OSTST 2026

Presentation

Arctic Contribution to GMSL Trends and Uncertainties

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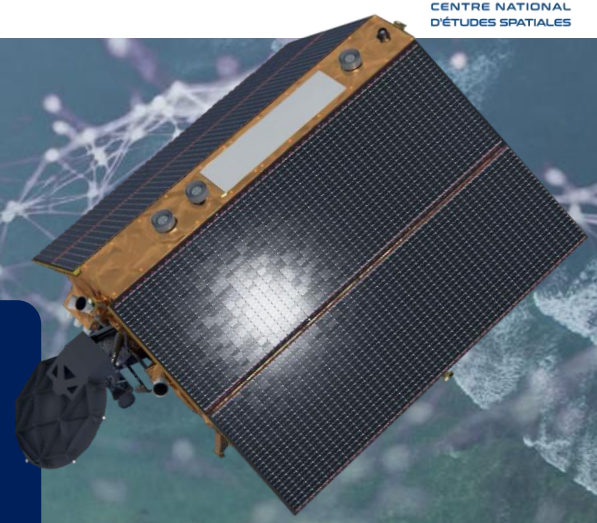

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Background and Objective

- Potential changes to the orbits of the future reference satellite missions could potentially alter the estimates of global mean sea level (GMSL).

- The alteration could arise either from variations in the along-track sampling of ocean variability within a given domain, or from the **sampling occurring over distinct oceanic regions.** The work assesses the latter issue by estimating the contribution to the GMSL trend of the Arctic Ocean.

- **Objective:** Quantify the contribution of the Arctic Ocean on GMSL trends and acceleration and over periods from 1 year to 10 years based on the sampling of state-of-the-art real data

Approach

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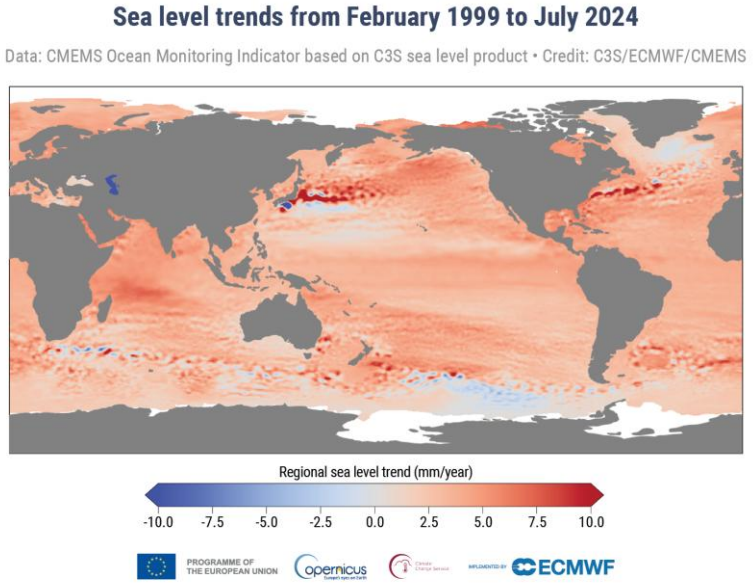
Mean Sea-Level – Including the Arctic Ocean

Merge:

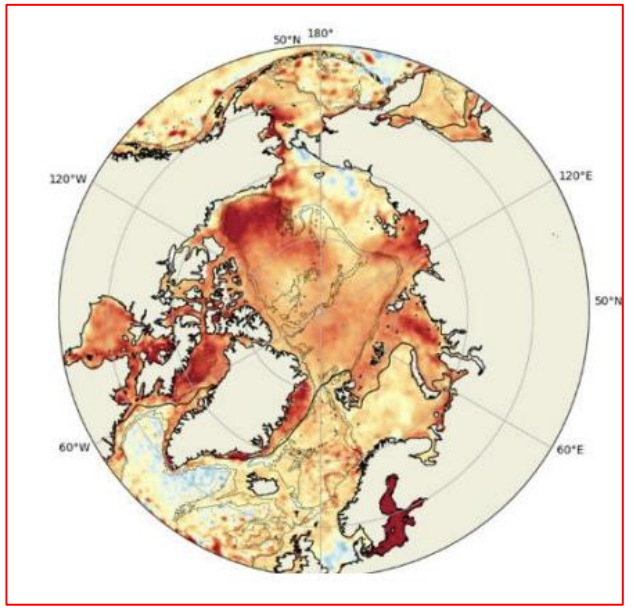
- L4 conventional altimetry dataset (south of 66°N) - multimission

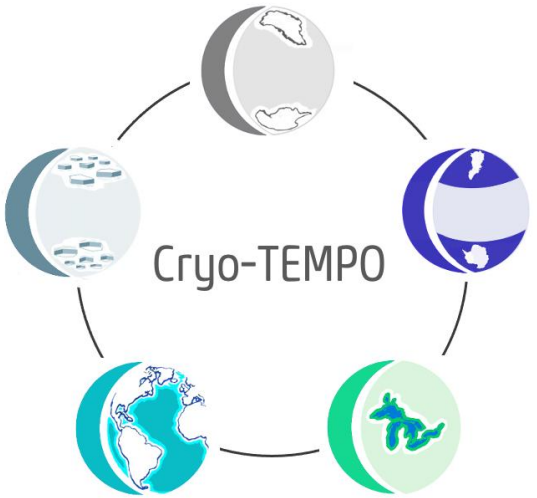


- Experimental Arctic satellite altimetry datasets (north of 66°N)

Monosmission (Cryo-TEMPO project)

Multimission (Cryosat, AltiKa, Sentinel-3) (Veillard et al., 2024)





