Interactions between urban and forest emissions in Manaus, Amazonia: The Brazilian component of GoAmazon

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Abstract

The GoAmazon experiment seeks to understand how aerosol and cloud life cycles are influenced by pollutant outflow from Manaus in the tropical rain forest, particularly the susceptibility to cloud-aerosol-precipitation interactions and the feedbacks among biosphere and atmosphere functioning and human activities. The scientific objectives are organized as Aerosol Life Cycle (ALC), Cloud Life Cycle (CLC), and Cloud-Aerosol-Precipitation Interactions (CAPI). One of the focus is to understand the production of secondary organic aerosol (SOA) from the interaction of urban pollution emissions with VOCs emitted from the forest. Manaus is a 2 million people urban area surrounded by hundreds of kilometers of forest, and the study of atmospheric processes in this interaction is important to regional and global climate change. A set of detailed aerosol, trace gases and cloud measurements will be performed over 6 different sites, followed by detailed meteorological transport studies. Three sites will measure atmospheric properties before the Manaus plume (ATTO, ZF2 and EMBRAPA), 2 sites will be downwind of the Manaus plume (Iranduba, close to the Negro River and Manacapuru) and one site will be operated downtown Manaus. This FAPESP proposal will involve mostly the operation of 3 upwind sites and Iranduba, but the data analysis and modeling will involve all GoAmazon sites and data. In Manacapuru, US DoE will operate the ARM Mobile Aerosol Observing System (MAOS-A and C) and the ARM Mobile Facility #1 (AMF1). In the sites operated by this proposal, a large set of measurements will be performed: aerosol optical measurements with spectral light scattering and absorption, aerosol size distribution, aerosol composition for organic and inorganic components, CCN (Cloud Condensation Nuclei), aerosol optical depth, radiation balance, atmospheric vertical thermodynamic structure among other measurements. Four aerosol mass spectrometers will be deployed to measure organic and inorganic aerosol composition with 30 minutes time resolution in several locations. Raman Lidar will measure the vertical distribution of aerosols and water vapor up to 12 Km. Trace gases such as O_3, CO, CO_2, CH_4, SO_2 and detailed VOCs characterization will also be determined. Measurements of cloud properties including cloud cover fraction, droplet size distribution, precipitation, water vapor and others will be combined with cloud and precipitation radars for a regional assessment of cloud-aerosol precipitation relationship. Boundary layer thermodynamic properties will be measured with radiosondes in several sites. High resolution BRAMS regional modeling will be performed daily with 2 Km resolution and full aerosol and trace gas chemistry. These observations will provide a dataset vital to constrain tropical forest

model parameterizations for organic aerosols, cloud and convection schemes, and terrestrial vegetation components. The dataset also will provide insights into how these are perturbed by pollution and how they influence climate.