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# Effect of spatial averaging of Doppler LIDARs on turbulence statistics within the atmospheric boundary layer and validation of a correction procedure

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Doppler LIDARs have a systematic bias in measurements of the turbulent wind field, which leads to a turbulence reduction in Doppler LIDAR measurements. The bias is caused by the spatial extend of the laser pulse and the sampling frequency of the backscattered light from the atmosphere. This error is an inherent effect of the Doppler LIDAR measurement principle and becomes especially important for powerful Doppler LIDARs with a large range, which are most useful for dual or triple Doppler LIDAR measurements of virtual towers. In case of our Wind Tracer system from Lockheed Martin Coherent Technology the bias without any corrections for the variance of the turbulent velocity fluctuations was 47% in comparison of time series with an ultrasonic anemometer. A theoretical analysis of this bias was done by Frehlich (1997) and a correction procedure was developed by Frehlich and Cornman (2002). Although the correction procedure was already used on data from field experiments, a validation by a high frequency in-situ measurement near a range gate center of a Doppler LIDAR was still missing. We show a comparison of turbulent velocity fluctuation variances and the outer scales of turbulence from an ultrasonic anemometer with those from our Doppler LIDAR to validate the correction procedure. The correction procedure could reduce the bias of the velocity variance by 29% and for the outer scale of turbulence by 43%. Both turbulence parameters had a remaining bias, which could not be explained.