

# Request for LAOF facilities in support of SOAS: Southern Oxidant and Aerosol Study

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**Facilities requested:** ISS, ISFS, CIRPAS Twin Otter

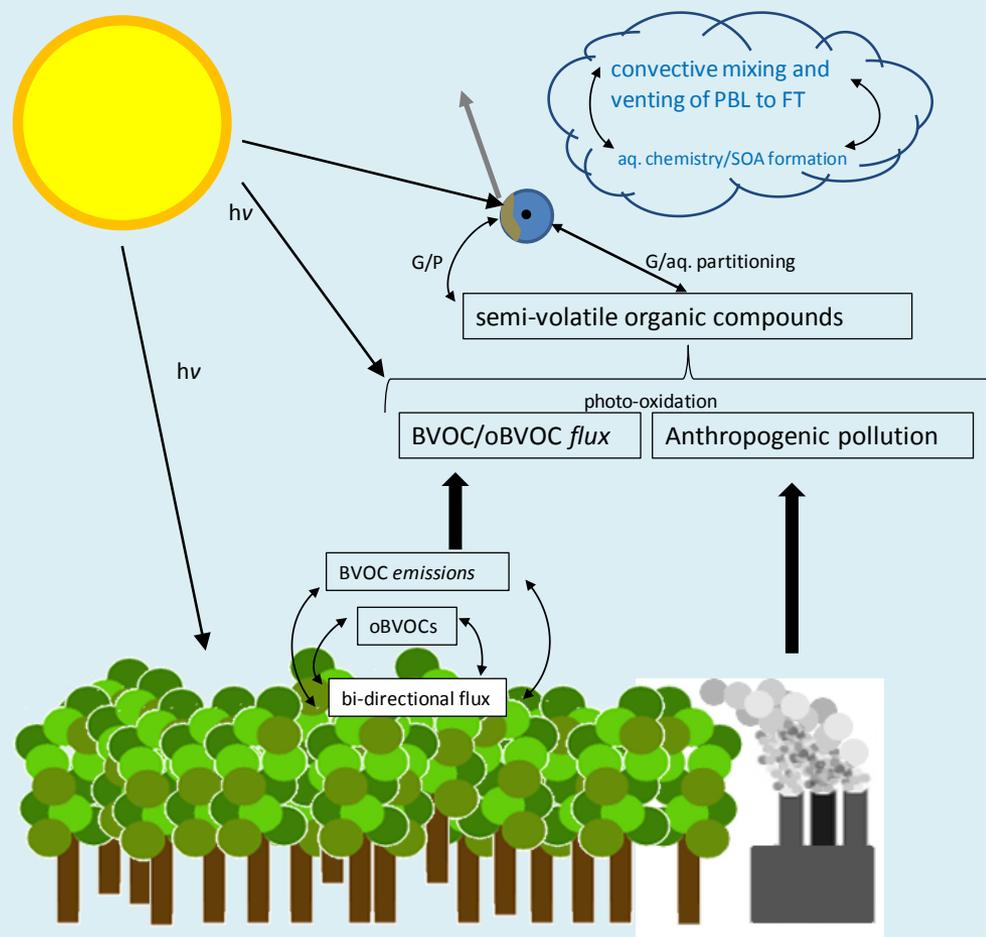
**Proposed dates:** July 2013

**Location:** Southeastern U.S.

**Previous EOL support in past 5 years:**

CHATS, BEACHON-ROCS

**SOAS Science Objective:** To quantify biogenic emissions and anthropogenic pollution interactions and their affect on atmospheric chemistry and subsequently air quality and climate.

