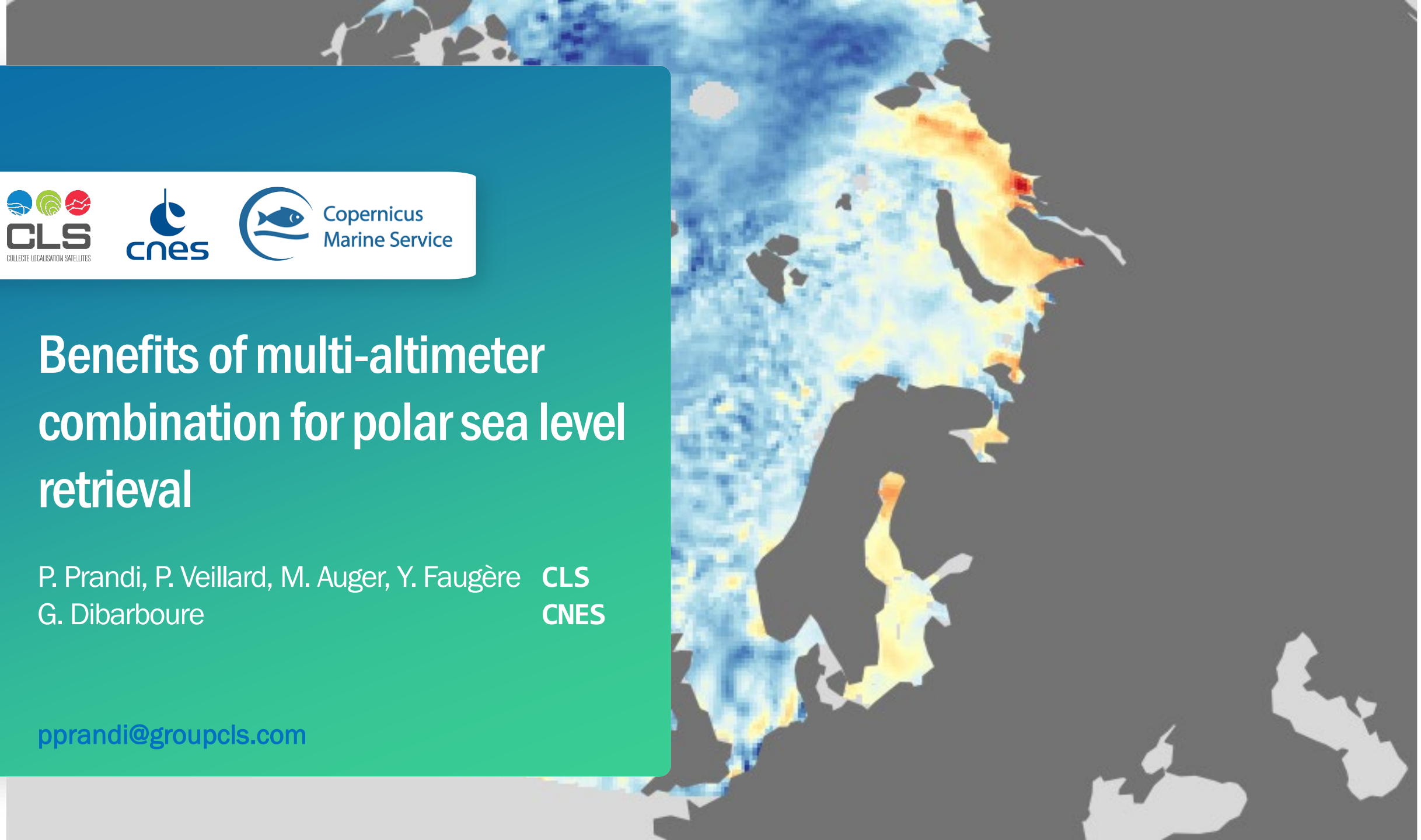

Benefits of multi-altimeter combination for polar sea level retrieval

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Polar Sea level products overview

1994 ERS-1 ground processor (Laxon)

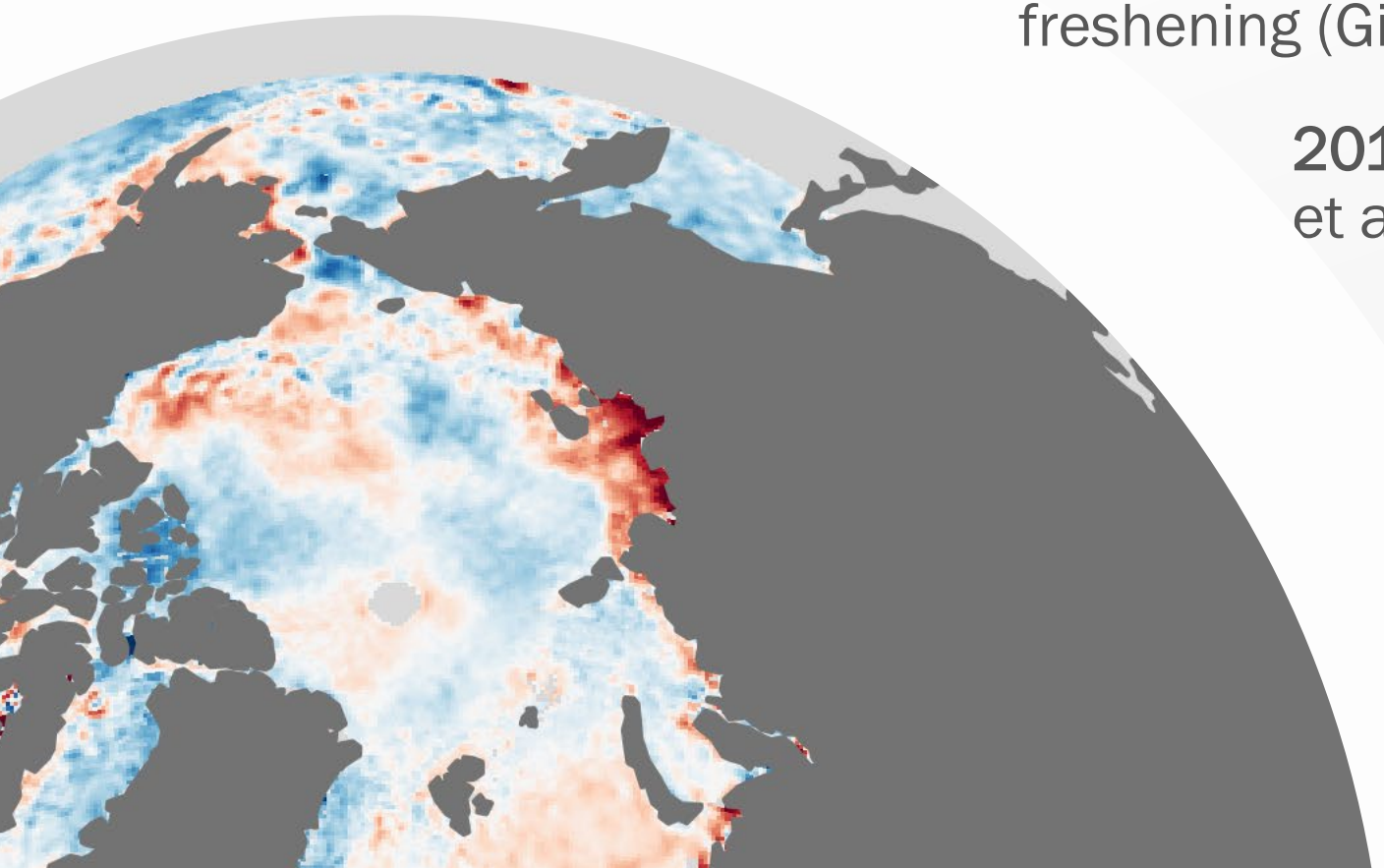
2004 map of Arctic sea level variance (Peacock and Laxon)

