Anthropogenic Emissions Change the Amount and Composition of Organic PM_1 in Amazonia

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The Amazon forest, while one of the few regions on the globe where pristine conditions may still prevail, has experienced rapid changes due to increasing urbanization in the past decades. Manaus, a Brazilian city of 2-million people in the central Amazon basin, releases a pollution plume over the forest, potentially affecting the production pathways of particulate matter (PM) in the region. As part of GoAmazon2014/5, a high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) and a suite of other gas and particle-phase instruments were deployed at the T3 research site, 70 km downwind of Manaus, during the wet and dry seasons. Through a combination of meteorology, emissions, and chemistry, the T3 site was affected by a mixture of biogenic emissions from the tropical rainforest, urban outflow from the Manaus metropolitan area and biomass burning plumes. Results from the T3 site are presented in the context of measurements at T0a/T0t and T2, sites representing predominantly clean and polluted conditions, respectively. The organic component consistently represented on average 70-80% of the PM1 mass concentration across sites and seasons, and constitutes the focus of this work. Positive matrix factorization (PMF) analysis was applied to the time series of organic mass spectra. The resulting factors, which included the so-called IEPOX-SOA, MO-OOA, LO-OOA, BBOA, Fac91 and HOA, provide information on the relative contributions of different sources and pathways to organic PM production. In addition, Fuzzy c-means clustering was applied to the time series of pollution indicators, including concentrations of NOy, total particle number, ozone and sulfate, in order to better understand the convoluted influences of different processes and airmass origin to each point in time. Through combination of the PMF and Fuzzy c-means analyses, insights are drawn about the relative composition of organic PM1 at varying degrees of influence of biogenic and anthropogenic processes. Results suggest that polluted conditions are associated with higher organic mass concentrations, with certain

pathways being favored to the detriment of others. This analysis and results represent a step toward the goal of improving the understanding of anthropogenic influences on the production of PM1 in Amazonia.

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