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Decadal Variations of the Atlantic Meridional Overturning Circulation as simulated by the VIKING20 Model

Patricia Handmann (1), Jürgen Fischer (1), Martin Visbeck (1), Erik Behrens (2), and Lavinia Patara (1)

(1) GEOMAR, Helmholtz Centre for Ocean Research Kiel, Kiel, Germany (phandmann@geomar.de), (2) National Institute of Water and Atmospheric Research, Wellington, New Zealand

Time series of observed deep circulation transports and water mass properties in the subpolar North Atlantic are beginning to be long enough to investigate multiannual to decadal variability of the deep water. At the same time high resolution ocean circulation models (1/20° resolution VIKING20 model) can be used to compare observations with model simulation. The models also allow to diagnose the deep water circulation processes more completely and to relate local to basin scale signals.

North Atlantic Deep Water (NADW) is a complex combination of water masses from different origins and pathways that meet at the exit of the Labrador Sea. The lower part of NADW is formed by water masses entering the subpolar basin over the Greenland-Scotland ridge. Iceland-Scotland Overflow Water (ISOW) from the eastern sills has the longest pathway and joins the densest deep water component from Denmark Strait (DSOW) after crossing the Mid-Atlantic-Ridge through Charlie-Gibbs Fracture Zone (CGFZ); together, they form the Lower NADW. The upper component of the NADW is composed of Labrador Sea Water (LSW), which is formed and modified through deep convection in the Labrador Sea.

Using 60 year long time series of North Atlantic water masses and currents produced by the Viking20 model driven by observed monthly winds, a comparison of transport variability of observed and modeled data will be presented at three locations: Deep flow at the exit of the Labrador Sea at 53°N; upper layer transports between New Jersey and Bermuda (OLEANDER section) and between the southern tip of Greenland and Portugal (OVIDE section). Is the model reproducing the observed long-term behavior of the different components in phase and amplitude? Do the results permit identification of the processes leading to these variations in transport variability? Finally, is it possible to extend the observed variability pattern over the observed time span (15 years) to the total time range of the model simulations (60 years)?