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GoAmazon2014/15 Experiment: Overview of main findings on the interaction of natural biogenic emissions with urban pollution from Manaus

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The GoAmazon 2014/15 experiment (Observations and Modelling of the Green Ocean Amazon) was a great opportunity to study how urbanization can change aerosol properties under pristine conditions in a tropical rain forest. The experiment took place from January 2014 to December 2015 in the vicinity of Manaus, Brazil, where 6 sampling stations were operated continuously and two airborne campaigns were performed in the dry and wet seasons with the DoE G1 plane as well as with the DLR HALO G5 plane for high altitude flights. Aerosol chemical composition was analysed using several Aerodyne AMS and ACSM instruments. Aerosol size distribution, light scattering and absorption, CCN activity were measured, as well as concentrations of VOCs, CO, O_3, CO_2, NO_2 and SO_2. The aerosol column was measured using AERONET sun photometers before and after the Manaus plume.

The three sites before the Manaus plume show remarkable similar variability in aerosol concentrations and optical properties. Aerosol composition showed a large dominance of organic aerosols for all sites, accounting for 65-75% of PM1 aerosol. Most of these were secondary organic aerosol (SOA), with very low sulphate and nitrate concentrations. The influence of the Manaus plume on aerosol properties was more intense during the wet season, because in the dry season a significant amount of large scale biomass burning aerosol was observed for all GoAmazon 2014/15 sites. Ozone in the wet season peaks at 8-12 ppb at the middle of the day, while carbon monoxide averages at 50-80 ppb. In the dry season (August-December), long range-transported biomass burning alters atmospheric composition significantly. Ozone can reach 50 ppb downwind of Manaus. Formation of SOA was very strong from the interaction of NO_x emissions with natural biogenic VOCs, accounting for 3 ug/m^3 of PM1 at the T3 site in Manacapuru. Isoprene oxidation products dominated the SOA component. Aerosol absorption was strongly affected by the urban emissions, and shows high impact on aerosol radiative forcing. Aircraft measurements allowed to study the spatial distribution of the aerosol plume as well as processes that leads to ozone and SOA production. A large source of organic particles were identified in high altitudes with the HALO plane, and it consists of VOCs oxidation products at 12-14 Km nucleating new particles with subsequent downdrafts that feeds the ground based CCN population. It was observed a reduction in cloud droplet size downwind of Manaus for liquid phase clouds, with impacts in precipitation.