Southeast Atmosphere Study (SAS) Data Meeting

March 31 – April 2, 2014

Southeast **A**tmosphere **S**tudy (SAS) Data Meeting

Program Printed version or →

Talks Please leave ~5 min for questions

Posters Two different poster sessions

All results are preliminary and not to be quoted outside this room.
Informal discussion is encouraged. Please ask questions!

Lunch Lobby of CG1
Three break-out groups during lunch on Monday

Wi-Fi UCAR Guests – password = nenvubgathi

Social hour Tuesday at 7 PM, FATE Brewing Company

Selected Results from the NOAA SENEX Study

J. de Gouw, C. Warneke, M. Trainer, D. Parrish, D. Fahey, D. Murphy, A. Ravishankara
R. Ahmadov, K. Aikin, J. Brioude, C. Brock, S. Brown, B. Dube, M. Dumas, P. Edwards,
G. Frost, J. Gilman, T. Gordon, M. Graus, J. Holloway, G. Hubler, D. Lack, A. Langford,
D. Law, B. Lerner, J. Liao, M. Markovic, S. McKeen, A. Middlebrook, K.-E. Min,
A. Neuman, J. Nowak, J. Peischl, I. Pollack, M. Richardson, J. Roberts, T. Ryerson,
J. Schwarz, P. Veres, N. Wagner, R. Washenfelder, R. Wommack
NOAA Earth System Research Laboratory & CIRES, Univ. of Colorado at Boulder

K. Bougiatioti, J. Lin, A. Nenes, Georgia Tech
G. Wolfe, T. Hanisco, NASA
B. Lee, F. Lopez-Hilfiker, J. Thornton, University of Washington
J. Kaiser, F. Keutsch, University of Wisconsin
J. Mao, L. Horowitz, NOAA GFDL
D. Hughes, A. Jaksich, C. Hatch, Hendrix College
A. Welti, ETH

Studying the Interactions Between Natural and Anthropogenic Emissions at the Nexus of Air Quality and Climate Change

SENEX Science Questions:

1. **What are the emissions of aerosol, aerosol precursors and greenhouse gases?**
   - Biogenic emissions
   - Anthropogenic emissions (point sources, urban, shale gas extraction)
   - Biomass burning emissions

