Aerosol mass spectrometry of biogenic aerosols in Amazonia during the dry season

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The Amazon forest comprises a very large continental tropical forest area. Natural biogenic aerosols have been observed to be produced secondarily in the atmosphere (the SOA) from the oxidation of VOCs. Additionally, natural primary biogenic aerosol particles (PBAP) contribute to the SOA. Therefore, the Amazon forest is an important laboratory for studying the biosphere-atmosphere coupling, and the links between the forest biology and the atmosphere.

Aerosols were collected in a pristine reserve 60 km NNW of Manaus, in the so-called TT34 tower at the ZF2 ecological reserve. Most of the air masses travel for 2,000 Km from the tropical Atlantic to the site, after being processed over the pristine tropical rain forest. From July to December 2013, an Aerosol Chemical Speciation Monitor (ACSM – Aerodyne Inc.) was used to characterize non-refractory aerosol particles smaller than 1 µm at the site. The period comprises the transition from wet to dry season, the whole dry season, and the beginning of the following wet season.

Other instruments were deployed to characterize aerosol size distribution (10-450 nm), light scattering and absorption. Thermo-optical analysis on quartz filter allowed for the quantification of Organic and Elemental Carbon.

Results

The average PM_1 aerosol loading was 5.91 µg m^{-3}, of which 78% are of organic composition, 8.5% are sulfate, 6.5% are black carbon, 4% are ammonium, 3% are nitrate. Chloride was observed in very small amounts, usually below detection limit.

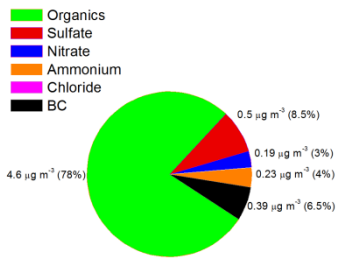

Figure 1. Contribution of the elements measured by the ACSM and MAAP to the total submicrometer particle loading.

The ACSM mass spectra was divided into four factors using the PMF: BBOA (Biomass Burning Organic Aerosol), LO-OOA (Less Oxidized - Oxygenated Organic Aerosol), IEPOX-SOA (isoprene derived – Secondary Organic Aerosol), and MO-OOA (More Oxidized – Oxygenated Organic Aerosol).

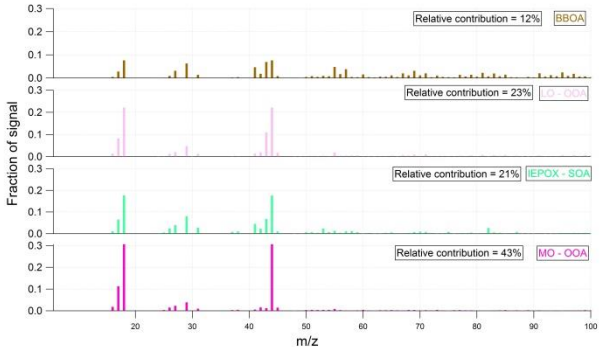

Figure 2. The 4 factors found through the PMF analysis and its relative contribution.

Large variability on the aerosol composition is observed associated with meteorology, storms and other climatic conditions. The 30 minutes organic aerosol concentrations shall be associated with aerosol absorption and scattering, as well as size distribution to calculate the effects of SOA and PBAP on aerosol optical properties over Amazonia in pristine conditions.

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