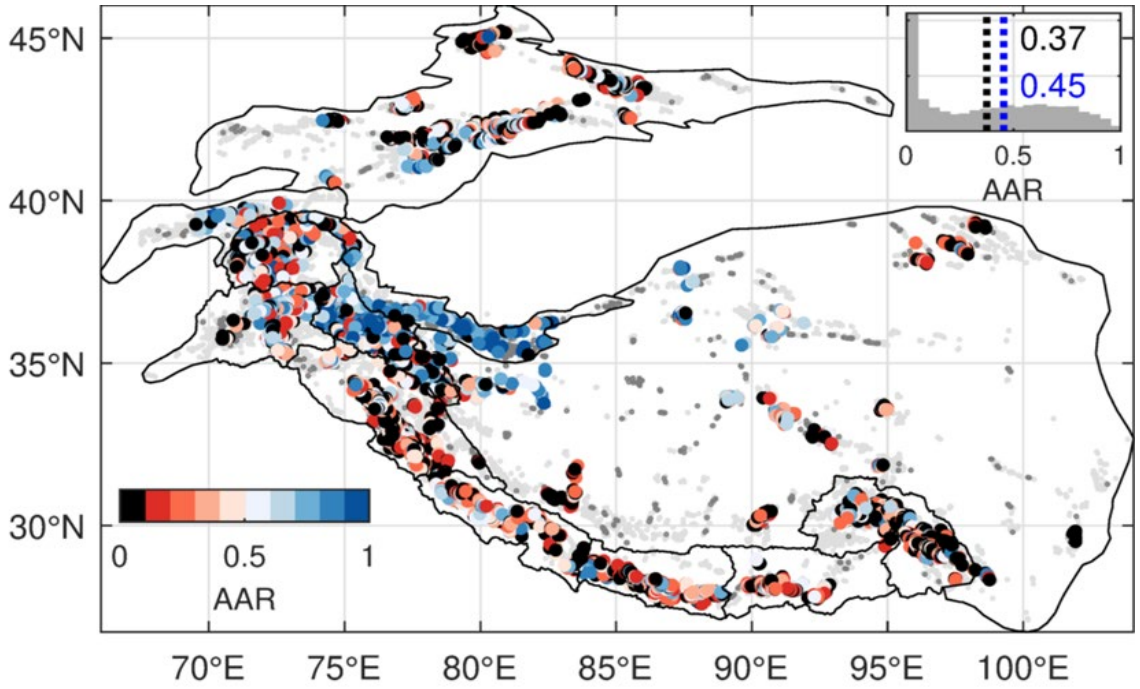
<<CRYOSPHERE AND HYDROLOGY>>

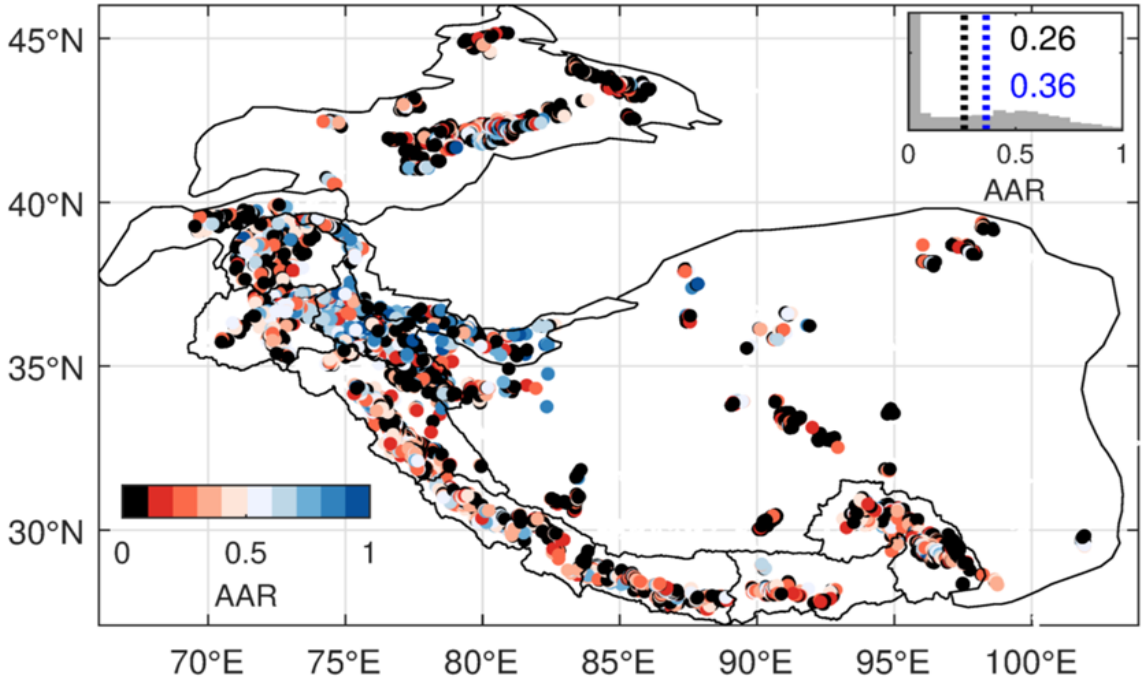
Results Highlight
Cryosphere and Hydrology