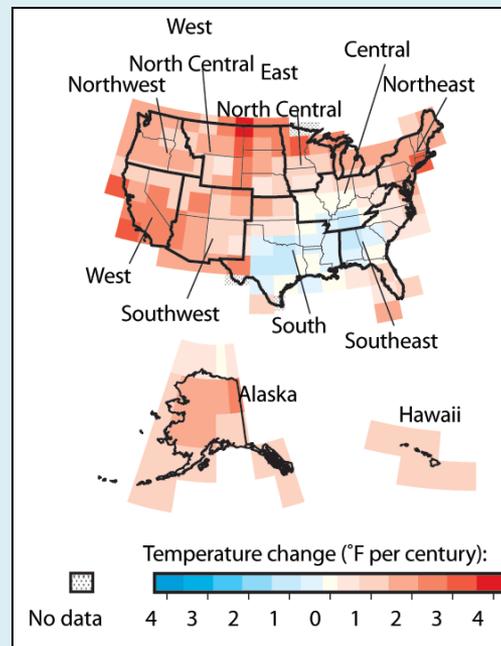


## SOAS Motivation

The warming observed for most of the U.S. has not occurred in the Southeast. The anomaly may be the result of aerosol produced by interactions of biogenic emissions with anthropogenic pollution.

## SOAS Science questions

- 1) What are the magnitudes, variations, and controlling processes for biosphere-atmosphere fluxes of oxidants and reactive carbon and nitrogen across spatial scales relevant for regional models?
- 2) What are the chemical and physical processes that control the oxidation of BVOC? How do anthropogenic emissions alter the distribution of the BVOC oxidation products, and what are the implications for the formation of ozone, reactive nitrogen, and aerosol precursors?
- 3) To what extent do anthropogenic influences impact biogenic SOA formation?
- 4) How does aqueous chemistry of BVOCs in clouds and wet aerosols influence atmospheric SOA?
- 5) What are the climate-relevant properties of biogenic aerosol?



