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Impact of ocean-atmosphere coupling on regional climate: the Iberian Peninsula case

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Regional models used for downscaling the European climate usually include a relatively small area of the Atlantic Ocean and are uncoupled, with the SST used as lower boundary conditions much coarser than the mesh of the regional atmospheric model. Concerns thus arise about the proper representation of the oceanic influence and the role of air-sea coupling in such experiments. A complex orography and the exposure to different air and ocean masses make the Iberian Peninsula (IP) an ideal test case for exploring the impact of including explicitly the North Atlantic in the regional domain and the added value that coupling brings to regional climate modeling. To this end, the regionally-coupled model ROM and its atmospheric component, the regional atmospheric model REMO are used in a set of coupled and uncoupled experiments forced by the ERA-Interim reanalysis and by the global climate model MPI-ESM. The atmospheric domain is the same in all simulations and includes the North Atlantic and the ocean component is global and eddy permitting. Results show that the impact of air-sea coupling on the IP winter biases can be traced back to the features of the simulated North Atlantic Ocean circulation. In summer, it is the air-sea interactions in the Mediterranean that exert the largest influence on the regional biases. Despite improvements introduced by the eddy-permitting ocean, it is suggested that a higher resolution could be needed for a correct simulation of the features of the large-scale atmospheric circulation that impact the climate of the IP.