2012 altimetry observes the Beaufort Gyre freshening (Giles et al.)

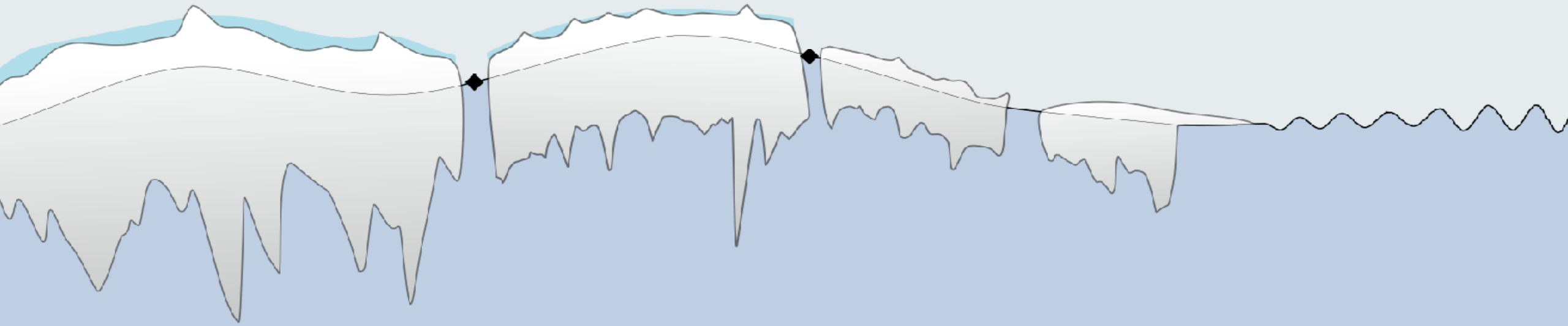
2016 CPOM dataset published (Armitage et al.)

2019 DTU processes the full record (Rose et al.)

Introducing **new polar sea level products** based on the combination of several altimeters



Sea level retrieval in polar oceans



From Quartly et al., 2019

Sea level retrieval in polar oceans

Classification to select leads and ocean

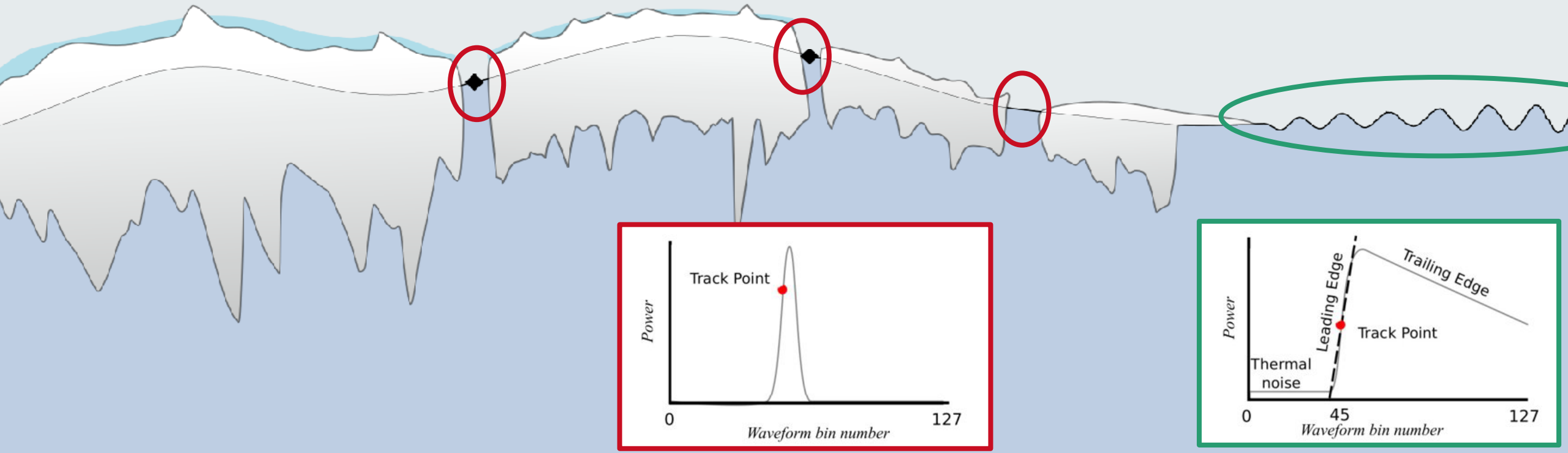
- Neural Net based (Poisson et al., 2018, Longépé et al., 2019)

From Quartly et al., 2019

Sea level retrieval in polar oceans

Range estimation through retracking

- Adaptive retracker (Poisson et al., 2018) on LRM able to process **both** specular and diffuse echoes,
- Empirical TFMRA retracker on SARM for specular echoes