Results Highlight 1
Cryosphere and Hydrology

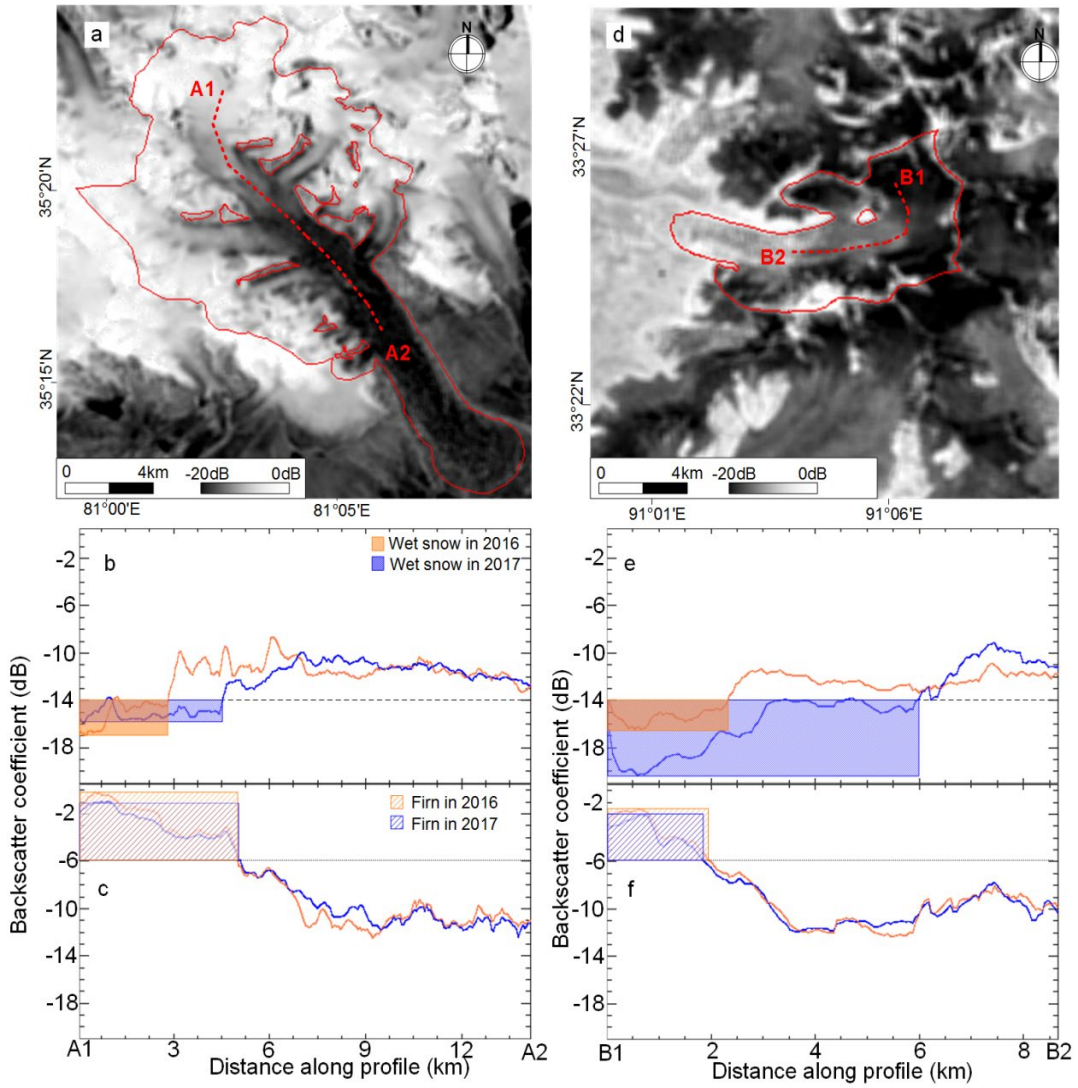
State of glaciers, 2000-2016 and 2015-2020

