Cloud and Precipitation During GoAmazon: The Effect of Aerosol, Surface and Thermodynamics

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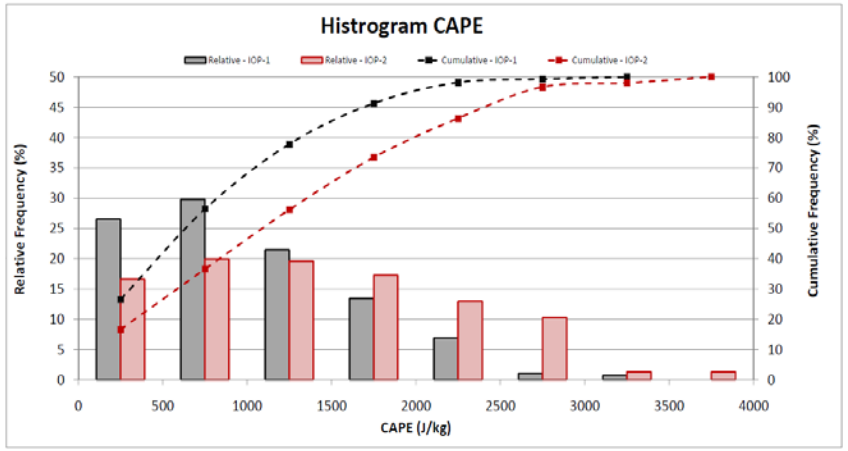
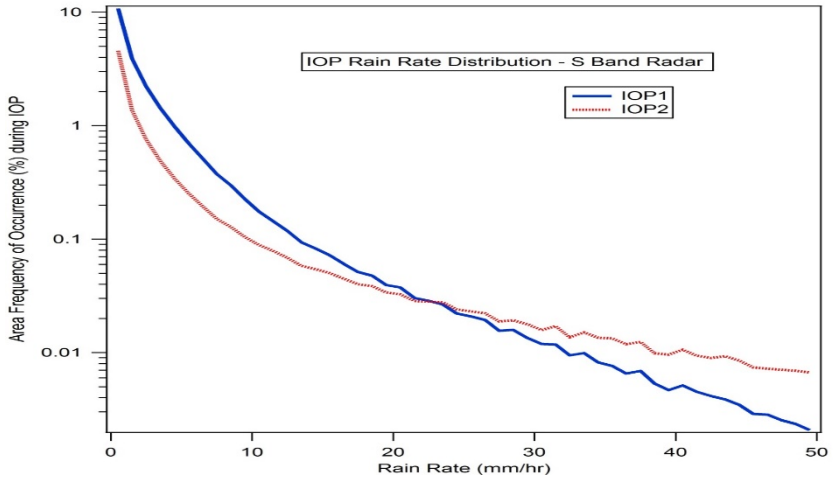
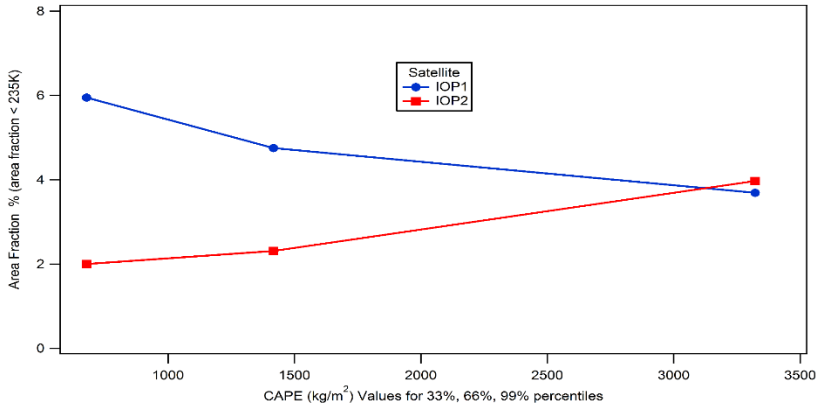
Outcome

