

Secondary Organic Aerosol: “Anthropogenic-Biogenic Interactions” Focus Group

Opportunities in Upcoming Field Campaigns for Data Sets Relevant to the Focus Questions

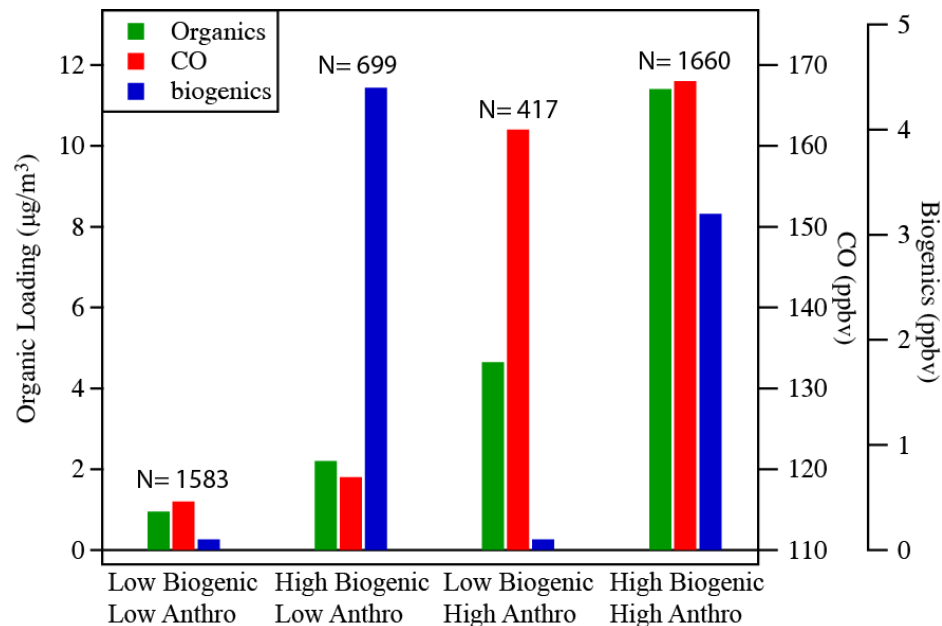
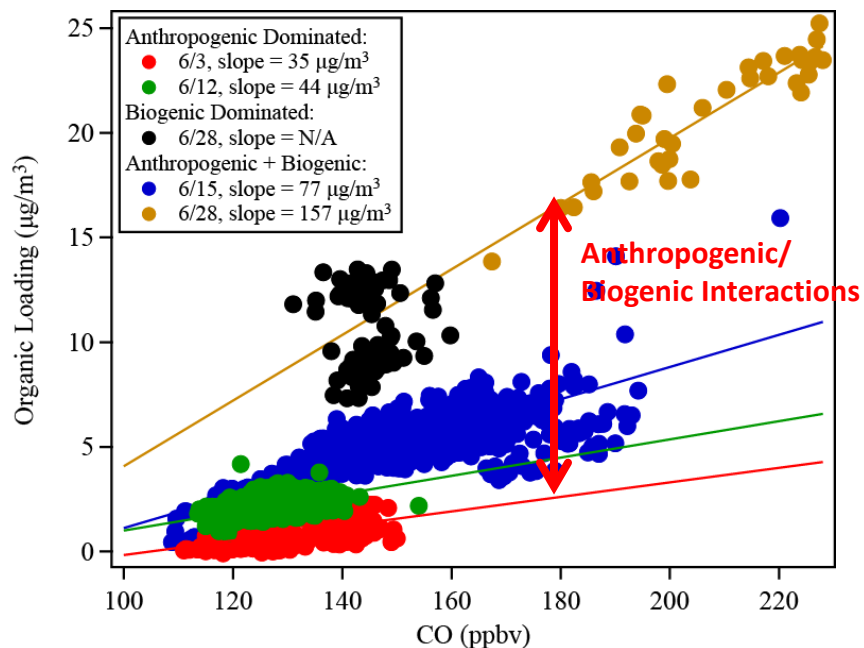
By bringing together scientists, we intend to:

