4.087 Characterizing secondary organic aerosol yields from biogenic hydrocarbon precursor mixtures using an aerosol chemical ionization time-of-flight mass spectrometer.

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Abstract:

We present a detailed characterization of an online method for simultaneous measurement of gas and aerosol chemical composition and abundance using chemical ionization high-resolution time-of-flight mass spectrometry equipped with an aerosol inlet (aerosol-CIMS). Characterization of the performance of the aerosol inlet shows unique volatilization profiles for a range of inorganic and organic aerosol with negligible thermophoretic effects under a centerline temperature of 330°C. To assess the performance of the aerosol inlet, a mixture of biogenic hydrocarbon precursors (α/β-pinene, limonene, sabinene) were oxidized via atmospheric gas-phase oxidation in an oxidative flow reactor and the gas and aerosol phase oxidation products were measured by aerosol-CIMS. As the temperature gradient of the aerosol inlet was increased, we observe changes in O/C ratios and highly functionalized species. We relate this observed, speciated chemistry to the volatility of the aerosol, and compare observed SOA yields to other methods. Comparison of aerosol mass measured by a single mobility scanning particle sizer and aerosol-CIMS suggests that while aerosol-CIMS is an important measurement technique for identifying aerosol chemical composition as it relates to aerosol physical properties like volatility, its ability to measure total organic aerosol is limited. Despite these limitations, multiple reagent ions (iodide, acetate) provide insight into total organic aerosol yields using aerosol-CIMS.