



EC-ESA Joint Earth System Science Initiative



22-24 November 2023 | ESA-ESRIN, Frascati, Italy

Polar meeting summary



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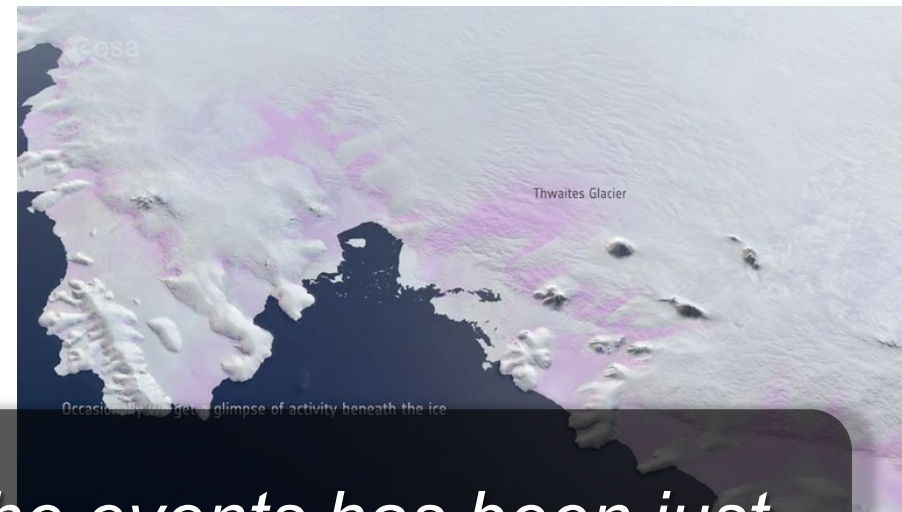
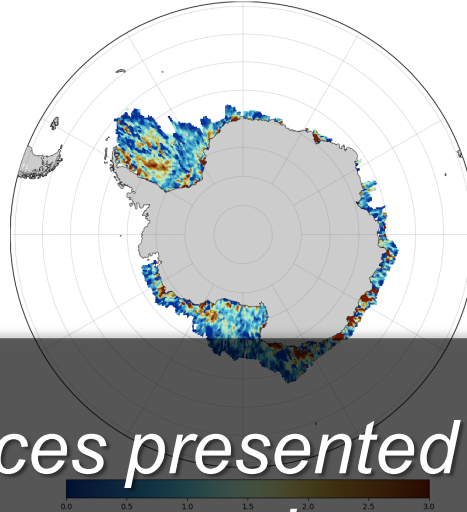
→ THE EUROPEAN SPACE AGENCY