2. **What is the composition and distribution of aerosol?**

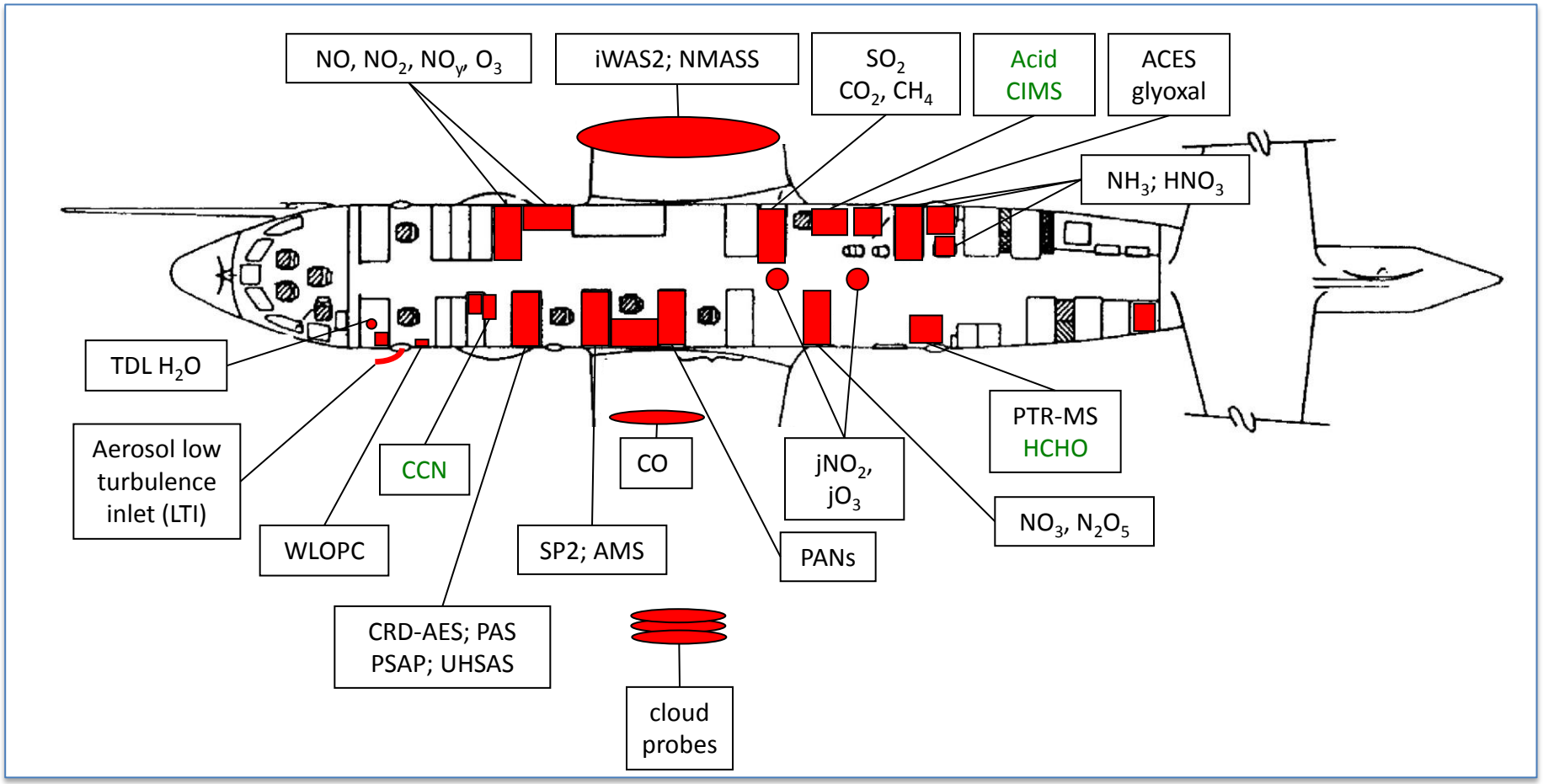
3. **What are the formation mechanisms of secondary species (ozone, sulfate, organics)?**
   - Interaction between biogenic and anthropogenic emissions
   - Net effect of aqueous-phase chemistry
   - Nighttime production

4. **Which deposition processes are critical for determining atmospheric concentrations of trace gases and aerosol?**

5. **What are the climate-relevant properties of aerosol?**
   - Extinction, absorption and CCN properties