Approach: hybrid dataset

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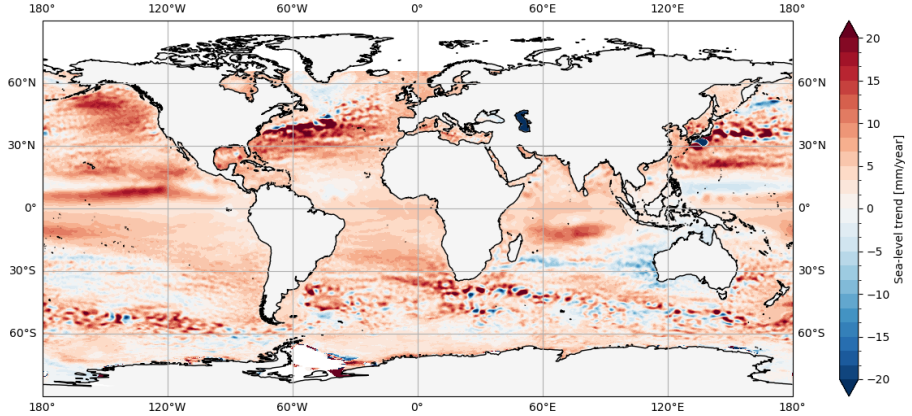
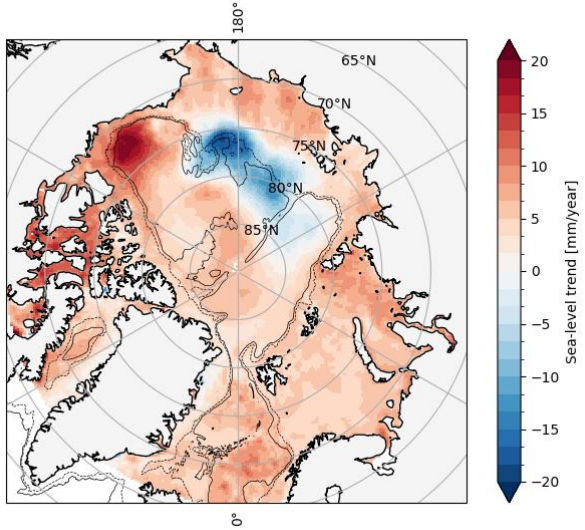
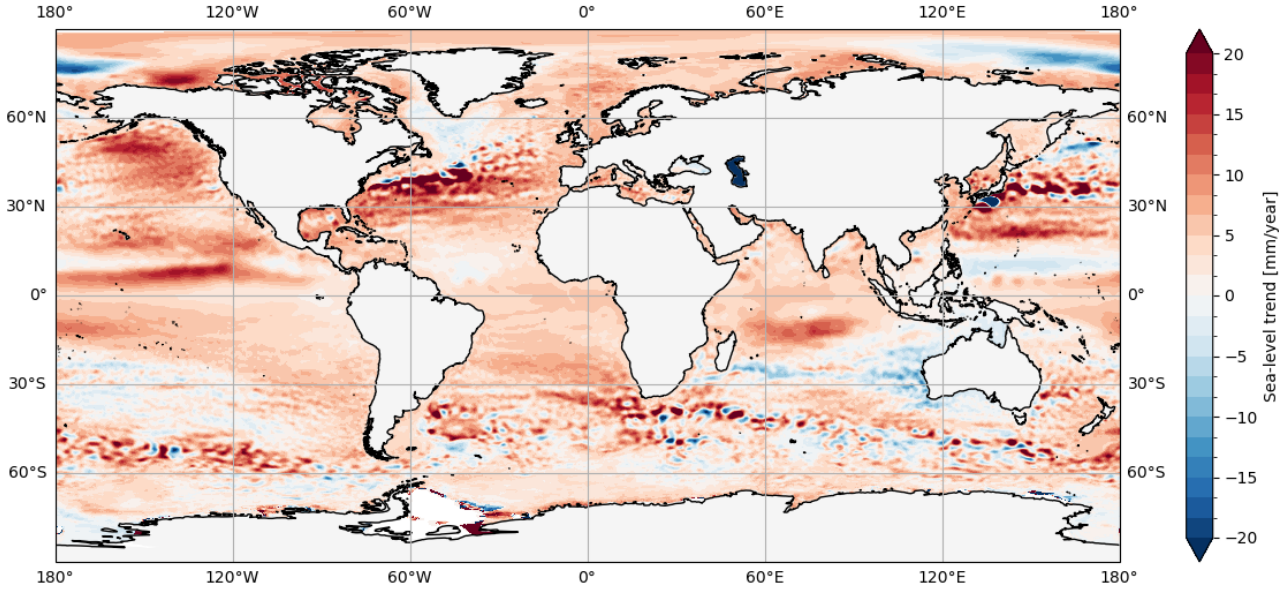
L4 conventional global altimetry maps



Experimental Arctic altimetry maps



Hybrid data-set



Regional sea-level trend 2011-2021

Approach: Sea-level trend and acceleration

Sea-level trend and acceleration

Compute and compare:

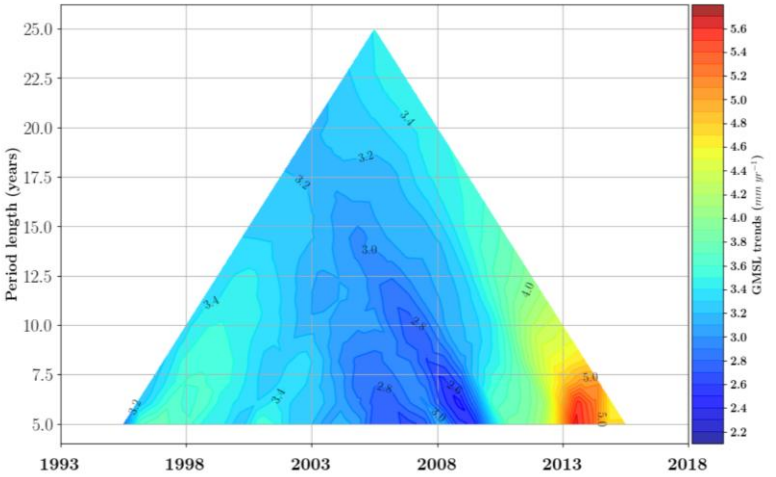
- sea-level trend
- sea-level acceleration

within 11-year period:

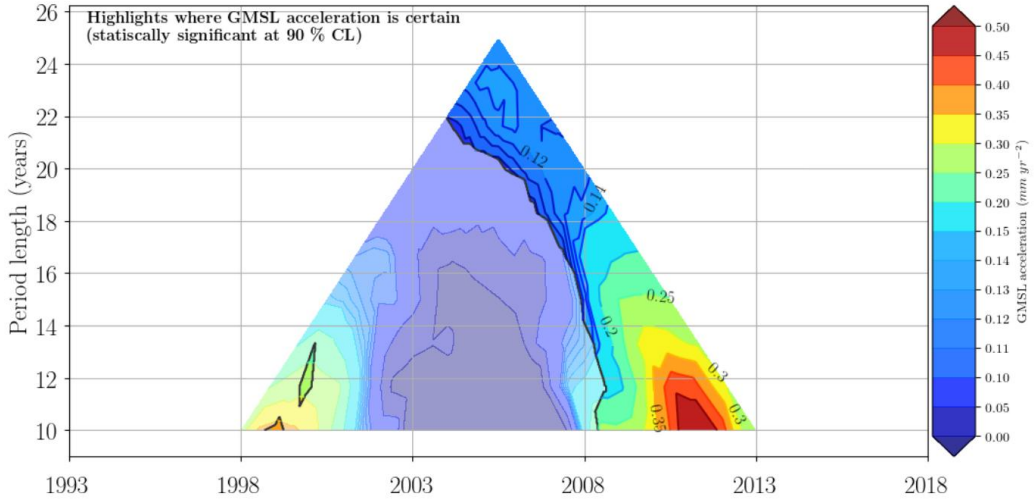
- Following Ablain et al. (2019)

with and without:

- Arctic contribution



Ablain et al. (2019)