From Quartly et al., 2019

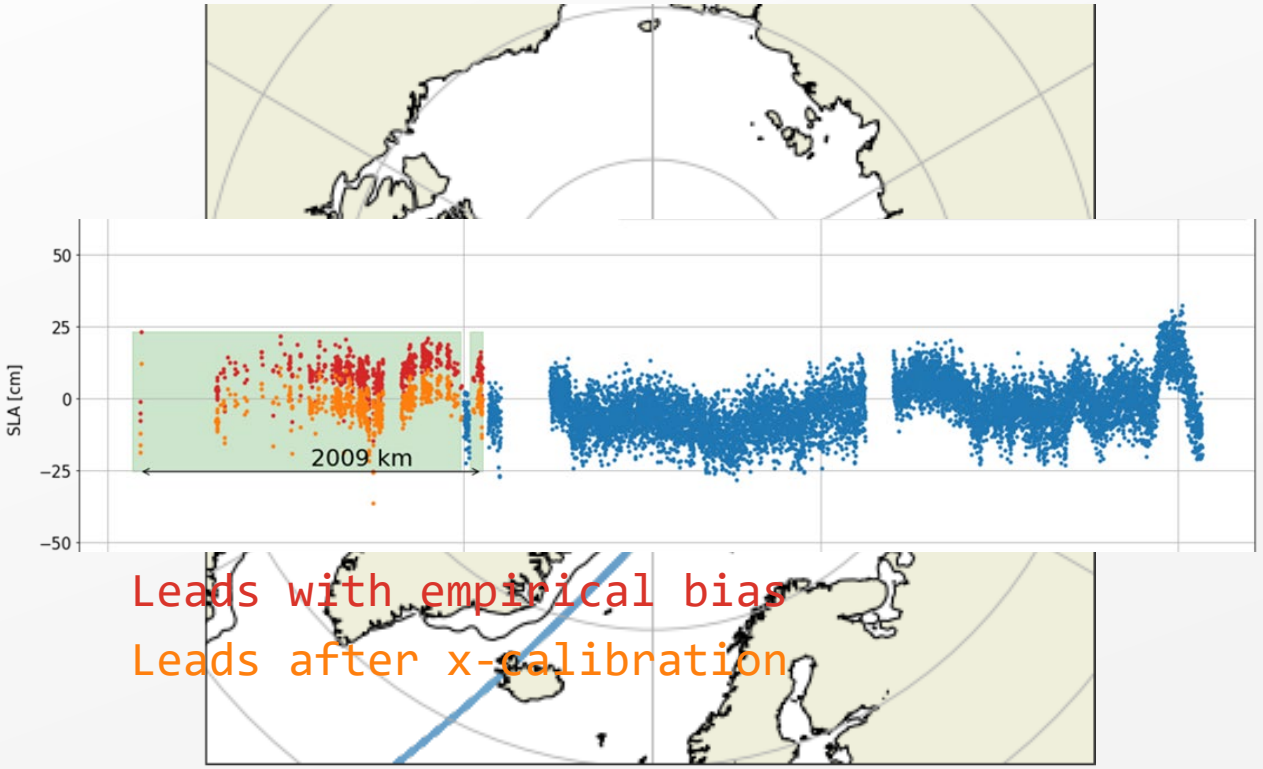
Importance of processing continuity

In most polar ocean approaches, leads and open ocean echoes are processed differently (eg. retracking),

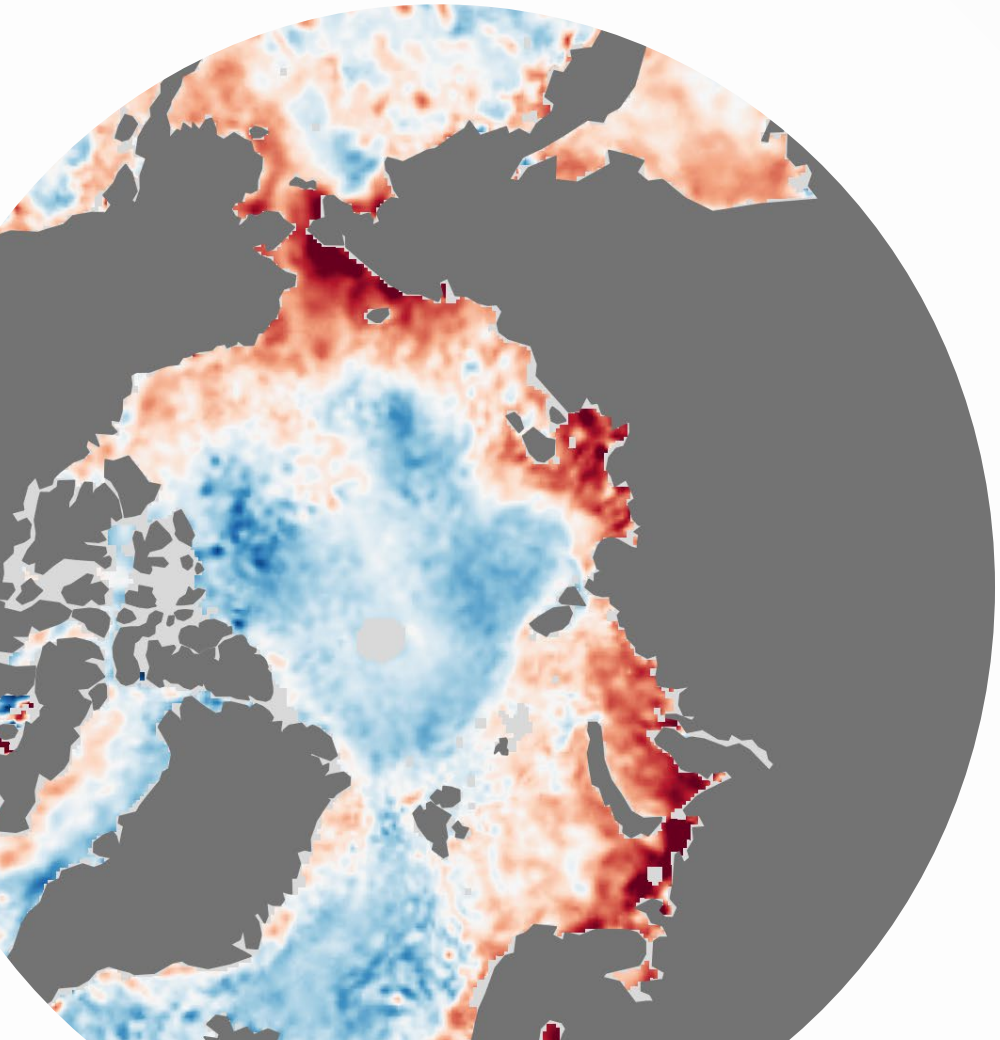
An empirical bias between both surfaces must therefore be estimated,

