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North Atlantic - European shelves ocean atmosphere circulation simulated by coupled AOGCM REMO/MPI-OM/HD

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Ocean-shelf exchange processes are recognized to be a challenge for modeling. We present a novel approach to investigate the interactions between the North Atlantic Ocean and the European shelves and to understand their impact on North Atlantic climate using a global ocean model with high horizontal resolution in this area. Thus, we avoid the shortcomings related to open boundary conditions and the lack of feedback with the larger-scale circulation but retain the necessary high horizontal resolution.
Several numerical experiments covering the period 1948-2006 were carried out. The used regionally coupled model consists of the regional atmosphere model REMO, the global ocean model MPI-OM with up to 5 km horizontal resolution in the North Sea and the hydrological discharge model HD, which simulates the river runoff. The coupled domain includes Europe, the North-East Atlantic and part of the Arctic Ocean. Lateral atmospheric and upper oceanic boundary conditions outside the coupled domain were prescribed using NCEP reanalysis data.
For a better understanding of the influence of tidal dynamics on the long term ocean and atmosphere variability, the model was run both with and without tidal forcing, which was derived from the full ephemeridic luni-solar tidal potential . The “dynamical” effect of tides on the mean North Atlantic circulation leads to a small reduction of the mean current in the open ocean and an amplification along the North European shelf edge. Tidally induced mixing leads to a reduction of North Atlantic SST. However, relatively strong positive SST differences (up to 3K) appear close to the amphidromic points of the M2 and S2 tidal constituents near Iceland and in the middle of the North Atlantic.