Arctic Sea-level variability

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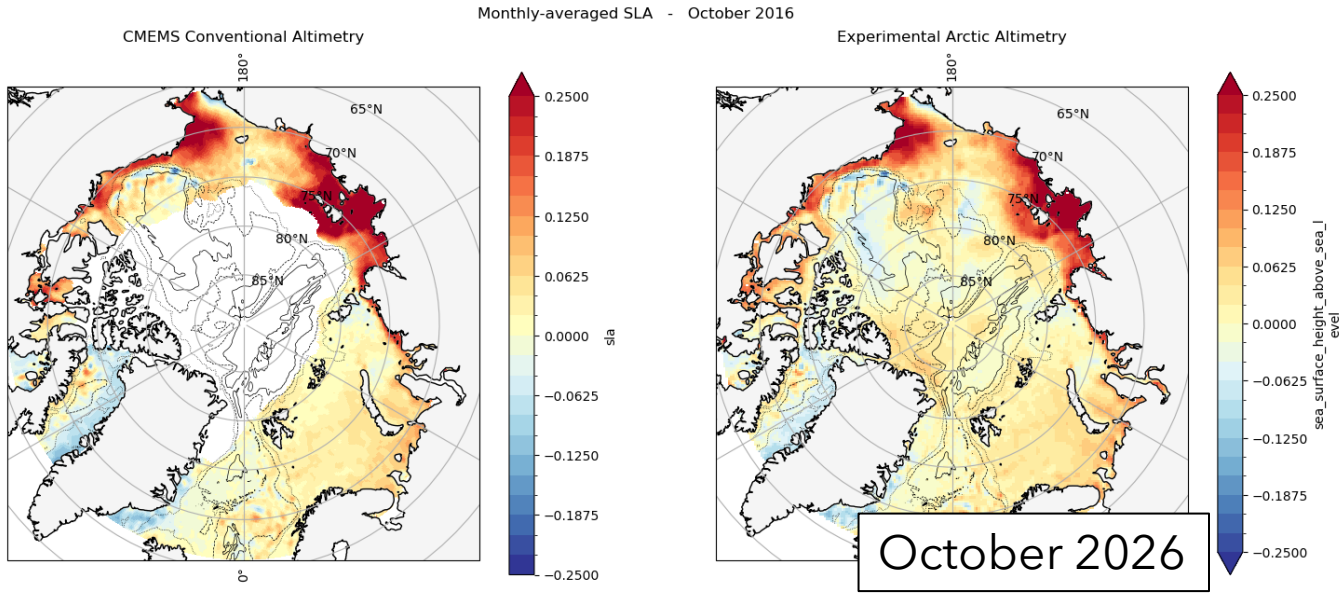
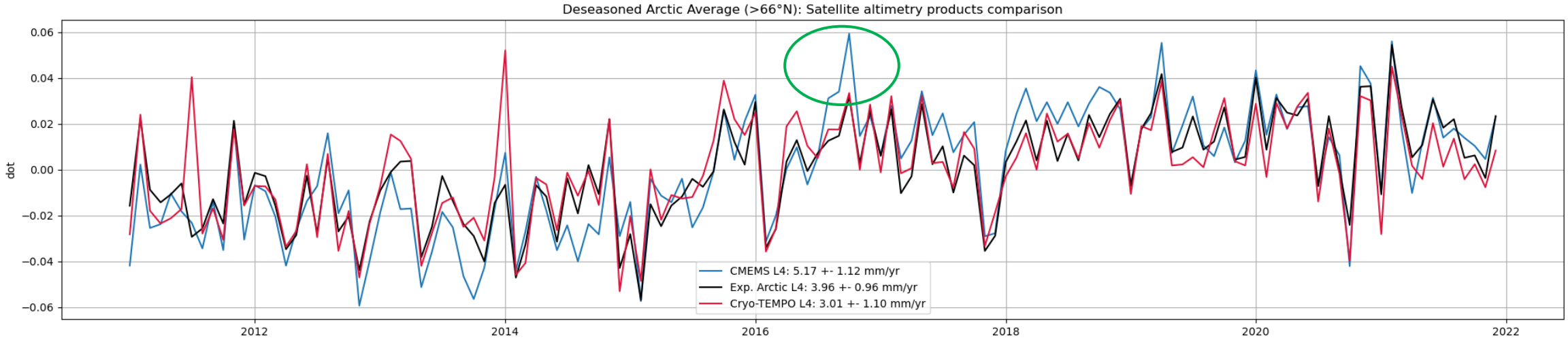


- Comparison between conventional and experimental altimetry maps
- Large differences due to spatial coverage (e.g. in October 2026) also reflect in different sea-level trend estimates and uncertainties
- > 5 mm/yr from conventional altimetry



