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Fine aerosol bulk composition measured on WP-3D research aircraft in vicinity of the Northeastern United States – results from NEAQS

R. E. Peltier[1], A. P. Sullivan[1,*], R. J. Weber[1], C. A. Brock[2], A. G. Wollny[2,3], J. S. Holloway[2,3], J. A. de Gouw[2,3], and C. Warneke[2,3]

[1]School of Earth and Atmospheric Science, Georgia Institute of Technology, Atlanta, GA, USA

[2]National Oceanic and Atmospheric Administration, Earth Systems Research Laboratory, Boulder, CO, USA

[3]Cooperative Institute for Research in Environmental Research, University of Colorado, Boulder, CO, USA

[*]now at: Department of Atmospheric Science, Colorado State University, Fort Collins, CO, USA

Abstract. During the New England Air Quality Study (NEAQS) in the summer of 2004, airborne measurements were made of the major inorganic ions and the water-soluble organic carbon (WSOC) of the submicron ($PM_{1.0}$) aerosol. These and ancillary data are used to describe the overall aerosol chemical characteristics encountered during the study. Fine particle mass was estimated from particle volume and a calculated density based on measured particle composition. Fine particle organic matter (OM) was estimated from WSOC and a mass balance analysis. The aerosol over the northeastern United States (U.S.) and Canada was predominantly sulfate and associated ammonium, and organic components, although in unique plumes additional ionic components were also periodically above detection limits. In power generation regions, and especially in the Ohio River Valley region, the aerosol tended to be predominantly sulfate (~60% μg $μg^{-1}$) and apparently acidic, based on an excess of measured anions compared to cations. In all other regions where sulfate concentrations were lower and a smaller fraction of overall mass, the cations and anions were balanced suggesting a more neutral aerosol. In contrast, the WSOC and estimated OM were more spatially uniform and the fraction of OM relative to PM mass was largely influenced by sources of sulfate. The study median OM mass fraction was 40%. Throughout the study region, sulfate and organic aerosol mass were highest near the surface and decreased rapidly with increasing altitude. The relative fraction of organic mass to sulfate was similar throughout all altitudes within the boundary layer (altitude less than 2.5 km), but was significantly higher at altitude layers in the free troposphere (above 2.5 km). A number of distinct biomass burning plumes from fires in Alaska and the Yukon were periodically intercepted, mostly at altitudes between 3 and 4 km. These plumes were associated with highest aerosol concentrations of the study and were largely comprised of organic aerosol components (~60%).

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