Submicron aerosol and trace gas composition near Manaus as observed during GoAmazon2014/5

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Work summary

- **10 month aerosol and trace gases characterization near Manaus**
- **Consistent first-order plume characterization**
- **Strong effect on isoprene mixing ratios due to anthropogenic activities**
- **Significant difference in size distribution between wet/dry seasons**
- **Four factors identified from PMF analysis of organics during dry season: Urban, biomass burning, biogenic and aged OA.**

Sampling site

Results shown here relate to measurements carried out at the T2 site from the GoAmazon 2014/15 experiment, near Manaus.

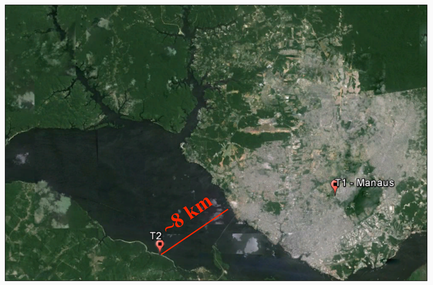


Figure 1 – *GoAmazon sampling sites*

Table 1 – List of instruments deployed at the GoAmazon T2 site

	Instrument	Analysis	Campaign	
			IOP 1 (Wet)	IOP 2 (Dry)
Gas Phase	PTR-Q-MS (Ionicon)	VOCs	X	X
	49i (Thermo)	Ozone	X	X
	43i (Thermo)	SO2	X	X
	CAPS (Aerodyne)	NO2		X
	Los Gatos Research	CO, N2O	X	X
	Los Gatos Research	CH4, CO2	X	
Aeorosol Phase	SMPS (TSI)	Aerosol Size Dist.	X	X
	ACSM (Aerodyne)	PM1 NR Composition	X	X
	Filters	Elem. Comp. & EC/OC	X	X
	MAAP (Thermo) & AE33 (Magee)	Black Carbon	X	X
	Nephelometer (Ecotech Aurora)	Light Scattering	X	X
	TEOM (Thermo)	$PM_{2.5}$ & PM_{10}		X
	CCNC (DMT)	Size-Resolved CCNC		X

Manaus plume characterization

Tracers of anthropogenic activity, BC and CO, have been used to constrain a chemical characterization of the Manaus Plume. Due to the proximity of the Negro River, a significant river breeze – wind pattern according to temperature gradient between water and land – was observed. Fig.1 shows histogram of BC measurements considering easterly winds only according to the hour of the day.

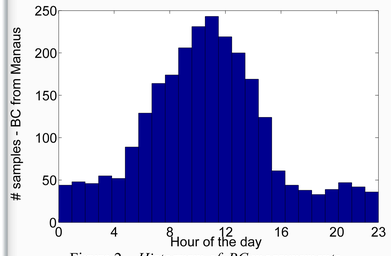


Figure 2 – *Histogram of BC measurements considering periods of time of easterly wind only.*

By correlating BC and CO data from easterly wind only allows us to constrain a chemical characterization of Manaus plume. Such values shall be used as a guide of Manaus pollution downwind of the site, namely T3.

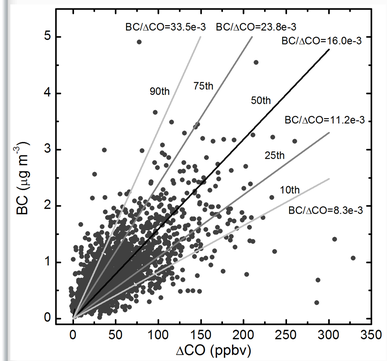


Figure 4 – *Correlation of BC and ΔCO from Manaus*

Taking in account periods of time of easterly winds (from Manaus), a clear rush hour pattern is observed for both BC and CO (Fig. 3).

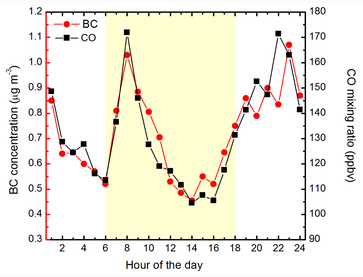


Figure 3 – *Diel variation of BC and CO, considering easterly wind only.*

In a similar analysis as performed above, SO_2, along with SO_4, do not show a distinct rush hour pattern, indicating the dominance of other sulfur sources on the site, probably from the diesel power plant.

