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Interactive comment on "Errors in radial velocity variance from Doppler wind lidar" *by* Hui Wang et al.

Anonymous Referee #1

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Summary: The authors present an analysis of errors in estimation of radial velocity variance. This is no doubt an important area of study to enable turbulence measurements using Doppler lidars. The effect of sampling intervals as discussed in section 3 is especially important given the current turbulence measurement strategies being employed. In addition, this manuscript presents a very nice discussion of the implications of the various lidar measurement parameters and non-stationarity of the atmosphere. Therefore, this manuscript deserves publication. I have the following issues with the manuscript in its current form which I believe are important to be addressed. I recommend major revisions.

General comments: This manuscript is missing some important literature review in terms of work already performed in this area such as (Lenschow et al. 2000; Frehlich 2001; Frehlich and Cornman 2002; Frehlich 2004 and more). These works have tack-

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Discussion paper

led the question of estimating the random error variance in the radial velocity variance estimate and their applications in various measurement scenarios and atmospheric conditions. Another important missing element is the influence of SNR on the random errors and biases produced in the radial velocity estimates (discussed in the above references).

Specific comments:

Page 2, Line 13: "For a pulsed lidar. . ." This statement appears to generalize that all lidars use step and stare measurement technique and 1s accumulation. However, most lidars employ continuous scanning. Therefore, please make clear that you are referring to the operation of the Galion lidar operated in step-stare mode.

Eq. (4): I am not sure I understand why the integral is over –inf to inf. Shouldn't the integral be over the range-gate length i.e. –L/2 to L/2, where L is the length of the gate? In your case, s-L/2 to s+L/s?

Page 4, Line 20 and Eq (15): How does this random error compare with the random error variance estimated using technique outlined in Lenschow et al (2000)? In addition, this seems to neglect the influence of SNR on the radial velocity error. For example, as SNR degrades, we expect the Crammer-Rao Lower Bound variance to increase resulting in greater uncertainty in the radial velocity estimate (or even biases due to improper peak estimation). How does the present formulation account for this? Also see (Frehlich 1997; Frehlich et al. 1998) for a discussion of this.

Page 6, Line 18-23: Here the lidar data is used to estimate stationarity. Isn't it better to use the sonic measurements to do this as it is at a much higher data rate and captures a larger range of scales?

References:

Frehlich, R., 1997: Effects of wind turbulence on coherent Doppler lidar performance. Journal of Atmospheric and Oceanic Technology, 14, 54–75.

âĂŤâĂŤ, 2001: Estimation of Velocity Error for Doppler Lidar Measurements. J. Atmos. Oceanic Technol., 18, 1628–1639, doi:10.1175/1520-0426(2001)018<1628:EOVEFD>2.0.CO;2.

âĂŤâĂŤ, 2004: Velocity Error for Coherent Doppler Lidar with Pulse Accumulation*. Journal of Atmospheric and Oceanic Technology, 21, 905–920.

âĂŤâĂŤ, and L. Cornman, 2002: Estimating spatial velocity statistics with coherent Doppler lidar. Journal of Atmospheric and Oceanic Technology, 19, 355–366.

âĂŤâĂŤ, S. M. Hannon, and S. W. Henderson, 1998: Coherent Doppler lidar measurements of wind field statistics. Boundary-Layer Meteorology, 86, 233–256.

Lenschow, D. H., V. Wulfmeyer, and C. Senff, 2000: Measuring second-through fourth-order moments in noisy data. Journal of Atmospheric and Oceanic Technology, 17, 1330–1347.

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