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Precipitation over the Iberian Peninsula: ECMWF re-analyses versus observational gridded datasets

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Iberian precipitation is characterized by high spatial and temporal variability due to a complex orography and diverse atmospheric regimes, with well-fed areas in the Northwest and semi-arid areas in the South. This makes the Iberian peninsula a challenging region to test the quality of global datasets, either based on observations or on model data.

A new daily precipitation gridded dataset over mainland Portugal is presented. This dataset is merged with a recent Spanish dataset to obtain a high resolution ($0.2^o \times 0.2^o$) Iberian dataset, labelled IB02. The combined dataset spans the period from 1950 to 2003 and is based on a dense network of rain gauges, with more than 2000 and 400 stations, respectively over Spain and Portugal.

IB02 is used in this study to analyze the performance of four global precipitation gridded datasets, two based on observations - Climate Research Unit (CRU) and Global Precipitation Climate Center (GPCC) and two ECMWF re-analyses – ERA40 and ERA-Interim, against the IB02 dataset.

These datasets will be compared with regard to annual mean and annual cycle of precipitation. This comparison also includes drought assessment using the standardized precipitation index (SPI). In addition, monthly and 5-days precipitation are evaluated using objective scores, such as bias and squared correlation.

The northwest-southeast contrasts in the geographical distribution of mean annual precipitation are well captured by all global datasets. However, the amounts are underestimated, mostly in mountainous regions. All global datasets perform better in Northwest and Southwest regions, where precipitation is mainly associated with synoptic-scale disturbances, in contrast with other regions of Iberia where convective events and complex orography play a more important role. In addition, all datasets are able to identify the major drought spells at the Iberian scale. Despite these similarities, GPCC outperforms CRU and ERA-I is superior to ERA40, with respect to smaller biases, annual cycle representation, drought detection and better correlations with IB02.

An interesting result of this study is that, the performance of the CRU dataset is similar to ERA-I re-analysis. The exception is the Cantabrian region, where ERA-I has a poor performance and ERA40 shows a better agreement with the observational datasets, mainly for drought detection.

On average over the Iberian Peninsula, the frequency of days with precipitation is overestimated by the two re-analyses. However, this overestimation is stronger in ERA-I, mostly during spring and summer, over the Cantabrian region. On the other hand, the events of heavy precipitation are underestimated, mostly by ERA40. At 5-days scale, both re-analyses reveal a poor skill to predict the magnitude of precipitation for higher amounts (superior to 20 mm). Nevertheless, both re-analyses, in particular ERA-I, demonstrate a higher ability to estimate correctly the peak locations.