Impressive set of projects and results



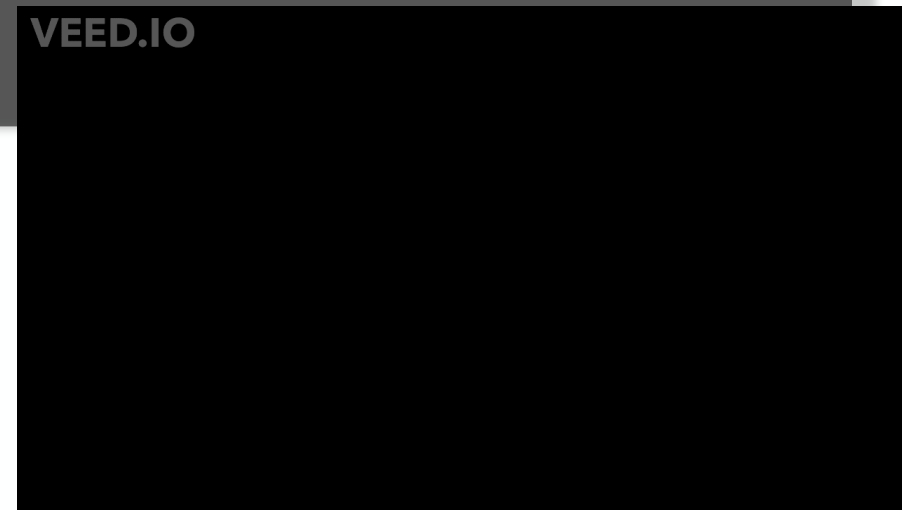
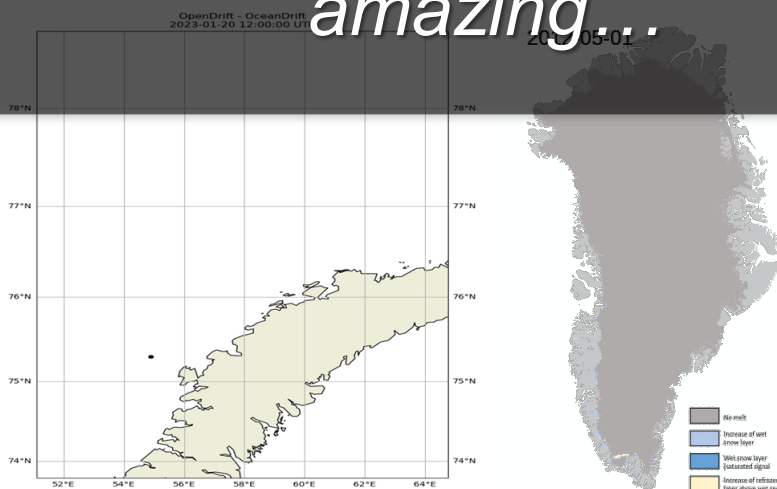
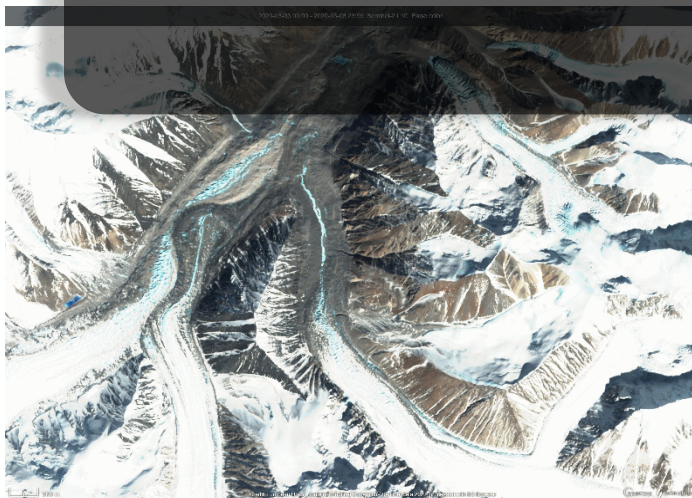
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1:sit_sd ASD_sh_radar_freeboard_20hz_median: sea_ice_thickness (m)
min -17.01 max 29.67 mean 1.034 std 2.047 med 0.932 mad 0.610 nb 35713



Occasionally, you get a glimpse of activity beneath the ice

The progress and advances presented at the events has been just amazing...



The Arctic...

