

SEMINAR

Development and application of an oxidation flow reactor to study SOA formation from ambient air

Brett B. Palm

University of Colorado-Boulder

Secondary organic aerosols (SOA) in the atmosphere play an important role in air quality, human health, and climate. However, the sources, formation pathways, and fate of SOA are poorly constrained. In this talk, I will introduce the oxidation flow reactor (OFR) technique for studying SOA formation from the oxidation of ambient air. I will discuss several advances we have made in performing and interpreting OFR experiments. This includes measuring and modeling oxidant exposures, modeling the fate of low-volatility gases in the OFR (wall loss, condensation, oxidation), understanding when non-atmospheric photolysis or oxidation processes influence the results of OFR oxidation, and comparing SOA yields of single precursors in the OFR with chamber yields. When all of these experimental details are carefully considered, SOA formation in an OFR can be more reliably compared with ambient SOA formation processes.

I will then present an overview of what OFR measurements have taught us about SOA formation in the atmosphere. I will present a comparison of SOA formation from the OH, O₃, and NO₃ oxidation of ambient air in a wide variety of environments, from rural forests to urban air. In all settings, the amount of SOA formed was typically larger at night than during the day. In the rural forest, SOA formation in the OFR correlated with biogenic precursors (e.g., monoterpenes). In urban air, SOA formation correlated instead with reactive anthropogenic tracers (e.g., trimethylbenzene). In mixed-source regions, the SOA formation did not correlate well with any one gas-phase precursor, but could be predicted by multilinear regression from several precursors. Despite these correlations, the concentrations of speciated ambient VOCs could only explain approximately 10-50% of the total SOA formed from the OH oxidation of ambient air. In contrast, ambient VOCs could explain all of the SOA formation observed from O₃ and NO₃ oxidation. Evidence suggests that lower-volatility gases (semivolatile and intermediate-volatility organic compounds; S/IVOCs) were present in ambient air and were the likely source of the SOA formation from OH oxidation that could not be explained by VOCs. These measurements show that S/IVOCs likely play an important intermediary role in ambient SOA formation in all of the sampled locations, from rural forests to urban air.

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Refreshments 3:15 p.m.

NCAR Foothills Laboratory

3450 Mitchell Lane, Boulder, CO 80301

FL2-1022, Large Auditorium

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For more information please contact Caitlyn Quinn, cquinn@ucar.edu, phone 303-497-1308.