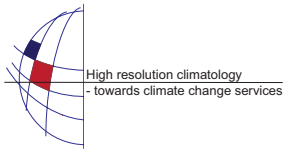
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-255, 2010
10th EMS / 8th ECAC



Aerosol lidar observations for wind power meteorology

A. Peña (1), S.-E. Gryning (1), E. Batchvarova (1,2), and T. Mikkelsen (1)

(1) Wind Energy Division, Risø National Laboratory for Sustainable Energy, Technical University of Denmark, Roskilde, Denmark, (2) NIMH, National Institute of Meteorology and Hidrology, Bulgarian Academy of Sciences, Bulgaria

With the advancement in wind power meteorology and the growth of the modern wind turbines, the need to measure and estimate meteorological parameters other than wind speed and direction has become more and more important. The effect on the wind profile, e.g. of the boundary-layer height h, has not (yet) been fully understood and investigated in the wind energy community, nor in the meteorological one. h has a significant effect on the wind profile at heights above 100 m and even lower when the atmospheric conditions are stable, e.g. during nighttime when low-level jets evolve. These heights are already being exploited by large wind turbines.

A possible reason for the lack of use of h in wind power meteorology might be that it is interpreted in different fashions and estimated using different techniques. Common sources for the derivation of h are surface turbulence measurements, turbulence profiles, spectral characteristics of turbulence, sodar measurements, radiosoundings, aerosol lidars and RASS that give different estimates because aerosols, turbulence, temperature and fluxes do not necessarily behave similarly in the atmosphere. Furthermore, aerosol or turbulence flux profiles show different characteristics, such as maxima, minima, and inflexions that produce different estimates of h.

A practical problem of the use of h as a parameter for its application in wind power meteorology is that it is not often routinely observed when performing wind resource assessment, in which 10-min averaging periods are used. Robust and accurate meteorological measurements of h are performed with radiosoundings launched every hour in the best of the cases. Nevertheless, this is not optimal since h might evolve in much shorter periods.

The main idea of this work is to routinely observe the aerosol profile in the entire atmospheric boundary layer from two commercial long-range aerosol lidars, inter-comparing the main characteristics of the lidars' profiles and their estimations of h in the frame of wind power meteorology.