Climate Simulations of the Barents Sea Region

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In the context of the EU-Project BALANCE (http://balance1.uni-muenster.de) the regional climate model REMO is used for extensive calculations of the Barents Sea climate to investigate the vulnerability of the Barents Sea region to climate change. Together with fifteen participating institutes from Norway, Sweden, Netherlands, Finland, the United Kingdom and Germany the influence of climate change is studied for the Barents Sea region. This project addresses a large variety of Earth system components, including the terrestrial and the marine ecosystems as well as some of the economic sectors, such as fishery/aquaculture, forestry and reindeer husbandry.
To investigate the climate of the Barents Sea region (Figure 1) the following simulations have been performed with the hydrostatic regional climate model REMO (Jacob, 2001). For simulations of today's climate of the Barents Sea region REMO has been calculated from 1979 until 2000 at ~18 km horizontal resolution. For initialization and at the boundaries Analysis- and Reanalysis-data of the European Center for Medium range Weather Forecast (ECMWF) have been used. This simulation is called baseline run and has been validated with observations from the Arctic Meteorology and Climate Atlas (NSIDC, 2000). The validation has been focused on 2m-temperature and precipitation according to the available observations. The seasonal cycle of the 2m-temperature is relatively well simulated. However January and July seem to be 1-2 °C colder than the observations.

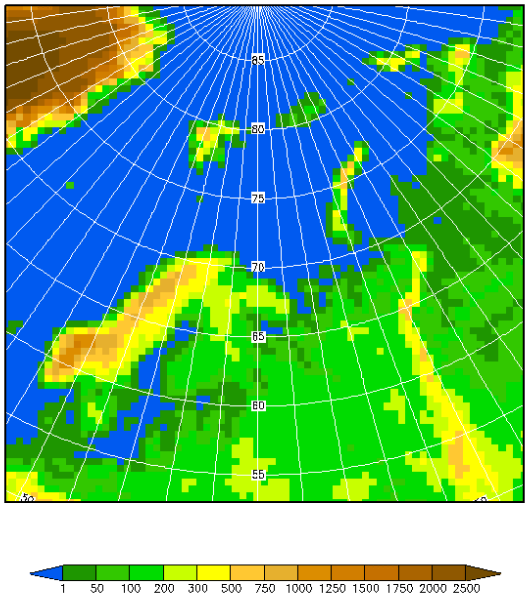

Figure 1: Model region of the Barents Sea, Orography [m].

A long run with the regional climate model REMO has been performed to simulate the climatic change of the Barents Sea region between 1961 and 2100 (Control and Climate Change run). For investigations of future climate development at ~50 km horizontal resolution REMO has been driven by the transient ECHAM4/OPYC3 IPCC-SRES B2 scenario (Roeckner, 1996). The ECHAM4/OPYC3 simulation has a warm bias in the sea surface temperature (SST), since it started 1860 using the SST of 1990. Therefore it is suggested (Roeckner et al., 1999) to look only at differences of time slices and not at the absolute values themselves. The analysis of the scenario describes the hypothetical changes in the Barents Sea region in the next century.

Decadal time slices have been investigated to point out in which season and in which region the biggest effects may occure. The annual mean 2m-temperature of the control and climate change run shows a clear trend as expected, the 2m-temperature increases about 5 degrees. The mean temperature over land is generally higher than the mean temperature over sea. The published temperature increase of the Arctic in the Arctic Climate Impact Assessment (ACIA, 2004) from 1960 to today of 1.5 ºC is in good agreement with our results. From 1960 to 2000 the annual mean temperature of the Barents Sea region rises exactly in the same way as in the simulation.

To investigate decadal changes four decades have been defined: a control period from 1980-1989, future decades from 2010-2019, 2040-2049 and 2070-2079. Only differences of these time slices will be analysed to point out where the biggest changes might be located. A stronger warming in January than in July is evident for all time slices. The warming is enhanced for the period 2040-2049 compared to the earlier period (2010-2019) as expected. The largest warming is located along the sea ice ridge and over Russia for the winter months.

References:

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