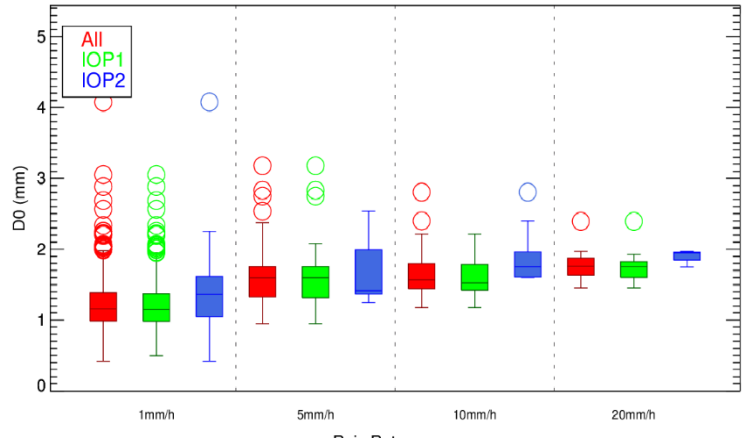
- *Rainfall and Cloud Characteristics – Wet and Dry Season;*
- *Rainfall and Cloud Organization – Wet and Dry Season;*
- *Rainfall and Cloud as Function of Topography – Wet and Dry Season;*
- *Rainfall and Cloud as Function of the Surface type;*
- *Rainfall and Cloud Microphysics as Function of the Aerosol.*

Rainfall and Cloud Characteristics – Wet and Dry Season



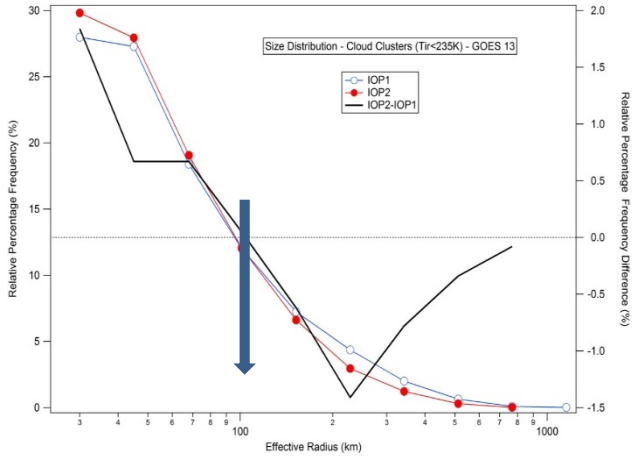






Rainfall and Cloud Organization – Wet and Dry Season

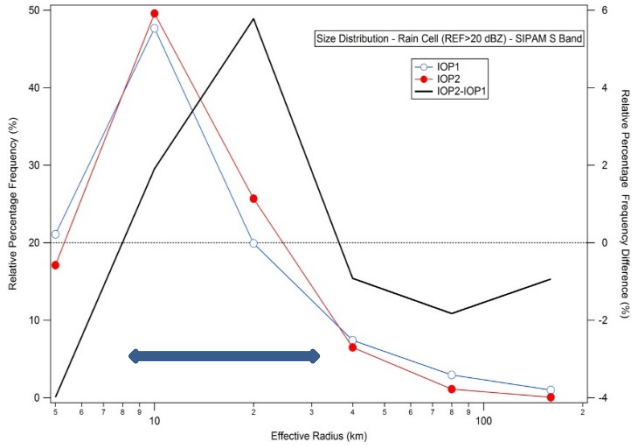
CLOUD



Dry Season – Proportionally has smaller Cloud Clusters than the Wet Season

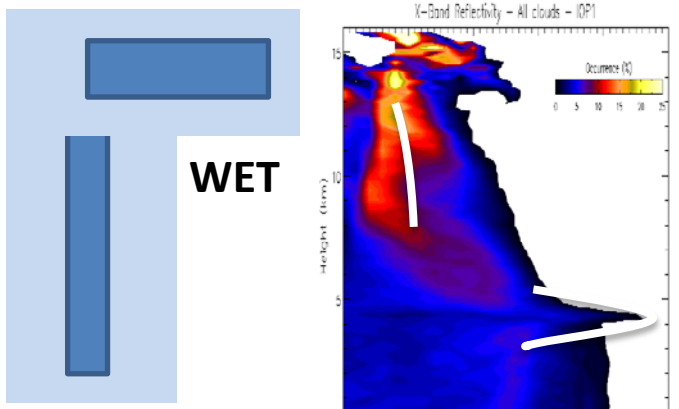
Wet Season – Proportionally has larger Cloud Clusters than the Dry Season

