Geophysical Research Abstracts, Vol. 7, 10443, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10443
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Aerosol mass spectrometry: Aerosol chemical and microphysical properties

T. B. Onasch (1), D R Worsnop (1), J T Jayne (1), M Canagaratna (1), H. Boudries (1), Q. Zhang (2), J.L. Jimenez (2), R Alfarra (3), J. Allan (3), and H. Coe (3)

(1) Aerodyne Research, Billerica, MA 01821, (2) Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO, (3) University of Manchester, UK
(onasch@aerodyne.com / Fax: 1-978-663-4918 / Phone: 1-978-663-9500)

Atmospheric aerosols play important roles in climatology, air quality, and human health. Assessment of these impacts requires detailed study of aerosol chemical and microphysical properties, including size-dependent chemistry and morphology. A recently developed Aerosol Mass Spectrometer (AMS) measures compositionally-resolved mass distributions and loadings of ambient aerosols in real-time. Sub-micron particles are aerodynamically focused into high vacuum and sized via particle time-of flight measurements. Flash vaporization, followed by 70 eV electron impact ionization mass spectrometry, provides universal and quantitative determination of mass loadings for the non-refractory components (that vaporize at 600-900 C). Mass spectra clearly separate inorganic (sulfate, nitrate, ammonium, chloride) and organic components, and provide insight into the chemical character of the organic matter. Beam width and light scattering probes measure shape and optical properties. Further aerosol characterization is achieved through comparisons with other gas and particulate instrumentation. For example, combining the mass distribution measurements with physical mobility size distribution measurements (measured via SMPS) provides detailed information of particle morphology and density.

Aerosol measurements obtained in the field from ambient and source specific sampling will be presented. Analysis of aerosol mass, size, and composition trends obtained during these campaigns reveal diurnal variations in the photochemically driven formation of inorganic and oxidized organic aerosols. The chemical composition of these aerosols can be clearly distinguished from those observed during vehicular exhaust or biomass burning pollution events. In particular, algorithms have been devel-

oped for deconvolving the organic mass fraction into multiple mass spectral components (e.g. hydrocarbons, oxidized organics, etc.). These results, when combined with airmass backtrajectory calculations and ancillary gas phase measurements allow for the characterization of particle sources. Similarities and differences in aerosol size and chemical composition as well as aerosol formation and transformation at these widely varying sampling locations will be discussed.