



## **Reproduction of links between atmospheric circulation and precipitation in NE Spain in an ensemble of RCMs**

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We evaluate relationships between large-scale atmospheric circulation (represented by circulation indices derived from gridded mean sea level pressure) and daily precipitation amounts in the Ebro river basin in NE Spain. The region is prone to both droughts and heavy precipitation, which are associated with major impacts on agriculture, ecosystems and society. The study is carried out over the 40-year control period (1961-2000) for three seasons: the cereal crops growing period (spring, AMJ), focusing on droughts; autumn (SON), with focus on extreme daily precipitation; and winter (DJF), which is relevant in terms of water resources. We study links of circulation characteristics to (i) mean daily precipitation, (ii) probability of wet and dry days, and (iii) probability of extreme daily precipitation (i.e. precipitation exceeding threshold defined by a high quantile of precipitation distribution in a given season). The links found in gridded observed data (the E-OBS database) are compared with those in an ensemble of 13 regional climate model (RCM) simulations driven by the ERA-40 reanalysis in order to identify main biases and drawbacks of the RCMs. We find that the RCMs are able to capture most of the basic features of the links between circulation and precipitation characteristics. Nevertheless, they have difficulties to reproduce the observed magnitude of the links and tend to underestimate differences between seasons.