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NASA LaRC airborne high spectral resolution lidar aerosol measurements during MILAGRO: observations and validation

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Abstract. The NASA Langley Research Center (LaRC) airborne High Spectral Resolution Lidar (HSRL) measures vertical profiles of aerosol extinction, backscatter, and depolarization at both 532 nm and 1064 nm. In March of 2006 the HSRL participated in the Megacity Initiative: Local and Global Research Observations (MILAGRO) campaign along with several other suites of instruments deployed on both aircraft and ground based platforms. This paper presents high spatial and vertical resolution HSRL measurements of aerosol extinction and optical depth from MILAGRO and comparisons of those measurements with similar measurements from other sensors and model predictions. HSRL measurements coincident with airborne in situ aerosol scattering and absorption measurements from two different instrument suites on the C-130 and G-1 aircraft, airborne aerosol optical depth (AOD) and extinction measurements from an airborne tracking sunphotometer on the J-31 aircraft, and AOD from a network of ground based Aerosol Robotic Network (AERONET) sun photometers are presented as a validation of the HSRL aerosol extinction and optical depth products. Regarding the extinction validation, we find bias differences between HSRL and these instruments to be less than 3% (0.01 km^{-1}) at 532 nm, the wavelength at which the HSRL technique is employed. The rms differences at 532 nm were less than 50% (0.015 km^{-1}). To our knowledge this is the most comprehensive validation of the HSRL measurement of aerosol extinction and optical depth to date. The observed bias differences in ambient aerosol extinction between HSRL and other measurements is within 15–20% at visible wavelengths, found by previous studies to be the differences observed with current state-of-the-art instrumentation (Schmid et al., 2006).

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