Geophysical Research Abstracts
Vol. 15, EGU2013-134, 2013
EGU General Assembly 2013

A New Height Error Revision Method of Predicting Long-Term Wind Speed with MCP Algorithm

Yujue Liu (1) and Fei Hu (2)

(1) Institute of Atomospheric physics,Chinese Academy of Sciences, Beijing, China (lyjsa@163.com), (2) Institute of Atomospheric physics,Chinese Academy of Sciences, Beijing, China(hufei@mail.iap.ac.cn)

Wind energy technology is one of the fastest in growing rate in new and renewable energy technologies. It is very important to select stronger windy sites in a country for the purpose of producing more electricity. Measure-Correlate-Predict (MCP) algorithms are used to predict the wind resource at target site for wind power development. MCP method model bases on a relationship between wind data (speed and direction) measured at the target site and concurrent wind data at reference site nearby. The model is then used with long-term data from the reference site to predict the long-term wind speed and direction distributions at the target site. MCP method is in order to be able to determine the annual energy capture of a wind farm located at the target site.

Over the last 15 years well over a half dozen of MCP methods in the literature. The MCP algorithms differ in terms of overall approach, model definition, use of direction sectors, and length of the data. Such as 1)a linear regression model; 2)a model using distributions of ratios of wind speeds at two sites; 3)a vector regression method; 4)a method based on the ratio of standard deviations of two data sets, etc. Unfortunately, none of these MCP algorithms can predict wind speed from two sites at different altitudes. If the target site is much higher or lower than the reference site, the result accuracy will be much poorer.

Inner Mongolia grassland is known as one of the regions that rich in wind resource in China. The data we use is from three wind measurements, consisting of nearly one year of six layers in XiLinGuoLe of Inner Mongolia . Firstly, we use the maximum likelihood method to estimate k, shape parameter and c, scale parameter of the Weibull function for different time periods. And then we find out that c has a power law function of height, and that k varies as the form of a quadratic function of height and obtains the max value in the height of 10 to100 meters. Finally, we add the height distribution regularity of k, c to MCP algorithm, forming a new MCP method.

In this research, we have compared a set of performance measures that are consistent with ultimate goals of MCP process. Four different metrics are chosen to evaluate the results of the new MCP method. The four different metrics characterize the estimation of 1) the coefficient of correlation, 2) the correct mean speed, 3)the correct wind distribution, and 4)the correct annual energy production at the target site, assuming a sample wind turbine power curve. The mean and standard deviation of those estimates are used to characterize the results. The results indicate that the new MCP method works much better than all the MCP method found in the literature when two sites have different height. The new MCP method can be used in the hole Inner Mongolia grassland and other region for accurate wind assessment.

Key words: wind resource, Weibull distribution, long-term wind speed, MCP, metrics