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Evaluation of the WRF model for precipitation downscaling on orographic complex islands

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General Circulation Models (GCMs) have proven to be an effective tool to simulate many aspects of large-scale and global climate. However, their applicability to climate impact studies is limited by their capabilities to resolve regional scale situations. In this sense, dynamical downscaling techniques are an appropriate alternative to estimate high resolution regional climatologies.

In this work, the Weather Research and Forecasting model (WRF) has been used to simulate precipitations over the Canary Islands region during 2009. The precipitation patterns over Canary Islands, located at North Atlantic region, show large gradients over a relatively small geographical area due to large scale factors such as Trade Winds regime predominant in the area and mesoscale factors mainly due to the complex terrain.

Sensitivity study of simulated WRF precipitations to variations in model setup and parameterizations was carried out. Thus, WRF experiments were performed using two way nesting at 3 km horizontal grid spacing and 28 vertical levels in the Canaries inner domain. The initial and lateral and lower boundary conditions for the outer domain were provided at 6 hourly intervals by NCEP FNL (Final) Operational Global Analysis data on 1.0x1.0 degree resolution interpolated onto the WRF model grid.

Numerous model options have been tested, including different microphysics schemes, cumulus parameterizations and nudging configuration Positive-definite moisture advection condition was also checked. Two integration approaches were analyzed: a 1-year continuous long-term integration and a consecutive short-term monthly reinitialized integration.

To assess the accuracy of our simulations, model results are compared against observational datasets obtained from a network of meteorological stations in the region. In general, we can observe that the regional model is able to reproduce the spatial distribution of precipitation, but overestimates rainfall, mainly during strong precipitation events.