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AWI climate models: From global to regional scales

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In this work we present a set of climate simulations using a hierarchy of AWI climate models. First one is the global AWI-CM2 containing global ocean (FESOM2) and atmospheric (ECHAM6) components. The second one is the regionally coupled AWI-RCM1 with the same global ocean (FESOM2) but regional atmosphere (REMO). The main novelty of these models is its common ocean component FESOM2, which is based on a finite volume dynamical core on unstructured meshes. FESOM2 allows us to simulate the ocean circulation on globally eddy-resolving spatial scales in climate simulations with a throughput of 5-10 model years per day.
We start from the global model AWI-CM2 in which FESOM2 with a mesh globally adjusted to the quarter of the baroclinic Rossby radius and ocean eddies activity with 2 km minimal and 20 km maximal resolution is coupled to the global atmospheric model ECHAM6 with about 100 km resolution. Then, results are downscaled with the regionally coupled climate model AWI-RCM1. In this case FESOM2 setup remains unchanged, but the resolution of the atmospheric component increases from 100 to 12 km due to the use of REMO. With this approach we avoid problems with boundary conditions for the ocean model as well as a long ocean model spin-up by locating the regional atmosphere areas over different ocean regions.
We investigate the impact of using an eddy-resolving ocean model and increasing the atmospheric resolution on the representation of the North Atlantic, European and Arctic climate. Our results are discussed with a special emphasis on the perspectives regarding the use unstructured ocean models in high-resolution climate simulations.