- A new, revolutionary data set to characterise glacier state and constrain models: altitudinally resolved mass balance from remote sensing
- Anomalous state in the West (healthy glaciers, large AAR); overall decline of glacier health (2x more glaciers lost accumulation area)





Results Highlight 2
Cryosphere and Hydrology



- We developed a **novel index of the glacier accumulation type** entirely **based on** glacier surface wet snow and firn **observations from Sentinel-1**.
- We used different stereo satellite data including Corona, ASTER, SPOT and Pléiades data to assess the **mass balance variability and trends** in various subregions in High Mountain Asia **since about 50 years**.
- We showed the potential of very-high resolution Pléiades stereo data to **measure glacier-wide mass balance at annual and seasonal scales.**
- We developed an **automated workflow to derive seasonal velocity variations** over entire High Mountain Asia using Sentinel-1 and Sentinel-2 data.

Huang, Hock, Lei, Bolch et al. (2022), Sci. Bul.

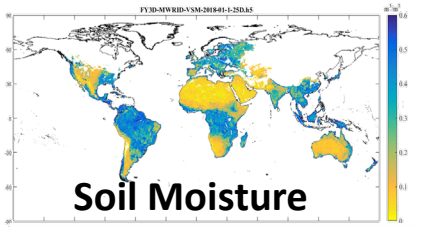
Results Highlights 3

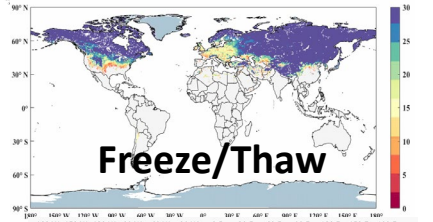
Cryosphere and Hydrology

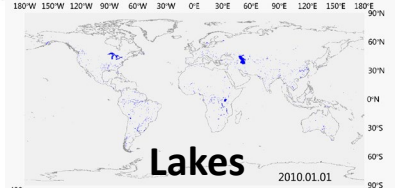
Joint team (France CESBIO and China NSSC & AIR) presented the results for two objectives

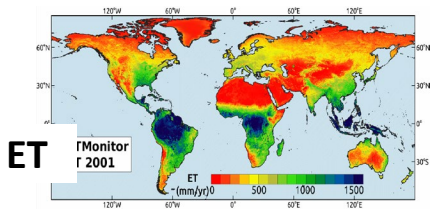
A Cryosphere Mission study to target snow accumulation and melting processes

Building a water cycle observation constellation system from current and future satellites

