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The analog method as a MOS-like downscaling for ENSEMBLES RCM-precipitation: application over Spain

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Global climate models (GCM) are basic tools to study the climate. However due to their coarse resolution, generally few hundred kilometres (Solomon et al. 2007), they are not useful to study regional aspects of the climate of order of tens of kilometres (Cohen, 1990). This is especially true for Spain, which is geographically complex and heterogeneous and it is characterized by a great variability of precipitation (Serrano et al. 1999, Trigo and Palutikof, 2001). Consequently, developing regional climate scenarios is a key aspect for any impact and adaptation study to climate change in Spain.

In contrary to the traditional approach in which the statistical downscaling has been considered as an alternative to dynamical downscaling, we used the two kinds of downscaling approaches together in order to combine their advantages. This hybrid approach is becoming popular (Maraun et al. 2010, Piani et al. 2010, Quintana Seguí et al 2010, Themeßl et al. 2010) thank to the better skill of RCMs (e.g. Herrera et al. 2010a) and the increase of availability of RCMs (e.g. due to projects like ENSEMBLES).

In this study, the fields of precipitation simulated by an ensemble of RCMs are statistically post-processed in order to downscale and to calibrate their precipitation fields using the analog method, (AM; Lorenz, 1969), according to the approach of the Model Output Statistics (MOS, Wilks, 2006). The simulations used as predictors have been the ERA40-driven RCMs provided by the EU-funded project ENSEMBLES. The Spain02 precipitation dataset (Herrera et al. 2010b) is used as predictand.

The results show a big reduction of the systematic error of the RCMs in representing the spatial pattern of the climatology of several standard and extreme precipitation indices, maintaining or slightly improving the daily skill of the RCM. Besides, the AM shows a good representation of the annual cycle. These outcomes suggest the potential transferability of this method to other regions, the robustness of the method itself and the potentiality to calibrate also relatively low-performing model. Although generally good results are obtained testing the method in the wettest or driest years, considering the former, the AM added value is less evident. Consequently, the main limitation of the method, i.e. it cannot simulate unobserved weather patterns, should be cautiously considered in the application for future scenarios of precipitation: this method will perform worse in a future climate that differs greatly from present climate.