The Reno Aerosol Optics Study—Overview and Preliminary Results

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During June 3-28, 2002, the Reno Aerosol Optics Study was conducted at the Desert Research Institute (DRI) in Reno, Nevada. The objective of this study was to characterize, under controlled conditions, both existing and new in situ instruments designed to measure aerosol light extinction, absorption, and scattering. Three cavity ringdown extinction instruments, one classic extinction cell, three integrating nephelometers, two photoacoustic absorption instruments, and five filter-based absorption instruments participated in this experiment. Good coverage of the visible spectrum was achieved from the operating wavelengths of the various instruments, with limited measurements being made in the near UV and near IR.

A new mixing chamber (~76-L volume) was used to deliver varying amounts of white, black, and ambient aerosols and filtered air to all instruments. The white aerosols studied were submicrometer ammonium sulfate, and several submicrometer black aerosols studied included kerosene soot and diesel emission particles. Individual tests were run with aerosol extinction varying between low (~50 Mm^{-1}) and high (~500 Mm^{-1}) values and aerosol single-scattering albedos ranging from ~0.3 (pure black aerosol) to ~1.0 (pure ammonium sulfate).

The primary emphasis of the study was to evaluate the accuracy and precision of current methods for measuring the light absorption coefficient of atmospheric aerosols (σ_{ap}). Two independent standards for σ_{ap} were found to agree within about 10% at a wavelength of 532 nm: photoacoustic absorption vs. the difference of extinction and scattering (Figure 1). These standards provide the basis for deriving calibration curves for the filter-based instruments.

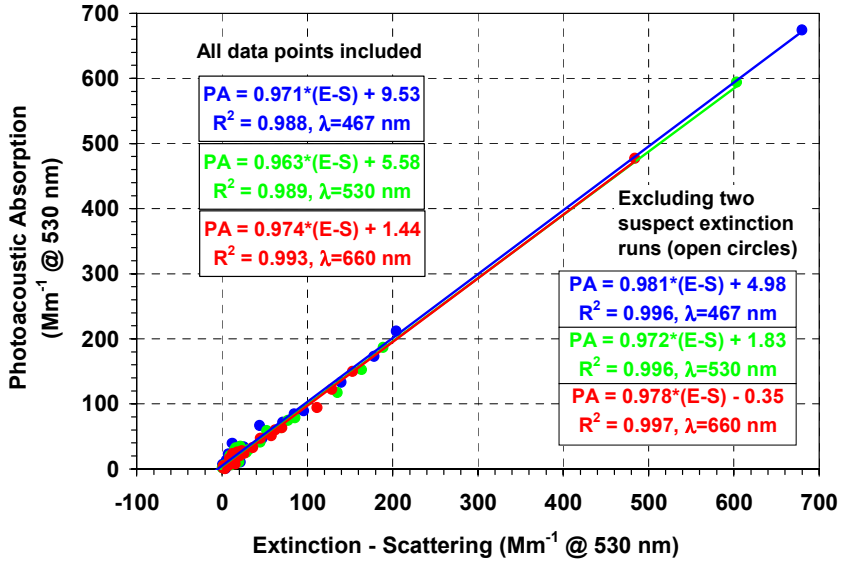

Figure 1. Aerosol light absorption measured by the DRI photoacoustic instrument plotted against the difference between extinction (E) and scattering (S). The photoacoustic absorption measurements were adjusted from 532 to 530 nm to match the E – S calculation. Regressions were calculated both including and excluding suspect extinction runs.