4.069 Effects of Ammonia on SOA Formation and Composition .

Early Career Scientist

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Abstract:

Particulate matter (PM) is comprised of suspended particles in the atmosphere large enough to diminish visibility or affect temperature by absorbing or scattering light. Secondary organic aerosols (SOA), a major component of PM, are largely formed from the oxidation of volatile organic compounds (VOC). Despite research efforts to understand SOA formation from VOC reactions with oxidants such as OH, O_3, and NO_x, a large uncertainty remains on how ammonia (NH_3) affects such reactions. NH_3 is widely released from agriculture and other natural and industrial sources. The U.S. Department of Commerce estimates the U.S. produces 9 million metric tons of NH_3 annually rendering it among the top 5 producing countries. This study investigates the effects of ammonia on SOA formation, optical properties, and chemical composition. SOA is formed from the oxidation of anthropogenic- and biogenic-relevant VOCs in a smog chamber at the desired relative humidity. After SOA formation, NH_3 is introduced into the chamber. The particle growth is monitored with a scanning mobility particle sizer (SMPS). A Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer (PTR-ToF-MS) is used to track VOCs and a Time-of-Flight Aerosol Mass Spectrometer (ToF-AMS) is used to analyze particle composition. Subsequently, samples are collected and analyzed via direct analysis in real time mass spectrometry (DART-MS) and electrospray ionization mass spectrometry (ESI-MS). These techniques are used to determine whether NH_3 reacts with SOA to form nitrogen-containing compounds. Additionally, absorption coefficient of SOA extracts is measured. The experimental results from this study will be incorporated into two models: 1) UCI-CIT, an airshed model that contains comprehensive SOA chemistry for the South Coast Air Basin of California and 2) a coupled meteorological-air quality model for continental-scale modeling of the U.S. The combination of experimental and modeling results will allow us to evaluate the impact of NH_3 on SOA and ultimately air quality and climate.