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Ground based chemical characterization of submicron aerosol during the South American Biomass Burning Analysis (SAMBBA) field experiment

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This work presents the results of an Aerosol Chemical Speciation Monitor (ACSM) which was successfully operated at a ground station in Porto Velho, Brazil, during the South American Biomass Burning Analysis (SAMBBA). SAMBBA is an international research project based on experimental and modeling activities designed to investigate the impacts of biomass burning emissions on climate, air quality and numerical weather prediction over South America. The measurement program was headed by the deployment of UK's Facility for Airborne Atmospheric Measurements (FAAM) BAe-146 research aircraft over Brazil during the dry season of 2012. The aircraft operation was coordinated with ground-based measurements at Porto Velho, operated by the University of Sao Paulo. Besides the aerosol chemical speciation, continuous measurements of aerosol size distribution and optical properties were carried out at the ground station, together with CO, CO_2 and O_3. Filters for trace elements measured by XRF and for OC/EC determined using a Sunset instrument were also collected at the ground based component of SAMBBA.

The ACSM collected data for three weeks during September 2012. This period included a strong biomass burning event which showed a marked peak in f60, linked with Levoglucosan, a well-known biomass burning marker. During the biomass burning event, organics concentrations rose up to 80 μg/m^3, black carbon close to 6 μg/m^3 and CO mixing ratio above 2 ppmv. Fast biomass burning aerosol processing in the atmosphere could be observed through the relative contributions of $C_2H_3O^+$ vs. CO_2^+ relative to total organic mass (f44 vs. f43). A clear diurnal variation throughout the sampling period has been observed for organic aerosols with a median peak of 9 μg/m^3 at 04:00 LT and a minima of 5 μg/m^3 at 18:00 LT. Preliminary results indicate that organics are responsible for 85% of PM1 non-refractory aerosols. The data set will allow the study of interactions between biomass burning and biogenic emissions, focusing on changes in the radiation balance, atmospheric chemistry and effects on the terrestrial biosphere including carbon uptake by the Amazonian forest.