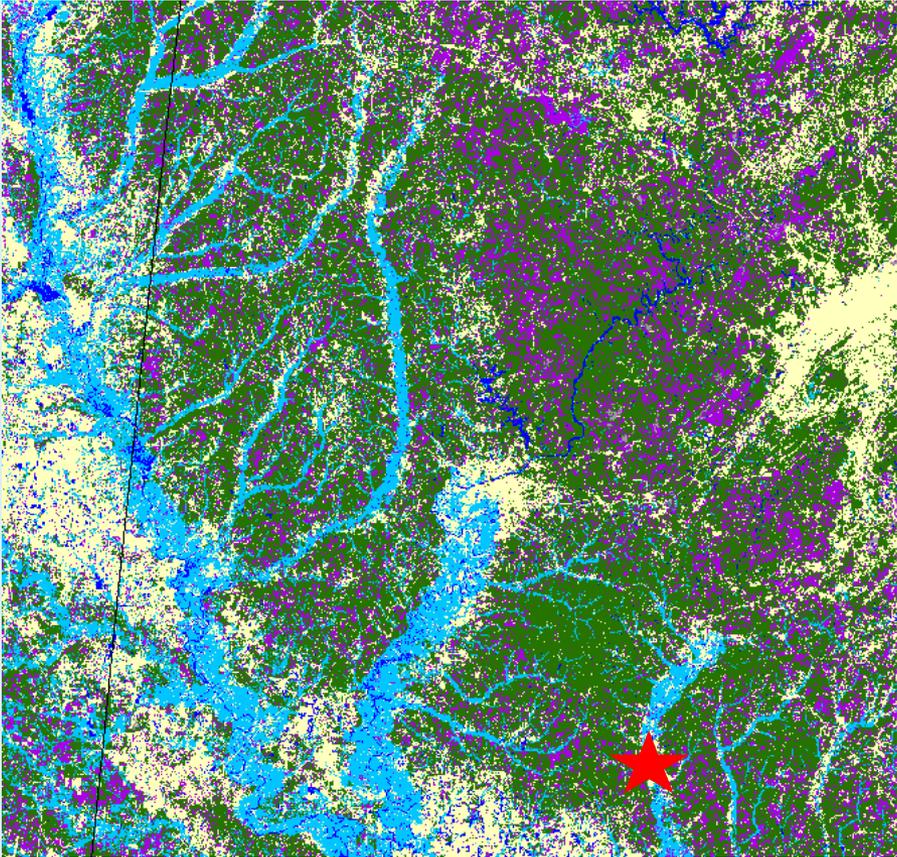
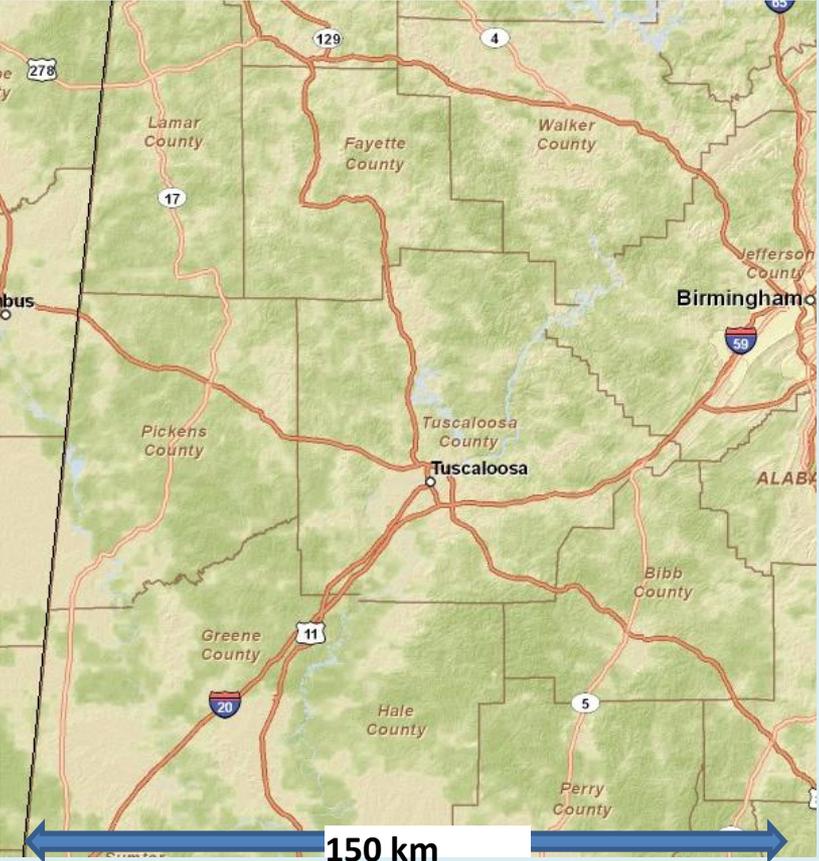
*Annual mean temperature anomalies 1901-2005. Figure courtesy of U.S. EPA*

# SOAS Hypotheses and Experiments

- Ground experiment: Canopy and boundary layer measurements (ISS, ISFS)
- *Secondary organic aerosol yields are significantly higher when BVOC are oxidized in an atmosphere impacted by anthropogenic emissions.*
  - *The BVOC oxidation schemes used in existing regional and global models do not accurately represent the processes controlling regional oxidants and aerosols.*
  - *Substantial chemical processing of BVOC takes place within the forest canopy leading to the release of oxidized VOC products into the atmosphere.*
  - *There is no missing OH sink in an isoprene dominated atmosphere if isoprene oxidation products are fully accounted for.*

- Aircraft experiment: Boundary layer measurements (CIRPAS Twin Otter)
- *Emission models do not include all sources of biogenic VOC and NO. There exist additional biogenic VOC and NO sources which have not yet been identified.*
  - *Regional scale monoterpene and methanol emissions, but not isoprene, are more correlated with variations in foliar density than with species composition.*
  - *Bottom-up BVOC emission estimates can be reconciled with observed boundary layer concentrations and satellite data products when using accurate descriptions of chemical transformations (e.g. OH driven loss rates) and transport dynamics.*
  - *Chemistry can impact the variance of a scalar in the boundary layer and lead to significantly modified top-down bottom-up diffusion functions.*

