Wind shear proportional errors in the horizontal wind speed sensed by focused, range gated lidars

The 10-minute average horizontal wind speeds sensed with lidar and mast mounted cup anemometers, at 60 to 116 meters altitude at Hovsøre, are compared. The lidar deviation from the cup value as a function of wind velocity and wind shear is studied in a 2-parametric regression analysis which reveals an altitude dependent relation between the lidar error and the wind shear. A likely explanation for this relation is an error in the intended sensing altitude. At most this error is estimated to 9 in which induced errors in the horizontal wind velocity of up to 0.5 m/s as compared to a cup at the intended altitude. The altitude errors of focused range gated lidars are likely to arise partly from an unaccounted shift of the weighting functions, describing the sample volume, due to the range dependent collection efficiency of the focused telescope. Possibilities of correcting the lidar measurements both for wind velocity and wind shear dependent errors are discussed. The 2-parametric regression analysis described in this paper is proven to be a better approach when acceptance testing and calibrating lidars.