(1) collect and analyze field data to understand when and where anthropogenic-biogenic interactions occur in the ambient atmosphere; (2) investigate and understand the mechanisms responsible for these interactions both in the gas and condensed phase using field data and laboratory SOA studies, which should inform each other to yield a cohesive and testable framework of understanding; (3) ~~develop accurate and efficient representations of these processes that can be implemented in models, and~~ (4) ~~investigate the implications these interactions have on climate and how they will be altered with changes in future climate.~~

Specifically, the Focus Group will address three high-priority aspects as **Focus Questions:**

- (**focus 1**) the fate of organic peroxy radicals in the gas phase, as affected by anthropogenic activities, and the impact of any modified fates on SOA production and subsequent climate-relevant SOA properties (i.e., size distributions and optical properties),
- (**focus 2**) the physical state of organic aerosol as affected by anthropogenic activities and the resulting impacts on SOA production and subsequent climate-relevant properties of the modified aerosols, and
- (**focus 3**) particle-phase reactions as affected by anthropogenic activities and subsequent climate-relevant SOA properties.

CARES 2010: Increased SOA production from anthropogenic-biogenic interactions



Enhanced SOA formation found when both anthropogenic and biogenic emissions mixed together compared to scenarios where these emissions did not mix.... **Why? Analyze data in relationship to three focus questions.**

Reference: Shilling, J. E. et al., Enhanced SOA formation from mixed anthropogenic and biogenic emissions during the CARES campaign, *Atmos. Chem. Phys.*, 2013.

BBOP: Biomass Burn Observation Project

Focused on the time evolution of biomass burning aerosols

Objectives depend on day to day changes in occurrence of fires.

