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Calibration of High Spectral Resolution Lidar

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NCAR's High spectral resolution lidar (HSRL) is a micro-pulse lidar system that is safe to deploy in populated urban areas and on airborne platforms. One of the unique features of the HSRL is the ability to simultaneously measure aerosol backscatter and extinction. HSRL separates molecular scattering from air molecules and cloud particle backscatter, based on their Doppler spectrum widths and from these signals backscatter cross-section and extinction profiles can be measured.

Molecular scattering is used as a reference for estimating extinction. The HSRL simultaneously estimates individual backscatter from molecular and aerosol particles using broad and narrow Doppler spectrum widths, respectively. Absolute accuracy of the backscattered signals and their separation into molecular and aerosol scattering depends on spectral purity of the transmitted signals, accurate measurement of transmit power, and precise performance of filters. An end-to-end calibration procedure for accurately characterizing lidar measurements is essential for quality control of datasets.

Path-integrated backscatter measurements are used for calibrating lidar observations. Lidar measurements in stratocumulus clouds with cloud droplets are used as a reference for calibration. Since, the HSRL independently estimates backscatter and extinction observations as a function of range, it is straightforward to compute the extinction to backscatter ratio (lidar ratio). As the lidar ratio for cloud droplet is a constant, measurements in stratocumulus cloud is used for calibrating the HSRL. In this paper an overview of calibration of the HSRL is presented. Calibration procedure based on path-integrated backscatter measurements and range resolved methods are compared.