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Atmospheric Measurement Techniques Discussions

Interactive comment on "A six-beam method to measure turbulence statistics using ground-based wind lidars" *by* A. Sathe et al.

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An unbiased lidar estimate of the radial velocity is a sum of the radial wind velocity averaged over the sensing volume and the random error of estimation of the radial velocity. The last has property of the white noise, it is caused by echo signal fluctuations and lidar shot noise (see, for example, Chapter 2 in book [1]). The lower signal-to noise ratio (SNR), the larger this error. The variance of the radial velocity measured by lidar is a sum of the radial velocity variance and the random error variance. Therefore, in the right part of Eq. (5) it is necessary to subtract the random error variance and then instead of 6 unknowns one has 7 (6 components of the Reynolds stress tensor plus the variance of lidar estimate of the radial velocity, if this variance is the same for any

beam). The authors neglect the variance of lidar estimate of the radial velocity. It is quite possible that for the distances between the lidar and the sensing volume of 89 m (vertical beam) and 126 m (elevation 45 deg) the error of lidar estimate of the radial velocity is very small, but for large distances (when SNR is rather small) and weak turbulence the variance of random error of radial velocity measured by lidar can be comparable with the wind velocity variance. What limitations of the proposed method there are? The radial velocity is estimated from measured Doppler spectrum. If it is estimated as a centroid (first spectral moment), the weighting function in Eq. (3) is known. For WindScanner lidar, as a rule, the radial velocity is estimated as a point of Doppler spectrum maximum. In this case correct accounting of the probe volume averaging effect is a complex problem (see Figure 2.1 in [1]). Do the authors plan to solve this problem in their future studies? How it can be done?

1. Banakh V.A., Smalikho I.N. Coherent Doppler wind lidars in a turbulent atmosphere. Boston – London: Artech House, 2013. 248 p.

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