Validation of ECMWF re-analyses using the new PT02 gridded precipitation datasets

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A new high-resolution daily precipitation gridded dataset over mainland Portugal, PT02, is presented. This dataset spans the period from 1950 to 2003 and is based on more than 600 stations. The data used to create the PT02 dataset was subject to a quality control, including suspicious data identification and in-homogeneity detection. The interpolation method applied to create the PT02 dataset was the ordinary kriging, which was compared with simpler techniques, namely, inverse distance weighting methods.

Additionally, the performance of two ECMWF re-analyses – ERA40 and ERA-Interim is analysed over the Iberian Peninsula. For this purpose, the PT02 dataset is combined with a recent Spanish high-resolution daily precipitation gridded dataset (Spain02) to create a high resolution (0.2º × 0.2º) Iberian dataset.

Several aspects of the ECMWF re-analyses were evaluated, including spatial pattern of annual mean, annual cycle and drought identification. Drought assessment is performed using the standardized precipitation index. Monthly and 5-days precipitation is evaluated using simple scores, such as bias and squared correlation. Finally, the accuracy of spatial patterns of the 5-days precipitation of ECMWF re-analyses is also assessed using the correspondence ratio, defined as the ratio between the area where both datasets represent precipitation and the area where at least one of the datasets depicts precipitation.

In general, despite a similar performance in some aspects, ERA-Interim outperforms ERA40 over the Iberian Peninsula. The northwest-southeast contrasts in the geographical distribution of mean annual precipitation are well captured by the two re-analyses. However, in the vicinity of mountainous regions, total amounts are strongly underestimated, mainly by ERA40. This is consistent with the misrepresentation of the sharp orographic features of Iberia due to the coarser resolution used by ERA-Interim and in particular by ERA40.

The strong annual cycle over the Iberian Peninsula is reasonably well captured by the two re-analyses. However, its amplitude is underestimated by both datasets. On average over the Iberian Peninsula, the frequency of days with precipitation is overestimated by the two re-analyses, mainly by ERA-Interim, while both re-analyses, mostly ERA40, underestimating the number of days with precipitation exceeding 10 mm/5-days. Despite the poor skill to predict events with higher precipitation amounts (exceeding 20 mm/5-days), ERA40 and ERA-Interim demonstrate a greater ability to estimate correctly the peak locations of such events, with ERA-Interim being superior to ERA40.

Given the large variety of precipitation regimes in the Iberian Peninsula and a strong dependency of precipitation on orography, PT02 and its combination with Spain02 will be a valuable contribution to the validation of increasingly high resolution re-analyses and climate simulations.

The PT02 dataset is available from the Portuguese Meteorological Service (Instituto de Meteorologia, IM) website, for non-commercial purposes (see www.meteo.pt).