This bias is highly uncertain,

Not needed here thanks to processing continuity on SARAL/AltiKa



Leveraging the altimetry constellation



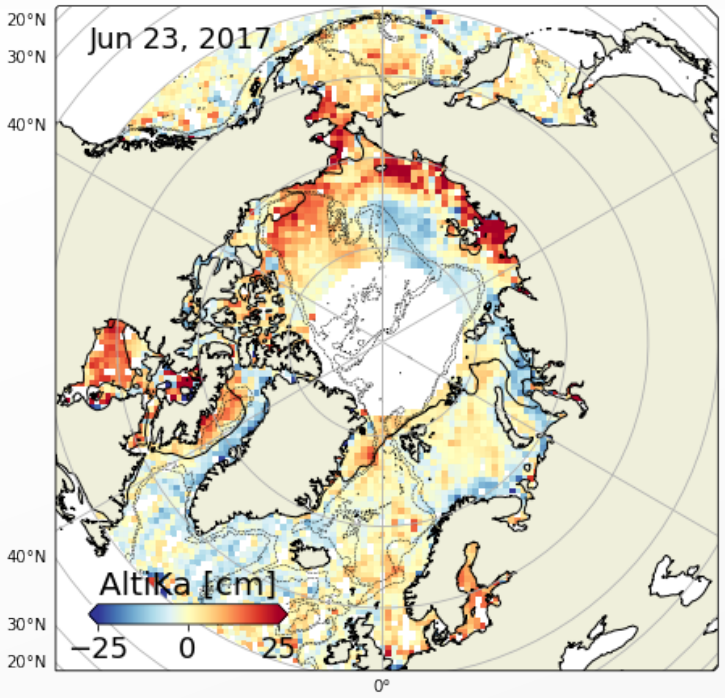
Combining CryoSat-2, Sentinel-3A and SARAL/AltiKa provides a much better data coverage

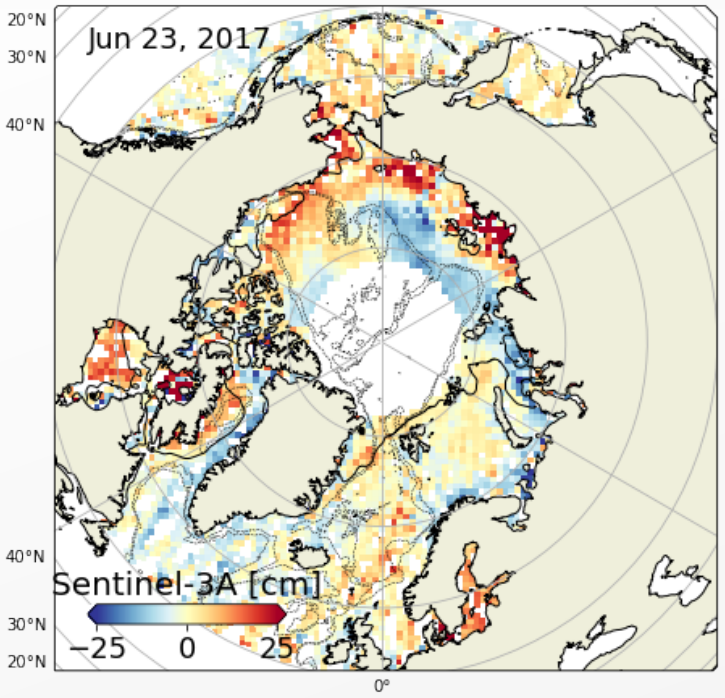
Processing continuity on SARAL/AltiKa provides a consistent baseline for cross-calibration

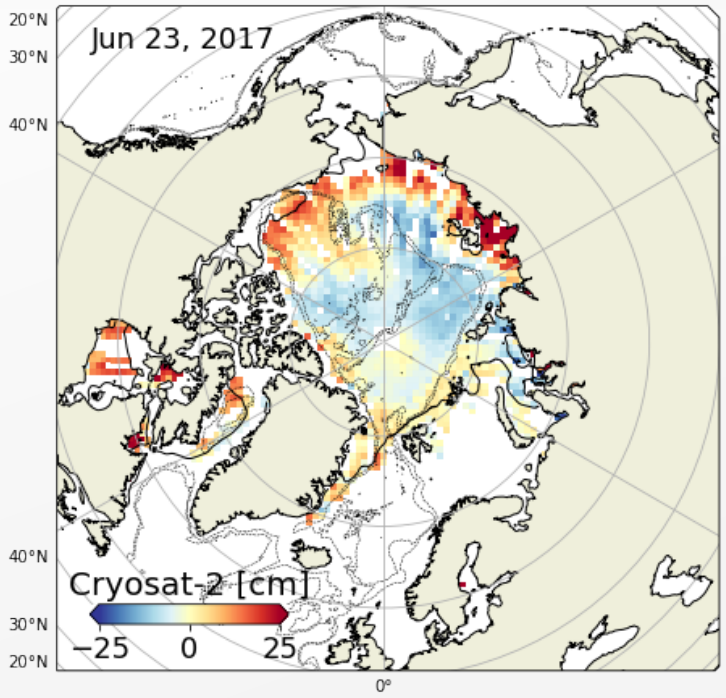
Optimal interpolation scheme maps along-track data to 3 day/25 km grid

Looks nice, but how good is it really ?

Inter-satellite consistency







Three missions observe similar variability pattens (temporaly and geographically)