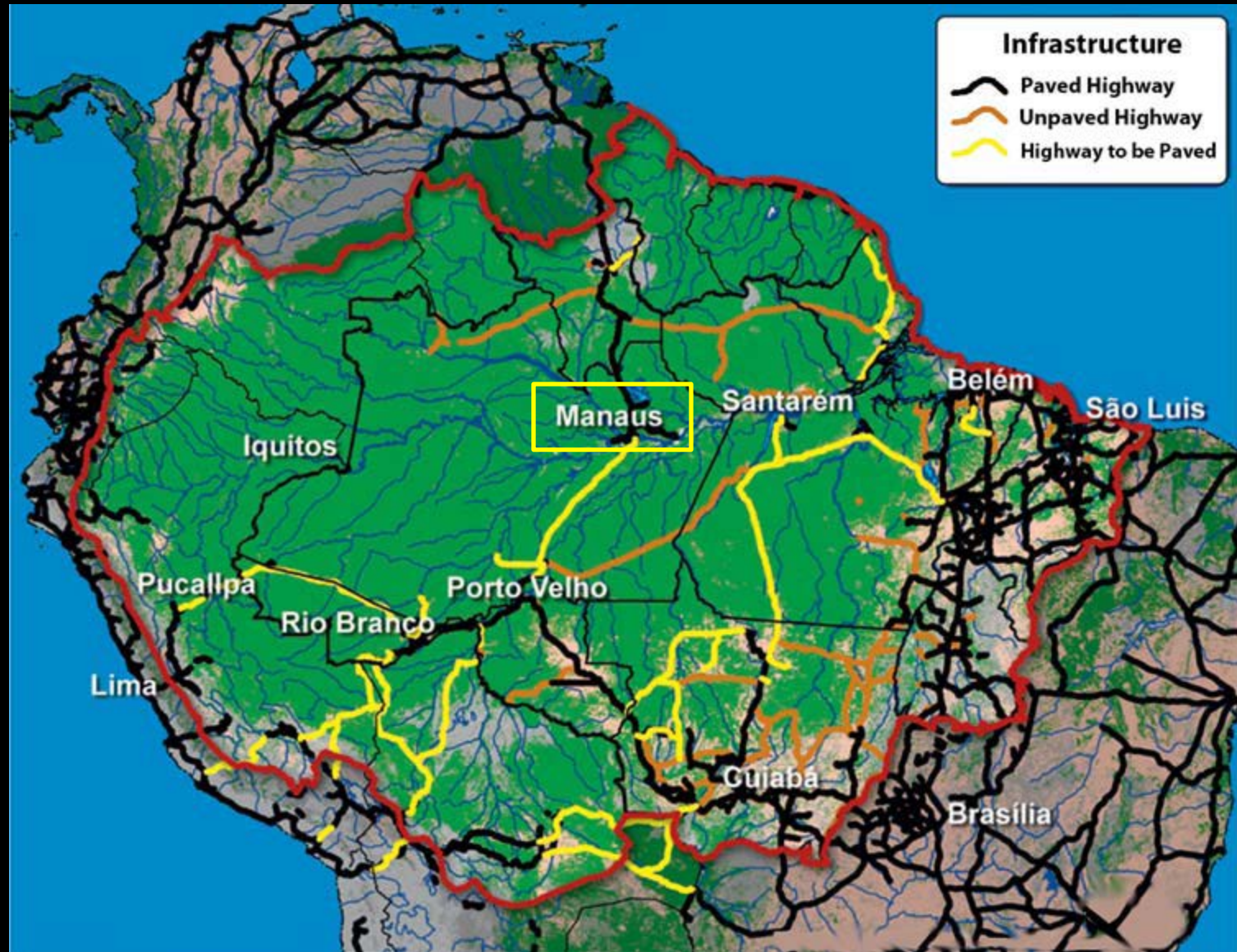
- Sampling of wildfires or prescribed burns in the near-field
 - Sampling of older biomass burn plumes
 - Conduct studies that contrast the behavior of soot/BC/brown carbon/etc from fires with emissions from urban areas, namely Portland, OR. With same instruments SOA will be studied. The Portland plume very quickly runs into regions with very high terpene emission rates. So, this will look like CARES, except terpenes in place of isoprene. Anthropogenic-biogenic interactions.
-

Experimental strategy follows closely that of CARES.

Measurements will be made in regions with varying degrees of anthropogenic impacts. SOA yields, SOA/O₃ and O₃/NO_z relations, size distributions, light scattering and absorption → Focus Questions #1

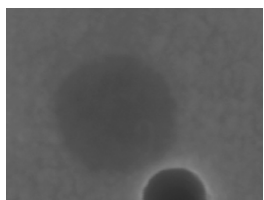
Hygroscopicity → Focus Questions #2

GoAmazon2014/5: Site Location



AMAZE08: Dominance of Secondary Organic Material in Submicron Particles

1. SEM



2. AMS

O:C of 0.4 to 0.5, consistent with chamber SOA particles

3. CCN

Measured CCN activity accurately predicted using $\kappa_{\text{organic,SOA}}$ from lab results

4. AMS

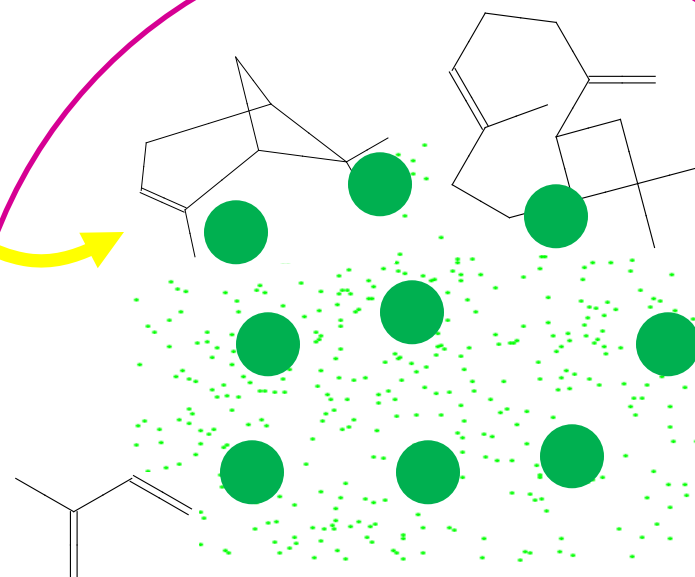
Similarity of measured mass spectra to those chamber SOA particles

