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Evaluation and projection of temperature and precipitation extremes in Canary Islands

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Canary Islands (Spain), located in the Atlantic Ocean at about 28.3°N, 16.6°W, can be considered, from a climatological point of view, as a complex region, given their location, close to the African continent, and their rugged orography, with altitude variations of more than 3000 m in less than 20 km horizontally. Almost 80% of the precipitation is related to atmospheric disturbances and the local effect of the orography is essential to the development of extreme precipitation, which usually affects small areas of the islands. Moreover, the stratification of the atmosphere and the aforementioned orography, usually causes that the thermal extremes do not affect the entire island territory in the same way. For all these reasons, the use of mesoscale models, or statistical approaches, is necessary to carry out an appropriate climate regionalization based on the data provided by global climate models (GCM), whose spatial resolutions are too coarse to obtain useful information for small and complex regions.

In this work, WRF (Weather Research and Forecasting) model was used to perform dynamical downscaling simulations, using the results from two different CMIP5 (Coupled Model Intercomparison Project Phase 5)-GCM models (GFDL and MIROC) for initial and boundary conditions. The simulations were carried out for three periods, a recent past period (1980-2010) and two in the future (2030-2060 and 2070-2100), and for two different greenhouse gases scenarios (RCP4.5 and RCP8.5), defined in the CMIP5.

Some of the indices defined by ETCCDI (Expert Team on Climate Change Detection and Indices) were selected to analyse the extreme temperature and precipitation events at present and their expected changes in the future periods. All these indices, obtained from WRF simulations, were compared, for the present period, with those computed from data acquired by weather stations located in the different islands, obtaining a good agreement. The projections for the future periods show a general increase in events associated with maximum temperatures, such as the number of tropical nights. However, the expected number of heavy precipitation events decrease in the future, contributing to a smaller amount of annual precipitation.