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# Modelling the Variability of the Wind Energy Resource on Monthly and Seasonal Timescales

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We study the variability of the wind energy resource in France on monthly to seasonal timescales. On such long-term timescales, the variability of the surface wind speed is strongly influenced by the large-scale situation of the atmosphere. As an example variations in the position of the storm track west of France directly impact surface wind in the North of France in autumn and winter.

We investigate the relationship between the large scale circulation and the surface wind speed, summarizing the former by a principal component analysis, so that the large-scale mass distribution is described by a small set of coefficients. We then apply a multi polynomial relationship to model the monthly and seasonal distribution of surface wind speeds given the knowledge of these few coefficients. Different methods for this reconstruction are assessed. While the first attempts to reconstruct the wind with a daily resolution, the three others directly aim at reconstructing the distribution of the wind, assuming it is well described as a Weibull distribution : One is based on the reconstruction of 3 moments of this theoretical distribution, another is based on the reconstruction of two percentiles, and the last one is based on the direct reconstruction of the shape and scale parameter of the Weibull distribution. The last two methods show good performance and better skills to reproduce the monthly and seasonal distribution of the wind speed with respect to the climatology.

We then apply those methods to seasonal forecasts from the European Center for Medium-range Weather Forecasts (ECMWF) in an attempt of forecasting the monthly and seasonal distribution of the surface wind speed. For one month time-horizon, the forecasting performance is superior to climatology.