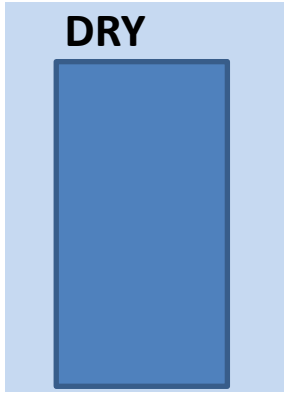
RAINFALL

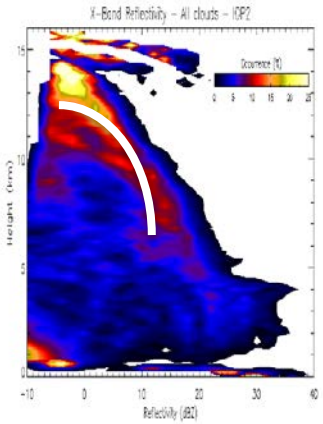


Dry Season – Proportionally has more rain cell of sizes around 7-30 km

Cloud Cluster Median Size and Life Time- 75 km Diameter – 1,5 Hours Life Time (Tir < 235 K)

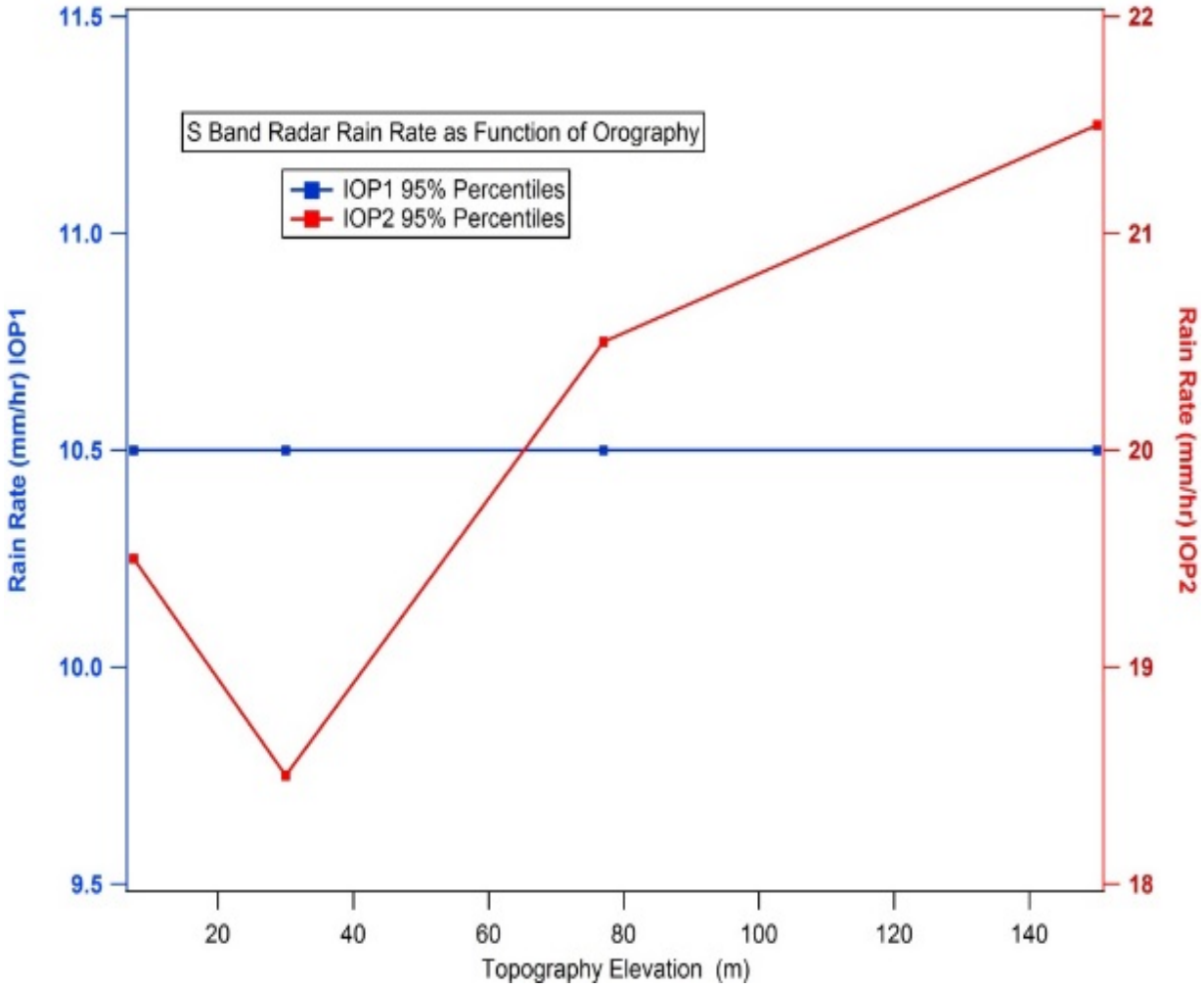




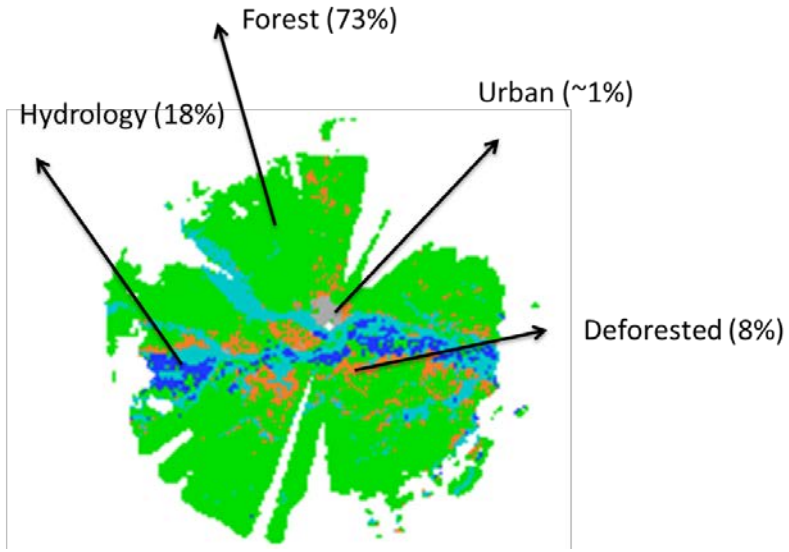


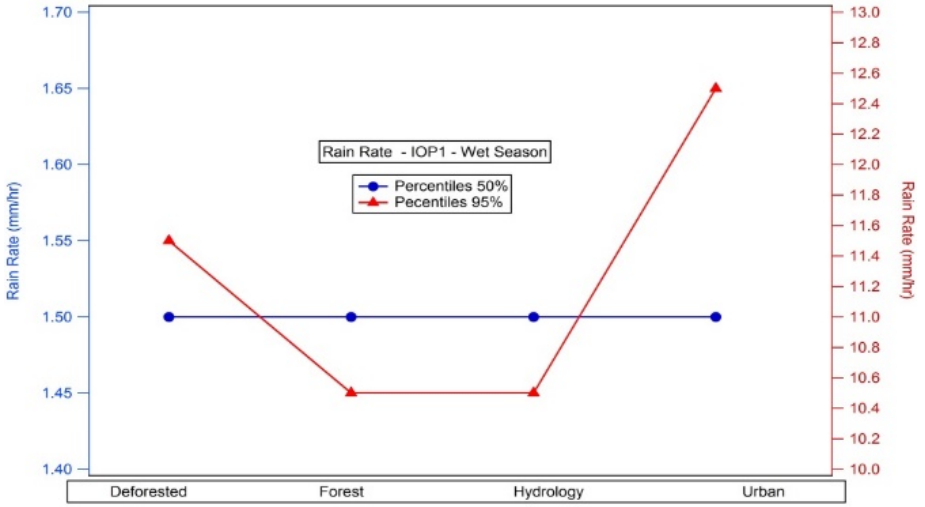
Rain Cell Median Size and Life Time - 7,5 km Diameter – 0,6 Hours Life Time (Ref>20 dBZ)

