ABSTRACT
Organic aerosols (OA) account for about 1/2 of the submicron particle mass in the atmosphere leading to important impacts on climate, human health, ecosystems, crops, and visibility. OA can be emitted directly (primary OA, POA) or formed chemically from gases in the atmosphere (secondary OA, SOA), with SOA dominating at most locations. OA sources, properties, and evolution are poorly understood, creating substantial uncertainties about the effectiveness of impact mitigation strategies. I will present results from a variety of approaches aimed at providing better constraints on OA sources, properties, and evolution. SOA from the isoprene epoxide is important globally and its main aging pathway appears to be aqueous chemistry. (Almost) pole-to-pole observations as part of the NASA ATom project are providing unique measurements of OA in the Southern Hemisphere, with initial evidence supporting the importance of faster removal by photolysis or heterogeneous oxidation than used in models. The global remote aerosol is very acidic, generally with pH < 0. Urban outflow continues to produce copious amounts of SOA in 2015-16 campaigns in both summer (Seoul, Korea) and winter (NE US), and consistent with older campaigns. Oxidation Flow Reactors (OFR) allow quantifying SOA potential in the real-world (including from aircraft) and extensive modeling shows that they can be operated with tropospheric-relevant chemistry. OFR reveal the importance of semivolatile and intermediate volatility precursors, both primary and secondary. Gas-particle partitioning can be studied in carefully-designed experiments in environmental chambers, once wall losses and tubing effects are taken into account, and reveals a dependence of the accommodation coefficient on species vapor pressure. Thermal decomposition appears to be major when analyzing ambient oxidized aerosols, for any instruments based in thermal desorption.

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