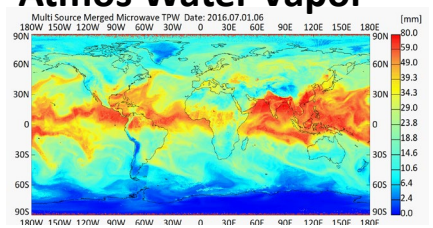


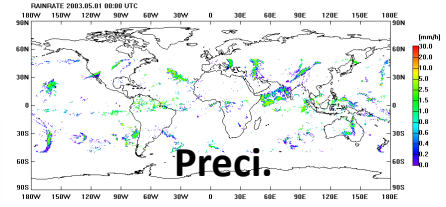


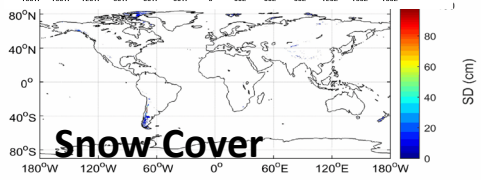


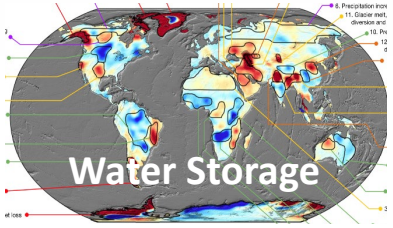


Atmos Water Vapor

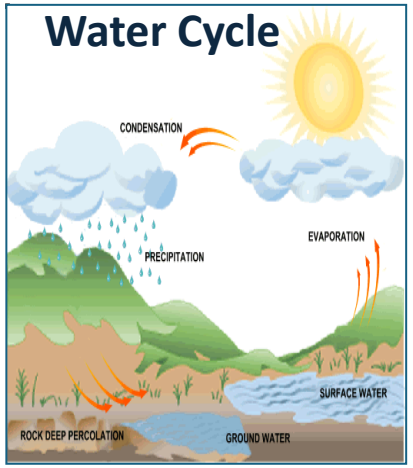








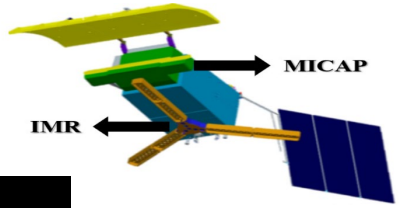
Current Satellite Constellation

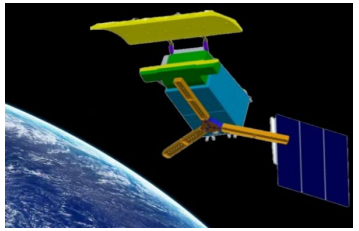


Further Enhancements

Preci. Mission (FY-3G)

