Parallel Session B: Coupled Models

B2: Ocean-Ice-Atmosphere

Impact of regional air-sea coupling on the simulation of the Iberian Peninsula current climate

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The climate of the Iberian Peninsula (IP) is characterized by great temporal and spatial variability. Changes in the position and intensity of the Azores High cause air masses of different origins to influence the weather over Western Europe, and hence, on the IP, at regional and local scales. The interaction of this variety of air masses with a particularly complex topography and the existing land-sea contrasts produces a range of differentiated regional climates. Moreover, the Iberian climate is also influenced by the large-scale North Atlantic ocean circulation, especially by the Gulf Stream and the North Atlantic Current. In this context, the use of high-resolution atmosphere-ocean coupled models (AOGCMs) is potentially necessary to achieve a correct representation of the IP climate and its variability. However, current oceanic and atmospheric components of state-of-the-art global AOGCMs generally have a resolution which is too coarse to represent adequately the circulation patterns of the North Atlantic, a key region for global climate.

The aim of this study is to examine the role of air-sea coupling processes in the representation of the present-day climate of the Iberian Peninsula. To that end, we perform a series of ocean-atmosphere coupled and atmosphere-only simulations that expand from 1980 to 2012. We adopt the regional atmospheric model REMO (Jacob, 2001) and the regionally-coupled model ROM (Sein et al. 2015). In our experiments, the atmospheric model is run with a horizontal resolution of 25 km. The horizontal resolution of the ocean model reaches up to 10 km (eddy permitting) within the IP and decreases gradually, reaching a minimum of 100 km in the southern seas. Outside the coupled domain, simulations are driven by ERA-Interim reanalysis, with a horizontal resolution of 75 km. Additionally, the role of forcing resolution in the representation of the climate of the IP is assessed by the examination of a series of simulations forced with data from MPI-ESM (Giorgetta et al. 2013). The MPI-ESM RCP85 simulation used as boundary conditions has T63 (c.a. 1.9°), 47 levels in the atmosphere, 1.5° resolution (near the equator) and 40 vertical z-levels in the ocean. Our results show that air-sea coupling magnifies winter temperature and precipitation errors relative to the E-OBS gridded observational database due to drawbacks in the representation of the North Atlantic ocean circulation. However, in summer, when large-scale circulation patterns only influence the IP climate to a small extent, air-sea interactions reduce biases. In this season, the influence of the Mediterranean Sea plays a role in the improvements observed.

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