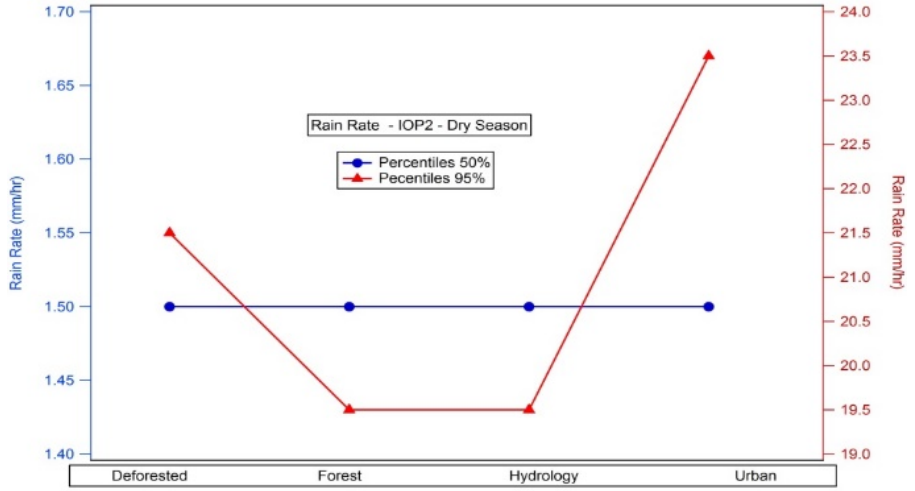
Rainfall and Cloud as Function of Topography – Wet and Dry Season