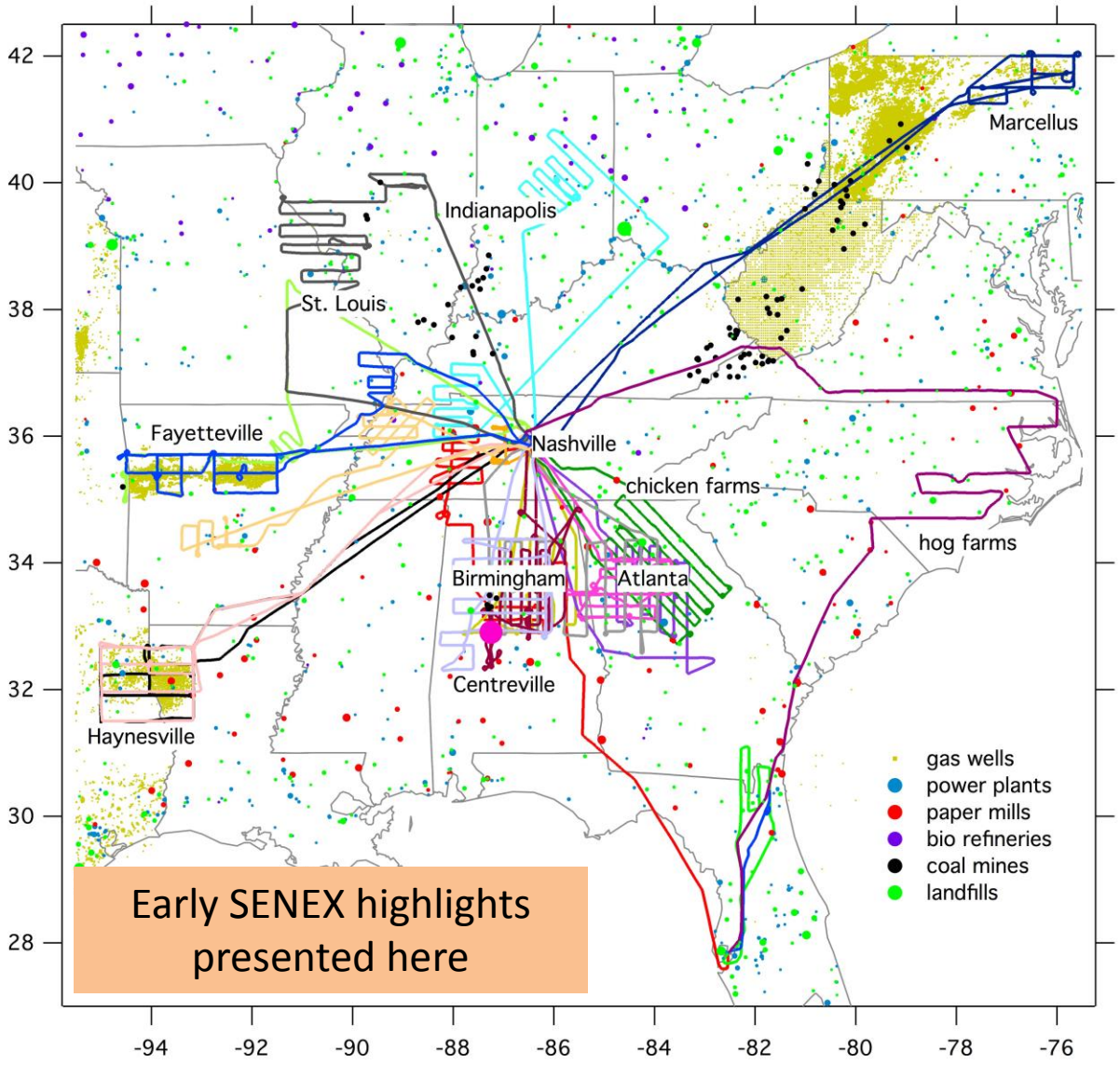
Photo: L. Gratz

SENEX NOAA WP-3 Payload



7900 lbs of scientific equipment for gas- and aerosol phase measurements tailored to answer the SAS/SENEX science questions
http://esrl.noaa.gov/csd/projects/senex/

SENEX Science: 18 flights in the SE United States



Early SENEX highlights presented here

Urban: Atlanta, Birmingham, Nashville, St Louis, Indianapolis

Power plants: EC Gaston, Scherer, Johnsonville, … (coal and gas)

