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Climate Change in Small Islands

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Isolated islands are especially vulnerable to climate change. But their climate is generally not well reproduced in GCMs, due to their small size and complex topography. Here, results from a new generation of climate models, forced by scenarios RCP8.5 and RCP4.5 of greenhouse gases and atmospheric aerosol concentrations, established by the IPCC for its fifth report, are used to characterize the climate of the islands of Azores and Madeira, and its response to the ongoing global warming. The methodology developed here uses the new global model EC-Earth, data from ERA-Interim reanalysis and results from an extensive set of simulations with the WRF research model, using, for the first time, a dynamic approach for the regionalization of global fields at sufficiently fine resolutions, in which the effect of topographical complexity is explicitly represented.

The results reviewed here suggest increases in temperature above 1C in the middle of the XXI century in Azores and Madeira, reaching values higher than 2.5C at the end of the century, accompanied by a reduction in the annual rainfall of around 10% in the Azores, which could reach 30% in Madeira. These changes are large enough to justify much broader impacts on island ecosystems and the human population. The results show the advantage of using the proposed methodology, in particular for an adequate representation of the precipitation regime in islands with complex topography, even suggesting the need for higher resolutions in future work.

The WRF results are also compared against two different downscaling techniques using an air mass transformation model and a modified version of the upslope precipitation model of Smith and Barstad (2005).