Arctic and Southern Ocean Sea level maps and along-tracks From satellite altimetry from 2011 to 2021

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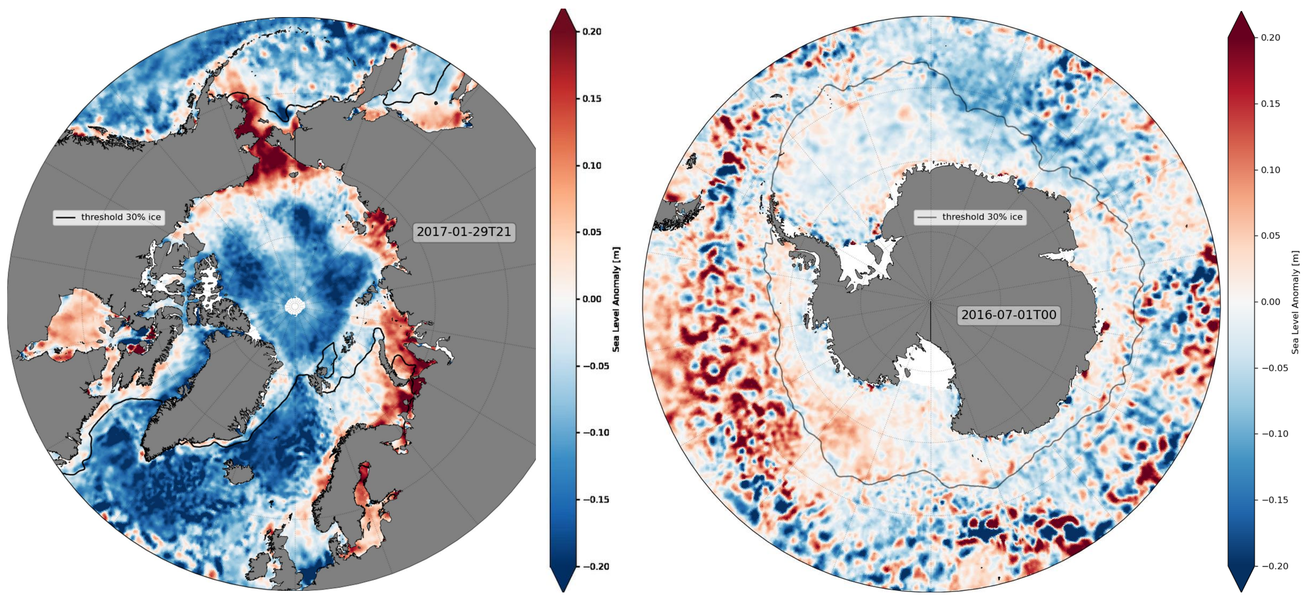
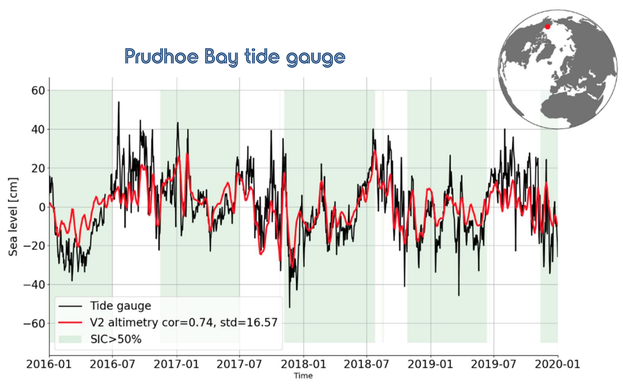
Dataset

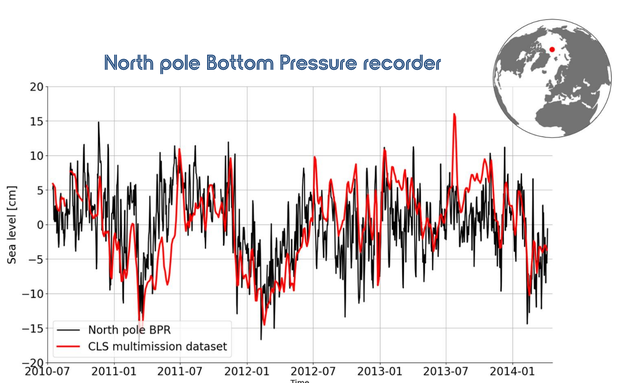
- Sea level maps and along-track are produced for 2011-2021 over the Arctic [1] and for 2013-2021 over the Southern Oceans [5].
- They combine satellite observations from the open ocean and from fractures in the ice (leads) up to 88°N.
- 3 satellites are combined (SARAL/AltiKa, Sentinel-3A and Cryosat-2) to get a better resolution.
- The products are available on the AVISO regional portals [2].