Shale gas: Haynesville, Marcellus, Fayetteville

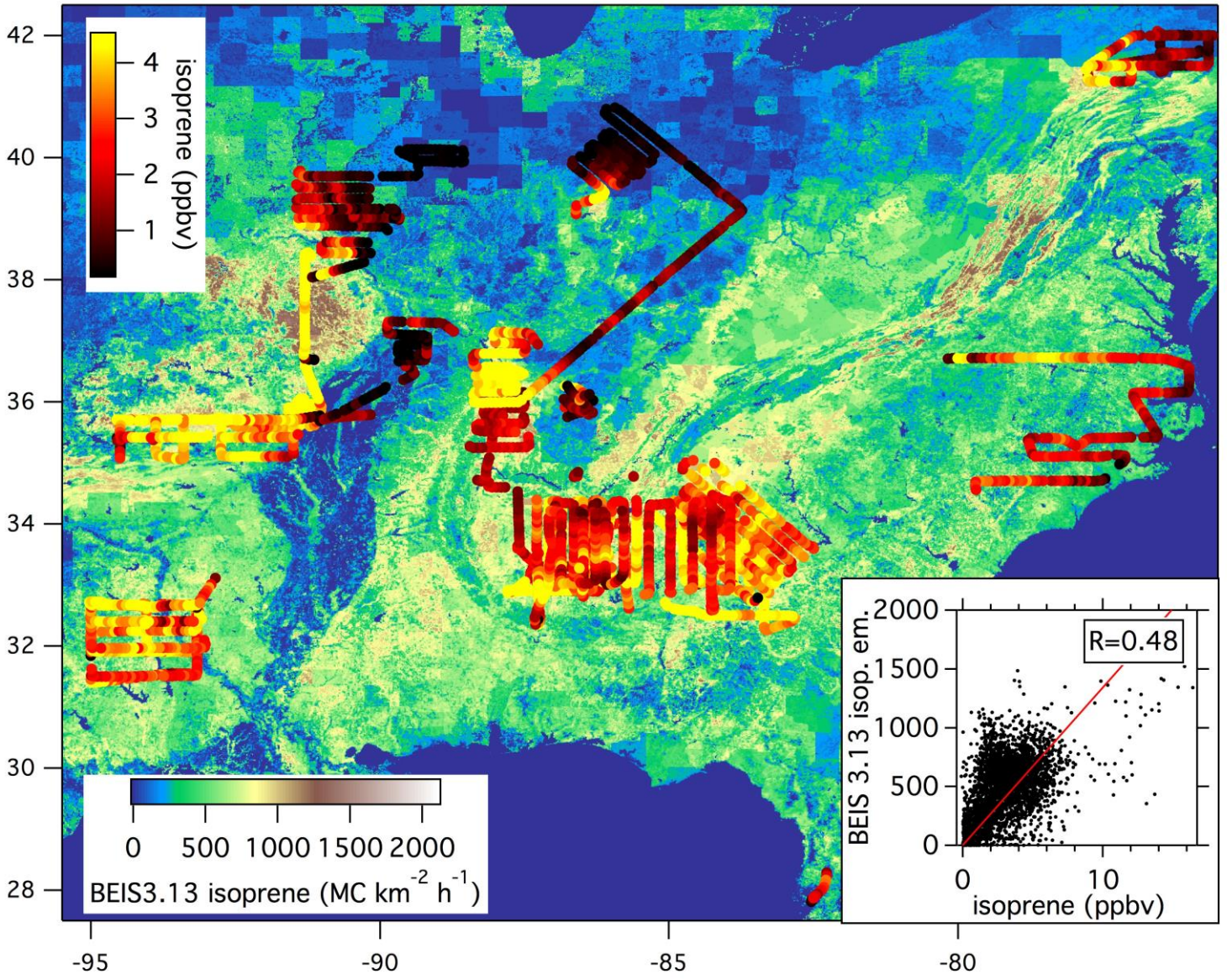
Biogenic: Ozarks, with high NO_x, at night

Night: Atlanta, Birmingham, fire, power plants

Inter-comparison: C-130, Centreville site

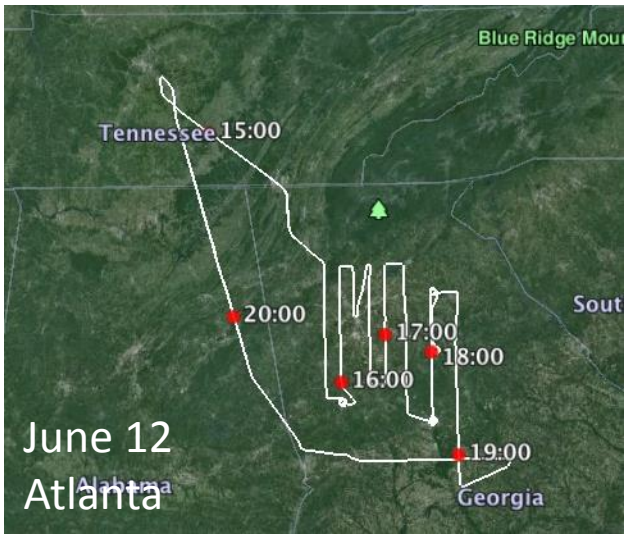
Bio Refineries
Paper mills
Coal Mines
Landfills
Chicken and hog farms