Rainfall and Cloud as Function of the Surface type

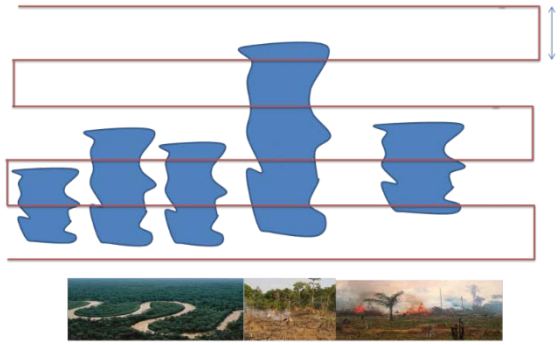


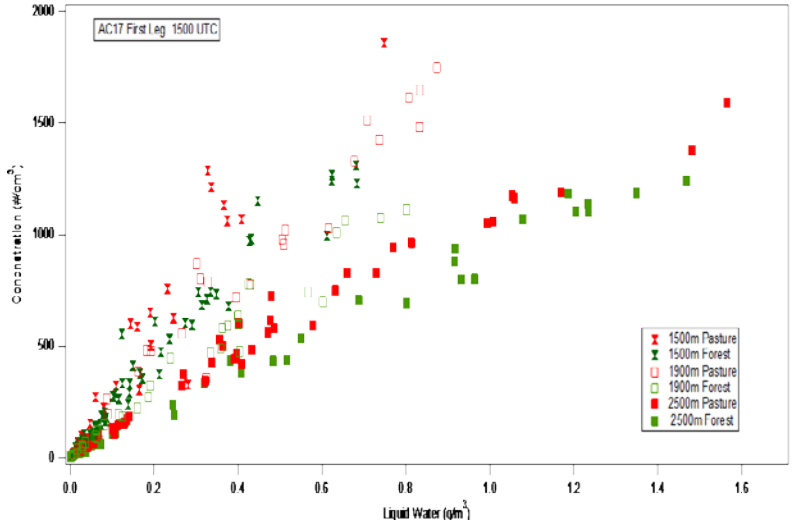




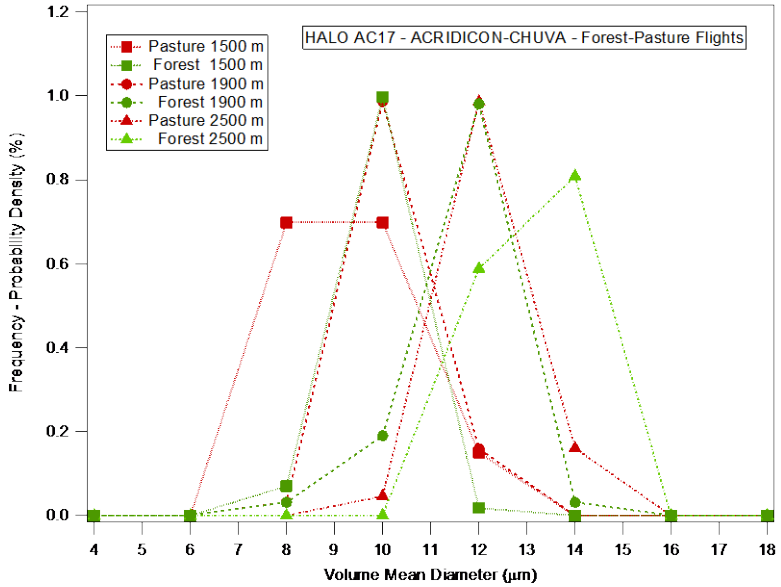
Rainfall and Cloud as Function of the Surface type

HALO – ACRIDICON CHUVA - AC17





Forest – Deforested areas – same level nearly same time (300 s in each leg). Liquid Water Content (LWC) as function of Cloud Droplet Concentration for different Height. ***Forest clearly show small concentration for the same LWC -> Large droplets***



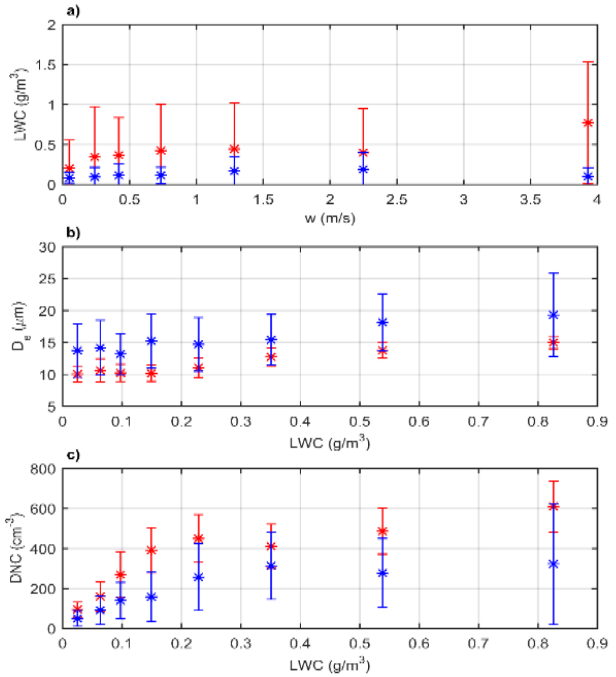
Forest – Deforested areas – same level nearly same time. Cloud droplet diameter for Pasture and Forest Legs. ***Forest has large droplets***.

Rainfall and Cloud Microphysics as Function of the Aerosol

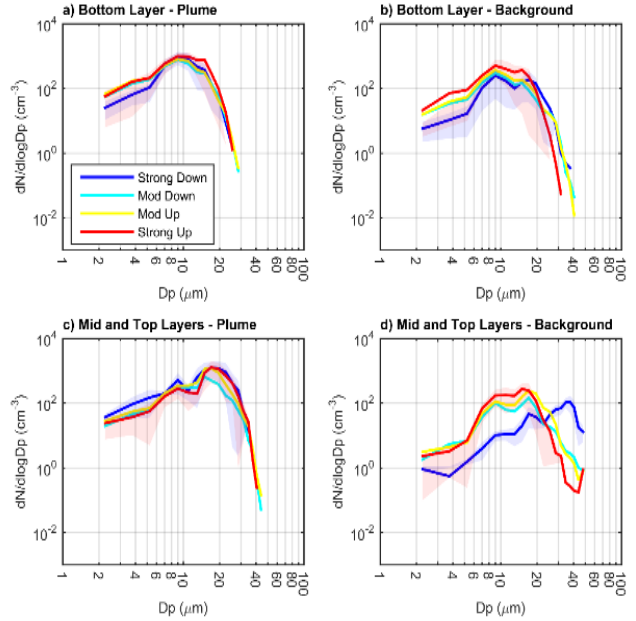
The Effect of Manaus Plume in the cloud microphysics.

First time cloud-aerosol-precipitation is studied during the Amazonas Wet Season and the Effect of Urban pollution in the Amazonas Cloud Properties.