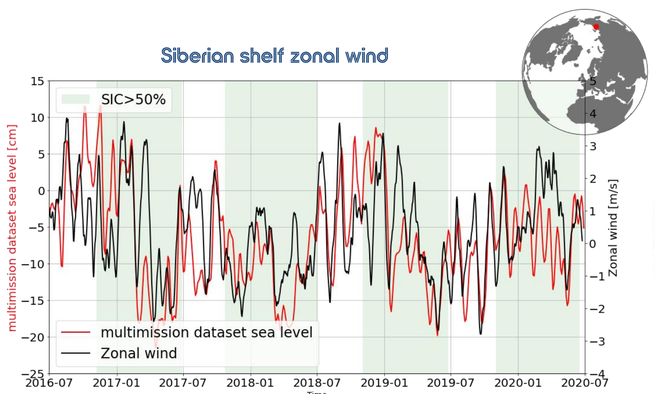


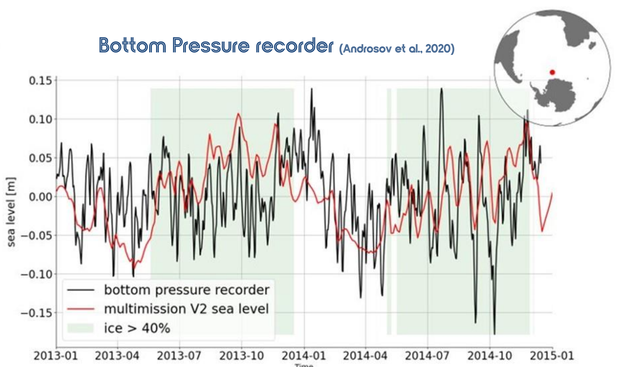
Validation with in-situ time series

- Validation observations are scarce in the Arctic Ocean.
- One tide gauge provides hourly sea level in the seasonally ice-covered region at Prudhoe Bay showing great correlation with altimetry at monthly time-scale.
- A bottom pressure recorders is also available at the north pole in an all-year round ice-covered region showing great correlation where only leads are observed.
- In the Siberian region, sea level variations respond to wind forcing. Positive zonal wind in the region produces barotropic accumulation of water on the shelf. Altimetry sea level and zonal wind are well correlated in the Siberian shelf region at long-term and intra-seasonal temporal scale.
- In the southern ocean, great correlation are made between altimetry sea level and a bottom pressure recorder from [7].



