Long term correction performed with reanalysis data and its impact on uncertainty analysis

Sonia España, Bastien Adamo, Manuel Campillo, Sergi Roma
Alstom Renovables España S.L sonia.espana@power.alstom.com

Abstract

When performing a site wind resource assessment, onsite data usually have a short measurement period compared to the time life of the future wind farm. Then it is required a correction of the average wind speed to achieve long-term representativeness. Seldom a conventional meteorological mast with long-term data is available to correlate with short-term measured wind data. In other cases Reanalysis data are often used to apply long-term corrections.

The aim of a long-term correction is to reduce the uncertainty on wind speed variability over time. The uncertainty associated to the long-term correction remains one of the main sources in a uncertainty analysis and is difficult to be quantified. In some cases the uncertainty is left as constant due to the difficulties to quantify it. The challenge of this work is to characterize the uncertainty related to long term correction using Reanalysis data and compare it to the uncertainty of using short term data.

Objectives

It is known the difficulty to quantify the uncertainty related to the long-term correction. For this issue with a sample of 1576 correlations will be set the uncertainty as a function of the short-term measured period. The maximum and minimum error done in the correlation will also be plotted as a function of the period, the method of calculation and the Pearson’s coefficient $R^2$.

Methods

For the analysis, data sets from 6 real meteorological masts have been selected. All these data sets have long term measurement periods longer than 7 years. From here on referred to as long-term measured series.

I. Each data set has been divided into several shorter periods of different length: 3 months, 6 months, and from 1 to 7 years. From here on referred to as short-term series.

II. These short-term series were correlated with Reanalysis series from different sources: Vortex Series(1), Metar(2) and MetOffice(3). The divided series are corrected to achieve long term (LT) representativeness using two different methods:

   LT1: Long term correction (LT) using Linear correlation.

   LT2: LT using Alstom’s Measure-Correlate-Predict(4) (MCP) method.

III. The results will be shown in box-plot graphics. All the errors plotted show the deviation of the short-term series (with and without correction) from the long-term measured series of each meteorological mast. The analysis focused on two different results:


   b) Error on average wind speed using short-term series corrected for the long term using reanalysis data.

Finally the uncertainty introduced when using Reanalysis data as the only input data for the wind resource analysis is calculated: average wind speed from the Reanalysis series has been compared against the average wind speed from the long-term measured series.

Results

The plot shows the deviation from the average wind speed measured on the long-term series. As it was expected figure 1a) shows a big dispersion when the 3 months and 6 months series are used. The seasonality introduced and the very short period of measurement produce a big error. In figure 1b) when a long term correction is applied to the short-term series, the error is significantly reduced. When less than 1 year of data is available the error can be halved but when the number of years of the short term series is higher the difference between the short term series with and without corrections is highly reduced. We go further on this issue on figure 3).

Conclusions

i. Using reanalysis series for long term corrections highly reduces the uncertainty related to the long term characterization for periods of measurement shorter than 3.5 years. When more than 3.5 years of data are available on site, a further analysis must be done regarding the quality of the correlation to choose the way that lead us to less uncertainty.

ii. Despite the good results for using Reanalysis data as a long term correction, it has been checked that using it as the only input data for a resource assessment leads to very high uncertainty.

iii. We also conclude that Pearson’s coefficient $R^2$ is not a good reference to characterize the uncertainty of a correlation as unique parameter.

Further Work

All the statistics from this analysis will be improved when more long-term measured series will be available.

References