Geophysical Research Abstracts
Vol. 13, EGU2011-12691, 2011
EGU General Assembly 2011

Correction of LIDAR measurements with high-resolution CFD simulations

Catherine Meissner (1), Matthieu Boquet (2), Saskia Bourgeois (3), and Martin Hölzli (4)

(1) WindSim AS, Norway (catherine@windsim.com), (2) Leosphere SAS, France (mboquet@leosphere.fr), (3) Meteotest, Switzerland (saskia.bourgeois@meteotest.ch), (4) Energiewerkstatt Consulting GmbH (m.hoelzli@energiewerkstatt.at)

The use of LIDAR systems in site assessment has increased dramatically in recent years. The advantage of being able to measure in several heights and up to the hub height of the turbine makes the remote sensing tool more and more attractive, especially, as hub heights are increasing and standard measurement masts are no longer able to provide data in the necessary heights. However, LIDAR systems show some shortcomings for site assessment in complex terrain. The measured radial wind speed needs to be transformed to the horizontal wind speed. This is done using geometrical equations and in these equations it is assumed that the wind field is homogeneous across the swept measurement area. This assumption might hold over flat terrain without thermal effects but it is violated in complex terrain and may lead to measurement errors up to 10 percent in very complex flow situations. As long as these shortcomings exist it is not possible to do a proper site assessment in complex terrain solely with LIDAR measurement data. A measurement mast will always be required.
With computational fluid dynamics (CFD) simulations it is possible to correct the LIDAR measurement errors. The inhomogeneity of the vertical component of the wind speed can be simulated by CFD and can be used to correct the LIDAR measurements. CFD simulations are run with a horizontal resolution between 10 and 20 meters and are therefore able to resolve the horizontal variation of the vertical wind speed component over the LIDAR measurement area. It is also possible to take into account thermal effects in the CFD simulations which have an influence on the horizontal variation of the vertical wind speed. After the correction of the LIDAR data by the CFD simulations the LIDAR data can be used directly for site assessment by scaling the existing CFD results.
The problems with existing remote sensing measurements will be discussed and validation studies for the developed correction method will be shown. Several sites with a range of complexity will be investigated and the original and corrected LIDAR data will be compared with observations from measurement masts. The Remote Sensing Correction Tool developed by WindSim has proven that it can reduce the relative error of a LIDAR to one percent and thereby provide more accurate LIDAR measurement data.