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Source apportionment of Aerosol Mass Spectrometer data in Pittsburgh, Mexico City, and Riverside, California by positive matrix factorization

I. Ulbrich (1), Q. Zhang (2), D. Salcedo (4), K. Dzepina (1). K. Docherty (1), M. Canagaratna (3), D. Worsnop (3), J. Jimenez (1)

(1) Dept. of Chemistry, and Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, 80309, Boulder, Colorado, USA, (2) Atmospheric Science Research Center, State University of New York, 12204, Albany, New York, USA, (3) Aerodyne Research, Inc., Billerica, Massachusetts, USA, (4) Centro de Investigaciones Quimicas, Universidad Autonoma del Estado de Morelos, Mexico

Better understanding of the sources of ambient aerosols will improve the ability of regulators to enact controls that will be most effective in reducing aerosol pollution. A well-known source apportionment technique, Positive Matrix Factorization (PMF, Paatero, 1997), has been applied to three well-characterized Aerodyne aerosol mass spectrometer (AMS) datasets acquired across North America, including Pittsburgh (2002), Mexico City (2003) (both quadrupole AMS), and Riverside, California (2006) (high-resolution time-of-flight AMS, or HR-ToF-AMS). The Aerodyne AMS does not detect elemental carbon or metals (common and important in most PMF analyses), therefore the application of this technique to AMS data yields significantly different source profiles than in previous PMF studies. Additionally, fragmentation of molecules during ionization gives each mass spectrum strongly interrelated data. PMF analysis of the organic portion of datasets from multiple sampling locations reveals strong similarities between the source profiles at all locations. In addition to a hydrocarbon-like organic aerosol (HOA) component at urban sites, all sites have multiple oxygenated organic aerosol (OOA) components that resemble spectra from chamber studies of secondary organic aerosol (SOA) formation. Biomass burning organic aerosols (BBOA) can also be separated in some studies. Comparison of organic aerosol components with other particulate and gas-phase species from the campaigns gives insight into both aerosol sources and transformation processes.