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Aerosol physical properties over the Amazon basin

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Black carbon (BC) particles originating from incomplete combustion account for a significant fraction of the atmospheric aerosol burden. These particles directly influence the Earth's radiation and energy budget by absorbing shortwave radiation[1]. Moreover, BC-containing particles can act as cloud condensation and ice nuclei (CCN & IN), influencing cloud microphysics and precipitation regimes. The widespread burning of tropical forests in South America is an important source of atmospheric BC with potentially large impact on regional and global climate.
Here we present long-term measurements (2012-2018) of physical and chemical properties of aerosol particles at the Amazon Tall Tower Observatory (ATTO), located ∼150 km northeast of Manaus, Brazil[2]. This research site is a unique platform for studying near-pristine atmospheric conditions in contrast to heavily polluted periods. A Single Particle Soot Photometer (SP2) was used to measure the mass of individual refractory BC particles (rBC), calculate the diameter of rBC cores, and determine the thickness of their coatings. Average aerosol absorption and scattering coefficients were obtained using a multi-angle aerosol photometer (MAAP) and a nephelometer, respectively.
The long-term measurements show a strong seasonality of the aerosol optical properties, with a maximum of absorption and scattering coefficients during August-October, resulting from intense deforestation and pasture maintenance fire emission and low precipitation rates. During the dry season, the aerosol population at the ATTO site is mostly a superposition of rather fresh smoke from local fires, aged smoke from regional fires, and strongly aged smoke from African fires[3]. The single scattering albedo (SSA) also varies considerably over the year, with a maximum during the wet season, when the aerosol composition is dominated by large biological particles from the Amazon rainforest with intrusions of African dust from long-range transport[4].

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