Relating Chemical and Optical Aerosol Properties at Mauna Loa Observatory

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This paper studies the connection between *in situ* aerosol optical properties and their elemental composition at the ESRL/GMD Mauna Loa Observatory (MLO). The data analyzed come from two independent data sets that were collected at MLO between 1992-2010. These types of co-located measurements enable the identification of the aerosol composition (and, thus, potential sources) responsible for observed changes in the aerosol optical properties. The first set of data, sampled by the Interagency Monitoring of Protected Visual Environments (IMPROVE) program, consists of total mass and chemical element mass concentrations of particulate matter with diameters less than 2.5 micrometers ($PM_{2.5}$). The second data set contains aerosol optical and number concentration data from ESRL/GMD long-term measurements at MLO. The chemical and optical data sets were merged together for this analysis.

At MLO, $PM_{2.5}$ mass and sulfur have the strongest correlations with aerosol scattering while bromine and potassium are most strongly correlated with aerosol absorption. Elements with strong correlations in the all-hours data are also strong in the night-only data. However, the correlation coefficients (R^2) are higher for the all-hours data. Correlations between derived optical parameters, such as single-scattering albedo and the scattering Angstrom coefficient were very weak. The next step is use the results to explain observed aerosol properties in terms of possible sources, not just during the springtime dust season but at other times of year as well.

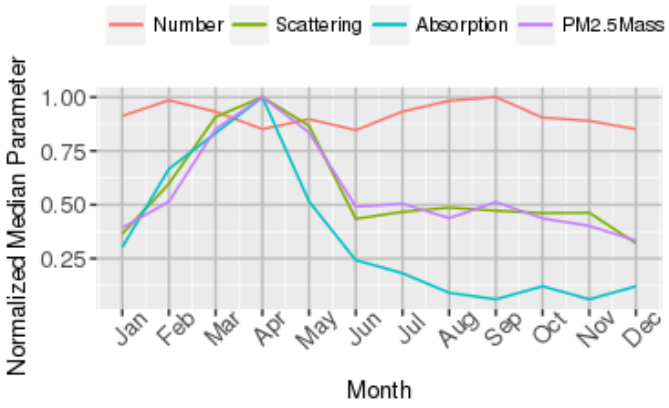

Figure 1. This figure shows monthly cycles of aerosol number concentration, aerosol scattering, aerosol absorption, and PM2.5 mass concentration.

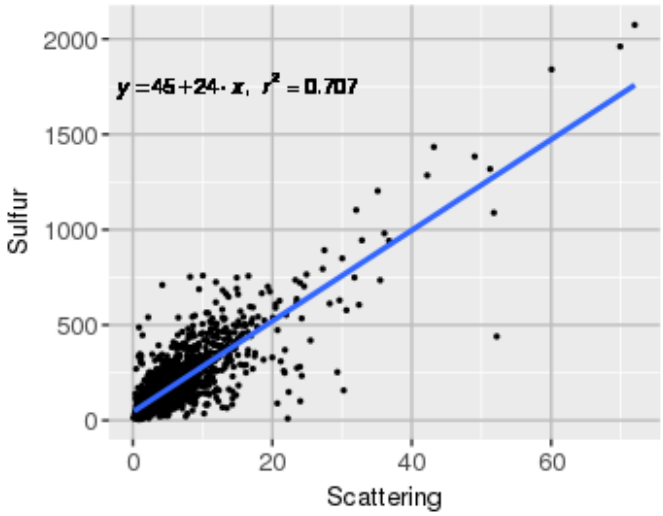

Figure 2. This figure depicts relationship between aerosol scattering and elemental sulfur mass concentration. Both plots are for all-hours data.