The NOAA ESRL Airborne Aerosol Observatory: Climatology and Seasonal Variation of Aerosol Properties Over Central Illinois

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In June of 2006, ESRL began conducting regular (2-3 times per week) light aircraft measurements over central Illinois. The platform of the Airborne Aerosol Observatory (AAO) was a Cessna T206H aircraft. The primary objective of this program was to obtain a climatology of aerosol properties aloft for evaluating aerosol radiative forcing and testing chemical transport models. Through the end of the program in September 2009 (~40 months), 401 research flights and over 4000 level flight segments have been conducted, most of these over the Bondville surface monitoring station. Statistical distributions and climatologies of aerosol properties have been compiled for the set of AAO research flights. While insufficient to determine long-term trends, the 3+ years of data permit us to begin to understand seasonal variation of the aerosols over central Illinois. Seasonal variation in the scattering data is evident (Fig. 1), with larger scattering coefficients extending to greater heights above the surface in the spring through fall time frame. Elevated aerosol layers are relatively rare during the winter months. Boundary layer aerosols and aerosol layers aloft tend to last over synoptic (i.e., days to weeks) time scales, consistent with buildup and removal by meteorological events. An extended rainy period over the months of May through July 2008 (indicated on the plots by white boxes) is also evident in the aerosol data. Scattering coefficients are low during this period, consistent with hygroscopic aerosols being removed by water absorption, growth and subsequent cloud processing and/or rainout. The same period shows lower single-scattering albedos, suggesting preferential removal of hygroscopic aerosols by the wetter conditions. Low altitude fly-bys of the Bondville Station show that surface measurements of aerosol extinction are representative of aerosols in the lowest 1-2 km of the column. Although individual profiles can be quite variable, the climatological profile of single-scattering albedo shows relatively little variation in the vertical. Comparisons of AAO measurements with Aeronet Sunphotometer and the Cloud-Aerosol Lidar & Infrared Pathfinder Satellite Observation satellite-borne lidar data will also be discussed.

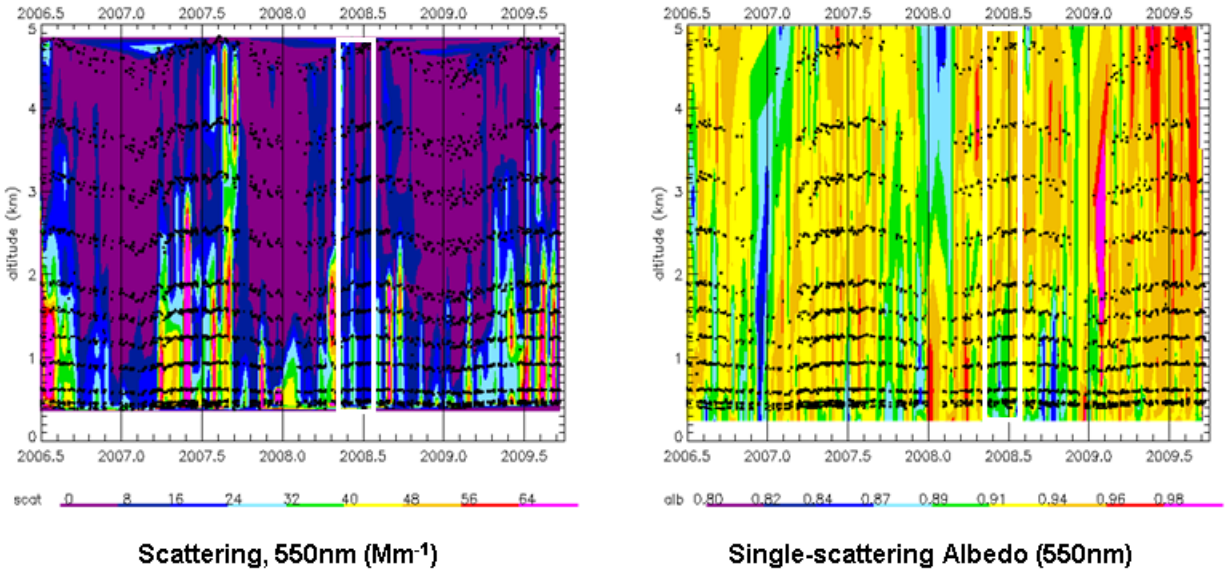

Figure 1. Contour plots of dry aerosol light scattering coefficient (550 nm) and single-scattering albedo in time-altitude space measured by the AAO over central Illinois. Black dots represent individual level flight segments. White boxes represent a three month rain-dominated period in summer 2008.