Seasonal and diurnal cycling of aerosol particles in and above the canopy at the ATTO site in the Amazon rain forest

F. Ditas[1], C. Pöhlker[1], H. Barbosa[2], J. Brito[2], X. Chi[1], I. Hrabe de Angelis[1], M. L. Krüger[1], D. Moran[1], J. Saturno[1], H. Su[1], A. O. Manzi[3], P. Artaxo[2], U. Pöschl[1], and M. O. Andreae[1]

[1]Max Planck Institute for Chemistry, Biogeochemistry Department, 55128 Mainz, Germany
[2]Institute of Physics, University of São Paulo, São Paulo, Brazil
[3]National Institute of Amazonian Research, Manaus, Brazil
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Presenting author email: f.ditas@mpic.de

The Amazonian rain forest is one of the few continental regions, providing the opportunity to study pristine aerosols approximating a pre-industrial atmosphere. During the wet season (December - May), the ambient aerosol is usually unaffected by anthropogenic emission and dominated by a biosphere-atmosphere exchange. In contrast, during the dry season (June - November), anthropogenic pollution events (e.g., biomass burning) of regional and/or global character are observed.

We will present measurements carried out at a remote research facility in the Amazonian rain forest (ATTO site, S 2°08'45", W 59°00'20'') approximately 140 km northeast of Manaus. The ATTO site is equipped with a variety of instruments to characterize microphysical and optical particle properties (i.e. particle number size distribution, total particle number concentration, BC mass, scattering coefficients, and chemical composition), which can be operated at two different inlet lines to investigate particles below (5 m) and above canopy (60 m).

Since June 2014 a quasi-continuous data set of simultaneous particle number size distribution measurements below and above canopy is being collected covering nucleation to coarse mode sizes.

The observed particle number size distributions show a pronounced diurnal cycle throughout all size ranges (cf. Fig. 1). The number concentration of Aitken and accumulation mode particles exhibits distinct minima before sunrise and a 'growth-like' behavior during daytime, while coarse mode particles show a rather broad minimum and gradual increase during daytime with maximum concentration during nighttime.

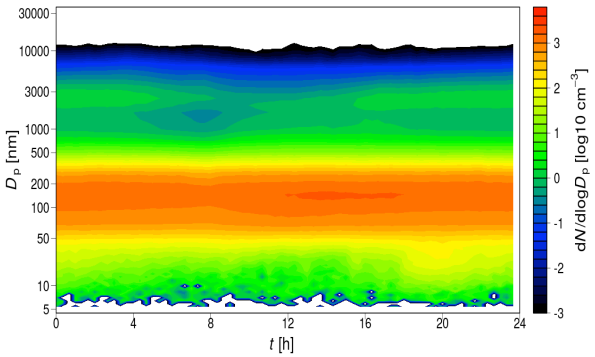

Figure 1. Average diurnal variation of particle number size distributions below canopy measured during June – August, 2014.

As already reported by earlier studies, textbook-like new particle formation and growth is not observed in the Amazonian rainforest. Nevertheless, short particle bursts in the nucleation mode size range are regularly observed and show highest abundance in the first half of the night as well as a minimum during daytime (cf. Fig. 2).

Simultaneous measurements below and above canopy show generally similar results indicating well-mixed conditions. However, single burst-like peaks in the nucleation mode size range exhibit more detailed structures above canopy, which may result from atmospheric dynamics. Moreover, several of those particle peaks can be associated with the occurrence of fog.

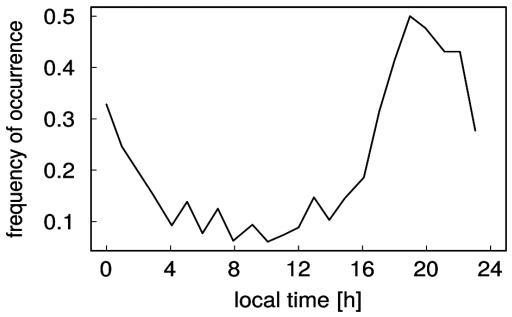

Figure 2. Frequency of occurrence of burst-like peaks in the number concentration of particles smaller than D_p = 40 nm (June – August, 2014).

The continuous measurements of meteorological parameters, aerosol particles and trace gases at the ATTO site give us an increasingly clear picture of the biogeochemical and hydrological cycling as well as the anthropogenic fingerprint in the unique ecosystem. Finally, the new large ATTO tower (325 m), which will be finished this year, will serve as a new platform for advanced aerosol research to shed light onto biosphere-atmosphere interactions in Central Amazonia.

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