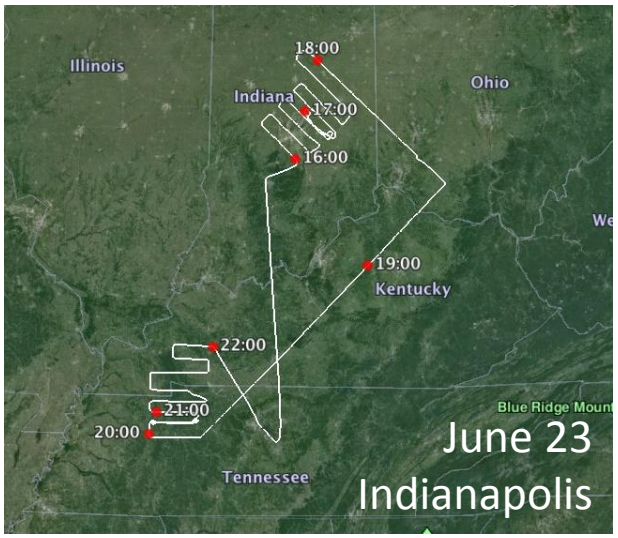
Emissions: Isoprene Measurements and Inventory

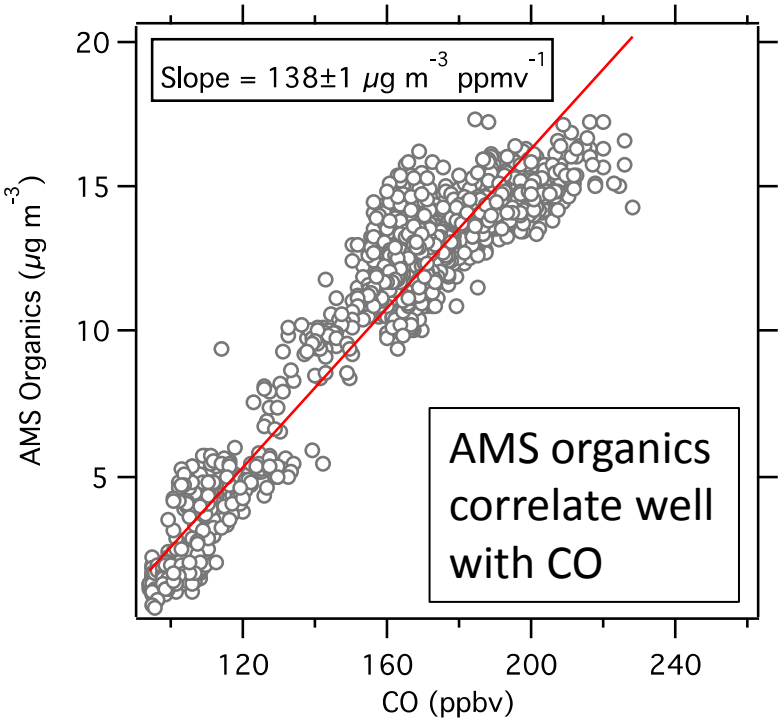


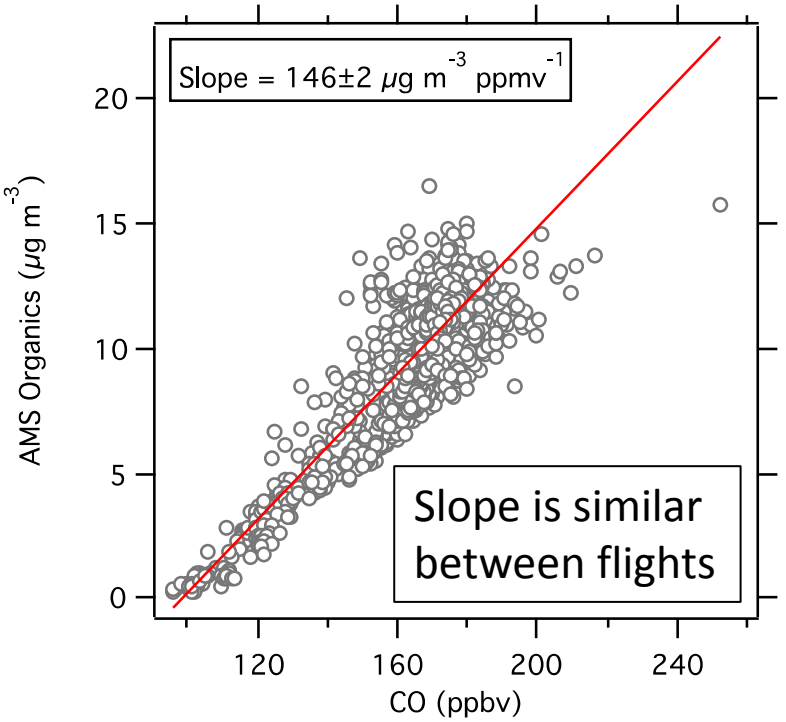
BEIS describes distribution of emissions well (Carsten Warneke)

