Geophysical Research Abstracts
Vol. 17, EGU2015-14804, 2015
EGU General Assembly 2015

Bias of remote sensing data for wind energy yield assement

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It is shown that estimates of mean wind speeds based on ground based remote sensing measurements can be biased significantly due to data gaps caused by lack of the back scatter signal. For this purpose Doppler wind measurements of sodar and lidar operated at the Boundary Layer Field Site Falkenberg of the German Weather Service were analyzed. The effect of signal to noise ratio induced data gaps of sodar and lidar measurements was investigated by repeated analysis of the same data set with stepwise reduced simulated system sensitivity. The comparison of the mean values of the correspondingly petered data sets with the original mean values revealed differences significantly larger than explainable by statistical noise. The obvious reason is a correlation between wind speed and back scatter intensity. Due to the different back scatter mechanisms of lidar (aerosol) and sodar (micro-turbulence) respectively it is not surprising that the correlation is quite different for lidar and sodar. Correspondingly the height dependence and temporal variability of the bias are different, although the order of magnitude is similar for both techniques. Attempts to correct for the bias on the basis of the observed data gap frequency will be demonstrated, but they were not successful so far, because a general model of the quantitative functional relation between bias and availability is missing. As long as no correction is possible, the design of the applied measuring system must warrant a sufficient sensitivity to achieve the necessary data availability at the measuring heights of interest. According to the analysis of data sets of one year duration the availability must exceed 95% in order to keep the bias induced uncertainty of sodar- or lidar wind measurements within $\pm 1\%$. For 80% availability the uncertainty increases up to $\pm 4\%$.