We are therefore confident that this is signal, not noise

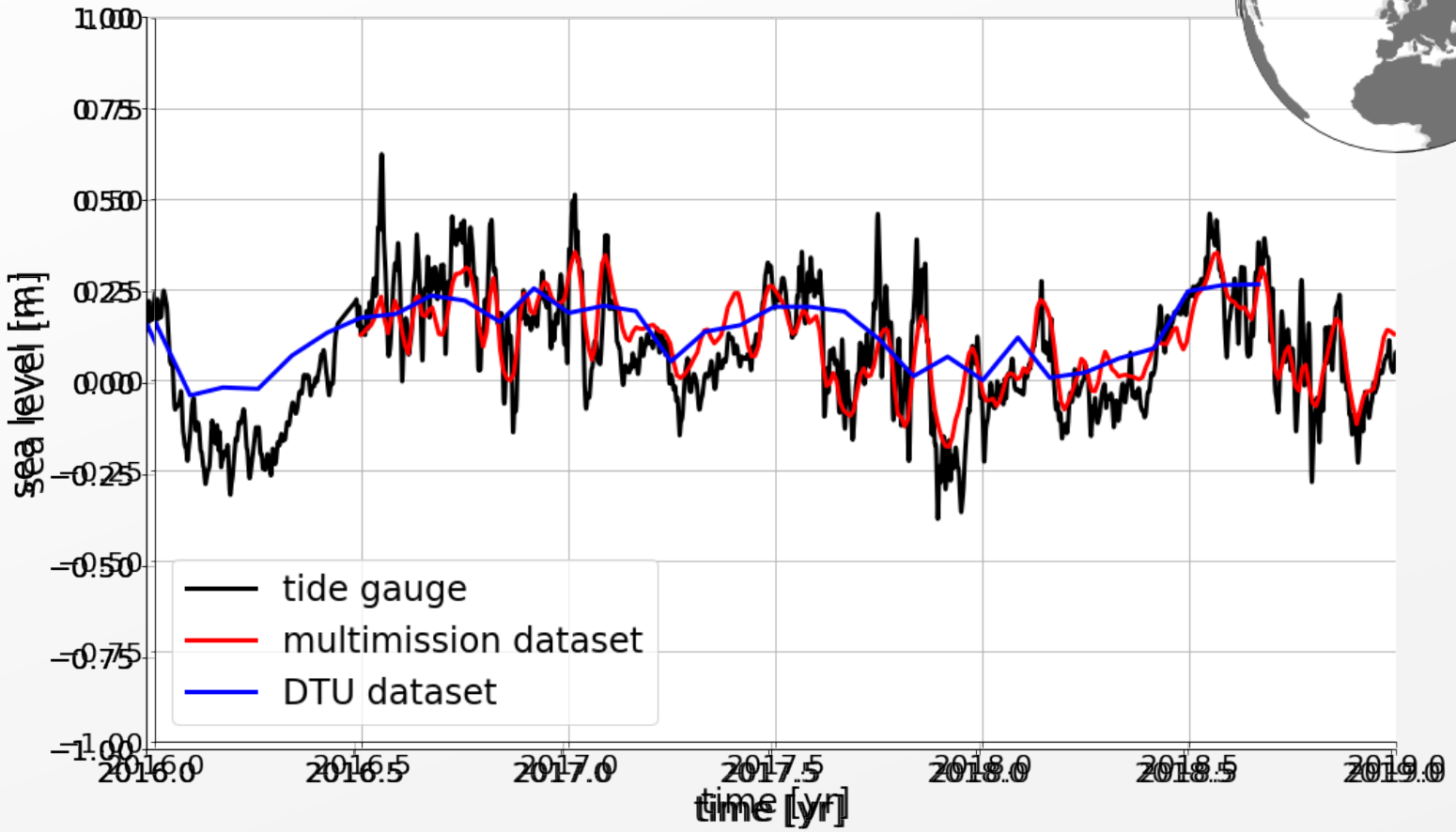
Tide gauge comparisons

Good tide gauges are scarce in the Arctic,

Prudhoe Bay area is seasonally ice-covered

Monthly DTU dataset can not represent high frequency sea level signals

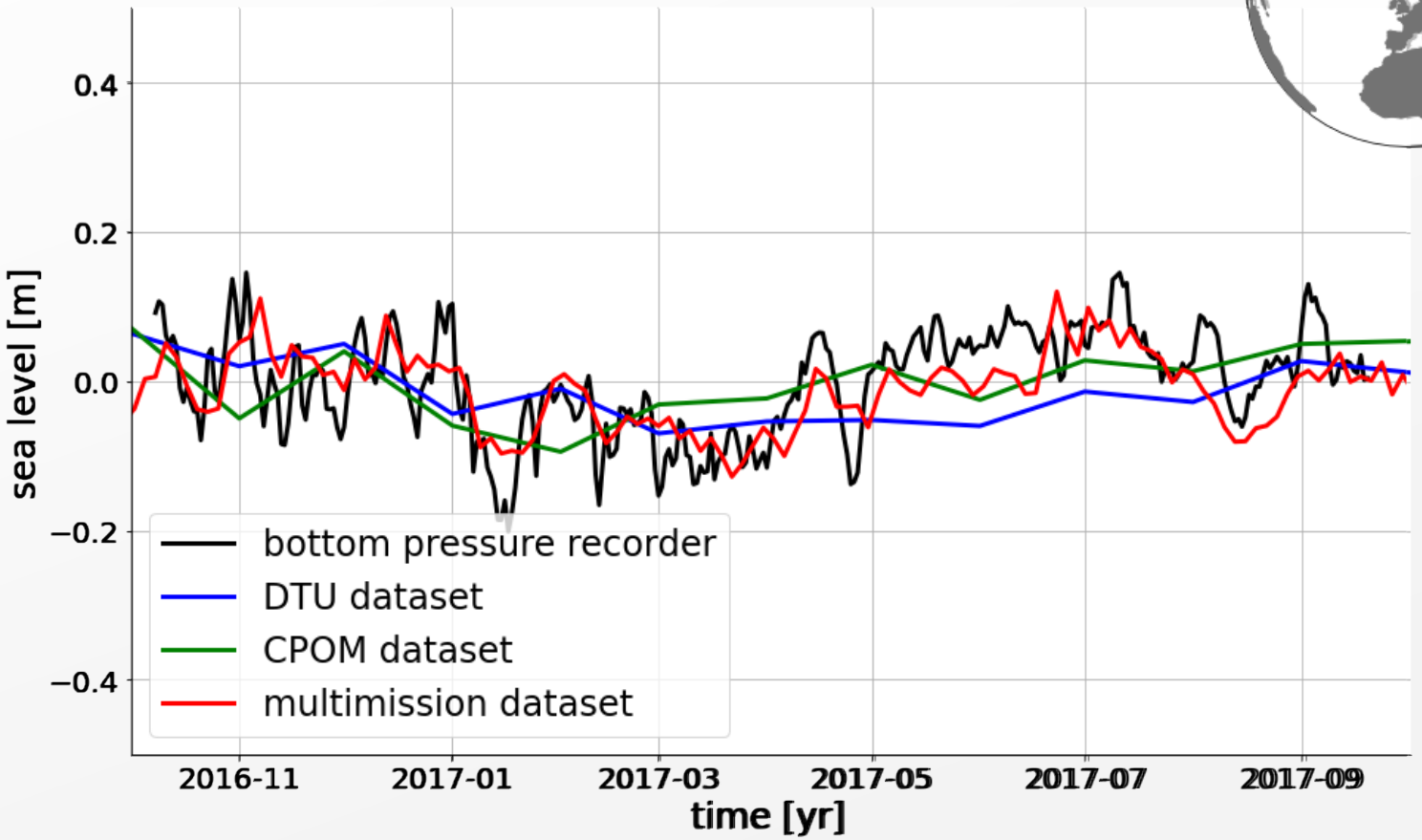
Better agreement with our multi-mission dataset