Arctic Sea-level trend

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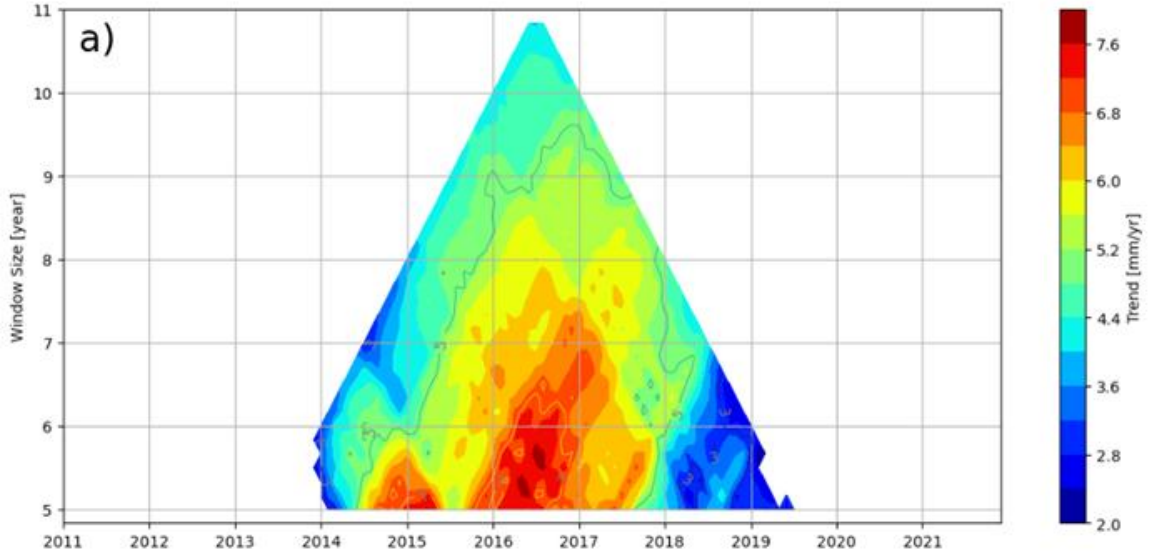
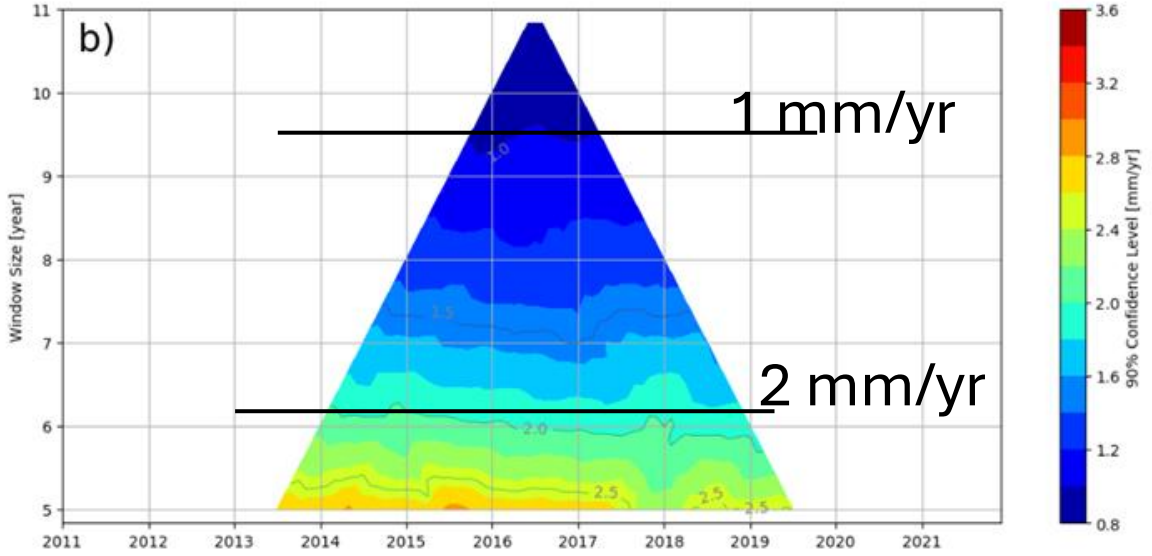
Arctic Sea-Level Trend: time-window dependence

Experimental multimission altimeter products dedicated to Arctic Ocean (2011-2021)

trends



uncertainties



- Only linear trends significant at 90 % CI are shown.
- The shortest window size is 5 years

Arctic Sea-level trend

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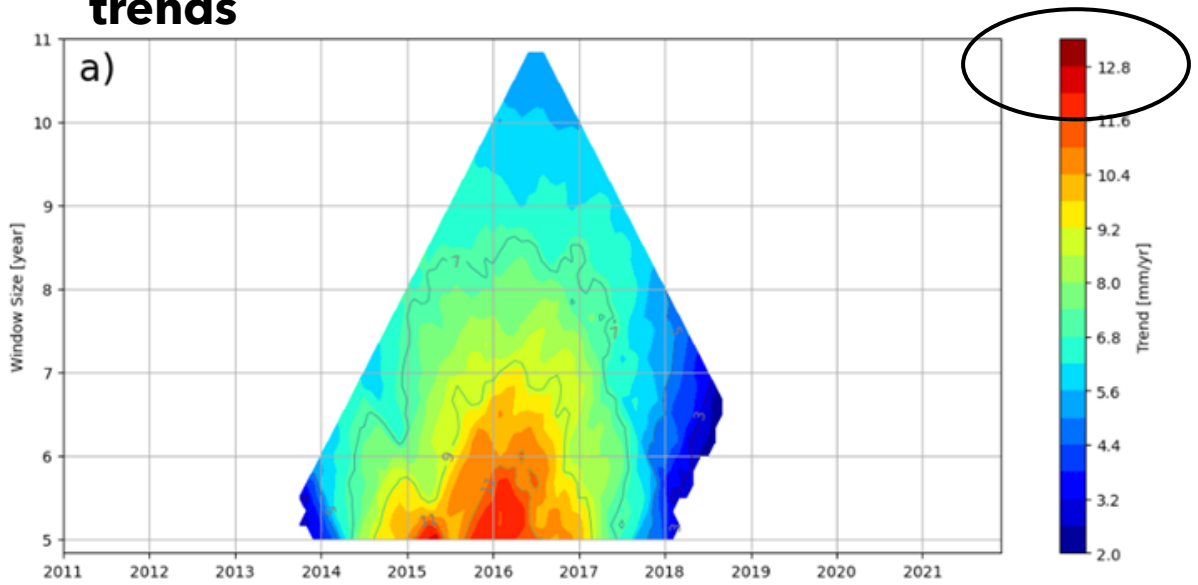
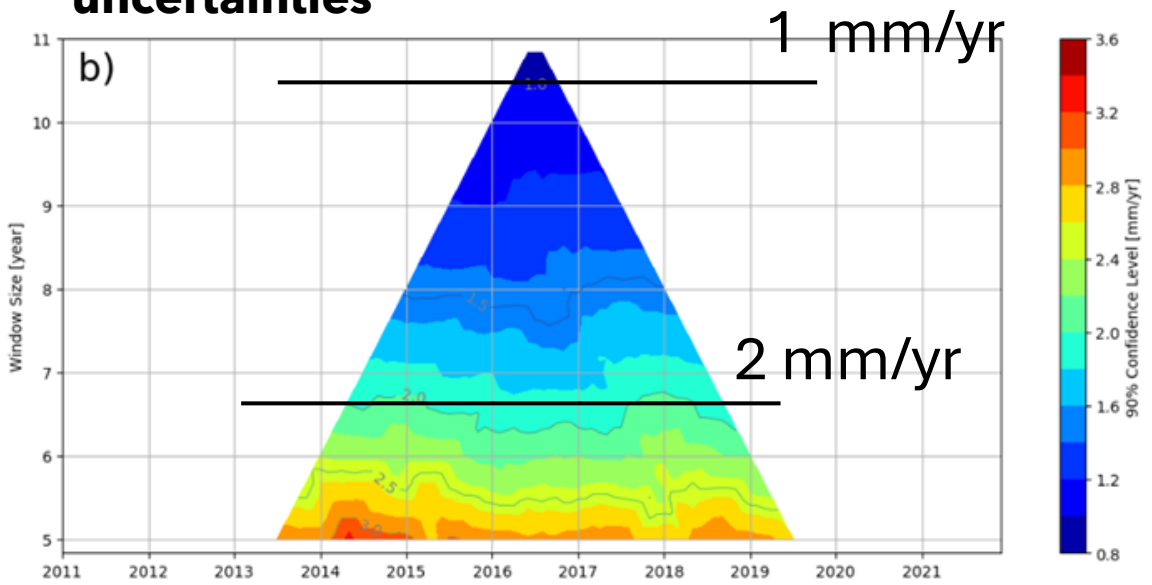
Arctic Sea-Level Trend: time-window dependence

