# Light Absorption of Aerosol Particles in Amazonia

Bruna A. Holanda[1], Joel F. Brito[1], Henrique Barbosa[1], Samara Carbone[1], Glauber Cirino[2], Luciana Rizzo[3], Meinrat O. Andreae[4], Jorge Saturno[4], Christopher Pöhlker[4], Scot Martin[5], Brent Holben[6], Paulo Artaxo[1].

[1]Institute of Physics, University of São Paulo, São Paulo, Brazil, [2]National Institute of Amazonian Research, Manaus, Brazil, [3]Federal University of Sao Paulo, Diadema, Brazil, [4]Biogeochemistry and Multiphase Chemistry Departments, Max Planck Institute for Chemistry, Mainz, Germany, [5]Harvard University, Cambridge, MA, USA, [6]NASA Goddard Space Flight Center, Greenbelt, MD, USA.

Keywords: Aerosol light absorption, Biogenic emissions, Amazon rainforest, GoAmazon2014/5

Presenting author email: brunaah@if.usp.br

As part of the Green Ocean Amazon experiment (GoAmazon2014/5), a detailed characterization of spectral light absorption is being performed in five research sites, located in the central Amazon forest from different distances upwind and downwind of Manaus. There are three sites T0 located upwind of Manaus where it is possible to observe pristine conditions in wet season: ATTO (T0a), ZF2 ecological research site (T0z) and EMBRAPA (T0e). The site Tiwa (T2) is being operated under the direct influence of the Manaus plume at 5 km downwind of Manaus, right on the opposite side of the Negro River. Finally, at about 60 km downwind of Manaus is located the Manacapuru site (T3). Aerosol light absorption is measured by the use of Aethalometers and MAAPs. In T0, absorption coefficient enhances from an average of 0.9 to 3.8 $Mm^{-1}$ from wet to dry season. In T2, the coefficient varies from 6.4 to 10.0 $Mm^{-1}$, showing that aerosol descendant from Manaus plume absorbs radiation more effectively than aerosol from less impacted area. Finally, in T3 the absorption coefficient enhances from 1.4 to 3.2 $Mm^{-1}$, much lower values in comparison with T2. For all the stations, grater absorption coefficients are observed during dry season in comparison with wet season, as a result of the larger BC concentration present in the biomass burning events.

In T0z, with the dominance of natural biogenic aerosol and brown carbon, the so called anomalous absorption is of particular interest. A special experiment was designed to study the wavelength dependence of aerosol absorption for $PM_{2.5}$ as well as for $PM_{10}$ particles during the wet season in Central Amazonia. Aerosol analyses were made from May to August 2014. In this experiment, four aerosol absorption instruments were used to measure the concentration of Equivalent Black Carbon (BCe). Two sets of 7 wavelengths AE33 Aethalometers and MAAPs were operated in parallel using $PM_{2.5}$ and $PM_{10}$ inlets, characterizing aerosol optical properties of both modes, coarse and fine. Particles were measured under dry conditions using diffusion dryers. All the instruments showed very similar behavior, measuring BCe concentrations of about 0.11 $\mu g/m^3$ from May to June, and increasing to values up to 4 $\mu g/m^3$ in August, when the dry season has already started. The correlation between $PM_{10}$ and $PM_{2.5}$ showed very good agreement ($R^2$=0.98). As such regression correlation is dominated by high values of BCe, the correlation slope was re-calculated, but applying upper cut-offs in the considered data. The results of these analyses are shown in figure 1, clearly depicting an absorption threshold in which coarse particles (linked to primary biogenic aerosol) start to play a significant role on the light absorption. Above such value (~2 $Mm^{-1}$) no significant contribution of coarse aerosol is observed.

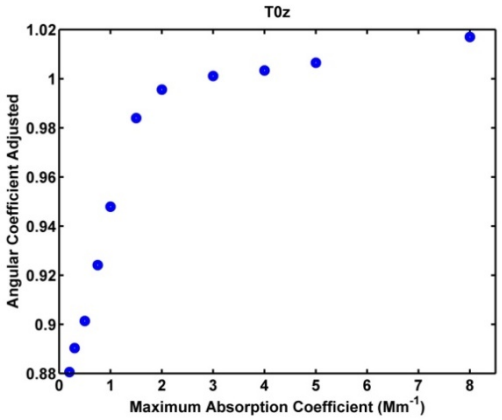


***Figure 6*** *– Slopes of the correlation between absportion coefficient measured by AE33 with PM10 and PM2.5 inlets, as a function of the maximum absorption used in the regression.*

Absorption and Scattering Aerosol Optical Depth was also measured with an AERONET sunphotometer operated at T3 and T0e. These measurements were performed during the biomass-burning season, from August to October 2014. Scattering aerosol optical thickness varied from 0.1 to 1.5, with a slope of 0.98 in a T0e vis-à-vis T3 correlation, showing similar scattering properties and little influence of the Manaus plume. For the absorption AOD, however, values ranged from 0.05 to 0.8 and the slope was 2.2, indicating a more absorbing aerosol at T3.