Doppler lidar mounted on a wind turbine nacelle – UPWIND deliverable D6.7.1

A ZephIR prototype wind lidar manufactured by QinetiQ was mounted on the nacelle of a Vestas V27 wind turbine and measurements of the incoming wind flow towards the rotor of the wind turbine were acquired for approximately 3 months (April - June 2009). The objective of this experiment was the investigation of the turbulence attenuation induced in the lidar measurements. In this report are presented results from data analysis over a 21-hour period (2009-05-05 12:00 – 2009-05-06 09:00). During this period the wind turbine was not operating and the line-of-sight of the lidar was aligned with the wind direction. The analysis included a correlation study between the ZephIR lidar and a METEK sonic anemometer. The correlation analysis was performed using both 10 minutes and 10 Hz wind speed values. The spectral transfer function which describes the turbulence attenuation, which is induced in the lidar measurements, was estimated by means of spectral analysis. An attempt to increase the resolution of the wind speed measurements of a cw lidar was performed, through the deconvolution of the lidar signal. A theoretical model of such a procedure is presented in this report. A simulation has validated the capability of the algorithm to deconvolve and consequently increase the resolution of the lidar system. However the proposed method was not efficient when applied to real lidar wind speed measurements, probably due to the effect, that the wind direction fluctuations along the lidar's line-of-sight have, on the lidar measurements.