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# Weather Dependent Upscaling Algorithms for European Wind Power

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A fully integrated European energy market is one of the priority policy areas of the European Commission [1]. Transmission system operators submit estimates of the energy production from renewable sources within their transmission zones to a higher level controller already today. This procedure shall ensure transparency and the security of supply. When trading zones are extended also the upscaling algorithms behind theses wind power estimates need to be revised – in particular for increasing shares of renewables.
This study introduces a new upscaling algorithm based on spatio-temporal cluster analysis. This algorithm bases on the temporal correlation of feed-in time series across Europe. Ten years of wind power generation across Europe have been simulated based on downscaled MERRA wind fields with hourly resolution and a spatial resolution of $7 \times 7$ km. Clusters are computed such that the intra-cluster correlation is below a chosen threshold. Consequently, the cluster size – and therefore the number of clusters, i.e. reference sites – is variable. It depends on the correlation pattern, which changes on diurnal and seasonal time scales as well as in dependency of the prevailing weather situation. We describe this relationship by connecting correlation patterns to circulation weather types computed from sea level pressure fields using a Lamb weather type classification. Furthermore, it is shown that taking meteorological variations into account significantly increases the skill of the upscaling estimate and helps to reduce the number of reference sites required.

**References**

[1] http://ec.europa.eu/priorities/energy-union-and-climate/, assessed April 14th, 2016