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Dynamical downscaling of warming scenarios with NEMO-Nordic setup for the North Sea and Baltic Sea

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The North Sea and Baltic Sea constitute one of the most complex and challenging areas in the world. The oceanographic setting ranges from quasi open ocean conditions in the northern North Sea to more brackish conditions in the Baltic Sea which is also affected by sea ice in winter. The two seas are connected by narrow straits which sporadically allow the important inflow of salt and oxygen rich bottom waters into the Baltic Sea. For this, the high resolution regional model NEMO-Nordic has recently been developed. Here, the model is applied on hindcast simulations and used to downscale several climate warming scenarios. The model can be interactively coupled to the regional atmosphere model RCA4 by exchanging air sea fluxes of mass and energy (Wang et al., 2015).
Comparison with well established models and newly compiled observational data sets (Bersch et al., 2013) indicates NEMO-Nordic performs well on climate relevant time scales. Emphasis is laid on thermal dynamics. Hindcast simulations demonstrate that simulated winter temperatures in the Baltic Sea can benefit from interactive air sea coupling by allowing interactive feedback loops to take place between the ocean and the atmosphere (Gröger et al. 2015). Likewise, a more realistic dynamical behaviour makes the interactive coupled model suitable for dynamic downscaling of climate warming scenarios. Depending on the driving global climate model and IPCC representative concentration pathway scenario NEMO-Nordic shows an average warming of the North Sea between 2 and 4 K at the end of the 21st century. However the warming pattern is spatially inhomogeneous showing strong east west gradients. Involved processes such as circulation changes and changes in radiative forcing will be discussed.

Bersch, M., Gouretski, V., Sadikni, R., Hinrichs, I., 2013. Hydrographic climatology of the North Sea and surrounding regions.

Centre for Earth System Research and Sustainability, University of Hamburg, www.icdc.zmaw.de/knsc hydrographic.html

Gröger,M., Dieterich, C., Meier, HEM., Schimanke, S., 2015: Thermal air-sea coupling in hindcast simulations for the North Sea and Baltic Sea on the NW European shelf. Tellus A, 67, doi:10.3402/tellusa.v67.26911.