Conventional multimission altimeter products (2011-2021)

trends



uncertainties



Conventional altimetry products in the Arctic returns much larger trends and uncertainties compared to experimental data-sets

Arctic Sea-level acceleration

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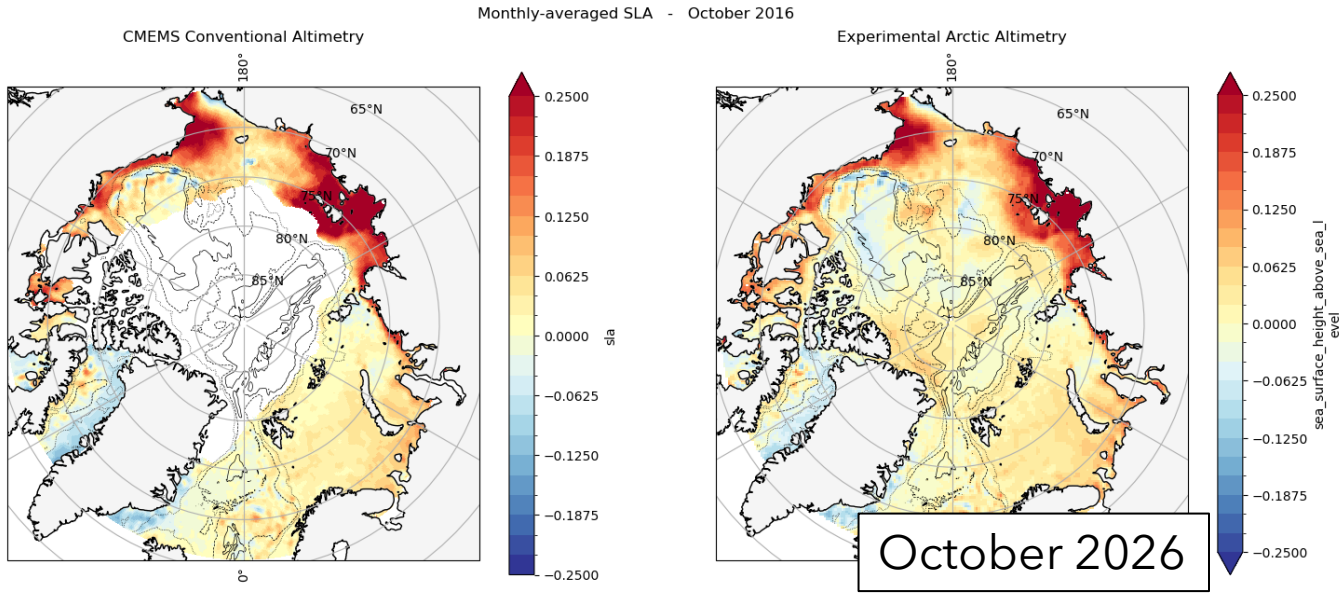
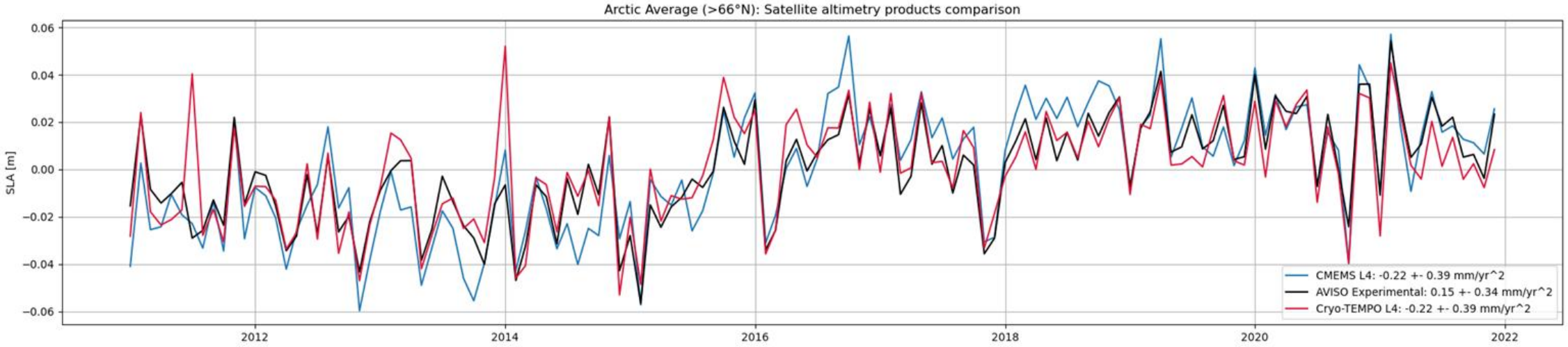


- Comparison between conventional and experimental altimetry maps
- Different sea-level acceleration estimates can be noticed but **fall within their uncertainties**