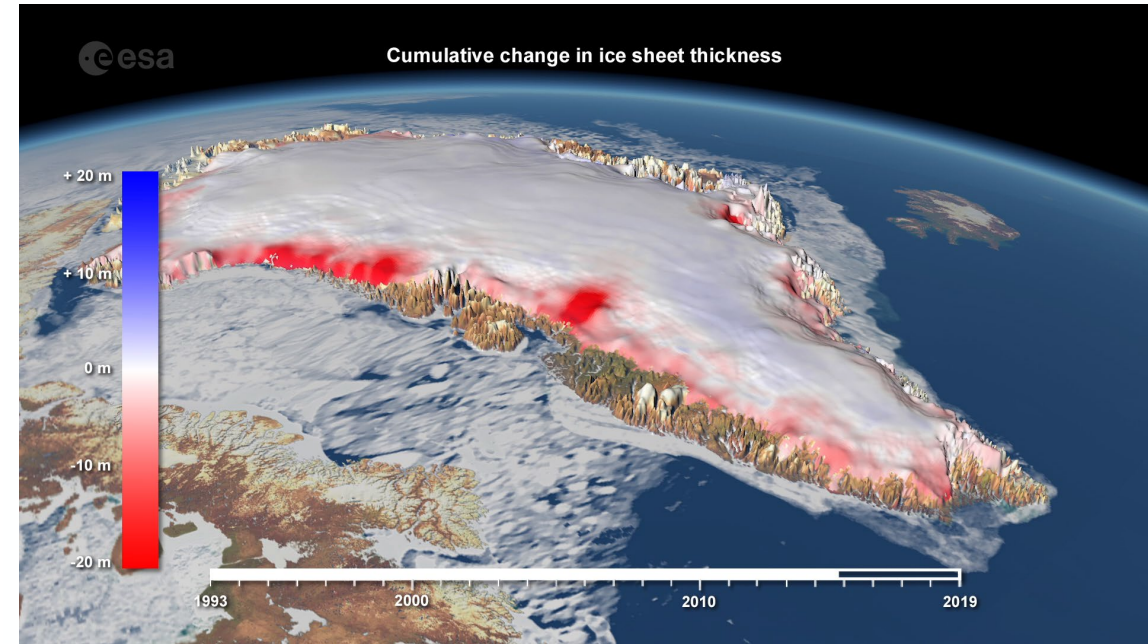
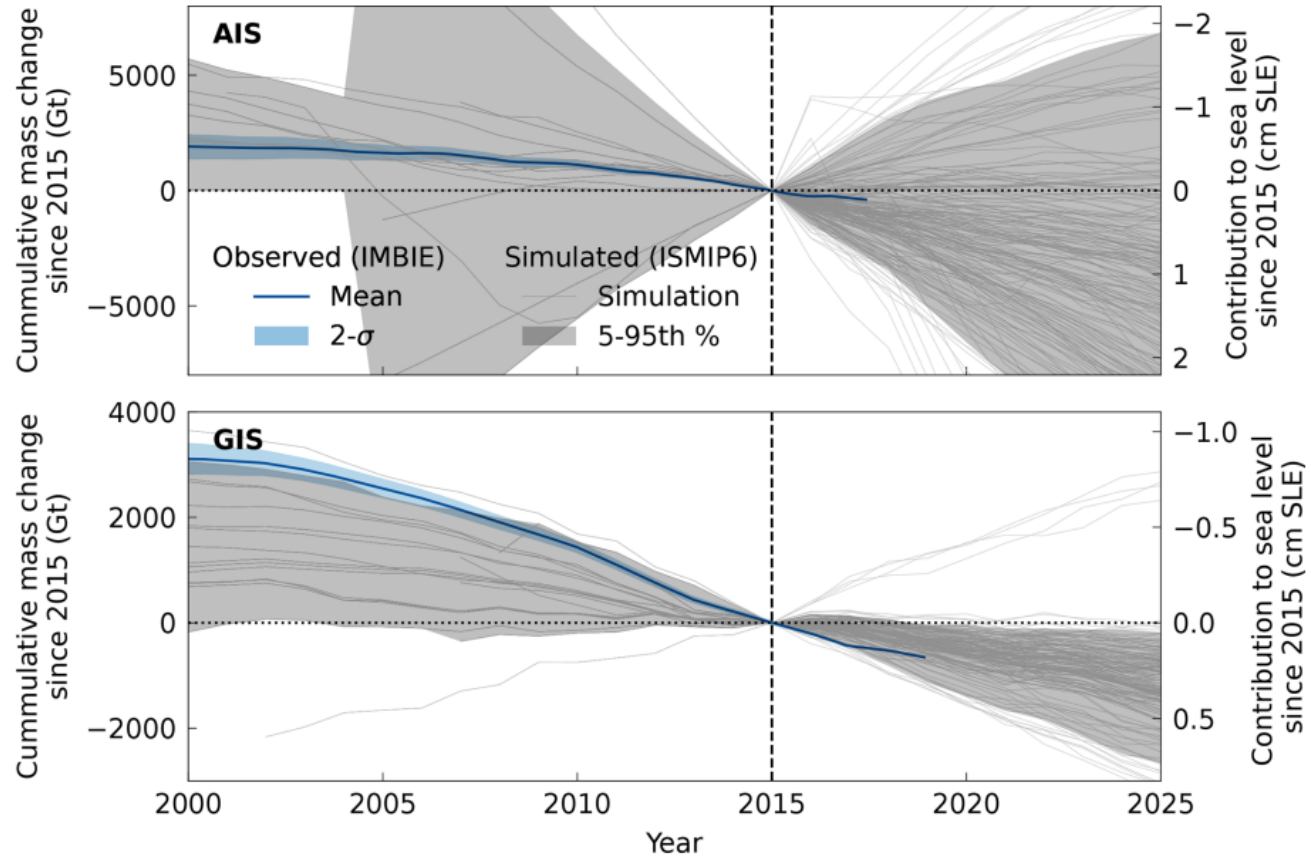
- Freshwater fluxes and impacts on ocean circulation (AMOC collapse??)
- Run-off/discharge impacts on biology (e.g., impact of Greenland run-off on ocean biology).
- Cryosat is expanding its mask to cover all coastal areas in SAR mode (support fiord-scale modelling)
- Arctic ocean biology and carbon
- Arctic biodiversity and ecosystems...
- Sea ice variability (trends), drivers (e.g., impacts of more frequent and intense extremes)
- The permafrost methane bomb..
- Arctic atmosphere....