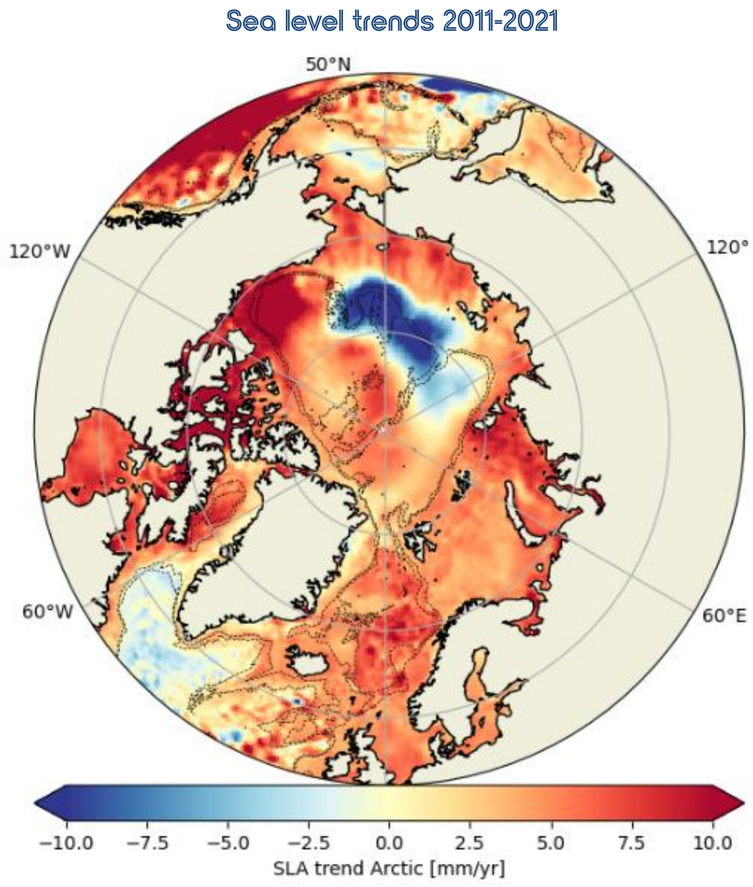


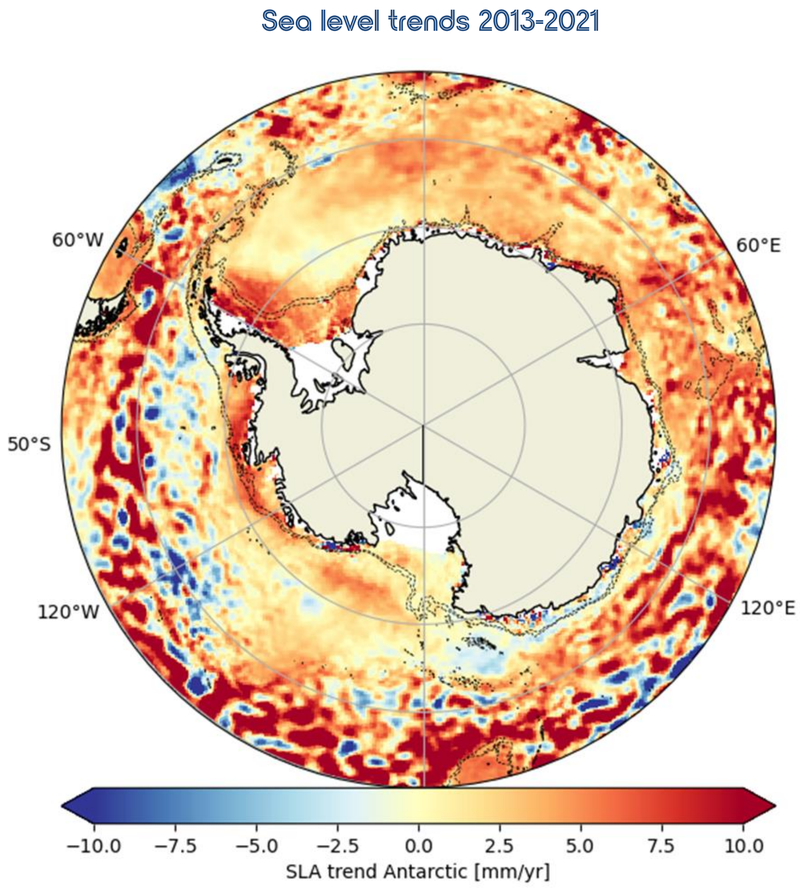




Map of sea level trends

- Sea Level Trends can be computed over 2011-2021 for the Arctic Ocean.
- Positive trends are observed on most of the basins continuous between ice-covered and open ocean.
- Negative trend is observed between the Chuckchi Plateau and the Lomonosov Ridge. It should correspond to freshwater diminution observed on model by [6, Figure 4].





- Sea Level Trends can be computed over 2013-2021 for the Southern Ocean.
- It shows positive trends in the West Weddell Sea that should be investigated.

Conclusion & Perspectives

- Sea level along-tracks and maps are produced for the Arctic and Southern Ocean and are available on Aviso [2].
- Validation has been performed and the product has been ingested in global products [4] and in the new MSS [8].
- Maps enable to estimate the evolution of the ocean at large timescale while along-tracks are dedicated for model assimilation.
- The time series should be extended backwards (Envisat) and forwards using new missions (icesat-2, swot, …).
- In 2024+, near-real time processing of the leads data is also planned to converge toward global operational CMEMS-SLTAC products incorporating the ice-covered regions.

References:
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[2] Gridded Sea Level Heights – Arctic Ocean, AVISO+ [data set], https://doi.org/10.24400/527896/a01-2020.001 Antarctic Ocean, AVISO+ [data set], https://doi.org/10.24400/527896/a01-2020.001
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[4] Ballarotta et al. :Improved global sea surface height and currents maps from remote sensing and in situ observations
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[6] Hall et al., 2023 : doi.org/10.1029/2022JC019247
[7] Androsov, A., Boebel, O., Schröter, J., Danilov, S., Macrander, A., & Ivanciu, I. (2020). Ocean bottom pressure variability: Can it be reliably modeled? Journal of Geophysical Research: Oceans, 125, e2019JC015469. https://doi.org/10.1029/2019JC015469
[8] Schaeffer et al., 2023 : doi.org/10.3390/rs15112910

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