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Climate change effects on extreme precipitation events in Morocco

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Morocco is a country highly vulnerable to extreme precipitation events. In the present study the past trends in extreme precipitation and future projections using an ensemble of regional climate models (RCM) are evaluated. The extreme precipitation distributions during the extended winter season (October to April) in 10 stations are fitted with Generalized Extreme Value models (GEV).

First, the dependence of the GEV parameters with time, winter North Atlantic Oscillation (NAO) and Mediterranean Oscillation (MO) indexes are tested. No significant trends are detected during the observation period 1961-2007. However, dependences between precipitation extremes and NAO or MO indexes are detected, in particular for the Atlantic stations.

Then, 15 RCM simulations provided by the ENSEMBLES European project ran with the A1B scenario are considered to provide future projections. The Cramér-von Mises (CM) statistic is introduced as a measure of adequacy between the observed extreme precipitation distributions at the different stations and the distributions simulated by the RCMs. The CM statistic can thus provide weights to build a multi-model ensemble of future projections based on model performance in present climate. Even if some models exhibit good skills, there is a great variability in the RCM abilities to reproduce the seasonal cycle and the extreme precipitation distributions at the different stations.

The projected changes on extreme precipitation are evaluated with quantiles computed for different return periods, ranging from 2 to 40 years, during the control period 1961-2007 and two projections periods, 2020-2050 and 2070-2099. The climate change scaling factors on extreme quantiles provided by the different RCMs are averaged with equal weights, or with weights obtained from the inverse of the CM statistic. The climate change signal in the RCM simulations indicate a decrease in extreme precipitation quantiles, -12% in average for the projection period 2070-2099 but a great variability and lower convergence between models is found for the projection period 2020-2050. Overall, there is a good model convergence towards a decrease for the Atlantic stations. For the Mediterranean stations, the projected changes are difficult to assess due to the great variability. The two weighting schemes tested to average the climate change scaling factors provided similar results.