And many more.. Many activities already exist, many efforts already on going, but also major needs and opportunities for collaboration and coordination efforts...

The Arctic has entered in a new regime where sea-ice-atmosphere interactions, exchanges of heat, carbon, energy, momentum, have radically change, impacting the role of the Arctic in the Earth system

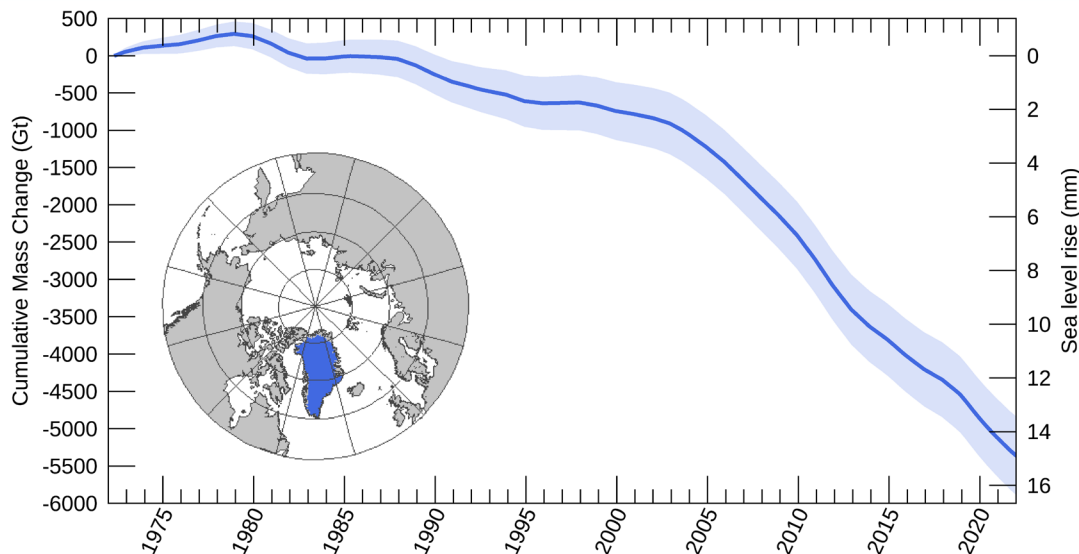
A major coordinated effort to fully understand and characterize this “new Arctic system” is urgent.... This require a major effort and synchronization of in-situ data collection, Earth Observation and process studies... EC-ESA ESSi could be a mechanism to launch/support such an effort....

