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Big Brother Experiments with the Regional Climate Model COSMO-CLM in an Idealised Setup to Investigate Lateral Boundary Conditions

Nora Leps (1), Jennifer Brauch (2), and Bodo Ahrens (1)

(1) Atmosphäre und Umwelt, Goethe University Frankfurt, Frankfurt, Germany, (2) Klima und Umwelt, Deutscher Wetterdienst, Offenbach, Germany

Our work aims at improving the regional coupled atmosphere-ocean model system COSMO-CLM/NEMO for decadal prediction. We address the different restricting conditions of regional climate modelling: Lower boundary conditions of the atmospheric system in the form of the coupled ocean, initial conditions and lateral boundary conditions of the coupled ocean-atmosphere system.

Lateral boundary conditions (LBCs) are known to be an issue in dynamical downscaling with limited area regional climate models, and many studies have investigated the LBCs with regard to, e.g., frequency or resolution of LBCs, position of the domain and spurious effects. By default, the formulation of the LBCs in CCLM is a Davies relaxation scheme, which introduces a sponge layer at the lateral boundaries of the domain to dampen reflection of waves produced in the limited area domain at the prescribed boundaries. With idealised studies, it is possible to investigate the performance of this LBC formulation in CCLM in detail.

The used framework is that of “big brother experiments” (BBEs). In a BBE, a high resolution simulation is performed over a larger domain, then its output is filtered to represent coarse-grid input, which is used to drive a nested smaller domain on the same high resolution. The differences between the two simulations can directly be attributed to the LBCs. Such experiments were performed in an idealised setup of a zonal flow over flat terrain or idealised hills with varying domain positions.

First experiments show that for these idealised flows the relaxation works well for lateral boundary data on a high spatial resolution for different temporal resolutions. Next we plan to perform simulations with filtered lateral boundary data that only contains large scale features of the flow as well as different settings of the relaxation procedure.