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Climate change signal in the Portuguese precipitation: high-resolution projections using WRF model and EURO-CORDEX multi-model ensembles

Pedro Soares, Rita Cardoso, Daniela Lima, and Pedro Miranda
Instituto Dom Luiz, Faculty of Sciences of University of Lisbon, Lisbon, Portugal (pmsoares@fc.ul.pt)

Portugal, which is located in the west limit of the Mediterranean subtropics, is a small region with a complex orography with large precipitation gradients and interannual variability. In this study, the newer and higher resolution regional climate simulations, covering Portugal, are evaluated in present climate and used to investigate the rainfall projections for the end of the 21st century, following the RCP4.5 and RCP8.5 emission scenarios. The EURO-CORDEX historical simulations, at 0.11o and at 0.44o resolution, are evaluated against gridded observations of precipitation, which allows the assembly of four multi-model ensembles. An extra simulation, at even higher resolution (9km) with WRF is also analysed. In present climate, the models are able to describe the precipitation temporal and spatial patterns as well its distributions, although there is a large spread and an overestimation of larger rainfall quantiles. The multi-model ensembles show that selecting the best performing models adds quality to the overall representation of rainfall. The high-resolution simulations augment the spatial details of precipitation, but objectively do not seem to add value with respect to the coarse resolution. Regarding the RCP8.5 scenario, WRF and the multi-model ensembles consistently predict important losses of precipitation in Portugal in spring, summer and autumn, ranging from -10% and -50%. For all seasons, the changes are more severe in the southern basins. The precipitation distributions show, for all models, important reductions of the contribution from low to moderate/high precipitation bins and augments of days with strong rainfall. Furthermore, a prominent growth of high-ranking percentiles is predicted reaching values over 70% in some regions. Generally, the changes associated with the RCP4.5 scenario have the same signal and features, but with smaller magnitudes.

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