Ice Sheets...



IMBIE Team

Aschwanden et al. 2021



Greenland deserves special attention.... Major changes undergoing in Greenland have a major impact in the Arctic system but also in the people of Greenland...

Need to look not only at Greenland from the point of view of Climate Change, but we are now in a position to provide science base solutions to Greenlandic populations...

Antarctica...



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European Space Agency

Towards an advanced data-driven reconstruction of Antarctica.... With focus on the marginal zones, dynamic processes And sea ice-ocean interactions...

- a) Understand the complex interactions between the atmosphere and ice-sheet surface, and the potential for the triggering fractures, ice-shelf collapse and catchment destabilization.
- b) Understand the interactions between the Circumpolar Deep Water into ice-shelf basal melting detecting changes in location

Clear case for complementary work and collaboration across ESA and EU Polar Cluster projects

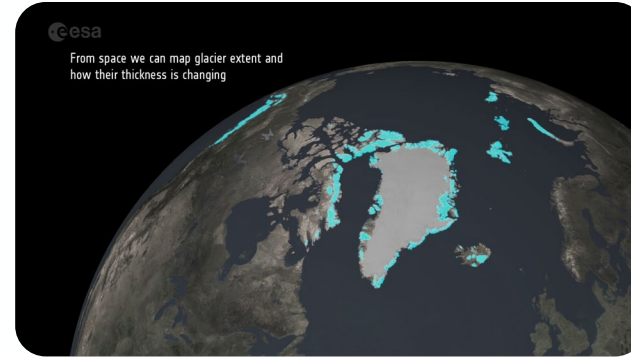
... and stability.
... predict the future evolution of the
... by linking observations of atmospheric,
... and ice-sheet properties to physical-based models,
... advanced AI, machine learning and hybrid methodologies.



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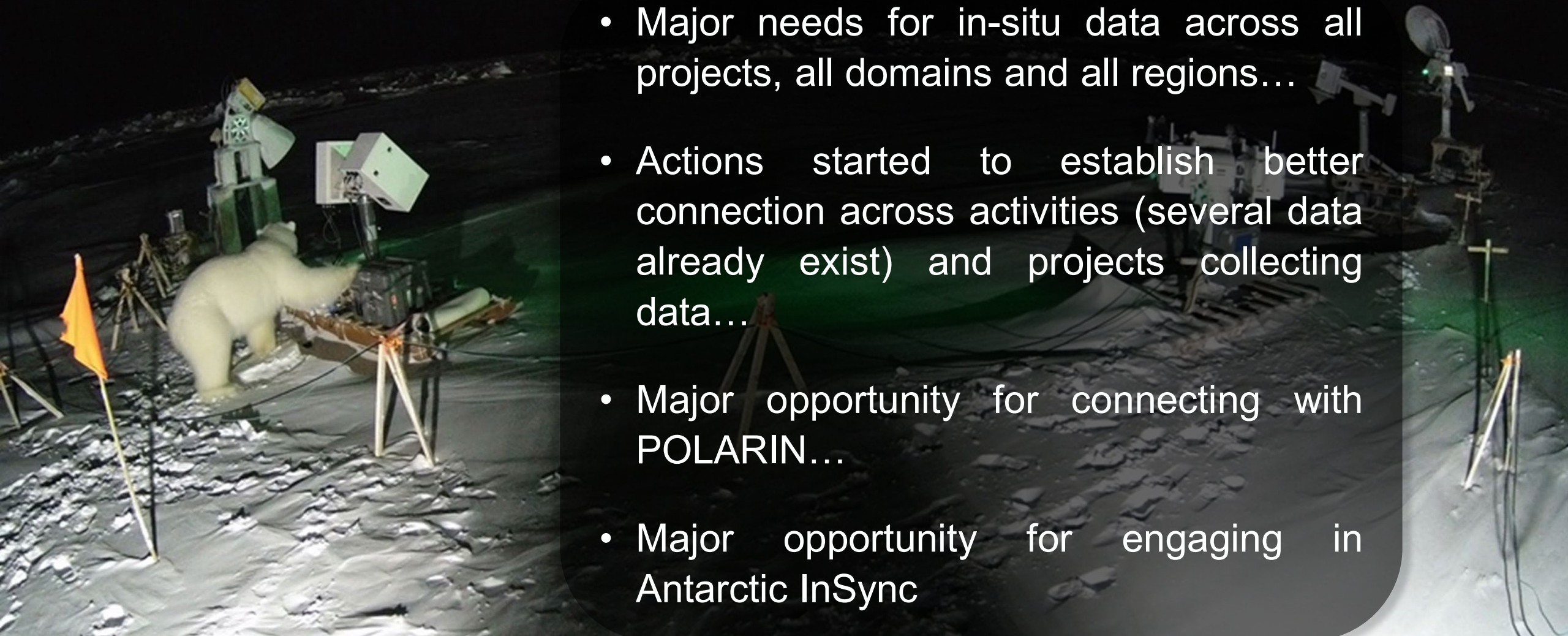
European Space Agency



