

Submicron particles at Thompson Farm during ICARTT measured using aerosol mass spectrometry

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Abstract

The composition and size of aerosols were measured using an Aerodyne quadrupole aerosol mass spectrometer at Thompson Farm in Durham, NH, during the International Consortium for Atmospheric Research on Transport and Transformation campaign during summer 2004. Submicron, non-refractory aerosol was dominated by organic matter and sulfate (averages of $5.7 \mu\text{g m}^{-3}$ and $3.6 \mu\text{g m}^{-3}$, respectively), with smaller contributions from nitrate and ammonium (averages of $0.3 \mu\text{g m}^{-3}$ and $1.02 \mu\text{g m}^{-3}$, respectively). Organic aerosol (OA) mass correlates well with anthropogenic tracers such as carbon monoxide (CO, $R^2 = 0.58$) and black carbon ($R^2 = 0.59$), but multiple analyses indicate possible contributions from primary, secondary, anthropogenic, and biogenic OA. Multivariate statistical analysis of the OA mass spectra indicates the presence of two types of oxygenated OA (OOA) and a hydrocarbon-like OA (HOA) component that also contains contributions from biomass burning OA (BBOA). On average, the HOA/BBOA component accounts for 21% of the total OA mass while the two OOA components account for 24% and 55%, respectively, of the OA burden. Observed nitrate correlates well with OA ($R^2 = 0.67$), suggesting interference, the presence of organic nitrates, processing/uptake of nitric acid by OA, or other temporally coincident processes because of the ammonia-poor environment with respect to sulfate. The relative increase of OA with respect to background compared to that of CO (average of $72.7 \mu\text{g m}^{-3} \text{ppmv}^{-1}$) indicates values that are higher than those based on previous measurements in New England.