CSQ-23 Summary

Question	Knowledge Advancement Objectives	Geophysical Observables	Measurement Requirements	Tools & Models	Policies / Benefits
What is the impact of extreme weather events on the Polar regions?	Measure the impact of extreme weather events on the Polar regions, both in the short term (seasonal to annual), and over the long term (impact on long-term decadal trends).	● Surface melt ● Ice speed change ● Surface elevation change ● Sea ice extent and thickness ● Freshwater input to the oceans	Fine temporal resolution (weekly), with enough sensitivity to measure change Multi-decadal record of change required over last 30-40-years, updating continuously in NRT High (100 m) spatial resolution for all components.	EO satellite datasets. Auxiliary data including bed topography and regional climate model data estimating surface mass balance, surface melt and runoff.	Climate change adaptation and mitigation policy. IPCC monitoring. Improve future projections of ice mass loss, which remain the greatest uncertainty in future sea level rise projections.

CSQ-23 Narrative

Climate change has led to more frequent occurrences of extreme weather. In the Polar regions prominent examples of this include the 2012 extreme surface melt event which covered the whole surface of the Greenland Ice Sheet (Nilsson et al., 2015); extreme lows in sea ice cover; and extreme snowfall events such as atmospheric rivers which can deposit double the amount of snowfall in a short period of time (Mottram et al., 2021), offsetting ice mass loss from dynamic processes (Davison et al., 2023). As the occurrence of extreme weather events evolves over time, we mush characterize this new variability, and understand its long-term impact on all elements of the Polar domain.

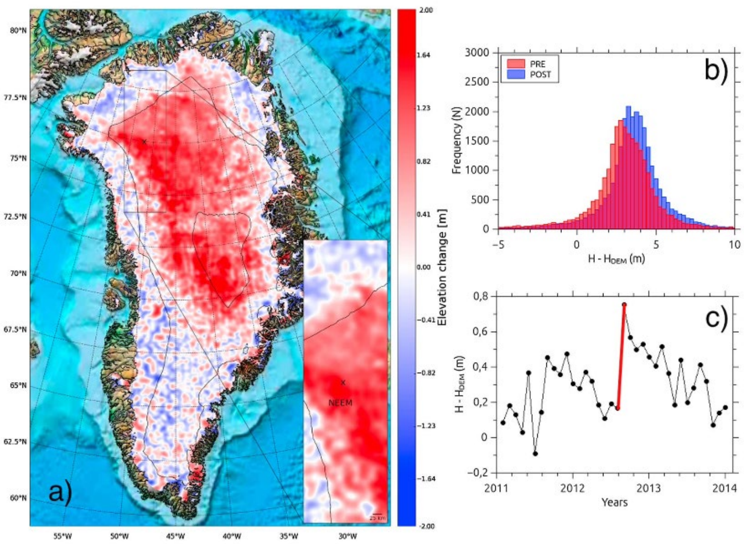

Fig. 4: (a) Surface elevation differences between the May–June and August–September 2012 CryoSat-2 L2i data. The differences in surface elevation shows a clear positive increase in the dry-snow zone and ablation in the coastal regions. Black lines indicate the 2000 and 3000 m elevation contours. Found in the supporting information are 2011 and 2012 reference figures. (b, c) Histograms (regional analysis) and time series (local analysis) of the changes in surface elevation around NEEM estimated from the reanalysed CryoSat-2 L1b data presented in this study. The 2012 elevation change is indicated in red. From Nilsson et al., 2015.

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