- Mass change assessments from all sources of higher temporal and spatial resolution
- Need for more process understanding (feedbacks)
- Derive essential hydrological services (snow density, runoff...) from EO using data assimilation and advanced AI / numerical modeling (digital twin)
- Maximise CRISTAL's potential for glacier mass balance and hydrology applications



- Major needs for in-situ data across all projects, all domains and all regions...
- Actions started to establish better connection across activities (several data already exist) and projects collecting data...
- Major opportunity for connecting with POLARIN...
- Major opportunity for engaging in Antarctic InSync



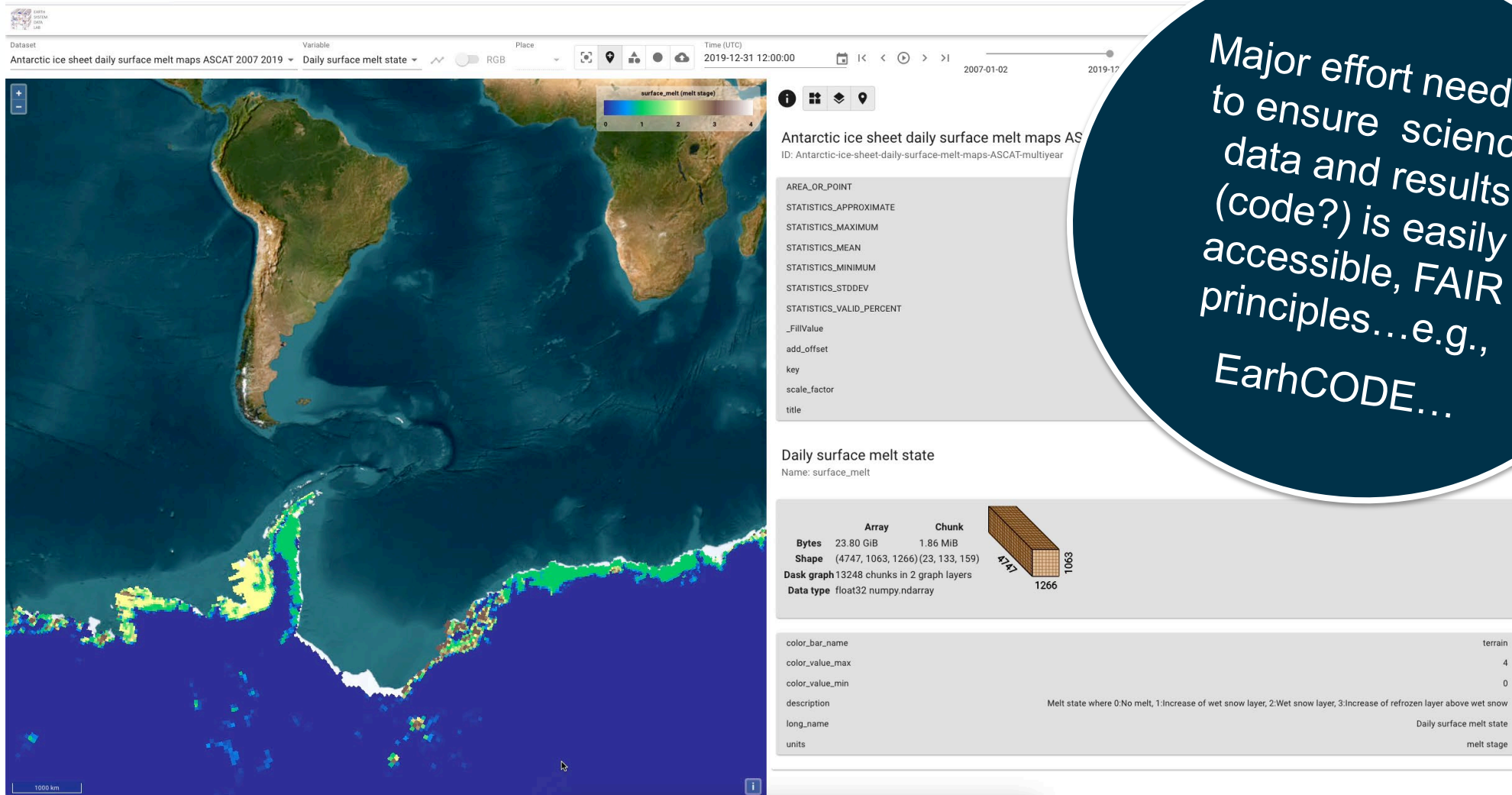
Open Science, FAIR principles and novel technology...