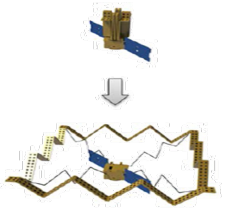
SSS Mission



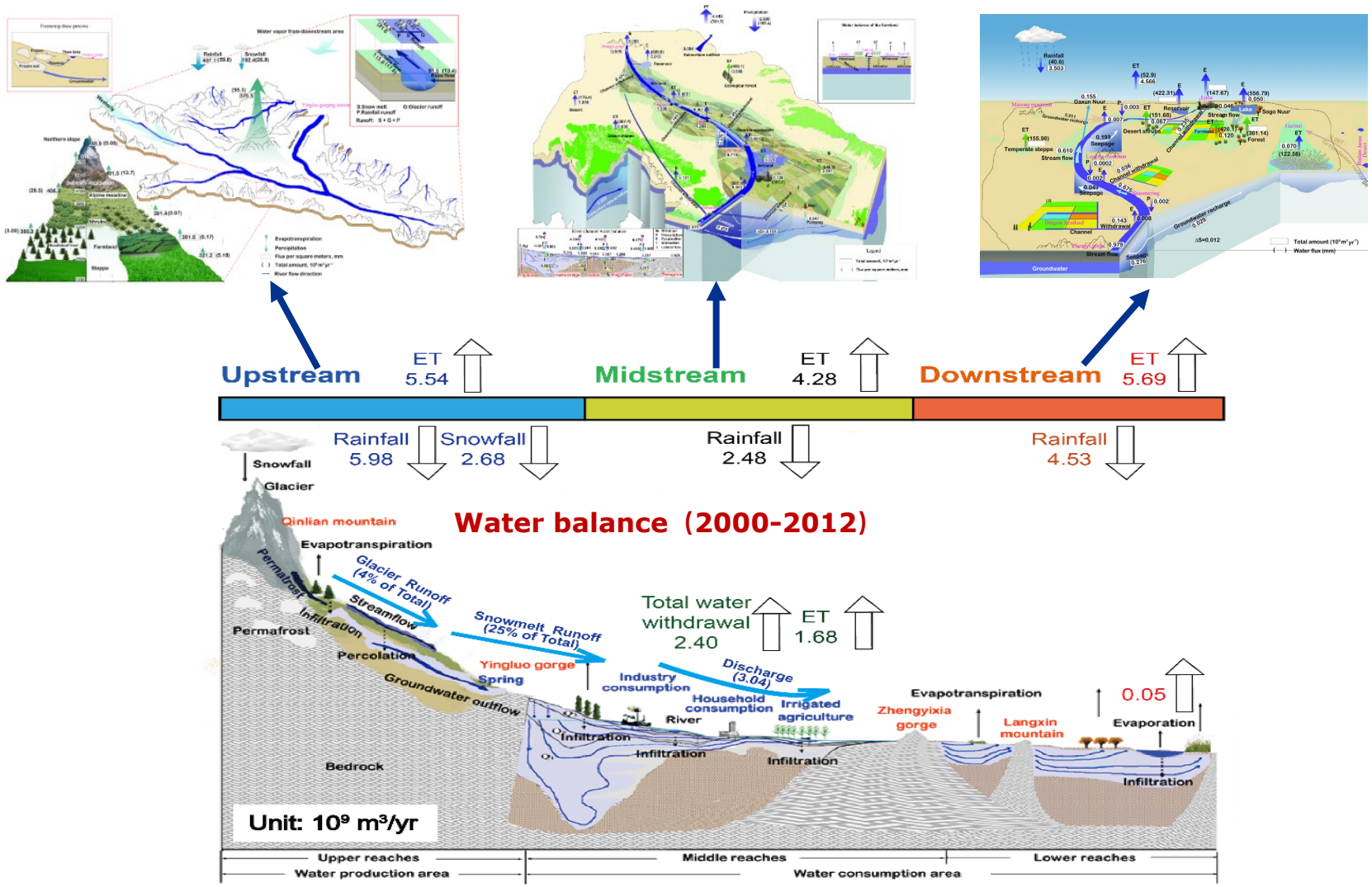


Water Resource Satellite

Cryosphere Monitoring Mission



water balance closure

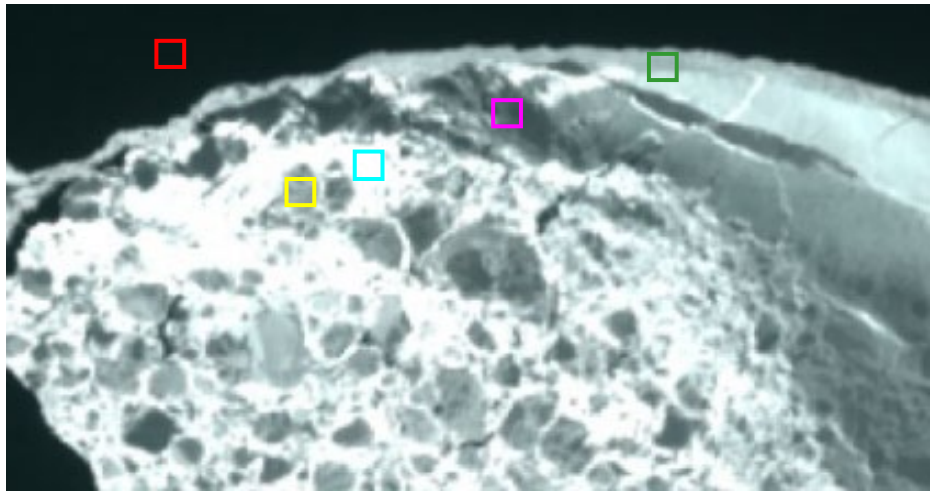


- Climate warming is a favorable factor in alleviating water scarcity
- Human activities have both positive and negative effects
