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Physical properties of the Atlantic - Arctic water exchange formation. Modelling and analysis

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Physical mechanisms of water exchange between North Atlantic (NA) and Arctic Oceans (AO) in 1958–2009 are analyzed using results of numerical experiments with the eddy-permitting ocean circulation model INMOM (Institute of Numerical Mathematics Ocean Model).

Changes of heat and salt transports by West Spitsbergen and East Greenland currents caused by atmospheric forcing produce the baroclinic modes of velocity anomalies in the layer 0–300m, stabilizing ocean response on the atmospheric forcing, which stimulates keeping water exchange between NA and AO at the certain climatological level.

We revealed the quick response of dense water outflow by near-bottom current in the deep NA layers through the Denmark Strait at monthly timescale on the North Atlantic oscillation (NAO) index change, as well as the response at the scale 39 months. The quick response on NAO is broken in 1969–1978, which is caused by the Great Salinity Anomaly.

Transverse oscillations of the Norwegian current front have the great influence on the formation of the intermediate dense waters of Greenland and Norwegian Seas (GNS). Dense water outflow to the NA deep layers through the Faroe Channels with the time lag of 1 year respond to the transverse oscillations of the front. The mass transport of by near-bottom current through Faroe Channels to the NA can be used as the integral index of formation and discharge of new high-density water portions generated due to mixing of salt warm Atlantic waters and freshened cold Arctic waters in GNS.

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