Aircraft Observations of Aerosol in the Manaus Urban Plume and Surrounding Tropical Forest during GoAmazon 2014/15

John E. Shilling[1], Mikhail S. Pekour[1], Edward C. Fortner[2], Paulo Artaxo[3], Suzane de Sá[4], John M. Hubbe[1], Karla M. Longo[5], Luiz A.T. Machado[6], Scot T. Martin[4,], Stephen R. Springston[7], Jason Tomlinson[1], Jian Wang[7]

[1]PNNL, [2]Aerodyne, [3]University of Sao Paulo, [4]Harvard University, [5]NASA, [6]INPE, [7]BNL

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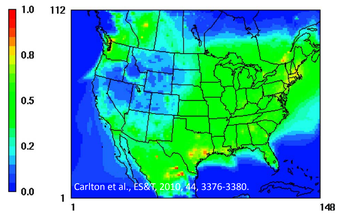
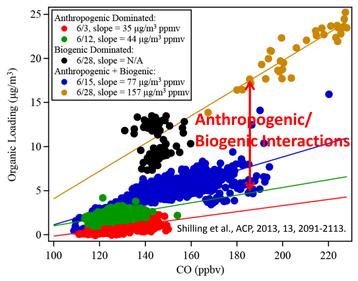
Motivation

- Modeling studies have suggested biogenic SOA formation is enhanced by anthropogenic emissions.
- Field studies have found evidence for this enhancement.
- GoAmazon 2014/5 campaign is an opportunity to investigate this process.
- Manaus urban plume is transported into the pristine background of the Amazon tropical forest.

Anthropogenically-Controlled Biogenic SOA Fraction

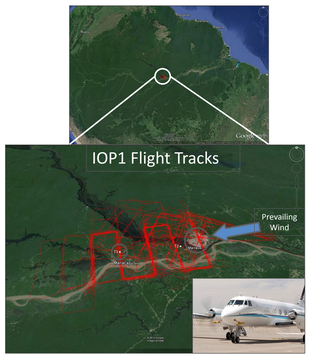


SOA Formation Measurements CARES Field Mission



GoAmazon G-1 Flight Domain and Strategy

- G-1 characterized the Manaus plume as it was transported downwind and interacted with biogenic emissions.
- IOP1 – Wet Season, February 15th – March 26th 2014
  - 16 Flights
- IOP2 – Dry Season, September 1st – October 10th 2014
  - 19 Flights



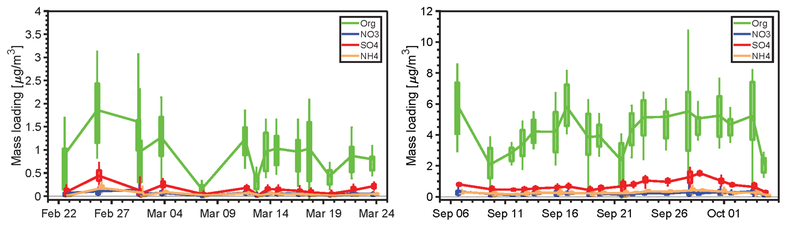
Acknowledgements

This research was supported by the U.S. DOE's Atmospheric System Research (ASR) program via the ICLASS SFA. The GoAmazon 2014/5 field campaign was supported by the DOE's Atmospheric Radiation Measurement (ARM) program.

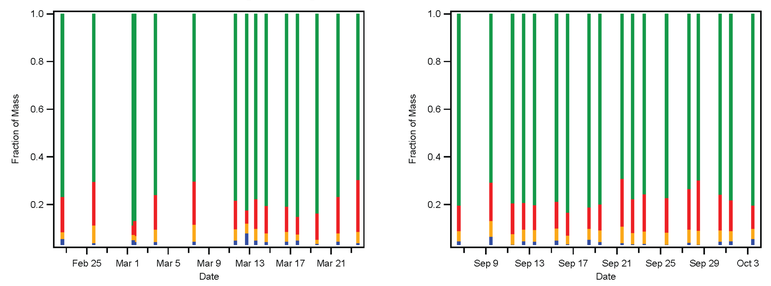
Overview and Comparison of Wet and Dry Season Aerosol