More useable

6. Make it accessible
5. Make it visualisable
4. Make it findable
3. Catalogue the data
2. Make it available
1. New Data

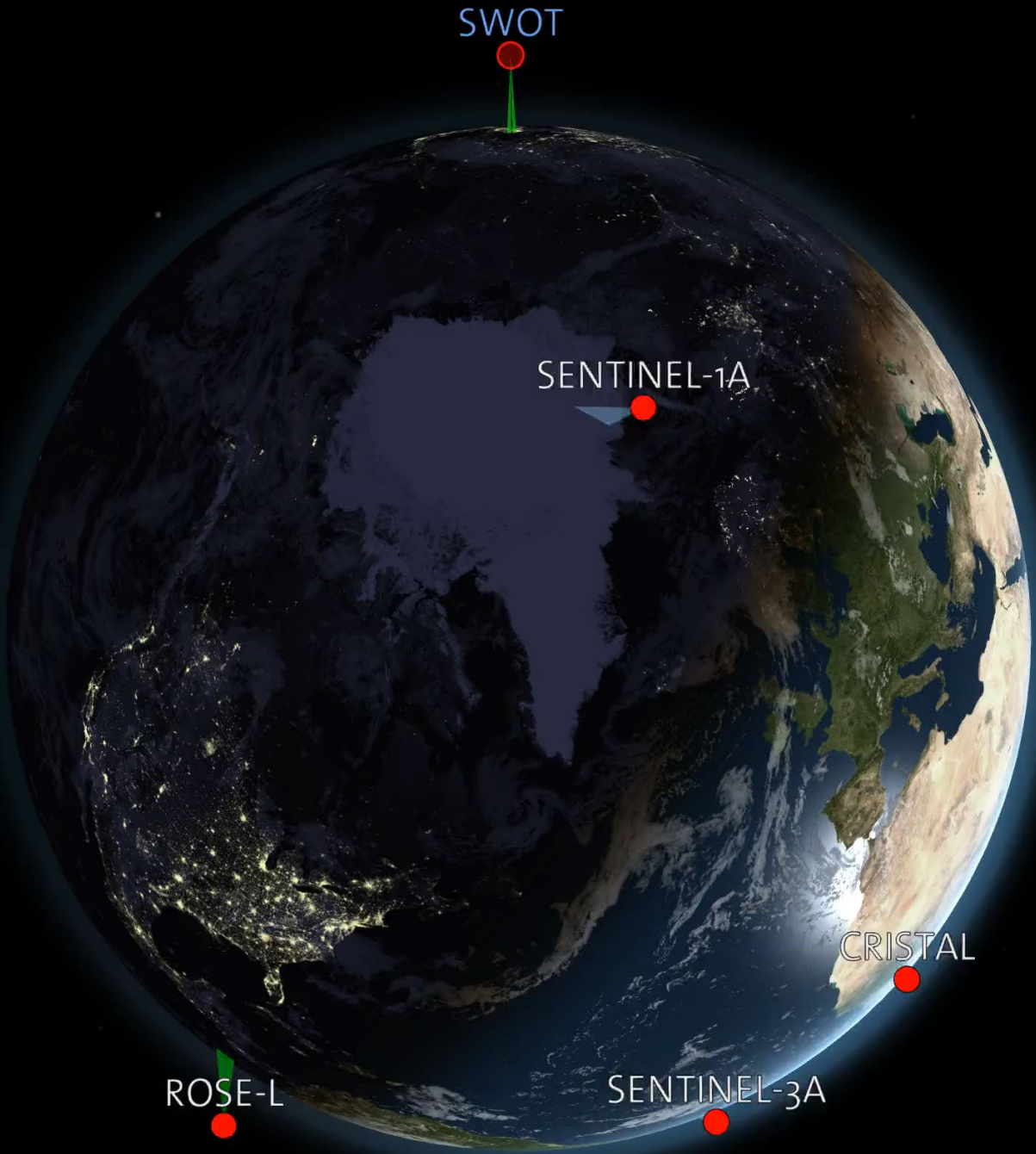
Less useable



Major effort needed to ensure science data and results (code?) is easily accessible, FAIR principles...e.g., EarhCODE...



Significant progress in Copernicus Polar activities...

**CTMR**

Orbit Number: 10410
Time Since ANX: 5034.760
Lat: 60°S 49' 59"
Lng: 112°E 48' 48"
Alt: 844.423 km
Daylight

CRISTAL

Orbit Number: 5314
Time Since ANX: 3401.558
Lat: 25°S 10' 18"
Lng: 0°E 34' 34"
Alt: 748.961 km
Daylight

MetOp-SG-B

Orbit Number: 10408
Time Since ANX: 4597.867
Lat: 81°S 02' 56"
Lng: 135°W 22' 35"
Alt: 849.308 km
Daylight

ROSE-L

Orbit Number: 1601
Time Since ANX: 2925.978
Lat: 1°N 55' 54"
Lng: 82°W 45' 26"
Alt: 698.486 km
Daylight

SENTINEL-1A

Orbit Number: 35973
Time Since ANX: 1371.835
Lat: 79°N 36' 27"
Lng: 46°E 02' 02"
Alt: 708.115 km
Daylight

SENTINEL-1B

Orbit Number: 24989
Time Since ANX: 4383.121
Lat: 81°S 08' 38"
Lng: 149°W 34' 26"
Alt: 724.914 km
Daylight

SENTINEL-3A

Orbit Number: 25420
Time Since ANX: 3534.148
Lat: 29°S 59' 46"
Lng: 27°W 59' 54"
Alt: 814.284 km
Daylight

SENTINEL-3B

Orbit Number: 14026
Time Since ANX: 5902.512
Lat: 9°S 15' 30"
Lng: 158°E 22' 33"
Alt: 807.385 km
Eclipse

SWOT

Orbit Number: 5147
Time Since ANX: 2404.437
Lat: 38°N 37' 41"
Lng: 127°E 47' 46"
Alt: 897.675 km

ROSE-L

SENTINEL-3A

CRISTAL

SENTINEL-1A

SWOT

Excellent collaboration...

