Geophysical Research Abstracts
Vol. 16, EGU2014-14530, 2014
EGU General Assembly 2014

Midlatitude Ocean-Atmosphere Interactions in a Warming Climate

Ralf Hand (1), Noel S Keenlyside (2), Richard J Greatbatch (1), and Nour-Eddine Omrani (1)

(1) GEOMAR Helmholtz Centre for Ocean Research Kiel, Marine Meteorology/Theory and Modelling, Kiel, Germany (rhand@geomar.de, +49 431 600 4052), (2) Geophysical Institute, University of Bergen, Bergen, Norway

Recent studies have shown that mid-latitude regions with strong SST gradients as they can be found in the Gulf Stream and it's extension are a key-region for midlatitude ocean-atmosphere interactions; SST variability on inter-annual to decadal timescales in this region has a distinct impact on the overlying atmosphere. Climate projections with coupled general circulation models show strong indications, that the strength and the shape of the ocean circulation might underly crucial changes in a warming climate.

This work presents an analysis of the atmospheric part of a long-term (covering the period until 2300) RCP 8.5 scenario run of a coupled general circulation model (MPI-ESM-LR) with focus on the North Atlantic. The ocean component of the model shows a strong decrease in the meridional overturning circulation and a northward-shift of the boundary between the subpolar and the subtropical gyre. This leads to significant changes of the ocean surface conditions in the Gulf Stream and the Gulf Stream extension. The weakened MOC and the northward shift of the SST front leads to a weakening of the SST gradients in the historical Gulf Stream area and a strengthening of the gradients east of Newfoundland.

We analysed the impact of the changes in the ocean on precipitation, a quantity which has been shown to be highly sensitive to the position of the SST front and the absolute value of SST in that region in previous studies. In winter the model shows a large region with strongly enhanced precipitation southeast off Newfoundland, likely related to a slight intensification of the North-Atlantic storm track present in the future projection. In summer the most prominent feature in terms of precipitation is a decrease in the region off the US east coast, where the historical control experiment had the strongest SST gradients, but shows weaker gradients in the future. A preliminary analysis of the hydrological cycle gives indications, that the precipitation changes are induced by a combination of (globally) warmer air temperatures enhancing the hydrological cycle and an effect due to shifted ocean surface patterns. Sensitivity experiments with the atmospheric component of the model are being performed to separate and quantify these two effects better.