Use of European Regional Reanalysis (windTrends) as reference data for long-term adjustments.

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Abstract:

WindTrends is a historical reanalysis database developed at Meteosim Truewind by means of the mesoscale atmospheric model MASS, aimed to provide a detailed description of wind variability in any European land or offshore location, till 50 km off the coast. For this purpose, atmospheric conditions during the period [1997-2009] were simulated in 12-hour blocks on a grid of 20-km spatial resolution designed to cover the whole Europe. Simulations were coupled to generate series of meteorological data with hourly sampling. This new data set provides stationary long-term series to analyse wind resource and its variability. In addition to wind resource assessment, WindTrends' many output variables may inspire a wide range of applications.

Wind farm project developers will often need to know how much power their wind turbines are expected to produce. A widely accepted methodology to answer this question is measurement–correlation–prediction (MCP), which needs – among other requirements – a reliable reference data source to predict the long-term mean wind resource.

As reference data, nearby weather stations or global reanalysis are used. However, land and offshore wind farms are often located in remote places experiencing different wind regimes from the nearest weather stations. Also global reanalysis may prove inaccurate, given the huge grid spacing of global models. At 20 kilometres resolution, WindTrends provides a possibility to overcome these up till now insurmountable difficulties. The final resolution seeks the balance between a detailed mesoscale description of wind resource and the inherent computational demand. The objective is to help developers estimate production in their points of interest for wind farm projects, especially in those locations close to the edge of cost-effectiveness.

A sample of 48 European surface weather stations and ten meteorological towers was selected to validate the new dataset. Among many other magnitudes and statistical indexes, wind anomaly, MCP-calculated long-term wind, mean absolute error, and the correlation parameter were analysed. Several filters such as classification by average wind speed or topographical environment were applied to estimate the model's performance in various wind regimes and sites. WindTrends was found to improve the accuracy and reduce the error margins of previous available reanalysis data, especially in areas surrounded by complex terrain and locations where wind speeds are high.

WindTrends generally offers higher correlation and more consistent data record than reference surface stations. Though all reference data used may be affected by error sources, no significant trends affecting MCP applicability have been found. Differences respect reality may still occur at this resolution.