Distribution of the four major landcover types around Tuscaloosa: lowland forest (light blue), upland forest (green), evergreen plantation (purple), cropland and urban (yellow). Water is dark blue. Red Star is the flux tower site

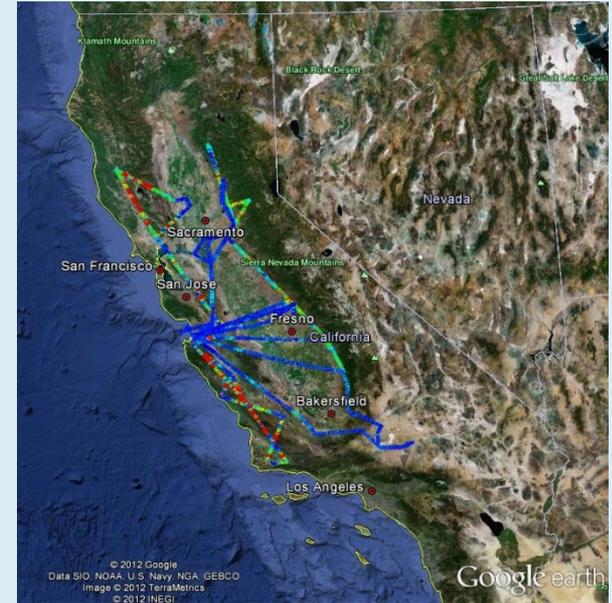


# CABERNET

California Airborne BVOC Emission Research in Natural Ecosystem Transects

*Pawel Misztal, Thomas Karl, Alex Guenther, Haf Jonsson, and Allen Goldstein*

## California, June 2011



### Summary:

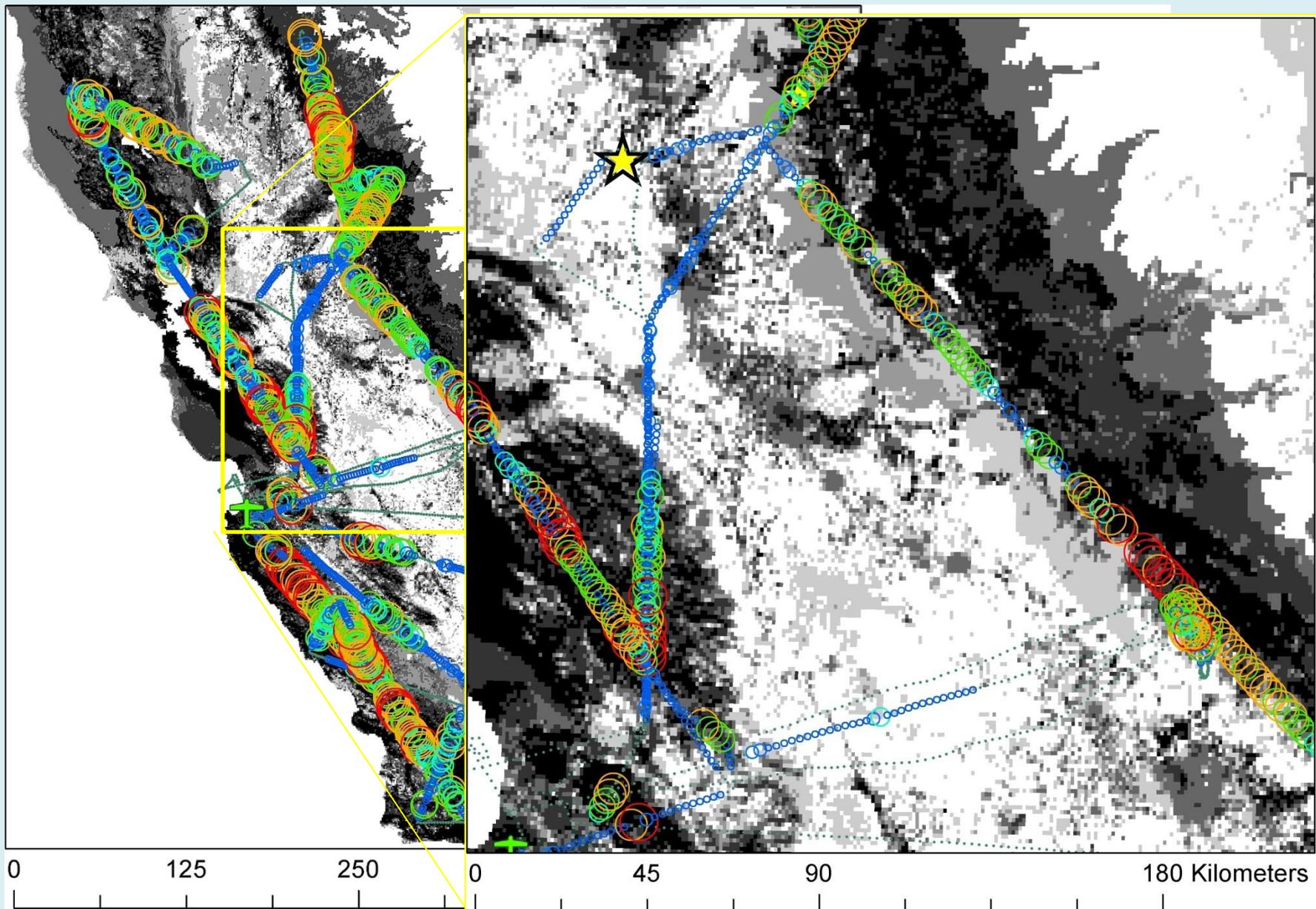
Eight research flights  
About 10.000 km sampled

