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Investigating continental-scale synchronicity of wind power national productions in the EU with different meteorological datasets.

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In a world more and more relying on renewable resources for satisfying its energy needs, a proper statistical description of spatial and time features of wind power productions is of crucial importance for energy systems managers in designing improved planning and scheduling tools.

In particular, some recent papers have investigated the time correlation, or synchronicity, of the wind power produced in different countries. Indeed, the synchronicity of national productions is an important factor in a continental-scale electricity market. In a simplified vision, countries in which wind often blows at the same time could find difficult to fully exploit their wind power productions avoiding moments with excess or deficit of supply. On the contrary, countries in which winds flow alternatively at different times in different countries could find easier to properly exchange each other individual productions in order to achieve a well -balanced and smooth collective supply curve and then rely more on wind as a secure power supply.

Remaining in the EU, [1] has analysed the 2014 time series for wind and solar power in 19 EU countries finding a clear evidence that the correlation between wind power series decreases quite fast with countries distance, with very little synchronicity remaining for countries more than 1000 km far away.

On the modelling side, [2] has investigated wind power time correlation based on long-term climate outputs from climate models, showing that synchronicity patterns are expected to remain quite stable in the next decades in the EU, and has pointed as robust international power interconnections are needed in order to fully exploit the potential benefits of wind power complementarity in the EU.

The present study continues and deepens the analysis of [2]. An updated model for wind power curves in Europe has been developed, introducing a detailed description of the present European wind turbines fleet based on [3] and using finer resolution meteorological data sets. Hourly wind data have been indeed obtained from the ECMWF integrated forecast system (IFS) (0.125° grid spacing) and from MERRA reanalysis at 0.66^ox0.5^o. The validation benchmark consists in data obtained from ENTSO-E transparency platform.

Although the dependence on the meteorological data set is quite evident, the modelling approach chosen seems able to properly reproduce synchronicity features for the years investigated and could then be a robust base for future investigations on, e.g., seasonal patterns, or to provide inputs for further studies related to the EU electricity grid.

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