5. AMS

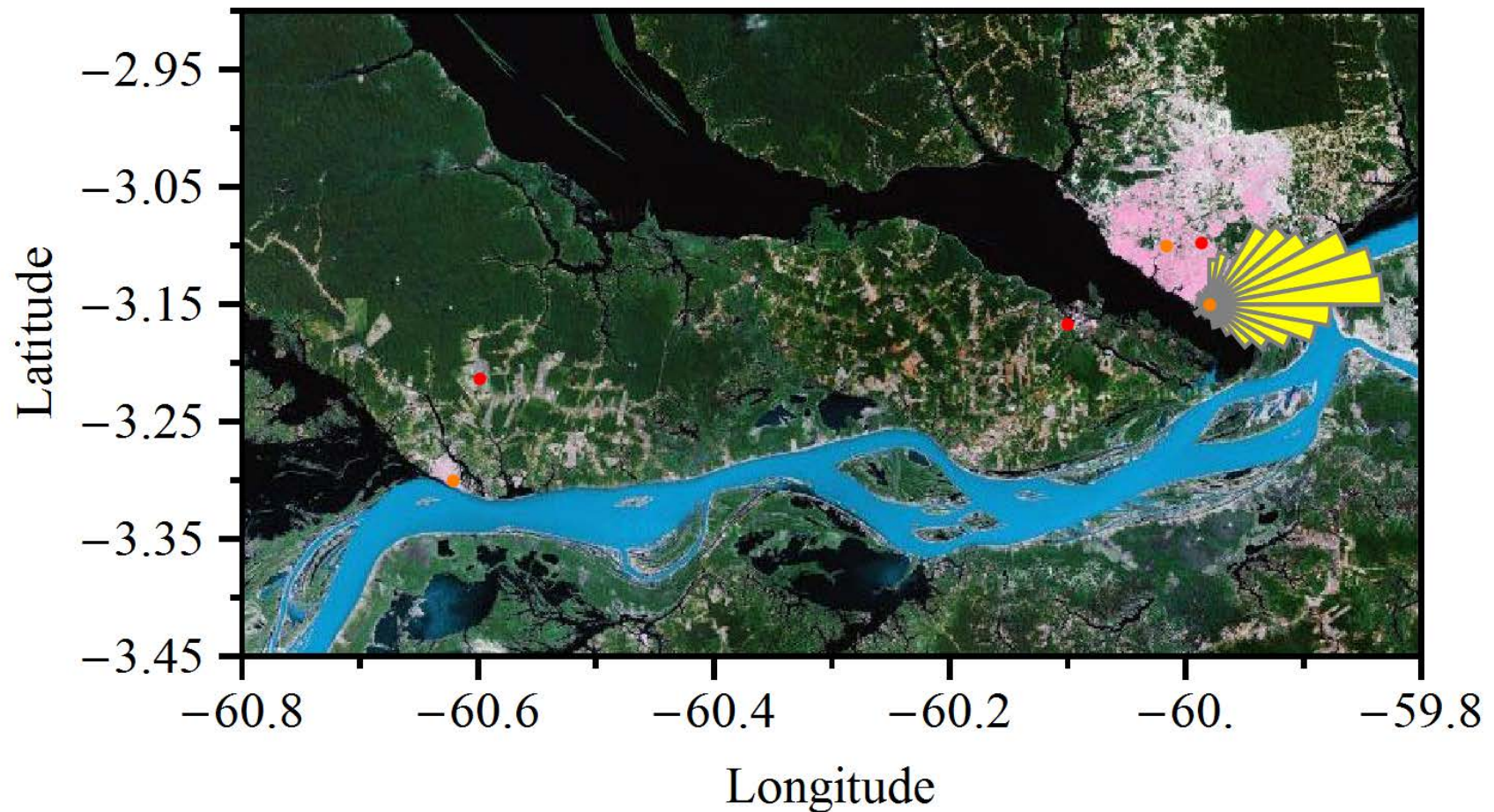
Absence of features for PBAPs

TT34

OH
NO₃
O₃

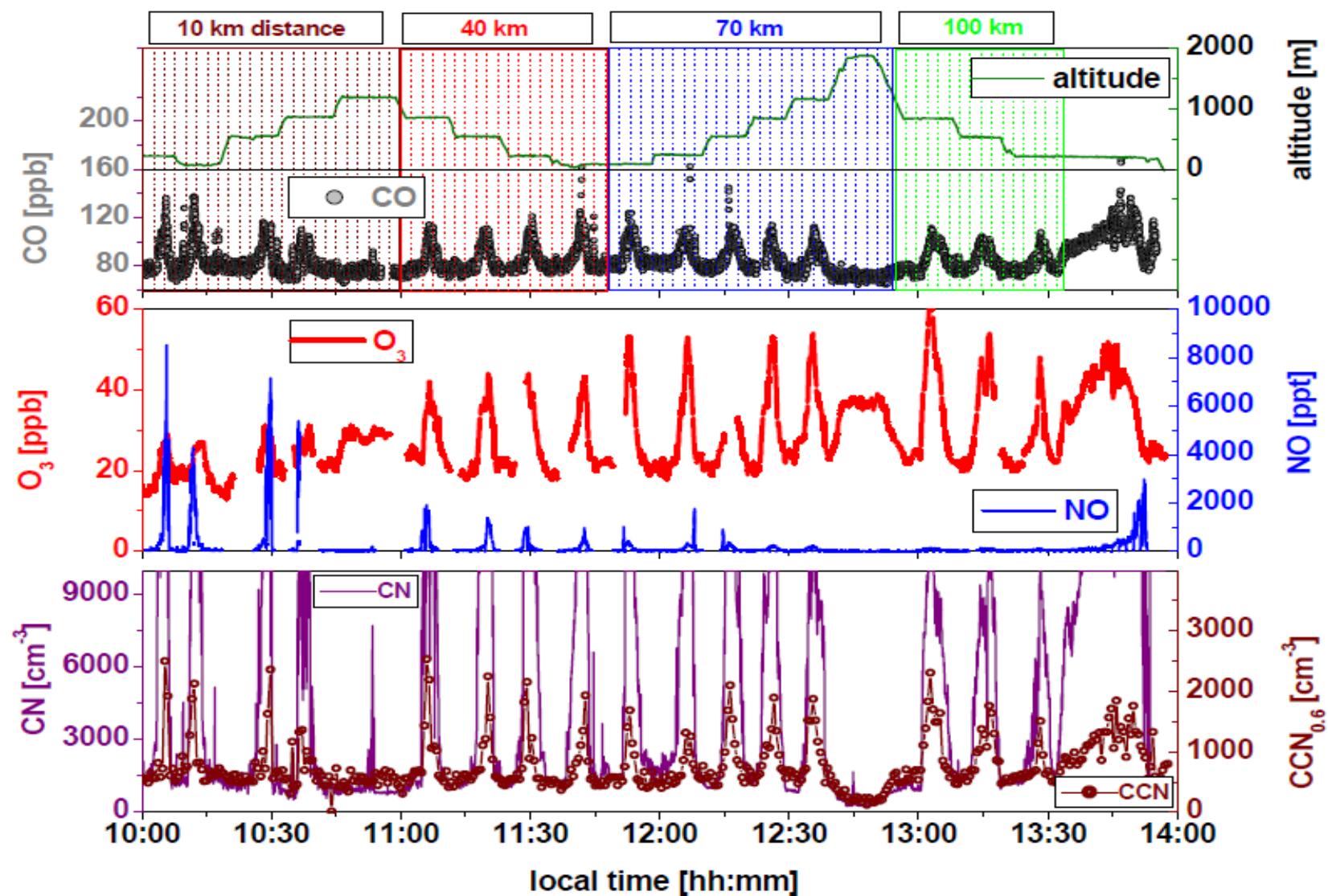


