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High-time resolved measurements of biogenic and anthropogenic secondary organic aerosol precursors and products in urban air

Rosa M Flores (1) and Paul V Doskey (2)

(1) Marmara University, Istanbul, Turkey (rflores@marmara.edu.tr), (2) Michigan Technological University, Houghton, USA (pvdoskey@mtu.edu)

Volatile organic compounds (VOCs), which are present in the atmosphere entirely in the gas phase are directly emitted by biogenic (∼1089 Tg yr-1) and anthropogenic sources (∼185 Tg yr-1). However, the sources and molecular speciation of intermediate VOCs (IVOCs), which are for the most part also present almost entirely in the gas phase, are not well characterized. The VOCs and IVOCs participate in reactions that form ozone and semivolatile OC (SVOC) that partition into the aerosol phase. Formation and evolution of secondary organic aerosol (SOA) are part of a complex dynamic process that depends on the molecular speciation and concentration of VOCs, IVOCs, primary organic aerosol (POA), and the level of oxidants (NO_3, OH, O_3). The current lack of understanding of OA properties and their impact on radiative forcing, ecosystems, and human health is partly due to limitations of models to predict SOA production on local, regional, and global scales. More accurate forecasting of SOA production requires high-temporal resolution measurement and molecular characterization of SOA precursors and products. For the subject study, the IVOCs and aerosol-phase organic matter were collected using the high-volume sampling technique and were analyzed by multidimensional gas chromatography with time-of-flight mass spectrometry (GCxGC-ToFMS). The IVOCs included terpenes, terpenoids, n-alkanes, branched alkanes, isoprenoids, alkylbenzenes, cycloalkylbenzenes, PAH, alkyl PAH, and an unresolved complex mixture (UCM). Diurnal variations of OA species containing multiple oxygenated functionalities and selected SOA tracers of isorprene, α-pinene, toluene, cyclohexene, and n-dodecane oxidation were also quantified. The data for SOA precursor and oxidation products presented here will be useful for evaluating the ability of molecular-specific SOA models to forecast SOA production in and downwind of urban areas.