- Water conflicts should be handled from a broad socioeconomic perspective

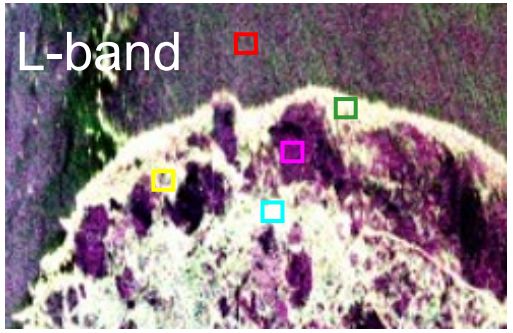
Results Highlights 5

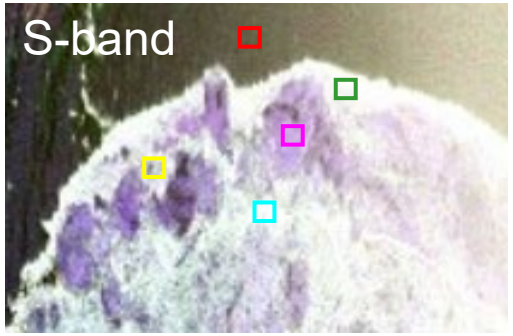
Cryosphere and Hydrology

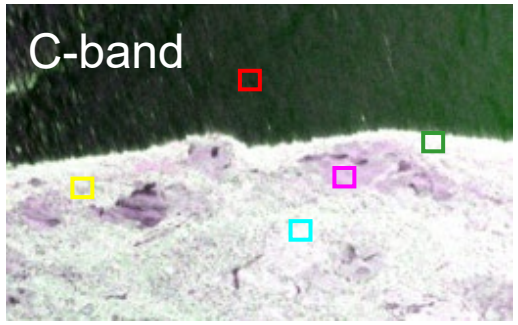
Airborne Multi-frequency Polarimetric SAR data