Downwind of Manaus



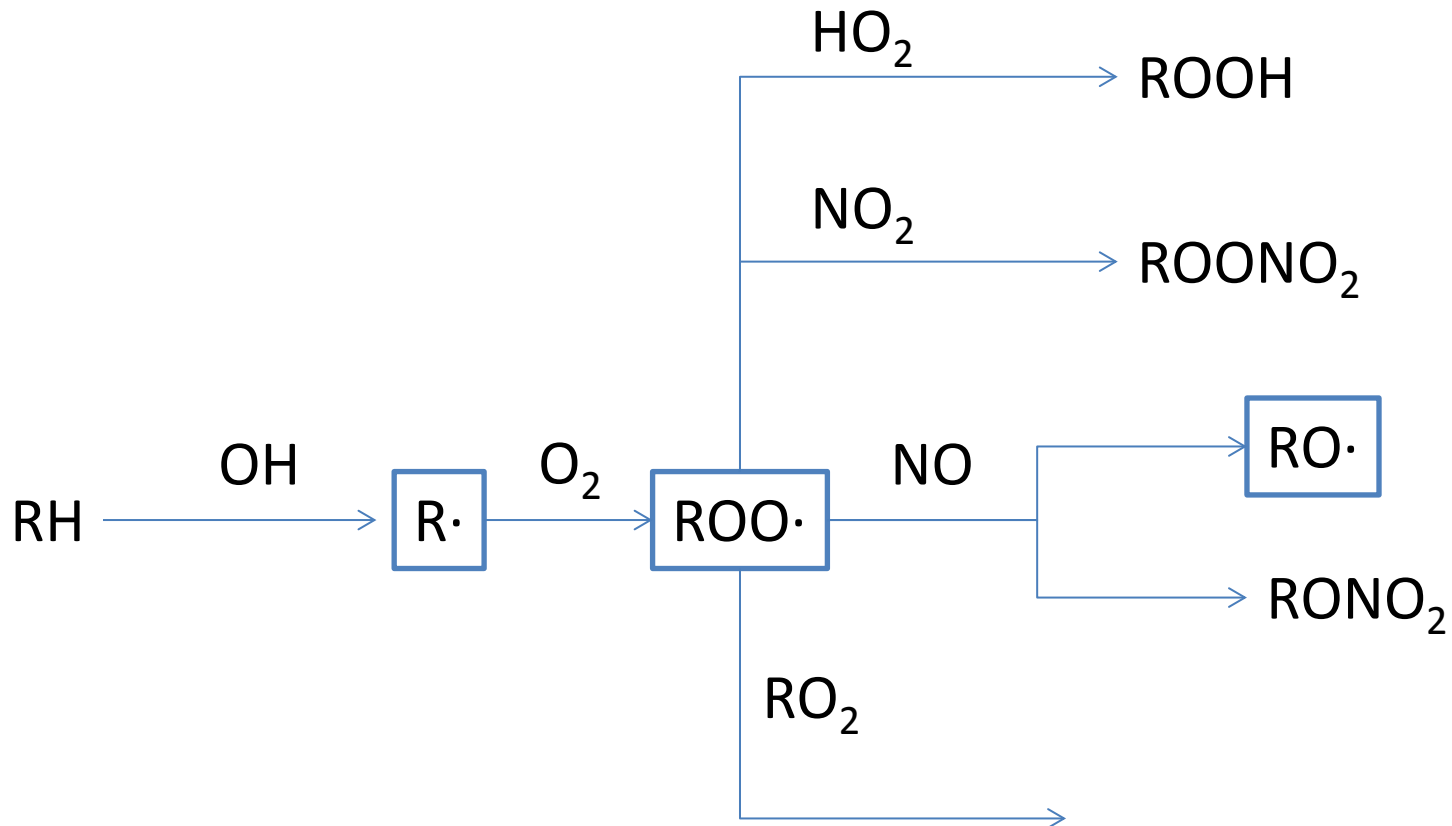
(-3.21328, -60.5987)	DOE ARM ACRF	T3
(-3.16667, -60.1)	TBD	T2
(-3.09722, -59.9867)	INPA/UEA	T1
(-2.14663, -59.005)	ATTO	T0
(-2.60908, -60.2093)	K34	K34
(-2.59458, -60.2093)	AMAZE08	TT34

