Correlation Between Anthropogenic Aerosols and Gases at MLO

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The recent availability of size- and time-resolved aerosol data at the CMDL Mauna Loa Observatory (MLO) [*Perry et al.*, 1999] allows for comparison with gas and aerosol measurements made routinely at MLO. The three-drum DELTA IMPACTOR instrument is the prototype of the unit being proposed for many Pacific sites for the Aerosol Characterization Experiment (ACE)-Asia study in spring 2001. Fine mass was established both gravimetrically and as a sum of all measured species, and was highly correlated with aerosol scattering coefficients (σ_{sp}). Using NOAA trajectory analysis and trace element analysis, the period of May 8-22, 1996, was divided into five classifications: (1) oceanic, in which the trajectory remains over the ocean for at least 12 days, (2) North Asia, including Japan, (3) Central Asia 1 (north of the Yangtze River), (4) Central Asia 2 (south of the Yangtze River), and (5) Central America. All data, gas, and aerosol were averaged in these categories, and a ratio to the values in oceanic periods was calculated (Figure 1). The CO_2 excess value was the CO_2 data with the average annual rate of rise over 10 years removed, leaving the strong annual cycle. The CO and methane data have a constant value removed to emphasize the variability over the 2-wk period. With the availability of high time resolution data, we can now attempt to combine the aerosol data, trajectory analysis, optical parameters for scattering (σ_{sp}) and absorption (σ_{ap}), gases such as CO_2, methane, and CO, and tracers such as Radon 222 into a single statistical package.

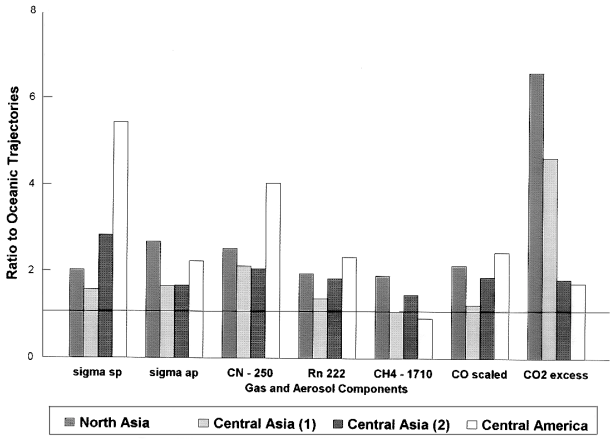

Fig. 1. Air mass trajectory analysis combined with aerosol and gaseous data. Ratio of gas and aerosol components to oceanic periods at MLO, May 1996 (nighttime winds only).

Trajectory analysis shows increased values for all parameters when compared to oceanic periods, with particularly large ratios for CO_2 from North and North-Central Asia and optical scattering from Central America. Central American transport coincided with large peaks of sulfates and biomass smoke. The satellite imagery of the May 1996 dust event is convincing proof of the impact of these major dust events on the Earth's albedo. Additional data are required, however, to ascertain if the lower free tropospheric sulfates, organics, and soot particles have an impact.

An absolute principal components analysis (PCA) was performed on the data. Two trajectories both anchored in the "Oceanic" conditions summarize the entire 2-wk period. Surprisingly, the midlatitude transport from middle and southern China has almost the same statistical signature as that from Central America. In general, trace element analysis will aid in source identification as trace elements are highly indicative of particular sources. Thus it appears that MLO is heavily influenced by anthropogenic sources around the Pacific Rim, making MLO a unique and valuable diagnostic site for future changes in Asian and American air pollutants.

REFERENCE

Perry, K.D., T.A. Cahill, R.C. Schnell, and J.M. Harris, Long-range transport of anthropogenic aerosols to the NOAA Baseline Station at Mauna Loa Observatory, Hawaii, *J. Geophys. Res., 104*, 18,521-18,533, 1999.