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Past Ocean surface conditions in Krossfjorden, Western Svalbard over the last century

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Understanding past climate conditions provide baselines for understanding future climate changes. Therefore the prediction of future climate depends on understanding the changes in interactions between ocean, sea ice and atmospheric conditions. Studies using diatom microfossils to reconstruct these parameters have been done in high Northern latitudes, but they are a rarity in the Arctic realm. With a modern warming affecting Polar Regions in higher magnitudes, understanding Arctic climate variability at both short and longer timescales is of utmost importance.

Our reconstructions of sea surface temperature (SST) and sea ice conditions from Western Svalbard are based on diatom microfossil records from a 32 cm long marine sediment core from Krossfjorden. The preliminary age model suggests that the core covers the last 80 years, owing to high sedimentation rates of the fjord. The core was subsampled for every cm and Diatom microfossils were extracted from each section. Planktonic diatoms are sensitive to various environmental parameters such as SST and sea ice, and possess high diversity and high preservation in the Arctic sediments. So they act as an excellent proxy to study past SST and sea ice variability. The quantitative SST reconstruction is done using the calibration dataset consisting of 52 diatom species and 183 surface sediment samples from the North Atlantic and Arctic. We used a Weighted averaging partial least squares (WA-PLS) transfer function to estimate past SST on the site from diatom counts. For sea ice reconstruction, a qualitative method based on relative abundance of Marginal Ice Zone (MIZ) diatom species was used.

The SST record from Krossfjorden indicates increasing SST for the last 80 years in this fjord and the MIZ diatom assemblage shows rapid decrease in sea ice in parallel with a retreating Arctic sea ice that started in late 1800's after the termination of Little Ice Age. With these records we suggest that the increased SST and decreased sea ice in the fjord could be attributed to increased Atlantic water advection and/or increased Northern Hemisphere warming for the past century and specifically the pronounced increase for the last 30 years, which is congruent with instrumental records.