Geophysical Research Abstracts
Vol. 21, EGU2019-14774-1, 2019
EGU General Assembly 2019

Aerosol physical properties at different heights of the ATTO tower in the central Amazon rainforest

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The Amazon ecosystem interacts strongly with the atmosphere, making the forest a kind of biogeochemical reactor that influences climatic processes on a continental scale. The ATTO (Amazonian Tall Tower Observatory) station is of great relevance for studying the aerosol properties in tropical regions. It is located in the central Amazon, approximately 160 km northeast of Manaus, surrounded by undisturbed forest. At the sitea unique set of instruments continuously measures organic and inorganic composition, optical properties, size distribution and vertical profile at two different heights (80 and 325 m). This study evaluated the distribution of aerosols along the vertical profile of the towers, between 60 and 325 m, based on their physico-chemical properties, during the wet season of 2018 (January – May). The data obtained at 60 m inlet allowed to characterize the nearly pristine condition at the ATTO site. Particle concentrations were low, with an average value of 340 cm^{-3} and average diameter of 150 nm. Black carbon average concentration and average scattering coefficient at 525 nm was measured as 340 ng m^{-3} and 9 Mm^{1}, respectively. The monthly variability in the rainy season for both black carbon concentration and the scattering coefficients was significant due to events of long-range transport of dust and biomass burning aerosols from Africa. The highest black carbon BC concentration occurred in May, around 700 ng m^{-3}, possibly under influence of regional pollution that was transported to the site. On the other hand, the maximum light scattering that occurred in January (18 Mm^{-1}) can be an indication of arrival of African dust Plumes. Average single scattering albedo (SSA) for the wet season was 0.81±0.06 at 637 nm, a relatively low value, indicating the relevance of absorption. Monthly averages of SSA showed that in February there was a predominance of scattering particles (SSA of 0.88±0.08) while in March particles were quite absorbing (SSA of 0.73±0.11). These results showed that different atmospheric processes, such as long-range transport of dust aerosols from Africa and sea salt from the Atlantic Ocean, sometimes with long-range-transported biomass smoke, are affecting the ATTO site in different periods. Clear differences of particle concentration and optical properties of the aerosols were observed in the vertical profile. Particle number concentration in May is higher near the canopy, with average of 468±219 cm^{-3}, in comparison to 416±191 cm^{-3} at 325 m. This gradient could occur because there are more biogenic particles near the canopy. Also, coagulation processes due to convective systems could play a role in the gradient. The scattering coefficient in June follows particle number concentration trends, with values of 23±10 Mm^{-1} and 7±3 Mm^{1} at 60 and 325 m, respectively. This also applies to the average values of the Ångström scattering coefficient, which average 1.45±0.31 at 60 m versus 1.85±0.42 at 325 m, and therefore, corroborate the measurements that coarse particles are more abundant at 60 m compared to 325 m. An overview of these measurements and analysis will be presented.