Bottom pressure recorder

BGEP bottom pressure recorders,

Better skill from the multi-mission dataset

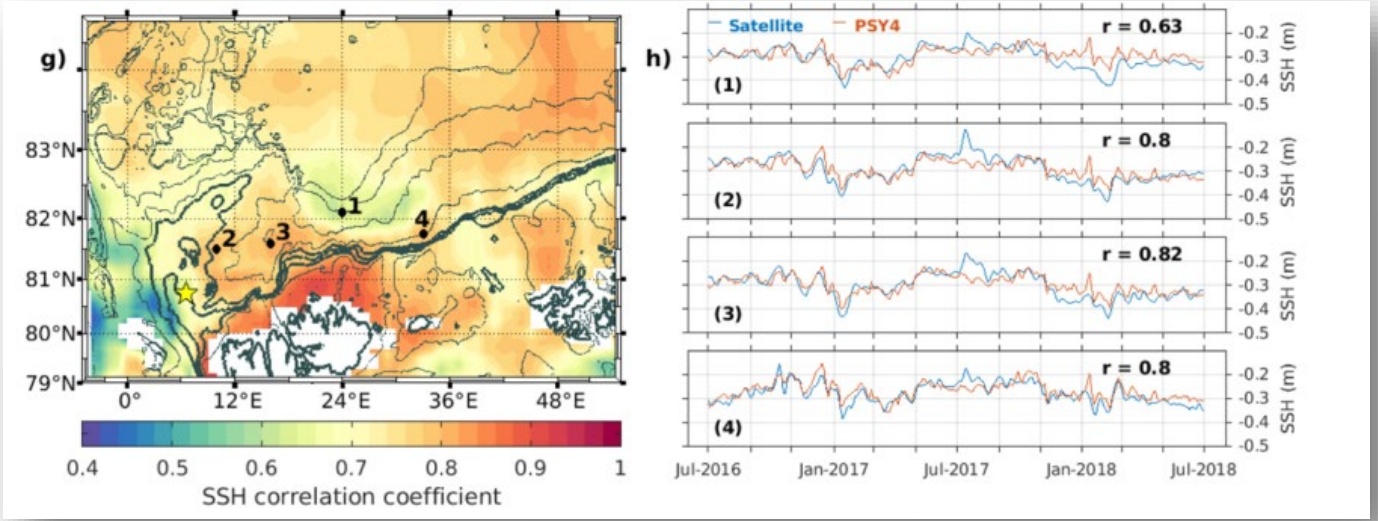


Model comparisons

Comparison to Glorys model north of Svalbard (in Athanase et al., 2020) show a good consistency between modeled and observed fields,

True even in ice-covered regions where altimetry-derived SSH are not assimilated,

Supports the observation of new pathways for Atlantic water into the Arctic

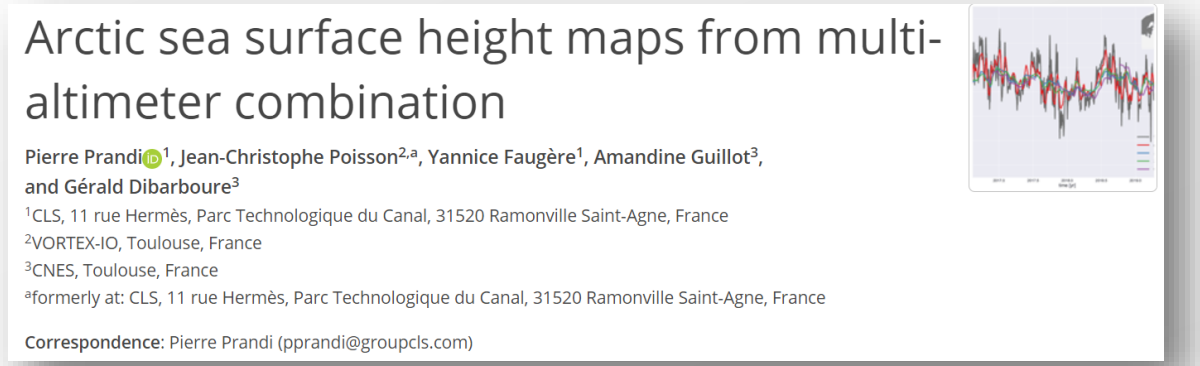


Adapted from Athanase et al., 2020

Arctic regional products

Two regional products are available for the Arctic Ocean

- One level 4 (gridded) product
  - from July 2016 to June 2020
  - 25 km, 3 day grid



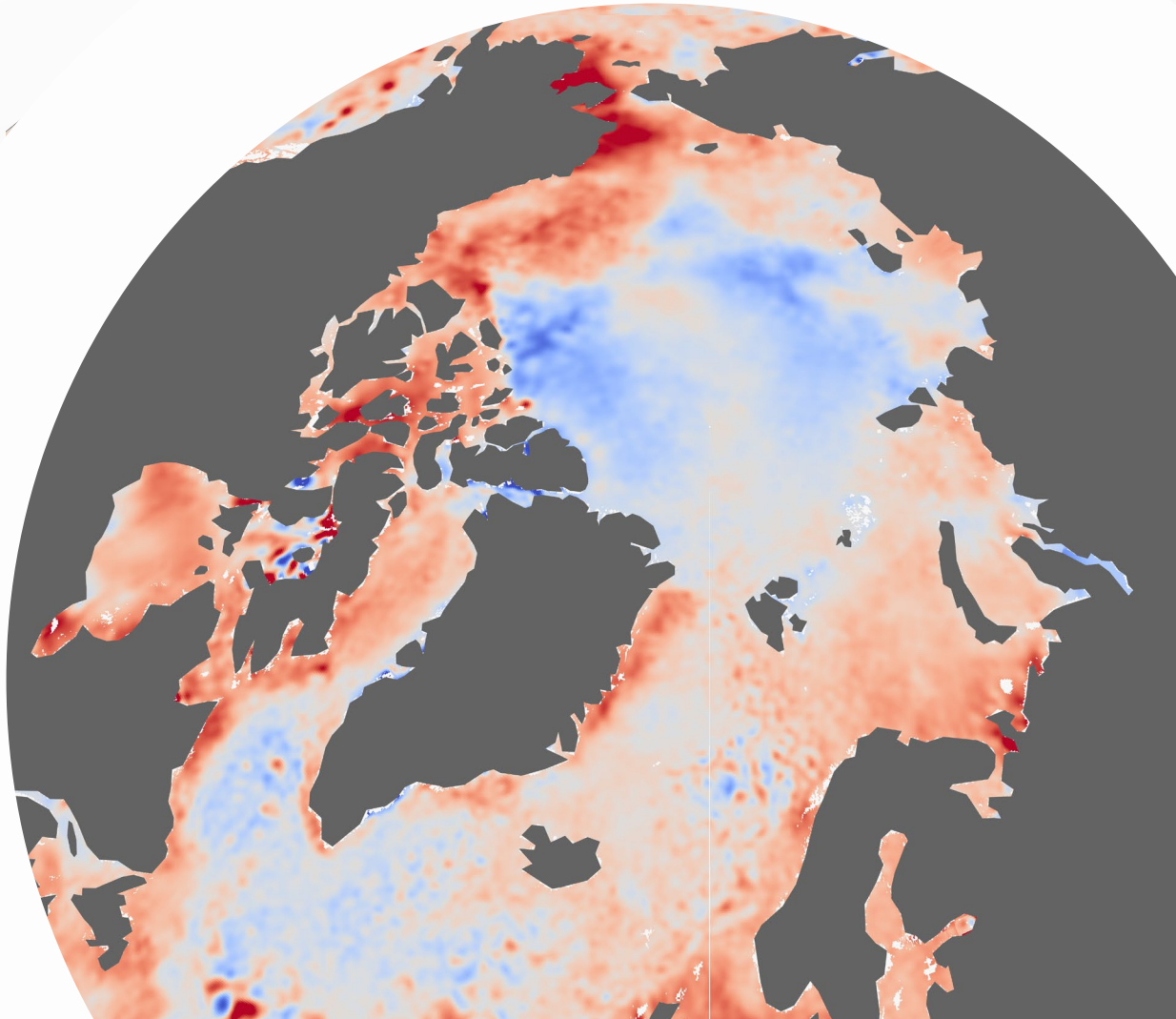
- level 3 (along-track)
  - Dedicated to data assimilation
  - Available @5Hz for SARAL, Sentinel-3A and CryoSat-2

