



Statistical analysis of the wind and wind power predictability in the Northeast of the Iberian Peninsula

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An understanding of the regional climate variability over a particular region can be achieved by applying a survey of different downscaling techniques. They translate the information supplied by the general circulation models to provide an evaluation of the potential predictability of some features of the regional climate. In addition, this type of analyses can be of some value in the assessment of possible impacts that the expected changes in the global climate could induce on the regional scale.

The analysis of the surface wind variability and estimations of its possible changes at the regional scale involve relevant implications for society. One example is the assessment of the variations and sustainability of wind energy resources. In this study the surface wind field variability and its potential predictability in a Northeastern region of the Iberian Peninsula is evaluated through its relation with the large scale atmospheric circulation over the North Atlantic area by applying two different statistical downscaling techniques. One is the Canonical Correlation Analysis (CCA), that searches for linear associations between large and regional scales. The alternative methodology is the non-linear analog approach. Wind speed observations for a maximum of 14 years period are used to calibrate and validate an empirical model that explores the main associations between the regional and the large scale circulations at monthly timescales. The statistical downscaling evidences the existence of predictability in the region for the surface wind field. A discussion on the ability of the different types of methodologies is carried out by comparing respective results.

A similar analysis in which the predictand is the wind power produced at three wind farms (four year of observations in the longest case) in the same area was conducted. As expected, due to the linear relation observed between wind and wind power at monthly timescales in a previous study, a certain degree of predictability for the power production is evidenced also in this case.

An assessment of the sensitivity of the linear methodology (CCA), as an evaluation of the potential sources of uncertainty affecting the regional estimations of the wind field was performed. It reveals a similar influence of the different parameters explored, for instance large scale domain, predictor field, etc. Additionally a direct relation between the sensitivity of estimations to changes in the methodology and the range of variability of the wind field at each location was found.

The statistical relationship found in the calibration period is used to perform a climatological reconstruction of the surface wind field and the wind energy availability within the last 500 years using reanalysis and observational data sources. The evaluation of past wind variability could have relevant applications for the study of regional wind predictability over the 21th century.