Disentangling the Manaus pollution plume from the biomass burning plume during the second GoAmazon 2014/5 Intensive Operating Period (IOP2)

Henrique de Melo Jorge Barbosa[1]

(1) pplied Physics Department. Physics Institute. Sao Paulo University (USP), Ed. Basilio Jafet, Sala 100. Rua do Matao, Travessa R, 187. 05508-900, Sao Paulo, SP, Brazil

hbarbosa@if.usp.br

Boris Barja[1,2], Diego Alves Gouveia[1], Eduardo Landulfo[3], Paulo Almeida[3], Bruna A. Holanda[1],

Theotônio Pauliquevis[4], Paulo Artaxo[1], Scot Martin[5]

(2) tmospheric Optics Group of Camagüey. Meteorological Institute of Cuba, Cuba

(3) entro de Lasers e Aplicações, Instituto de Pesquisas Energéticas e Nucleares (IPEN), São Paulo, Brasil

(4) niversidade Federal de São Paulo, Diadema-SP, Brasil

(5) arvard University, Cambridge, MA 02138-3826, USA

Abstract: The Green Ocean Amazon experiment (GoAmazon2014/5) seeks to understand how aerosol and cloud life cycles are influenced by pollutant outflow from a large industrial city in the tropical rain forest, particularly the susceptibility to cloud-aerosol-precipitation interactions and the feedbacks among biosphere and atmosphere functioning and human activities. For this purpose, six research sites were setup at different distances upwind and downwind from Manaus, in the central Amazon forest, and three of these have vertical profiling capabilities. A micropulsed lidar (MPLnet) from DOE/ARM is being operated at T3 site (3.21°S 60.59°W), 60 km downwind to the west of Manaus. A portable Raymetrics aerosol raman lidar from IPEN/SP was operated T2 site (3.21 ºS 60.60 ºW, 5 km downwind) during the second Intensive Operating Period (IOP2), and measures directly the emissions from Manaus. The third system is the UV Raman lidar from the University of Sao Paulo, continuously operated since 2011 at T0e (2.89 ºS 59.97 ºW), an upwind site 10 km to the east. T0e serves as a reference station, as the air masses there are not influenced by the local urban emissions. Using these three lidar systems and the AERONET stations at T3 and T0e, the scattering and absorption properties of the Manaus and biomass burning plumes were investigated. The measurements were conducted during the biomass-burning season, from August 15 to October 15 2014. Scattering aerosol optical thickness varied from 0.1 to 1.5, with a regression coefficient of 0.980.02, showing similar scattering properties at T0e vis-à-vis T3 and thus little influence of the Manaus plume. For the absorption AOD, however, values ranged from 0.05 to 0.8 and the regression coefficient was 2.2(2), indicating a much more absorbing aerosol at T3. A similar result was observed in the vertical. The aerosol backscatter profiles from T2 and T0e were remarkably similar, and even small-scale vertical structures of about ~100m inside the biomass burning plume were not destroyed as the air mass travels 36 km over the city and the river. The night-time aerosol extinction profiles, however, showed substantially more absorption at T2 then at T0e although not enough to justify the different absorption AOD. Possible reasons will be explored and discussed.

Keywords: Anthropogenic pollution plume; Biomass Burning; Lidar Ratio; GoAmazon

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