Datasets are freely available through AVISO for the Arctic both **gridded** and **along-track** (https://doi.org/10.24400/527896/a01-2020.001)

Prototype global product including the Arctic

Leads measurements are also used in a new global prototype using a Multiscale Interpolation (Ubelmann et al. 2021),

Data available at https://doi.org/10.24400/527896/a01-2022.009



Southern Ocean products

Gridded prodcuts are also available for the Southern Ocean

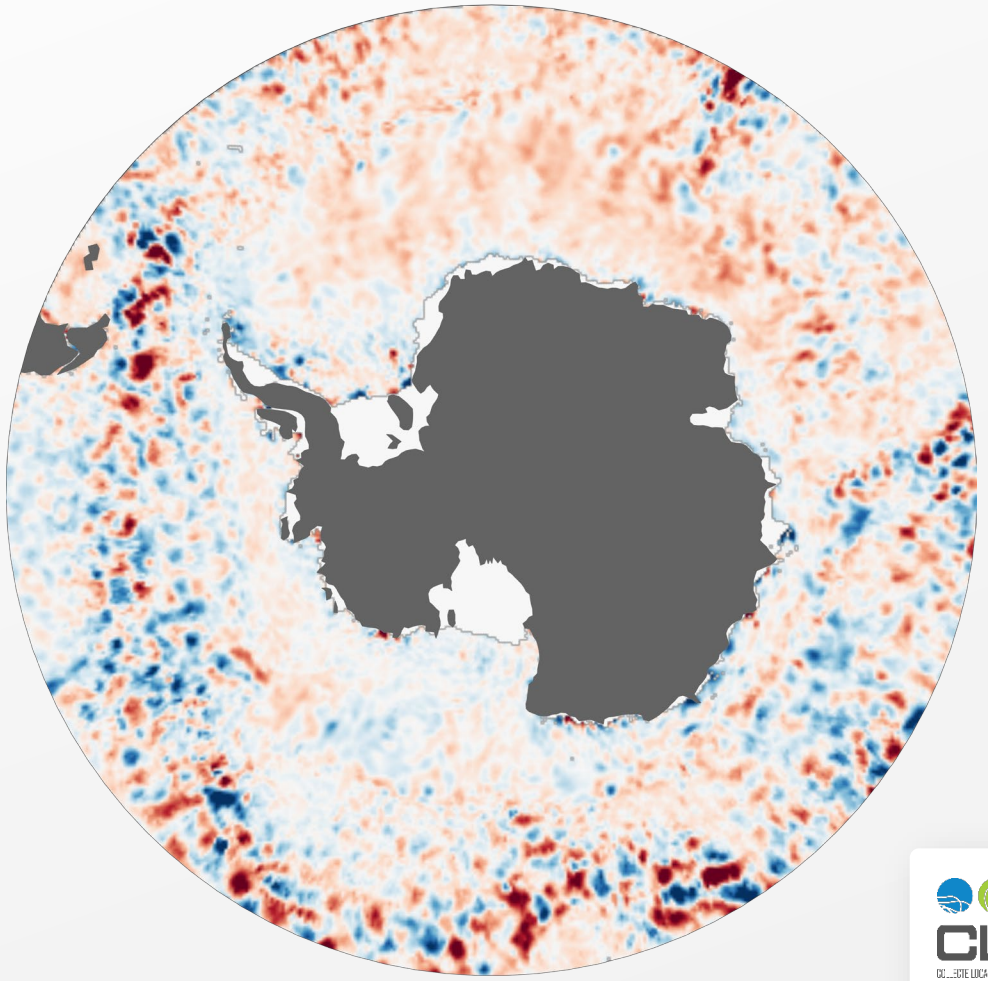
- From April 2013 to July 2019

Data Descriptor | Open Access | Published: 02 March 2022

Southern ocean sea level anomaly in the sea ice-covered sector from multimission satellite observations

Matthis Auger, Pierre Prandi & Jean-Baptiste Sallée

Scientific Data **9**, Article number: 70 (2022) | Cite this article



Dataset is available through AVISO (https://www.aviso.altimetry.fr/en/index.php?id=5108)

Perspectives

Maintain this product line

- Forward extension and inclusion of new missions,
- Backward extension based on reprocessing eoutcomes (eg ESA's FDR4ALT)

