Geophysical Research Abstracts
Vol. 21, EGU2019-7063, 2019
EGU General Assembly 2019

Pathways and watermass transformation of Atlantic Water entering the Nordic Seas through Denmark Strait in two high resolution ocean models

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The pathways and watermass transformation of the North Icelandic Irminger Current (NIIC) in the Nordic Seas are investigated by tracing the NIIC watermass in two ocean circulation models: the Modular Ocean Model (MOM) and the Parallel Ocean Program (POP). The two simulations use identical atmospheric forcing and have a horizontal resolution of 0.1 degree. However, the models differ strongly in their representation of the sea-ice cover in the Nordic Seas and, possibly as a consequence, display a different hydrography. Results from observational studies point towards a fast overturning loop north of Iceland that connects the NIIC watermass to the Denmark Strait Overflow Water (DSOW). However, our Lagrangian analysis shows that only 0.2 Sv of the entering NIIC water exits as DSOW in the two models. In POP, the main transformation to dense water takes place along a short path north of Iceland. In MOM however, the contributing part of the NIIC to DSOW takes a long path through the Nordic Seas and reaches Denmark Strait as part of the East Greenland Current (EGC). A small contribution of the NIIC watermass to the Iceland Scotland Overflow Water (ISOW) is found in both MOM and POP (7.8%, respectively 2.1% of the NIIC watermass). In the model simulations studied, the part of the NIIC watermass that is not connected to the overflows takes many different pathways through the Nordic seas. Analysis of the depth distribution and the thermohaline changes of the particles indicates that the watermass transformation that takes place north of Iceland is crucial for diversifying the pathways of the NIIC water.