Aerosols and Climate Forcing: New Directions for the CMDL Aerosol Research Program

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Aerosol research at CMDL focuses on characterizing the climate-forcing properties of aerosols at different locations. In addition to monitoring at the CMDL baseline stations, the CMDL aerosol research program includes long-term measurements at polluted continental sites, a movable observing system for year-long deployments in undersampled regions, bi-weekly aircraft flights above one site, and participation in intensive field programs for process-level studies. Results from these different approaches are being incorporated into a review paper for the U.S. Climate Change Science Program titled "A review of the understanding of the chemical composition and radiative forcing by tropospheric aerosols in the North Atlantic, North Pacific, and North Indian Ocean based on in situ observations." These ongoing aerosol research programs are currently being enhanced with initiatives in three areas:

a. The expansion of the network through collaborations with partners outside of NOAA, including the Meteorological Service of Canada (Alert, Canada), University of Puerto Rico (Cape San Juan, Puerto Rico), and the Department of Energy/Atmospheric Radiation Measurement program (Pt. Reyes, California). Later in 2005, collaborative aerosol observing systems will be deployed in China (Mt. Waliguan) and South Africa (Cape Point).
b. The addition of measurements that will facilitate evaluation of the aerosol forcing of climate that results from changes to clouds (so-called "indirect" forcing), by deployment of cloud condensation nucleus counters at Barrow, Alaska, and Bondville, Illinois, later in 2005.
c. The deployment of an instrumented light airplane to measure vertical profiles of aerosol chemical composition, size distribution, and radiative properties above the Bondville site beginning in fall 2005, a major expansion of the current in situ aerosol profiling program in Oklahoma (Figure 1).

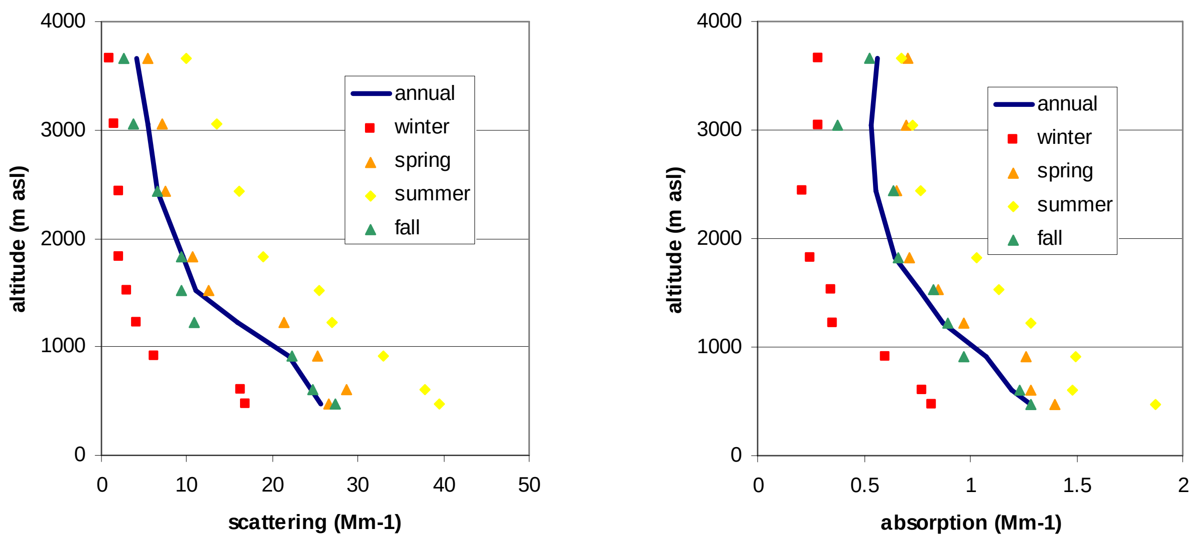

Figure 1. Three years of scattering and absorption profiles over Oklahoma reveal that scattering declines steadily with altitude above 2 km, while absorption remains relatively constant. The different profiles of absorbing versus scattering aerosols leads to profoundly different radiative effects with the surface aerosols producing a negative (cooling) forcing at the top of the atmosphere (TOA) while the aerosols at the top of the profiles produce a positive top of atmosphere forcing.