- 111 by 60.8 km represented by this box.
- Wind speeds at 1 km altitude are typically 10 to 30 kph.
- T2→T3 transit time of 2 to 6 hr.



Reference: Kuhn, U.; Ganzeveld, L.; Thielmann, A.; Dindorf, T.; Welling, M.; Sciare, J.; Roberts, G.; Meixner, F. X.; Kesselmeier, J.; Lelieveld, J.; Ciccioli, P.; Kolle, O.; Lloyd, J.; Trentmann, J.; Artaxo, P.; Andreae, M. O., "Impact of Manaus City on the Amazon Green Ocean atmosphere: Ozone production, precursor sensitivity, and aerosol load," *Atmos. Chem. Phys.* **2010**, *10*, 9251-9282.

The chemistry can be completely shifted under anthropogenic influences... NO_x concentration, $\text{SO}_2/\text{H}_2\text{SO}_4$ particles



GoAmazon2014: Secondary Organic Aerosol (SOA) formation: Interactions of Biogenic and Anthropogenic Emissions

Key Scientific Questions:

- What are the effects of urban emissions of NO_x , VOCs, SO_2 and H_2SO_4 formation on SOA production and particle properties in an otherwise natural region? → **Focus Questions #1, #2, and #3**
- What are the influences of revised BVOC oxidation mechanisms (especially isoprene) on SOA production? → **Focus Question #1**

Secondary Organic Aerosol: “Anthropogenic-Biogenic Interactions” Focus Group

Opportunities in Upcoming Field Campaigns for Data Sets Relevant to the Focus Questions

By bringing together scientists, we intend to:

(1) collect and analyze field data to understand when and where anthropogenic-biogenic interactions occur in the ambient atmosphere; (2) investigate and understand the mechanisms responsible for these interactions both in the gas and condensed phase using field data and laboratory SOA studies, which should inform each other to yield a cohesive and testable framework of understanding; (3) ~~develop accurate and efficient representations of these processes that can be implemented in models, and~~ (4) ~~investigate the implications these interactions have on climate and how they will be altered with changes in future climate.~~

Specifically, the Focus Group will address three high-priority aspects as **Focus Questions:**

(**focus 1**) the fate of organic peroxy radicals in the gas phase, as affected by anthropogenic activities, and the impact of any modified fates on SOA production and subsequent climate-relevant SOA properties (i.e., size distributions and optical properties),

(**focus 2**) the physical state of organic aerosol as affected by anthropogenic activities and the resulting impacts on SOA production and subsequent climate-relevant properties of the modified aerosols, and

(**focus 3**) particle-phase reactions as affected by anthropogenic activities and subsequent climate-relevant SOA properties.