Arctic Sea-level acceleration

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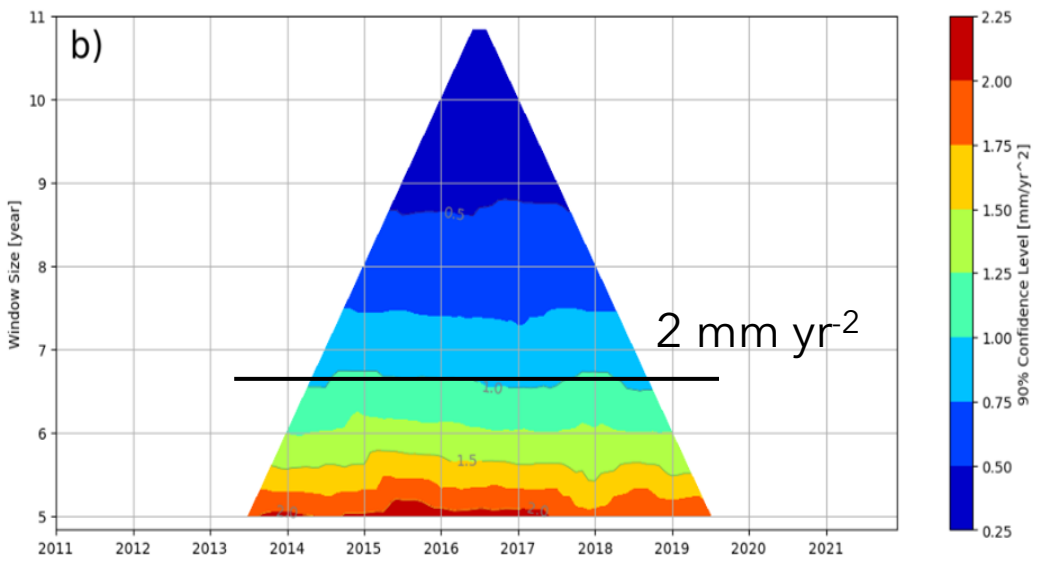
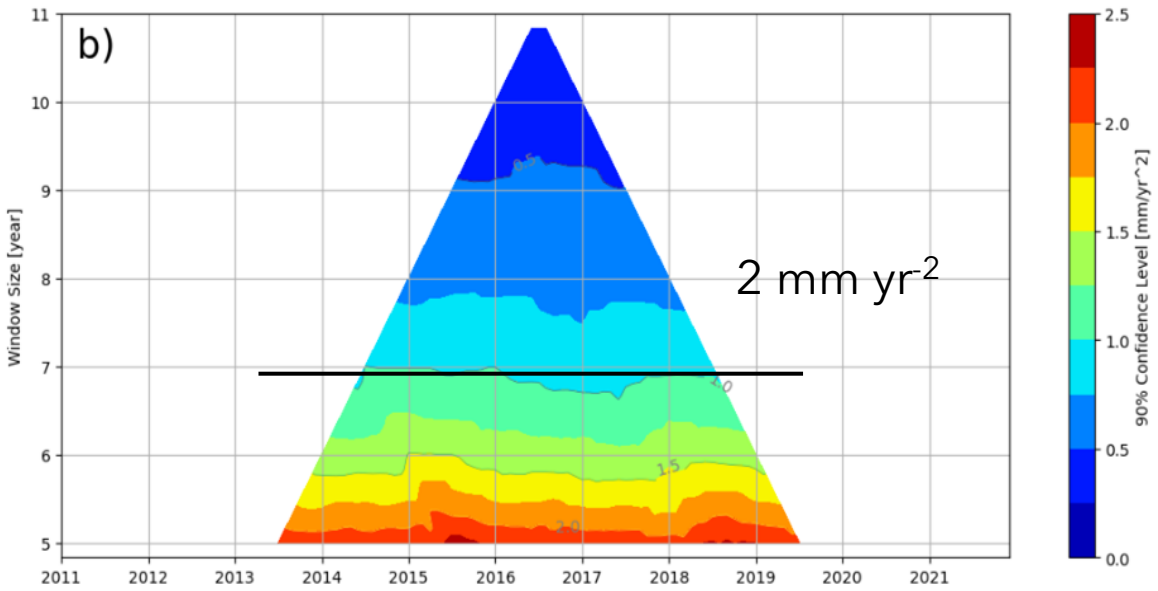
Arctic Sea-Level Acceleration: time-window dependence

- Large uncertainties associate to sea-level accelerations in the Arctic during the analysis period (2011-2021)

Uncertainties - Experimental



Uncertainties - Conventional



Arctic contribution to GMSL

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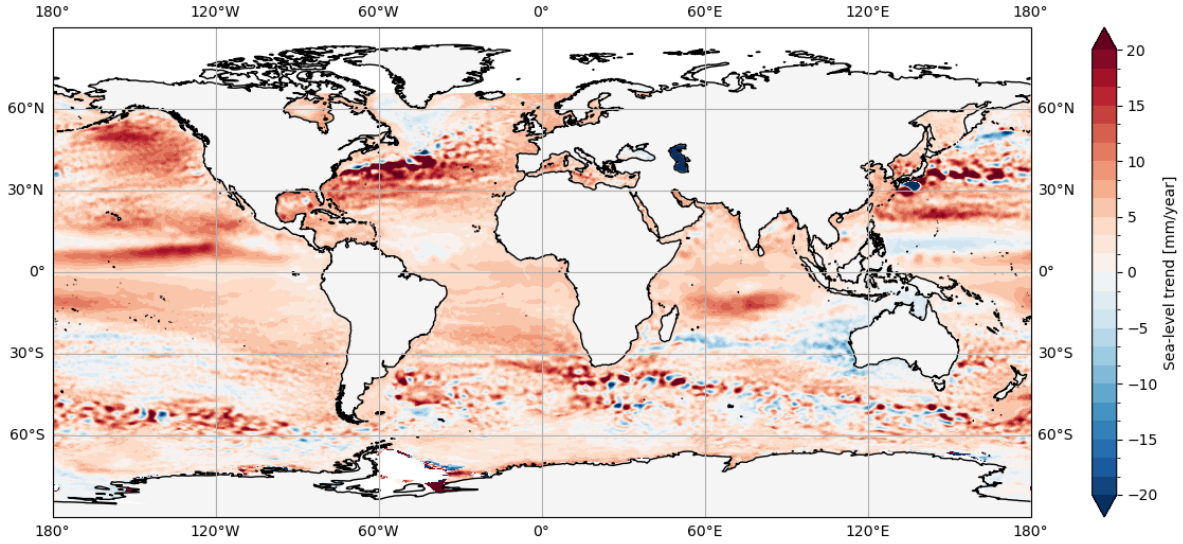
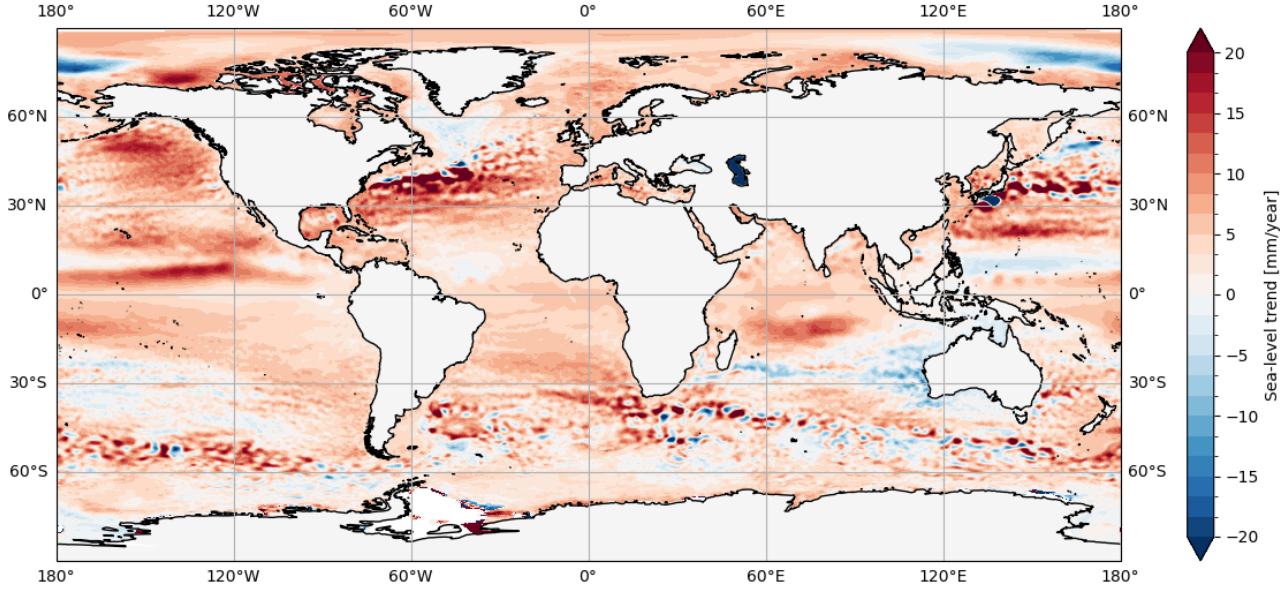
Conventional global altimetry maps



