



## Secondary Organic Aerosol Formation from Ambient Air in an Oxidation Flow Reactor at GoAmazon2014/5

Brett B. Palm (1,2), Suzane S. de Sa (3), Pedro Campuzano-Jost (1,2), Douglas A. Day (1,2), Weiwei Hu (1,2), Roger Seco (4), Jeong-Hoo Park (5), Alex Guenther (4,6), Saewung Kim (4), Joel Brito (7), Florian Wurm (7), Paulo Artaxo (7), Lindsay Yee (8), Gabriel Isaacman-VanWertz (8,9), Allen Goldstein (8), Matt K. Newburn (10), M. Lizabeth Alexander (10), Scot T. Martin (3), William H. Brune (11), Jose L. Jimenez (1,2), and the GoAmazon2014/5 Team

(1) Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, United States, (2) Department of Chemistry and Biochemistry, University of Colorado, Boulder, United States, (3) School of Engineering and Applied Sciences at Dept. of Earth and Planetary Sciences, Harvard University, Cambridge, MA, USA, (4) Department of Earth System Science, University of California, Irvine, USA, (5) National Center for Atmospheric Research (NCAR), Boulder, CO, USA, (6) Division of Atmospheric Sciences and Global Change, Pacific Northwest National Laboratory, Richland, WA, USA, (7) Institute of Physics, University of Sao Paulo, Brazil, (8) Department of Environmental Science, Policy, and Management, University of California, Berkeley, USA, (9) Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Cambridge, MA, USA, (10) Environmental and Molecular Sciences Laboratory, Pacific Northwest National Laboratory, Richland, WA, USA, (11) Department of Meteorology, Penn State University, USA

During GoAmazon2014/5, ambient air was exposed to controlled concentrations of OH or O<sub>3</sub> in situ using an oxidation flow reactor (OFR). Oxidation ranged from hours–several weeks of aging. Oxidized air was sampled by several instruments (e.g., HR-AMS, ACSM, PTR-TOF-MS, SMPS, CCN) at both the T3 site (IOP1: Feb 1–Mar 31, 2014, and IOP2: Aug 15–Oct 15, 2014) and T2 site (between IOPs and into 2nd IOP). The oxidation of ambient air in the OFR led to substantial and variable secondary organic aerosol (SOA) formation from any SOA-precursor gases, known and unknown, that entered the OFR. In general, more SOA was produced during the nighttime than daytime, suggesting that SOA-precursor gases were found in relatively higher concentrations at night. Similarly, more SOA was formed in the dry season (IOP2) than wet season (IOP1). The maximum amount of SOA produced during nighttime from OH oxidation ranged from less than 1 μg/m<sup>3</sup> on some nights to greater than 10 μg/m<sup>3</sup> on other nights. O<sub>3</sub> oxidation of ambient air also led to SOA formation, although several times less than from OH oxidation. The amount of SOA formation sometimes, but not always, correlated with measured gas-phase biogenic and/or anthropogenic SOA precursors (e.g., SV-TAG sesquiterpenes, PTR-TOFMS aromatics, isoprene, and monoterpenes). The SOA mass formed in the OFR from OH oxidation was up to an order of magnitude larger than could be explained from aerosol yields of measured primary VOCs. This along with measurements from previous campaigns suggests that most SOA was formed from intermediate S/IVOC sources (e.g., VOC oxidation products, evaporated POA, or direct emissions). To verify the SOA yields of VOCs under OFR experimental conditions, atmospherically-relevant concentrations of several VOCs were added individually into ambient air in the OFR and oxidized by OH or O<sub>3</sub>. SOA yields in the OFR were similar to published chamber yields. Preliminary PMF factor analysis showed production of secondary factors in the OFR that were similar to oxidized OA factors found in ambient air. Factors that are primary emissions or require reactive uptake (e.g., HOA, BBOA, and IEPOX-SOA) were not formed in the reactor, but were depleted at high ages (though at different rates).