Decadal variability in a new high resolution Finite-Element Sea-Ice ocean model

The Atlantic Meridional Overturning Circulation (AMOC), which carries warm waters into northern latitudes and returns cold deep water masses southward, has an major impact to the climate in the Atlantic region. One driving limb of the AMOC is the deep-water mass formation in northern latitudes. Future climate scenarios indicate that the deep-water formation in the North Atlantic could weaken during the 21st century due to global warming.

In this project we want to determine the processes that are responsible for the fluctuation in the deep-water mass formation rates, on interannual to decadal timescales. For this purpose we will use the coupled Finite-Element Sea-Ice ocean model (FESOM). This relatively new model approach works with an unstructured triangular surface mesh. This provides the opportunity to highly resolve areas of interest and to keep the model in a global context without complicated grid nesting.

For our purpose we will use a global model setup that has a special focus on the deep-water mass formation areas in the Atlantic (eg., Greenland Sea, Gin Sea and Labrador Sea) as well as on areas in the Southern Ocean (eg.,Weddell Sea and Ross Sea) and on important equatorial and coastal upwelling regions, which also play a major role in driving the large-scale ocean circulation. In this setup we will reach a eddy resolving resolution of at least 1/10° in the Labrador Sea to study the formation of different classes of Labrador Sea mode waters more accurately. We also want to investigate the effects of eddy induced horizontal mixing, between the Labrador Current and the central Labrador Sea, on the vertical ventilation activity of the main deep convection cell.