Hybrid data-set



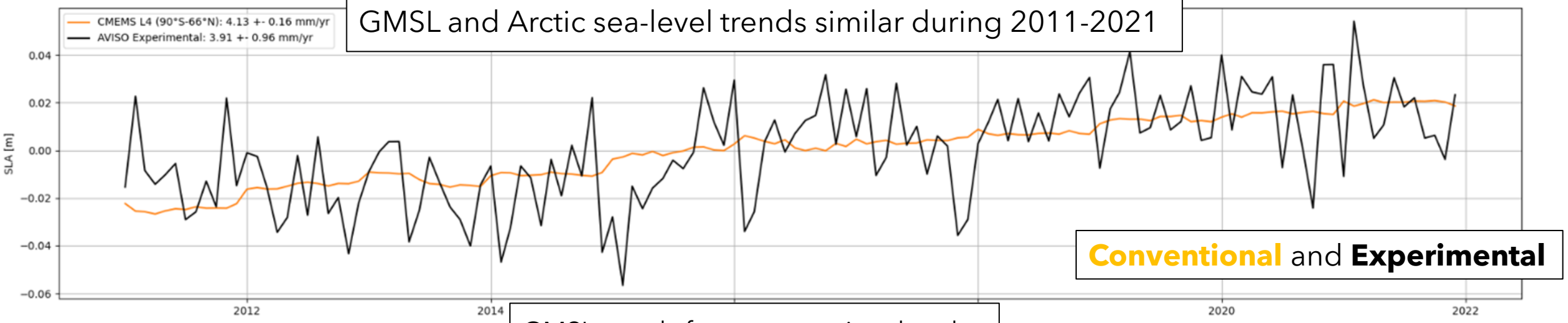
- Compare GMSL variability and trend derived from conventional and hybrid altimetry maps

- worth noticing: Arctic covers a small portion (3%) of the global ocean

Arctic contribution to GMSL

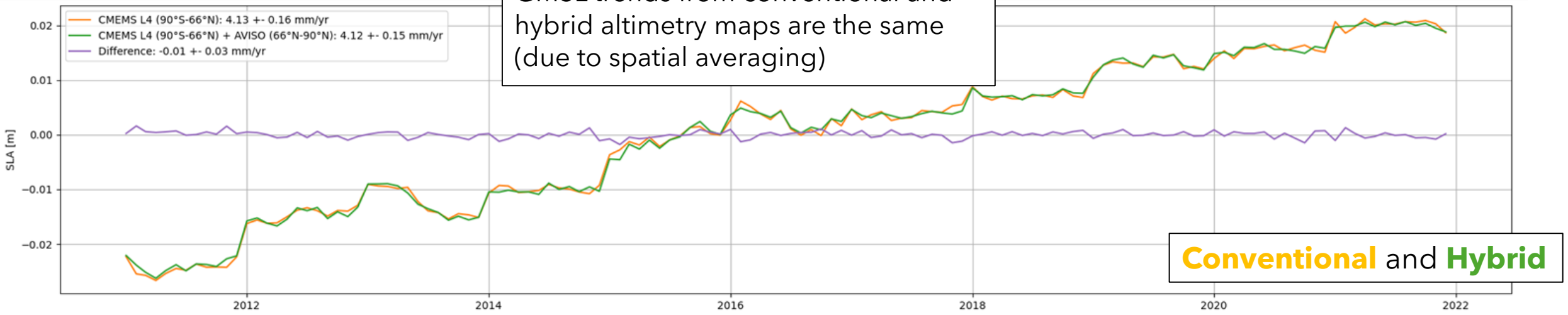
- Arctic sea-level trend compared to GMSL trend

GMSL and Arctic sea-level trends similar during 2011-2021



Conventional and **Experimental**

GMSL trends from conventional and hybrid altimetry maps are the same (due to spatial averaging)



Conventional and **Hybrid**

Arctic contribution to GMSL

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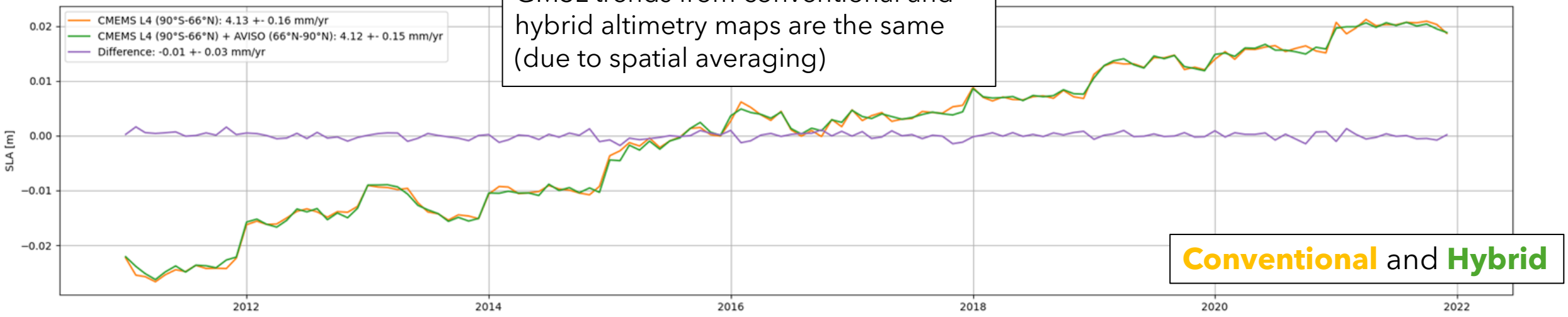
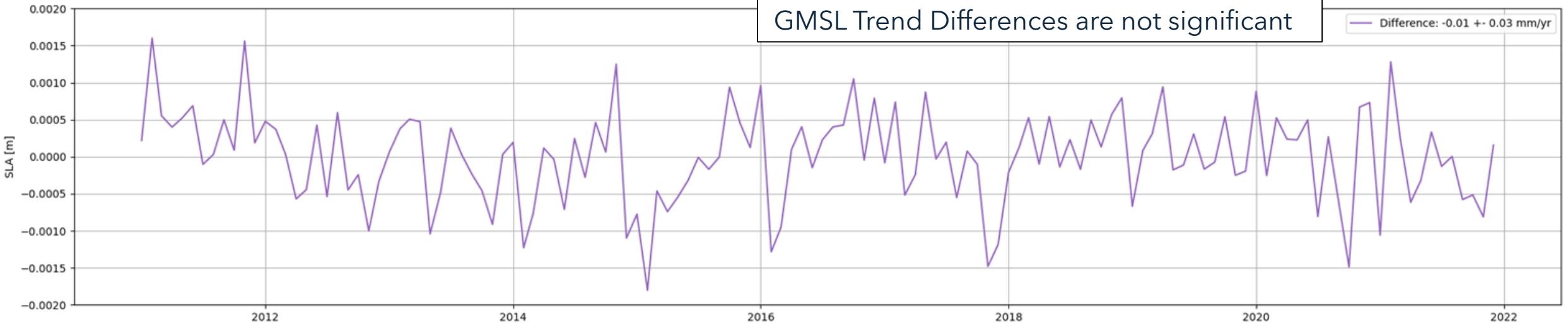
GMSL trends from conventional and hybrid altimetry maps are the same (due to spatial averaging)



