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Numerical sensitivity studies on the variability of climate relevant processes in the Barents Sea

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The Barents Sea is a key region in the North Atlantic / Arctic Ocean climate system because of the intense ocean-atmosphere heat exchange and the formation of sea ice. The latter process is connected with salt input, so called 'brine release' whereby water masses of Atlantic origin can be transformed into dense shelf bottom waters.

To investigate the sensitivity of simulated, climate relevant processes to different but well established and realistic initial and boundary data, a high resolution coupled ice-ocean model is applied to the Barents Sea. The model is based on the Hamburg Shelf Ocean Model (HAMSOM) and runs on a 7x7 km grid, based on the IBCAO topography. The model is initialized with different temperature and salinity data from the ACSYS BarKode data set and forced with NCEP atmospheric data.

Eight sensitivity experiments with initial and boundary conditions in different combination are performed over a period of 6 years (1979-1984). Results are analyzed with special emphasis on the ocean-atmosphere heat exchange, the ice extent and the brine release. The experimental variability is compared to the inter-annual climatic variability in order to assess the role of different forcing terms for regional climate modeling.

Our results show that the experimental variability can be partly of the same order than the inter-annual variability which suggests that data uncertainties could easily bias the results of climate variability studies. Modification of the Barents Sea inflow had the strongest effect on model results. The ocean-atmosphere heat flux proved to be the most sensitive parameter to oceanic and atmospheric anomalies whereas the ice extent and the corresponding salt input is more invariant to different boundary conditions.