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A 2-way online coupled Regional Model for climate simulation over Baltic Sea and North Sea Regions

H. Ho (1), B. Rockel (1), H. Kapitza (1), and S. Valcke (2)
(1) Helmholtz-Zentrum Geesthacht, Germany, (2) CERFACS, France

The regional climate model COSMO-CLM (COnsortium for SMall scale MOdelling model in CLimate Mode) is coupled with the regional ocean model TRIM-NP (the "nested and parallel" model which was developed in Helmholtz-Zentrum Geesthacht, Germany, on the basis of TRIM3D model developed at the University of Trento, Italy) by the OASIS coupler version 3 of CERFACS (France). The atmospheric model component COSMO-CLM is setup with a horizontal grid mesh size of 50km and 32 vertical levels. The initial and boundary conditions are from six hourly NCEP reanalysis data. The non-hydrostatic ocean model TRIM-NP is setup with a horizontal grid mesh size of 12.8km and 50 vertical levels. In a two-way online coupling mode, COSMO-CLM is linked to TRIM-NP through sea surface temperature SST as the lower boundary condition at every 3 hours and TRIM-NP is driven by standard atmospheric variables from COSMO-CLM at every 1 hour. Since the integration domain of TRIM-NP is smaller than that of COSMO-CLM the SST data beyond the outer area of TRIM-NP is taken from NCEP data.
The coupled model is applied in a study for winter months of 1997 over Baltic Sea and North Sea regions. In general, due to the higher resolution the regional ocean model TRIM-NP simulates quite well the monthly averaged SST (the high resolution reanalysis data OISST of NOAA) and observation over sea-ice free areas of Baltic Sea as it decreases the warm bias of the reanalysis data. TRIM-NP also has the capacity to capture the day-by-day changing of SST over Baltic Sea and along eastern coastline of North Sea. However, over the sea-ice areas of the Baltic Sea, TRIM-NP tends to underestimate the SST because up to now sea-ice has not been implemented in the ocean model. Thus, the improved SST over sea-ice area of Baltic Sea is provided by the Los Alamos sea-ice model (CICE) to TRIM-NP and then to COSMO-CLM. The air-sea interaction and feedback implemented in the coupling process contribute the more consistent heat fluxes and precipitation of COSMO-CLM over the interested region.