



The development and evaluation of new SMHI atmosphere-ocean-ice coupled model RCA4_NEMO

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With the motivation to improve the prediction of climate change impacts, and assess the energy budget and water cycle over North Sea and Baltic Sea region, a new high resolution regional atmosphere-ocean coupled model RCA4_NEMO has been developed in this study, which consists of Rossby Center new regional climate model RCA4, regional ocean model NEMO 3.3.1, sea ice model LIM3 and river routing model CaMa_Flood 3.0. The regional atmosphere model RCA4 runs in a horizontal resolution of 0.22° on a rotated latitude-longitude grid with 40 vertical levels covering Europe. NEMO runs in a resolution of 2 minutes with 56 vertical levels and CaMa Flood runs in a resolution of 15 minutes. The active coupling region covers the Baltic Sea and North Sea. The coupling among RCA4, NEMO and CaMa_Flood are carried out using OASIS3 coupler developed by CERFACS. This two way coupled system exchanges heat, freshwater, momentum fluxes, no-solar heat flux derivative from atmosphere to ocean, and receives SST, sea ice concentration, sea ice temperature and sea ice albedo from NEMO model for the coupling area. The atmosphere-ocean coupling frequency is set to 3 hours. To provide river runoff for NEMO, the river runoff from CaMa_Flood is sent to NEMO at daily frequency. This coupled system is validated in a hindcast experiment from 1979-2008 driven by ECMWF ERA-Interim data without flux correction. Comparing to uncoupled version and observations, this coupled model system can realistically simulate the present climate. The effect on the atmosphere is minor, but there is still some improvement for certain parameters. The improvement for the ocean model is more pronounced, particularly for SST and salinity. This 30-year long-term simulation shows that this coupled system is free of climate drift and suitable for climate change impact study under different climate scenarios at high resolution.