GoAmazon 2014/5 Wet Season — GoAmazon 2014/5 Dry Season

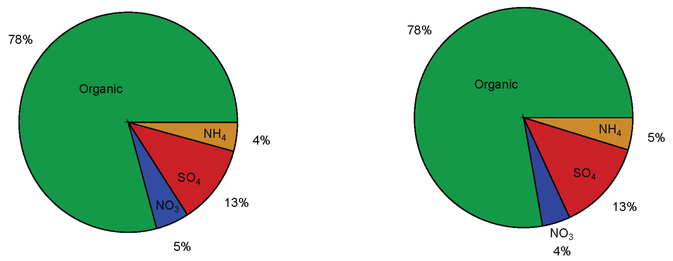
Flight-Averaged Speciated Particulate Mass Loading



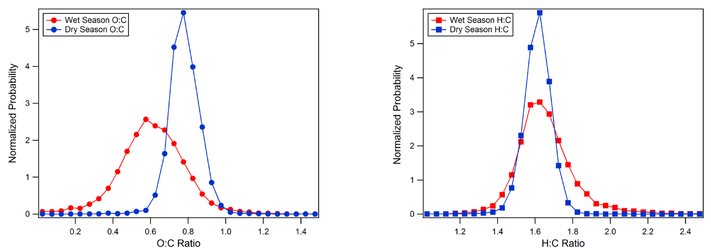
Flight-Averaged Particulate Fractional Composition



Averaged Particulate Fractional Composition

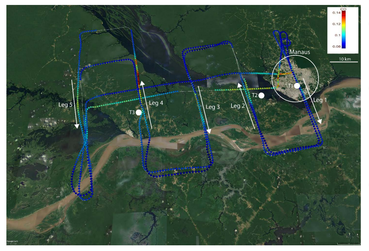


- Absolute loading of species is significantly higher in dry season.
- Fractional composition is remarkably constant between seasons.

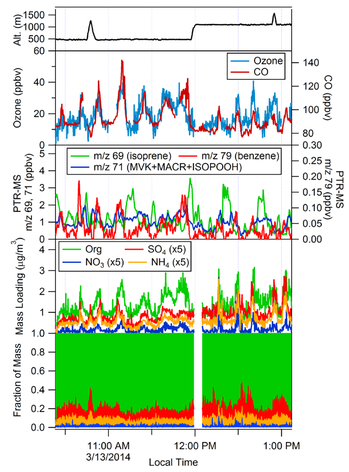


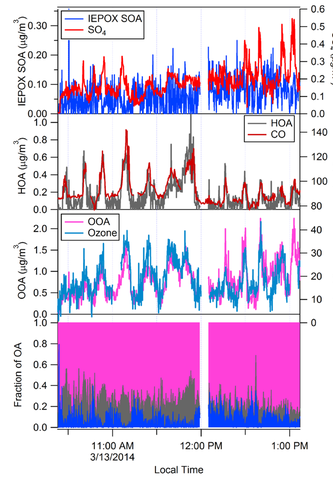
- Organic aerosol chemical composition varies with season.
- Organic H:C is similar between season.
- Organic O:C is significantly higher in dry season, indicating more oxygenated aerosol.

Evolution of the Manaus Plume

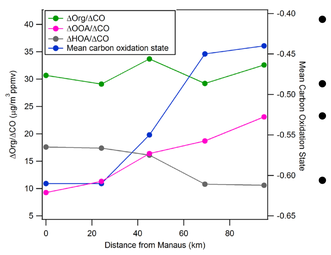


- March 13, 2014 is a golden day for studying plume aging.
- G-1 made successive plume crossings downwind of Manaus.
- Flight captures first 4-5 hours of plume aging.





- Sulfate enhanced in plume, particularly the southern edge.
- Aerosol loading is enhanced in the plume, particularly OA.
- Isoprene depleted in the plume, though still present.
- HOA correlates well with CO.
- OOA correlates well with ozone.



- OA becomes more oxidized with aging.
- ΔHOA/ΔCO decreases with aging.
- ΔOOA/ΔCO increases with aging, indicating SOA formation.
- Loss of HOA is balanced by formation of OOA resulting in constant ΔOA/ΔCO.

Conclusions

- Aerosol loading much higher in dry season.
- OA was more oxidized in the dry season.
- On March 13, 2014flight, ΔHOA/ΔCO values decreased from 17.6 to 10.6 µg/m^3 ppmv^{-1} after 4-5 hours of aging.
- ΔOOA/ΔCO increased from 9.2 to 23.1 µg/m^3 ppmv^{-1}.
- Loss of HOA is balanced by formation of OOA resulting in constant ΔOA/ΔCO.

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For More Information Contact: John Shilling
John.shilling@pnnl.gov

Shilling et. al., 2018, ACPD, doi.org/10.5194/acp-2018-193

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