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External forcing influence on Weather Types along the last Millennium

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Climate models are widely used to perform climate change projections under a set of assumptions of the evolution of climate forcings. Often, the analysis of these simulations include the study of the frequency changes in the main Weather Types, and of how these changes impact the mean and extreme values of climatic variables which are specially relevant to human activities, such as temperature and precipitation. However, less attention has been devoted to the analysis of Weather Types in paleoclimate simulations.

This study analyses the evolution of the most prominent Weather Types in a paleosimulation performed with a climate version of the mesoscalar model MM5 over Europe and the Iberian Peninsula for the last millennium. The simulation includes three varying external forcings: greenhouse gases, volcanic activity and solar radiation. We have analysed the frequency and persistence of the main Weather Types in winter and summer during the last millennium. For the characterization of the Weather Types, daily mean series of simulated SLP and Z500 fields have been employed over a window encompassing the Iberian Peninsula. Weather Types and their relative importance through the simulation were calculated for the whole simulated period. They have been obtained with a k-means clustering algorithm initialized with a set of seeds previously obtained with a PC-mode T clustering.

The results indicate that the different forcings considered may activate different mechanism depending on the forcing dominating in a given period (for instance, solar forcing dominates around the Maunder Minimum, volcanic around the Dalton minimum and greenhouse gases during the industrial period). These mechanisms yield modifications in the atmospheric circulation at continental scale which, in general terms, are more noticeable in summer than in winter.