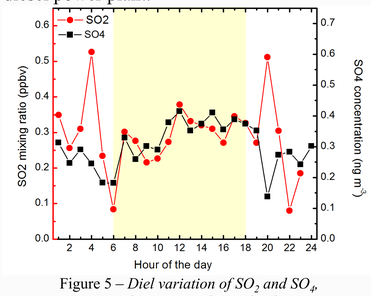


Figure 5 – *Diel variation of SO_2 and SO_4, considering easterly wind only.*

Diel variation of isoprene levels have shown a stark difference depending on local winds, northerly being mainly anthropogenic-free and easterly being Manaus direction

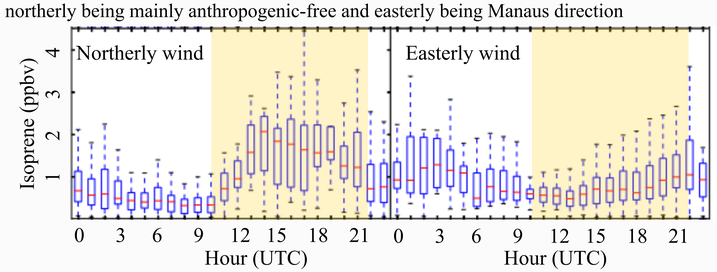


Figure 5 – *Diel variation of isoprene mixing ratios depending on local wind direction*

Aerosol composition and size distribution

Some of the results concerning aerosol chemical composition and size distribution are shown below. A significant shift from nucleation to accumulation mode aerosols is observed from IOP1 (wet season) to IOP2 (dry season). Such shift is reflected in much higher PM1 mass as well. The metric f44 (linked with O:C ratio of OA) shows relatively highly oxidized aerosols already at T2, with consistent increase in average values during dry season. Both results are consistent with a strong enhance of biomass burning emissions during the dry season.

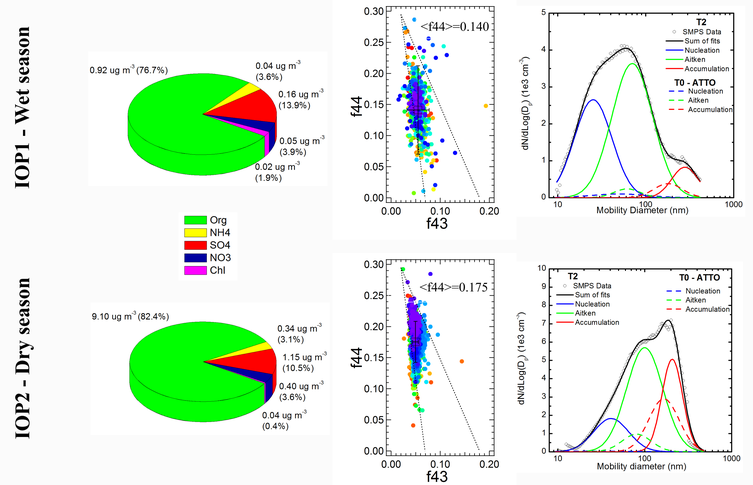
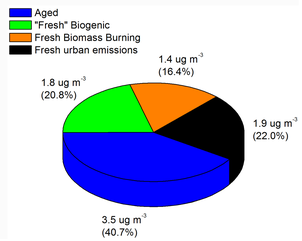


Figure 6 – *NR PM1 chemical composition, triangle plot and average size distribution for: IOP1 – wet season (top) and IOP2 – dry season (bottom).*

Organic aerosol source apportionment – IOP2

A *Positive Matrix Factorization analysis* has been applied to the organic aerosol spectra during the dry season, resulting in four factors: HOA (Urban), BBOA (biomass burning), Fac82 (isoprene SOA under low NOx condition) and LV-OOA (highly oxidized aerosols). LV-OOA factor dominates the OA mass (40%), whereas the other three factors show similar contribution. Further analysis include running PMF analysis on entire dataset and integration with trace gases measured at the site.



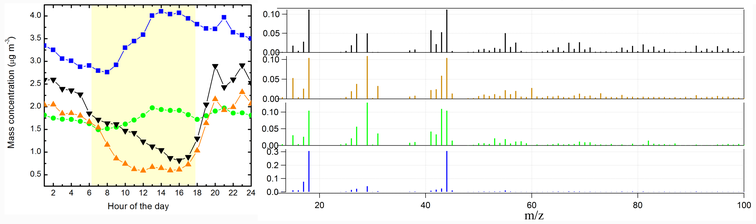


Figure 7 – *preliminary results of Positive Matrix Factorization of OA measured during IOP2*

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