

Aerosol Measurements Over Mauna Loa Observatory

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Aerosol measurements were conducted over Mauna Loa Observatory (MLO), an atmospheric baseline observatory, using the CCD Camera Lidar (CLidar) System. The system transmits 532 nm laser pulses vertically into the atmosphere and the side scattered light is detected by imaging using a CCD camera with wide angle optics and laser line filter. The camera is located upslope from the laser-base and 139 m perpendicularly away from the laser-beam. The altitudes of atmospheric constituents scattering laser-light were determined by the bistatic lidar system's geometry. The altitude resolution of the system is sub-meter at ground-level but degrades with increasing altitude. The scattering angle varies with altitude. The returned side-scatter signal is normalized to a molecular scattering model between 10.7 and 14.9 km. The molecular scattering signal component is then removed from the total scattering signal. An aerosol scattering phase function that describes the column average efficiency of aerosol scattering into a particular angle is needed to convert the CLidar derived side scatter to total scatter. Aerosol phase functions used were derived from AERONET sun photometer data taken at MLO during the daytime prior to the evening CLidar data. CLidar data were typically taken starting just after sunset for a duration of several hours on each experimental night, with each data image exposure being 332 seconds. CLidar data were corrected iteratively for transmission and converted to aerosol extinction using a single-scattering albedo of 0.9. Data were examined from 29 dates in 2006-2007 and 2007-2008. Aerosol flows near the 3400 m asl ground level of MLO can be complicated and highly variable. This study focused on MLO aerosol measurements at 4 to 10 km above sea level. The average aerosol extinction above MLO in these data at altitudes from 4 to 10 km ranged from 0.0035 km⁻¹ with a standard deviation of 0.0007 km⁻¹ at 4 km to 0.00033 km⁻¹ with a standard deviation of 0.0002 km⁻¹ at 9.7 km. Figure 1 shows the average aerosol extinction for the combined 2006-2007 and 2007-2008 years, by season. There were a limited number of experimental nights each season. Data show a fairly persistent aerosol layer between 4.7 and 5.5 km above sea level. Yearly average aerosol extinctions varied between years, with extinctions approximately 50% higher in 2007-2008 compared to 2006-2007.

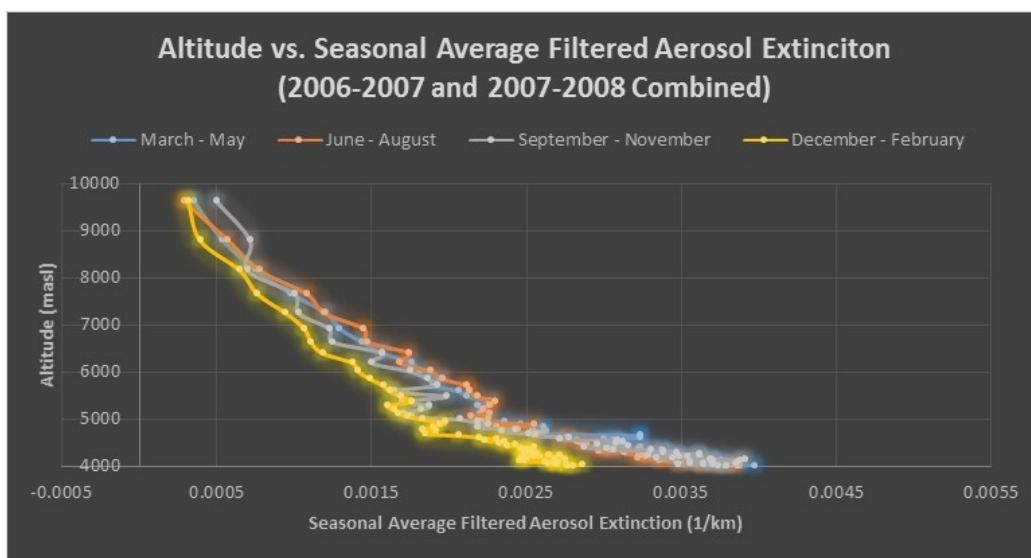


Figure 1. Seasonal trends of 2006-2007 and 2007-2008 CLidar aerosol measurements over MLO.