Conventional and **Hybrid**

Zoom on the differences

GMSL Trend Differences are not significant



Arctic contribution to GMSL

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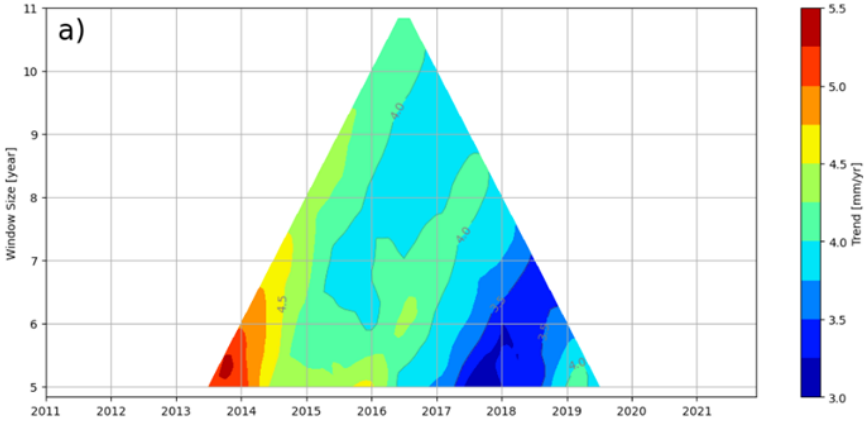
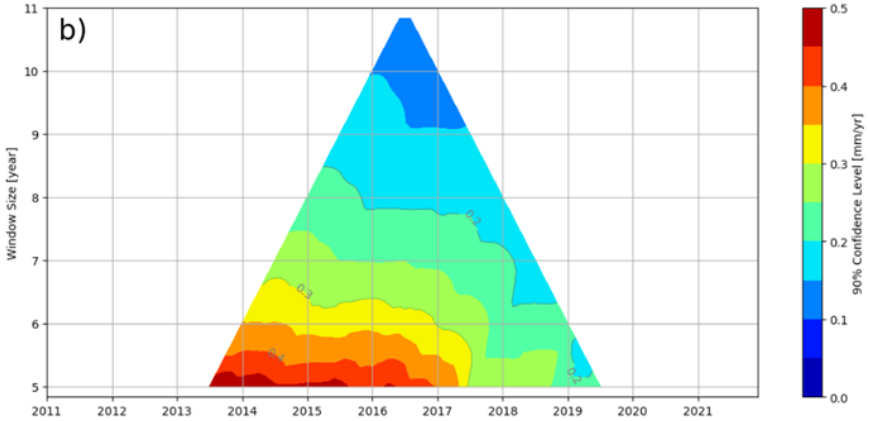
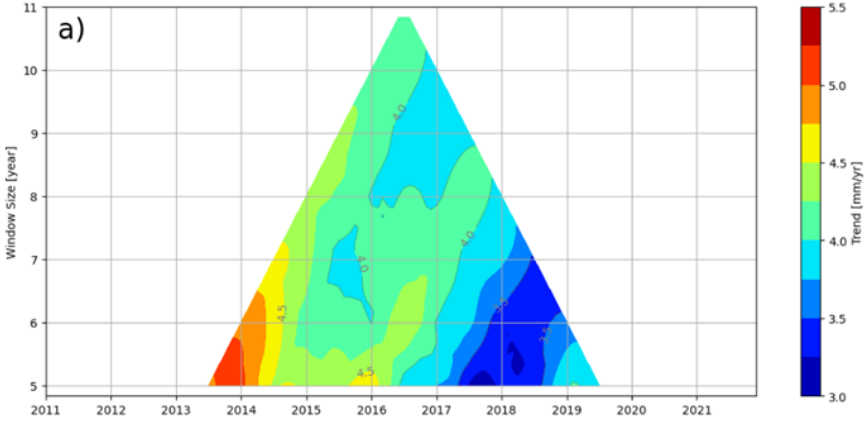
GMSL sea-level trends and uncertainties: including the **Arctic (lower)** or not (upper)

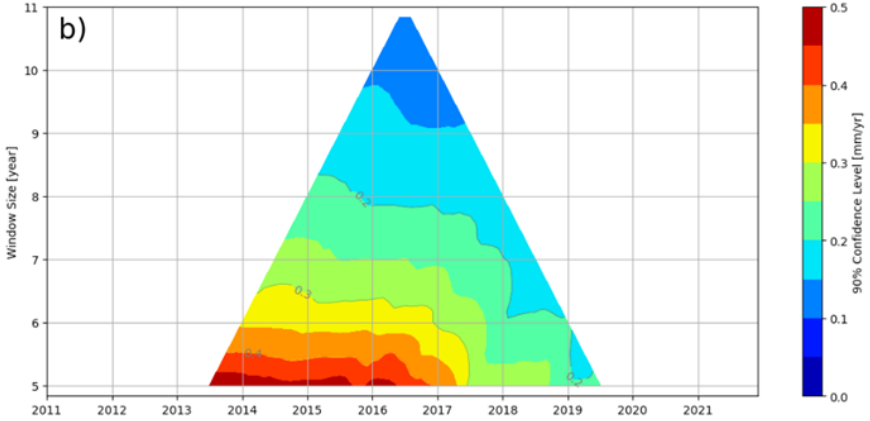
trends



uncertainties







Great similarities

Take-home messages

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- **Global and Arctic altimetry data products** collected over a **11 years** period (2011-2021).
- Mean sea level in the Arctic is affected by the **spatial coverage** in the altimetry products: **large sea-level anomalies** observed in conventional altimetry products when coverage is reduced compared to the Arctic products.
- **Mean sea-level trend** estimates based on conventional altimetry (5.12 +/- 1.2 mm/yr) are also **larger** than those obtained from Arctic products (3.96 +/- 0.96 mm/yr).
- **Accelerations within uncertainties** at a 95% confidence level.
- **Arctic sea-level** trend **comparable** with **GMSL** trend over the 11-year period.
- **Arctic contribution** to GMSL trend and acceleration is **small** (due to spatial averaging)