EMS Annual Meeting Abstracts
Vol. 12, EMS2015-537, 2015
15th EMS / 12th ECAM

Wind profile modelling using WAsP and 'tall' wind measurements

Rogier Floors, Mark Kelly, Ib Troen, Alfredo Peña, and Sven-Erik Gryning
DTU, Wind Energy, Department of Wind Energy, Roskilde, Denmark (rofl@dtu.dk)

Horizontal and vertical extrapolations of wind speed and power density are needed in the wind energy industry to perform wind resource assessments. The Wind Atlas Analysis and Application Program (WAsP) is a tool that combines several physical models to perform such extrapolations. For vertical extrapolations (the wind profile) this is done using the Weibull distribution and the geostrophic drag law. Wind lidar measurements obtained during the 'Tall wind' campaign at three different sites are used to evaluate the assumptions and equations that are used in the WAsP vertical extrapolation strategy. The surface fluxes were estimated from the wind, temperature and humidity profiles using an iterative method for consistency with WAsP, while the geostrophic wind and boundary-layer wind veering angle were estimated using the combined mast and lidar measurements. The effect of baroclinicity on the constants A and B in the geostrophic drag law was taken into account by specifying a mean offset between the thermal and surface geostrophic wind vector and a mean magnitude of the thermal wind vector.

Wind lidar and mast measurements from 11 different sites (that were not used in determining the empirical constants) in the North Sea area were used to evaluate different versions of the WAsP for vertical extrapolation of wind. The effect of baroclinicity and the implementation of newly chosen constants on the reversal height, the profiles of the Weibull A and k parameters and the overall model performance is discussed.