

# **Dynamical-statistical projections of annual and seasonal precipitation in Spain during the 21st century**

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Simultaneously to the global warming, it has been observed a redistribution of the rainfall and other atmospheric variables (e.g. pressure, wind, cloudiness), with even higher spatial variability than for temperature. For precipitation in the Mediterranean, observations indicate a loss in this resource that is estimated between 5-20% during 1901-2005, although the robust detection of precipitation trends is always problematic owing to their high spatial and temporal variability.

Atmosphere-Ocean General Circulation Models (AOGCMs) constitute the primary tool used by scientists to render future climate projections, at typical resolution of 100-300 km. Regional Climate Models (RCMs) operating at higher horizontal resolution (20-40 km) are being nested within AOGCM for specific regions of the world to better estimate climate change impacts at adequate spatial and temporal resolution. A novel technique for the statistical adjustment of these regional climate model outputs to local scales was recently developed by the authors. In this work we apply this statistical method to derive projected precipitation changes in Peninsular Spain and Balearic Islands during the 21st century.

Specifically, daily precipitation data generated by an ensemble of RCMs integrated in the European ENSEMBLES project has been used. The use of a multimodel strategy allows evaluation of the uncertainties arising from model errors and boundary conditions. A quantile-quantile correction is applied to the simulated regional projections. The method is based on detecting changes in the cumulative distribution functions between the recent past and successive time-slices of the simulated climate and applying those, after calibration, to the recent past (observed) series. The adjusted series from the RCMs are finally analyzed to quantify the climate change signal on precipitation.

Based on the ensemble mean, we find a persistent decrease of annual mean precipitation throughout the century, although with marked regional variability. Seasonally, we find increases and decreases in autumn and winter depending on the zone, while a general loss of precipitation in spring and summer.

**KEYWORDS:** Precipitation, Spain, Climate Change, RCM, Statistical Adjustment