**PTR-MS in vDEC flux mode**  
**3-5 masses per flight at 10 Hz**

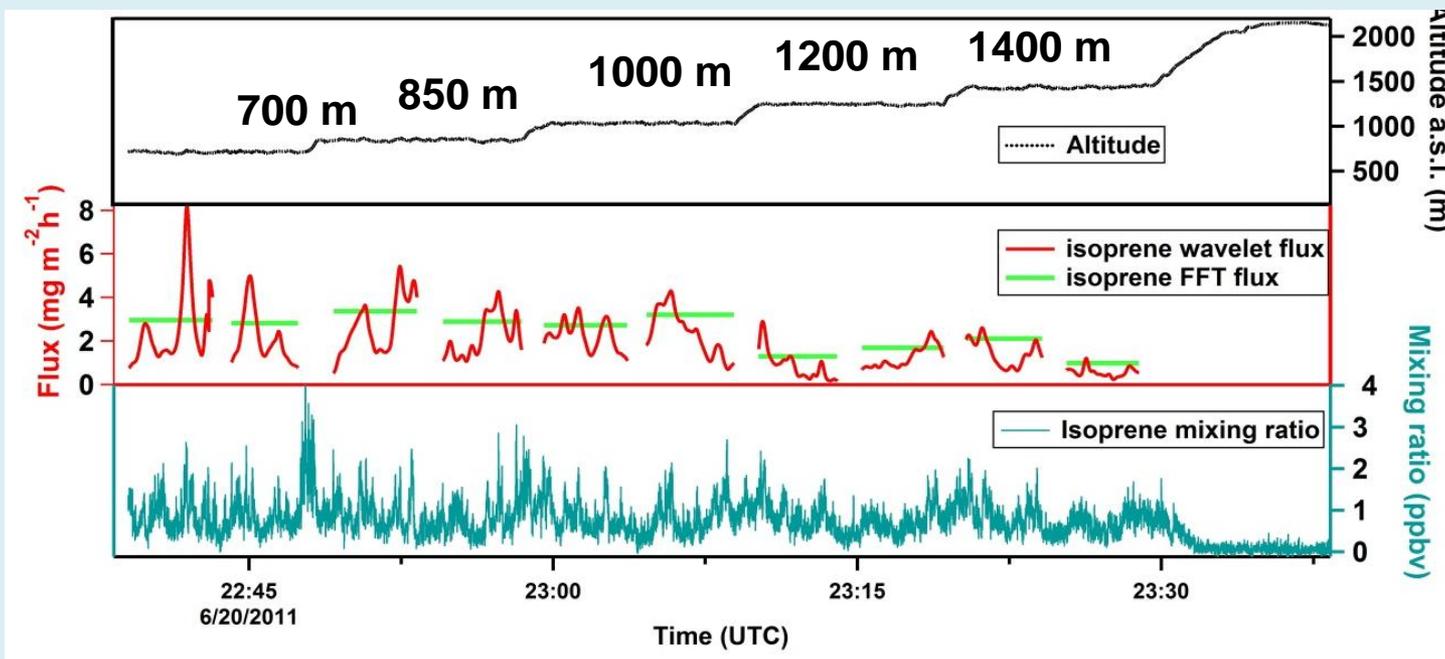
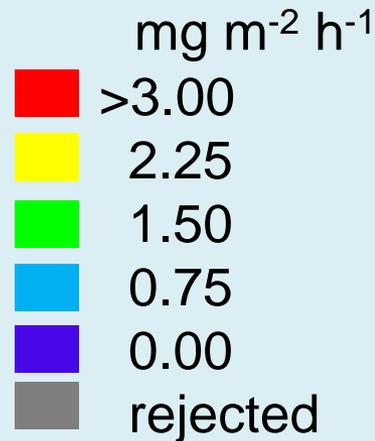
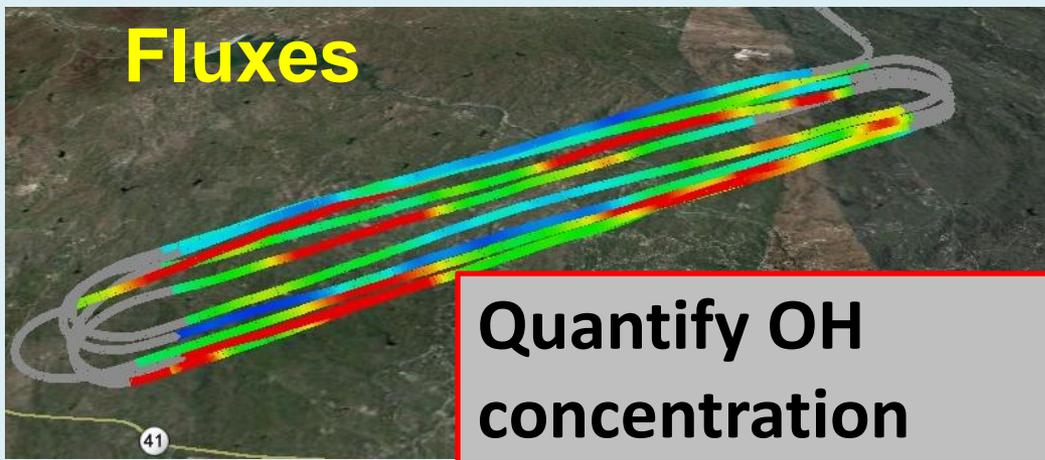
### Payload:

VOCs (PTRMS, cartridges)  
Methane, CO<sub>2</sub> (Picarro)  
Ozone (fast and slow (2B))  
3d Winds and complete micromet

# Airborne Flux flights: 1. transects



# Airborne Flux flights: 2. "Racetrack" BL profiling



John Mak light aircraft: ~150 flight hours  
vertical profiling with WASP and analysis on PTR-TOFMS  
-Relaxed Eddy Accumulation

