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Capabilities of Doppler SODAR and Doppler Lidar for the Derivation of Turbulence Parameters

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Doppler Sodar and Doppler Lidar are well established methods for determining profiles of the mean wind vector. For typical beam scan configurations the methods are referred to as Doppler Beam Swinging (few fixed beams) or Velocity Azimuth Display (many azimuths, fixed elevation). In all configurations the derivation of the wind vector is based on estimates of the first moments of the radial wind components.
Here we consider the estimate of second moments of the radial wind components and the potential derivation of turbulence parameters. Formally the DBS-equation for the 6 independent elements of the covariance matrix can be solved unambiguously, if an appropriate beam scan configuration is chosen. Nevertheless the error propagation estimate leads to acceptable accuracies for at most 3 of the 6 elements: These are the variance of the vertical wind component and the two components of the vertical flux of horizontal momentum.
Comparisons of simultaneous profiles of the vertical wind variance, as derived by Sodar-, Lidar- and in-situ measurements at the DWD boundary layer field site Falkenberg, and at a meteorological instrumentation near Hamburg will be presented. In addition the potential of Lidar-derived momentum flux profiles will be be discussed.