Geophysical Research Abstracts
Vol. 15, EGU2013-13119, 2013
EGU General Assembly 2013

Estimating return periods of extreme values from relatively short time series of winds

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An important factor for determining the prospect of individual wind farm sites is the frequency of extreme winds at hub height. Here, extreme winds are defined as the value of the highest 10 minutes averaged wind speed with a 50 year return period, i.e. annual exceeding probability of 2% (Rodrigo, 2010).

A frequently applied method to estimate winds in the lowest few hundred meters above ground is to extrapolate observed 10-meter winds logarithmically to higher altitudes. Recent study by Drechsel et al. (2012) showed however that this methodology is not as accurate as interpolating simulated results from the global ECMWF numerical weather prediction (NWP) model to the desired height. Observations of persistent low level jets near Colima in SW-Mexico also show that the logarithmic approach can give highly inaccurate results for some regions (Arfeuille et al., 2012).

To address these shortcomings of limited, and/or poorly representative, observations and extrapolations of winds one can use NWP models to dynamically scale down relatively coarse resolution atmospheric analysis. In the case of limited computing resources one has typically to make a compromise between spatial resolution and the duration of the simulated period, both of which can limit the quality of the wind farm siting.

A common method to estimate maximum winds is to fit an extreme value distribution (e.g. Gumbel, gev or Pareto) to the maximum values of each year of available data, or the tail of these values. If data are only available for a short period, e.g. 10 or 15 years, then this will give a rather inaccurate estimate. It is possible to deal with this problem by utilizing monthly or weekly maxima, but this introduces new problems: seasonal variation, autocorrelation of neighboring values, and increased discrepancy between data and fitted distribution.

We introduce a new method to estimate return periods of extreme values of winds at hub height from relatively short time series of winds, simulated at a high spatial resolution.

REFERENCES

Arfeuille, Gilles J. M., A. L. Quintanilla, L. Zizumbo, and F. C. Viesca, 2012. Wind Resource Assessment in a Tropical Region with Complex Terrain using SODAR and a Meteorological Tower Network to Measure Low Level Jets and Boundary Layer Conditions. 15th AMS Conference on Mountain Meteorology, Steam boat Spring, Colorado, USA, August 2012. Available on-line: https://ams.confex.com/ams/15MountMet/webprogram/Manuscript/Paper210184/ARFEUILLLE_etal_15MountMetConf_Aug2012.pdf

Drechsel S., G. J. Mayr, J. W. Messner, and R. Stauffer, 2012: Wind Speeds at Heights Crucial for Wind Energy: Measurements and Verification of Forecasts. J. Appl. Meteor. Climatol., 51, 1602–1617.

Rodrigo, J. S., 2010. State-of-the-Art of Wind Resource Assessment. CENER National Renewable Energy Center, Sarriguren, Spain. Available on-line: http://www.waudit-itn.eu/download.php?id=103&parent=79