Plume decrease cloud droplet size and increase cloud droplet concentration.



Mean LWC values for different log-spaced w intervals and mean Diameter and Droplet Number Concentration for log-spaced LWC intervals. Blue points indicate background measurements, while red ones are relative to the polluted ones.



Averaged DSDs as function of altitude, vertical motion and aerosol conditions. The shaded areas represent the dispersion between the 25% and 75% for the strong downdrafts (in blue) and updrafts (in red).

Impacts of the Manaus pollution plume on the microphysical properties of Amazonian warm-phase clouds in the wet season. Micael A. Cecchini, Luiz A.T. Machado, Jennifer M. Comstock, Fan Mei, Jian Wang, Jiwen Fan, Jason M. Tomlinson, Beat Schmid, Rachel Albrecht, Scot T. Martin and Paulo Artaxo – ACPD, 2016

Rainfall and Cloud Microphysics as Function of the Aerosol

Several Halo Cloud Profiles
(AC 7,8,9,11,12,13,14,18,19,20)
Only bellow melting layer

$$dlnD_0 \propto \left.\frac{dlnD_0}{dlnCN}\right|_{w,H} + \left.\frac{dlnD_0}{dlnw}\right|_{CN,H} + \left.\frac{dlnD_0}{dlnH}\right|_{CN,w}$$

Vertical Motion

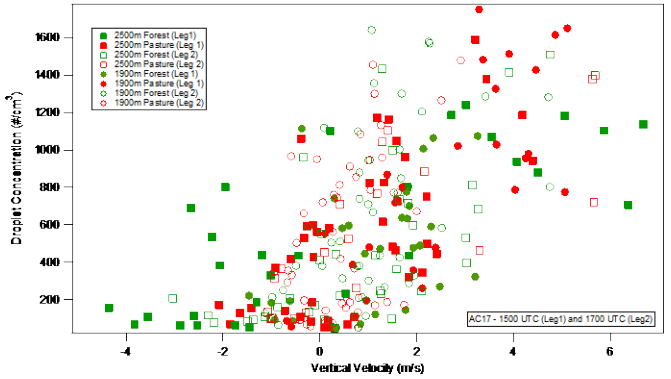
Aerosol Concentration ← | dlnCN | dlnw | dlnH | → Height inside the cloud

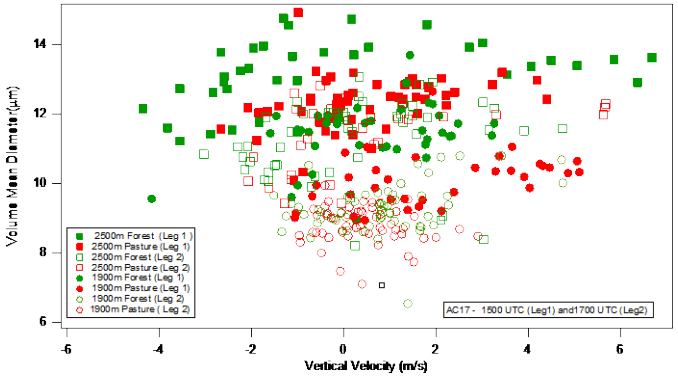
	dlnCN	dlnw	dlnH
Cloud Droplet Diameter ← dlnD₀	-0.30	0.052	0.32
Cloud Droplet Concentration ← dlnCDNC	0.61	0.32	-0.35

Vertical bars indicate which variables are considered constant in the derivatives.

The first term on the right hand side represents the variations observed in the mean volumetric diameter due to changes in Aerosol Concentration with similar w and H conditions.

As the derivatives are considered under the natural logarithm, the results are normalized and can be directly quantitatively compared.





HALO Flight AC17 Forest – Deforested areas – same level nearly same time. Cloud droplet concentration and diameter as function the vertical velocity at different Height

Summary

- Very different thermodynamic and rainfall characteristics behavior between the Seasons
- Typical convective spatial scale for each Season
- Topography effect mainly during dry season for high rain rate
- Influence of vegetation type on high rain rate (urban-deforested)
- Influence of Manaus Plume on cloud process during Wet Season
- Sensitivity of aerosol concentration, vertical motion and height in the cloud diameter and concentration