Sentinel-2 MSI UC Time: 2022-02-27 02:36:39, 4-hour ahead of SAR data







remote sensing

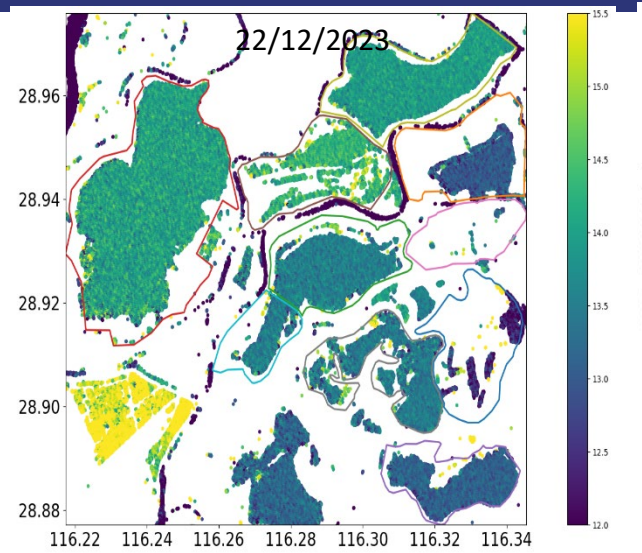
MDPI

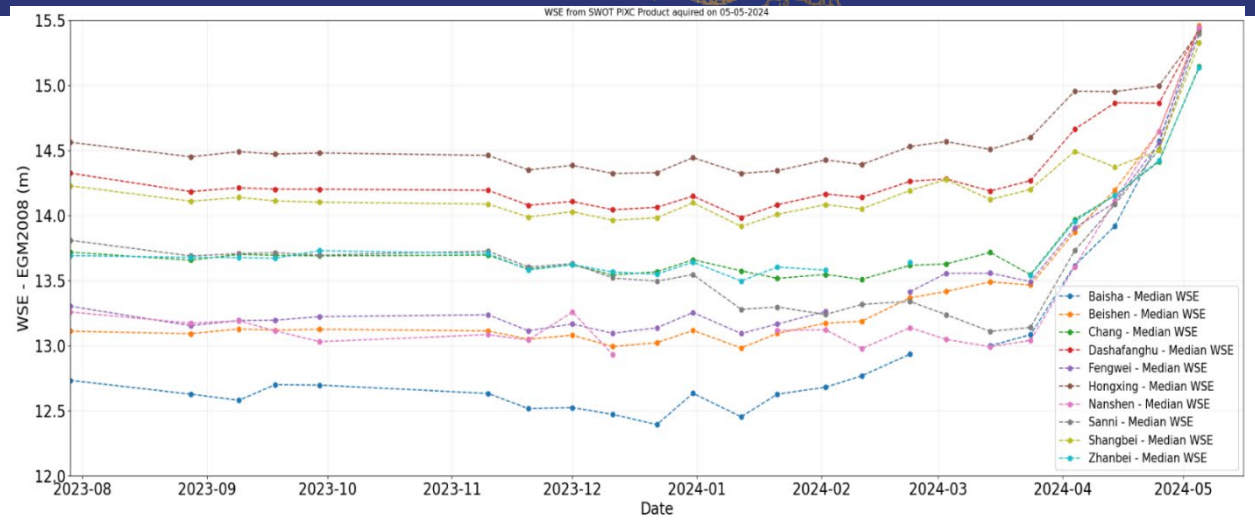
Assessment of Sea-Ice Classification Capabilities during Melting Period Using Airborne Multi-Frequency PolSAR Data

by Peng Wang [1,2], Xi Zhang [1,2,*], Lijian Shi [3], Meijie Liu [4], Genwang Liu [2], Chenghui Cao [2] and Ruifu Wang [1]

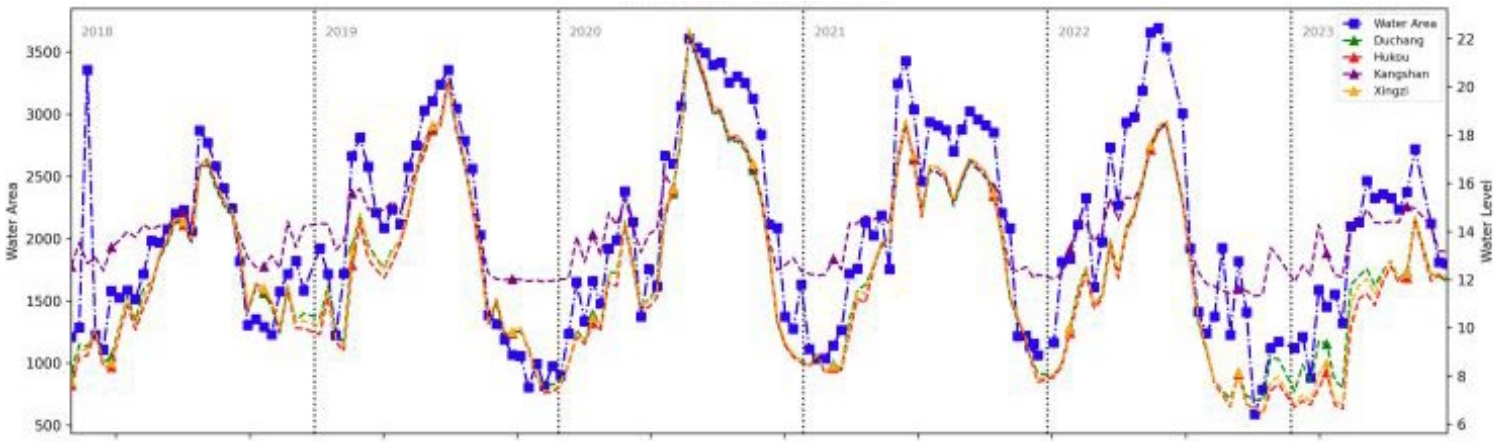
=> towards use of recent and future compact-polarimetric and polarimetric satellite missions and multi-frequency image combinations for all-seasons improved sea ice classification and iceberg detection

