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Changes in the Composition of the Fram Strait Freshwater Outflow

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Fram Strait is the largest gateway and only deep connection between the Arctic Ocean and the subpolar oceans. Monitoring the exchanges through Fram Strait allows us to detect and understand current changes occurring in the Arctic Ocean and to predict the effects of those changes on the Arctic and Subarctic climate and ecosystems.

Polar water, recirculating Atlantic Water and deeper water masses exported from the Arctic Ocean through western Fram Strait are monitored year-round by an array of moored instruments along 78°50'N, continuously maintained by the Norwegian Polar Institute since the 1990s. Complimentary annual hydrographic sections have been repeated along the same latitude every September.

This presentation will focus on biogeochemical tracer measurements collected along repeated sections from 1997-2015, which can be used to identify freshwater from different sources and reveal the causes of variations in total volume of freshwater exported e. g.: pulses of freshwater from the Pacific.

Repeated tracer sections across Fram Strait reveal significant changes in the composition of the outflow in recent years, with recent sections showing positive fractions of sea ice meltwater at the surface near the core of the EGC, suggesting that more sea ice melts back into the surface than previously.

The 1997-2015 time series of measurements reveals a strong anti-correlation between run-off and net sea ice meltwater inventories, suggesting that run-off and brine may be delivered to Fram Strait together from a common source. While the freshwater outflow at Fram Strait typically exhibits a similar run-off to net sea ice meltwater ratio to the central Arctic Ocean and Siberian shelves, we find that the ratio of run-off to sea ice meltwater at Fram Strait is decreasing with time, suggesting an increased surface input of sea ice meltwater in recent years.

In 2014 and 2015 measurements of salinity, δ^{18}O and total alkalinity were collected from sea ice cores as well as the underlying water column in Fram Strait. We use this dataset to investigate the feasibility of using concurrent δ^{18}O and total alkalinity measurements to separately identify precipitation, which probably makes up a significant fraction of the freshwater in Fram Strait, but has so far not been separately monitored.