Wintertime convection in the western Nordic Seas under changing atmospheric conditions

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Water mass transformation in the Iceland Sea during winter is thought to contribute to the lower limb of the Atlantic Meridional Overturning Circulation (AMOC) via the North Icelandic Jet. It is therefore important to understand how and where the convection takes place, including the atmospheric forcing and role of sea ice. Here we use historical hydrographic data, atmospheric reanalysis fields, sea ice concentration data, and a one-dimensional mixed-layer model to investigate the nature of the overturning in the Iceland Sea and its long-term trends. The deepest and densest mixed layers are found in the northwest part of the sea where the heat loss is strongest near the ice edge. While only a limited number of these profiles revealed water dense enough to feed the deepest part of the North Icelandic Jet, measurements of remnant mixed layers suggest that waters of this density class may be ventilated more regularly. A sudden slumping of isopycnals in the Iceland Sea around 1995 suggests that the supply of dense water to the deep North Icelandic Jet may have diminished over the past 20 years. Concurrent reductions in the turbulent heat fluxes and wind stress curl over the Iceland Sea are consistent with this scenario. Mixed-layer model simulations imply that further decreases in atmospheric forcing of the Iceland and Greenland Seas may significantly impact the ventilation of mid-depth waters in the Nordic Seas and the supply of the densest overflow waters to the AMOC.