Modification of Atlantic Water in the Barent Sea

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The effects of climate change are particularly apparent as the drastic decline of sea ice in Arctic Ocean (Stroeve and Notz., 2018). Warming of Arctic Ocean has become more pronounced in the recent 20 years (Polyakov et al., 2017). To predict climate change and Arctic sea-ice more than a decade in the future, a climate model that can represent the temperature and salinity of the Arctic Ocean is needed. However, the stratified structure of the Arctic Ocean is not maintained even in the latest climate models, because the mechanism of seawater inflow from other basins has not been sufficiently understood (Ilcak et al., 2016). The water modification in the Barents Sea, where multi-species water inflow and discharge into the Arctic Ocean, is focused on in this study.

A high-resolution (horizontal grid size is 2-8 km in the Barents Sea) ice-ocean model is employed to reproduce the Atlantic water transport and modification in the Barents Sea (Figire 1). The model is driven by 3 hourly sea surface boundary condition of JRA55-do (Tsujino et al., 2018) from 1990 to 2020. Restoring of sea surface salinity is not appled in our simulation.

The temperature, salinity, and mejor pathway of the Atlaintic water are reproduced in our model (Figure 2). The sea ice extent and sea-ice drift velocity are also well calculated. Quantitative analyses of isopycnal and diapycnal transports are conducted. It is found that the sea surface cooling and associated convection induce the loss of buoyancy of seawater in the southern Barents Sea. The vertical mixing with the near surface low-salinity water originated from the melting of sea ice supplies buoyancy to the cooled Atlantic water in the northern Barents Sea.

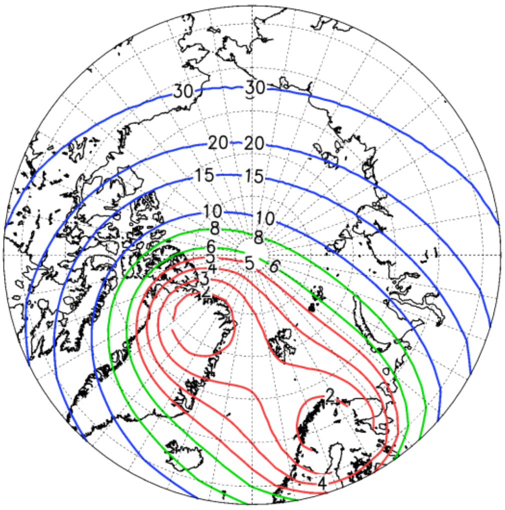

Figure 1: Horizontal grid size in the model.

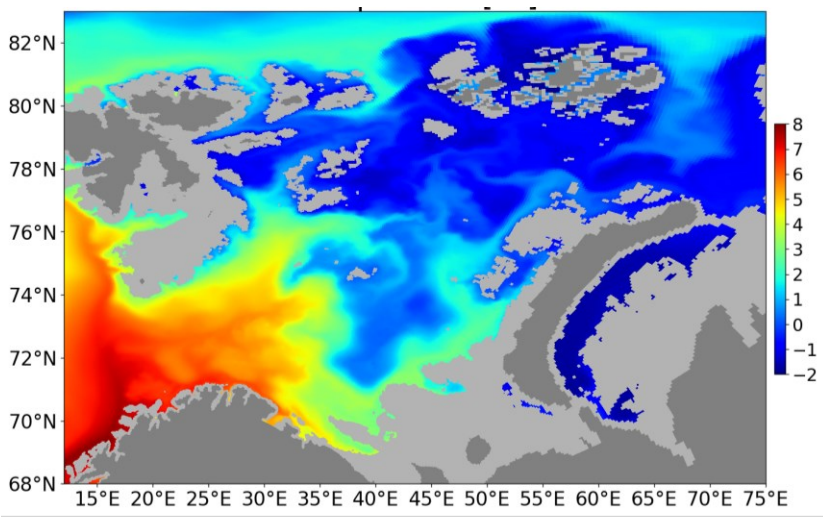

Figure 2: Simulated potential temperature at 150 m depth.

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