Results Highlights 6
Cryosphere and Hydrology





SWOT allows an unique **monitoring** of LWE and LWL with never unreached accuracy : a **breakthrough** in EO



Dramatic decrease of the state of Pöyang lake, a sensitive system monitored over Dragon's years

Dramatic upheaval of such sensitive and rich ecosystem providing so many societal services and benefits

Seed questions: Science & Application

Cryosphere and Hydrology

Seed questions: Science & Application
Cryosphere and Hydrology

What are the remaining issues concerning the exploitation of current mission data?

- Sentinel 1 and 2 data misalignments can be problematic for some applications needing high resolution (as between Landsat 8 and Sentinel2);
- Larger quota and better access to third party mission data (e.g. stereo images Pleiades; SPOT6/7, and non-ESA SAR;
- Sentinel1: lack of flexibility in choosing polarisations and acquisition modes;
- Some Chinese satellite data have scarce technical documentation, or not easily accessible.

What are the new science findings in the domain?

- Geodetic mass balance (i.e. glacier MB from space) provided a new understanding of patterns of glacier changes;
- We can constrain models to an unprecedented degree for understanding causes and future projections (theoretical work of decades ago that could not be verified);
- Sublimation is important in HMA water towers

What is the general performance and what are the limitations of geophysical parameters retrieval?

- Performance has improved because of the large range of methods available (e.g. machine learning, statistical approaches, etc).
- Limitations: not enough complementary in situ data (at appropriate spatial resolution) or data from other sensors for validation.

Seed questions: Science & Application
Cryosphere and Hydrology

EO data synergy: is there scope for data synergy and if so which EO missions/sensors are required?

- Yes: large interest in data synergy; and in combining different resolutions and sensors (active/passive, optical to microwave; e.g. stereo images with multispectral radiometers).
- However: challenges in combining data from different sensors acquired at different times; e.g. radar sensors at different frequencies.
- Synergies would be more efficient with higher temporal and spatial resolution
- We need complementary SAR missions (Tandem L and C)

Validation: Have the necessary validation data been collected and shared?

- Not enough validation data (see above); we also need documented accuracy of in-situ data; in situ measurements have to deliver at the accuracy of retrievals that are getting more and more accurate; instances of difficulties in obtaining in-situ data from China.

Seed questions: New EO Mission Exploitation
Cryosphere and Hydrology

What are the new domains where further research is needed?

- AI for data retrieval; high spatial resolution snow water equivalent; snow load over sea ice; estimation of components of total vapour fluxes.

What are the synergy between Europe and China new missions to be exploited?

- Altimetry mission: EU has no plans for laser altimetry: a case for synergies with Chinese mission and to increase coverage (e.g. IceSat2 coverage is limited);
- High resolution thermal infrared mission: synergies to overcome limited temporal resolution.

What complementarity in the operational use of the current / future missions (planning, observations, etc.) could be improved to allow better data exploitation?

- We need continuity of missions in terms of quality of data, spectral bands; and we need improvements (e.g. Sentinel NG);
- Combine Chinese and European missions to close data gaps;
- Sharing of data products and analysis tools should continue, with attention to cross-validation.

Scientific Recommendations
Cryosphere and Hydrology

- New scientific focus: cold regions' and high elevation water cycle and downstream water security

- Discussion: less topics, larger groups, more funding?