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Pathways and modification of Atlantic Water in the 9km-resolution NAOSIM model

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The Arctic Ocean receives warm and saline water from the Nordic Seas which enter through the Barents Sea and Fram Strait. The outflow from the Arctic Ocean consists of much fresher and colder waters. The Atlantic Water shapes the hydrography of much of the intermediate depth Arctic Ocean. The export of modified Atlantic Water takes place as part of the Polar Water and as intermediate water. The former can affect deep water production further downstream while the latter is an important contribution to the overflow waters from the Nordic Seas into the deep North Atlantic. In NAOSIM simulations, variability of Atlantic inflow into the Arctic has been demonstrated to affect the intermediate water properties and the overflow decades later.
While the Fram Strait section has been monitored for a decade, much less is known about the details of the transformation within the Arctic Ocean.

We use NAOSIM (North Atlantic/Arctic Ocean Sea Ice Models) hindcasts to investigate the transformations along the pathways of the Atlantic Water in the Arctic to elucidate critical processes and areas as well as their temporal variability in a high-resolution ocean-sea ice model under realistic atmospheric forcing. Combining tracers for the Atlantic inflow and for Pacific Water, for river water, and for sea ice melt water, we follow the propagation and modification of Atlantic Water in the Arctic Ocean for the period 1990 to 2010. We present variability in the distribution of the inflow into the Barents Sea, through Fram Strait and the immediate recirculation in Fram Strait. The heat loss and melt water input in the Barents Sea is monitored and the impact on the Barents Sea Branch of the Atlantic Water and its exchange with the Fram Strait Branch is followed. The exchange of Atlantic Water with the waters of the Siberian shelf sea and the water mass formation processes there are analyzed and related to water mass changes along the cyclonic pathway of the inflow branches.