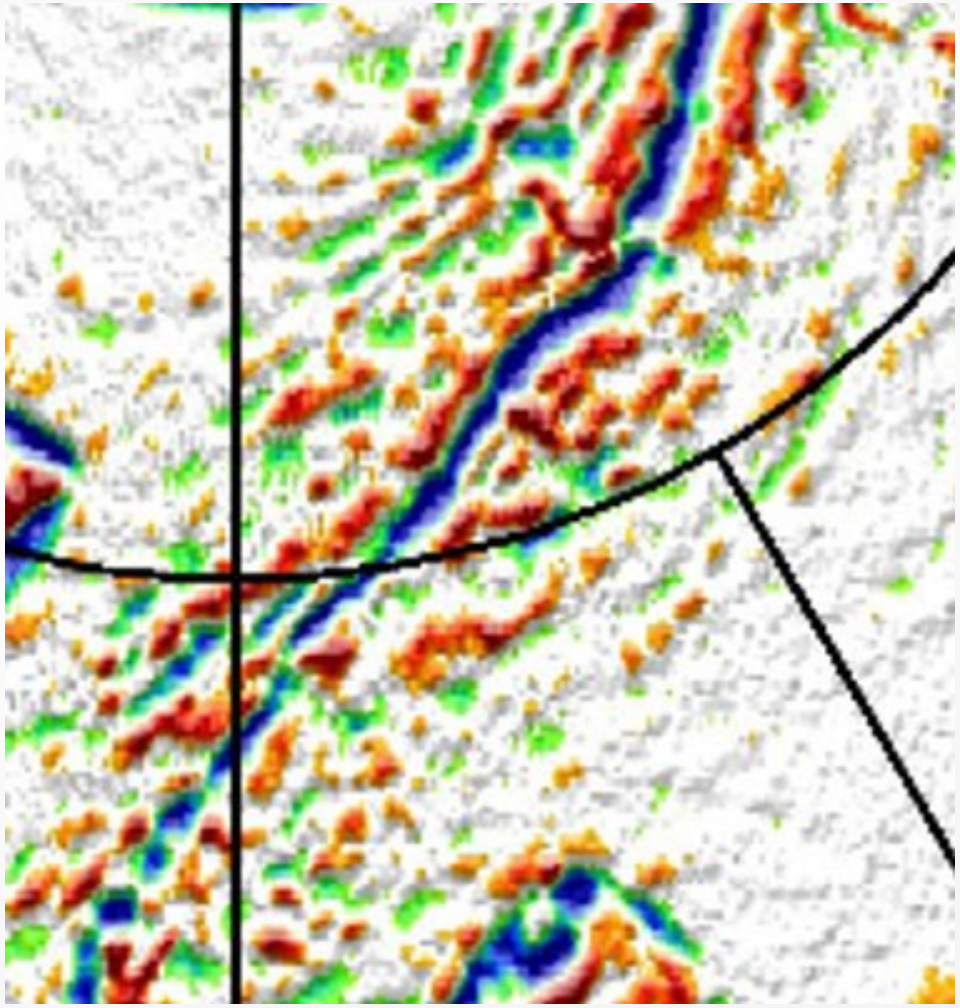
Leverage upcoming processings improvements

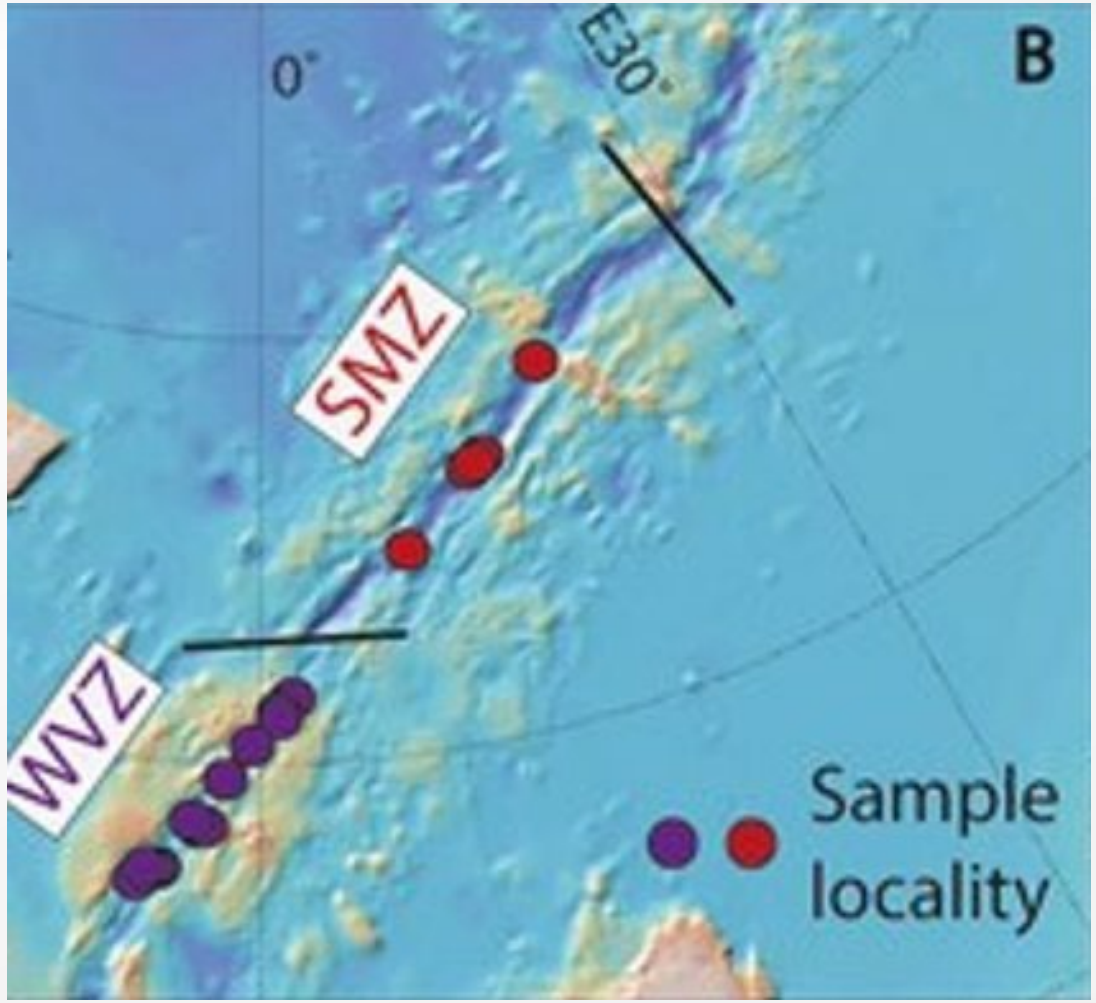
- New classification and retracking methods, especially for SAR mode,
- FES22 tidal models, updated mean sea surface solution, mapping method

Encourage the use of leads data

- Feed data to improve MSS and tide models in polar areas,
- Support science users

Inclusion of leads measurement in MSS solution





Conclusions

We've built polar sea level products based on measurements from three satellite atimetry missions,

These products have higher temporal and spatial resolution than previsouly existing ones,

We welcome feedbacks from the user community.

One key performance asset is (at least) **one reference mission with a processing continuity from open ocean to leads**,

These are prototypes, prefiguring future CMEMS operational products,

To meet CMEMS constraints, upstream data sources with **ad-hoc processing and validation** are required, for current and future missions