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Regional characterization of the observed and modelled wind over Spain

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Meteorological observations are essential to understand the physical processes affecting different meteorological and climatological scales. In particular, in the last years,the demand of wind records has grown for its use in a number of applications, such as the evaluation of wind energy resources, the transport and dispersion of pollutants within the frame of air quality studies, the analysis of extreme wind events by insurance companies, etc. Despite of this necessity, wind databases are scarce nowdays, and there are many barriers to overcome. In this respect, the use of numerical models for renewable energy assessment studies is an interesting issue that can provide sets of pseudo-real data for completing temporal and spatial coverage of meteorological records. This work tries to contribute to both aspects building an high-quality observational wind database for the Iberian Peninsula and to check the ability of a mesoscale model for reproducing the climatology of the observed wind field. This dual study contributes to the improvement of the quantification of the variability of the resources in space and time.

The observational data base consists of hourly observations of wind speed and direction collected from 1999 to 2007 at 732 automatic weather stations distributed over the Iberian Peninsula (IP). However, in this work we focus on a subset of 451 stations ,that have overcomed a strict quality control. On the other hand, wind data fields from a hindcast experiment performed over the IP with the MM5 model with a spatial resolution of 10km is used for comparison purposes.

We present the wind climatology over Spain, as well as the ability of a regional climate model for reproducing the observed climatology. This climatology has been performed identifying areas of similar temporal behavior at different time scales from daily to internannual. The method employed has been a two-step clustering analysis of the most important PCA modes applied to the wind speed. In adition, an analysis of the wind vector has been carried out using the same regions.
The analysis of the wind speed observation for the annual cycle reveals 5 different regions. The main differences among them is the month in which the relative maximum wind speed appears. The windiest month is March for most of the regions, although in coastal sites the maximum is reached during summer. On the other hand, the months when the wind speed is lower is related to changes in the wind direction.

Regarding the daily cycle, the analysis has been performed for each season. The number of regions and their distribution is quite dependent of the time of the year, appearing more regions in summer, which can be related with the enhanced regional circulation. The larger region for summer (more stations grouped in the same region) is obtained for stations located near coastal areas, whereas in winter the larger region groups most of the inner stations.

A preliminary comparison with the results of the hindcast performed with the regional model shows that it is able to reproduce most of these important features of the wind climatology. However, the model tends to be too homogeneous in general, which is an indication of the strong local characterization of the wind observations, which is not reproduced by the model due to its too coarse spatial resolution.