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A one year comparison of 482 MHz wind profiler radar and 1.55 μm Doppler Lidar wind measurements

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Abstract

The Doppler lidar is a modern remote sensing technology with a multitude of possible applications including high resolution wind profile measurements. The increasing resolution of operational Numerical Weather Prediction (NWP) models makes operational wind measurements with a high spatial and temporal density all the more important. They are needed to provide best information on the current atmospheric state for data assimilation in NWP models. The operational remote sensing of the vertical wind profile is currently dominated by radar wind profilers with frequencies ranging from L-band to VHF. At the Richard-Aßmann-Observatory in Lindenberg (Germany) a one year long comparison campaign was carried out to test the capabilities of the 1.55 μm HALO "Streamline" Doppler Lidar for possible future operational boundary layer wind profiling, complementary to radar profilers. Experiences and results from this campaign will be presented.

The Doppler Lidar was configured to continuously perform a VAD scan pattern using 24 azimuthal directions with a constant beam elevation angle of 75°. Radial wind estimates were selected using a rather conservative SNR based threshold of -18.2 dB (0.015). A 30 minute average wind vector was calculated based on the assumption of a horizontally homogeneous wind field through a singular-value decomposed Moore-Penrose pseudoinverse of the over-determined linear system. A quality control of the retrieved 3D wind vector components has been applied to ensure consistency between the retrieved winds and the assumptions inherent to the employed wind vector retrieval. In particular, the coefficient of determination R^2 was used to assess the "goodness of fit" and the condition number κ was used to exclude retrievals obtained from highly correlated Doppler velocities due to large azimuthal gaps within the VAD scan. Finally, the lidar measurements are compared with operational data from a collocated 482 MHz radar wind profiler running in a 4-beam DBS mode. The intercomparisons show very good agreements. This qualifies the Doppler lidar as an adequate wind measuring system for operational purposes primarily within the atmospheric boundary layer.