Organic Aerosol Near Urban Centers (Ann Middlebrook)

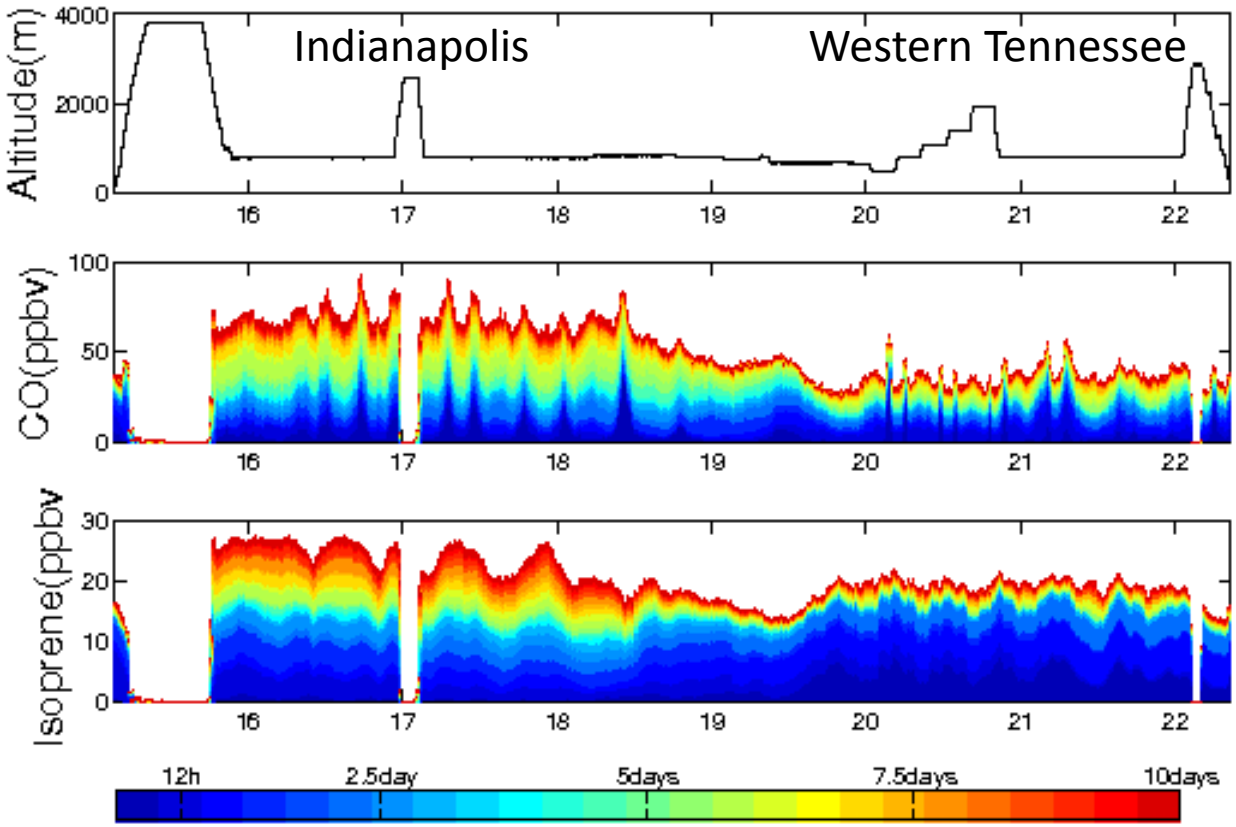








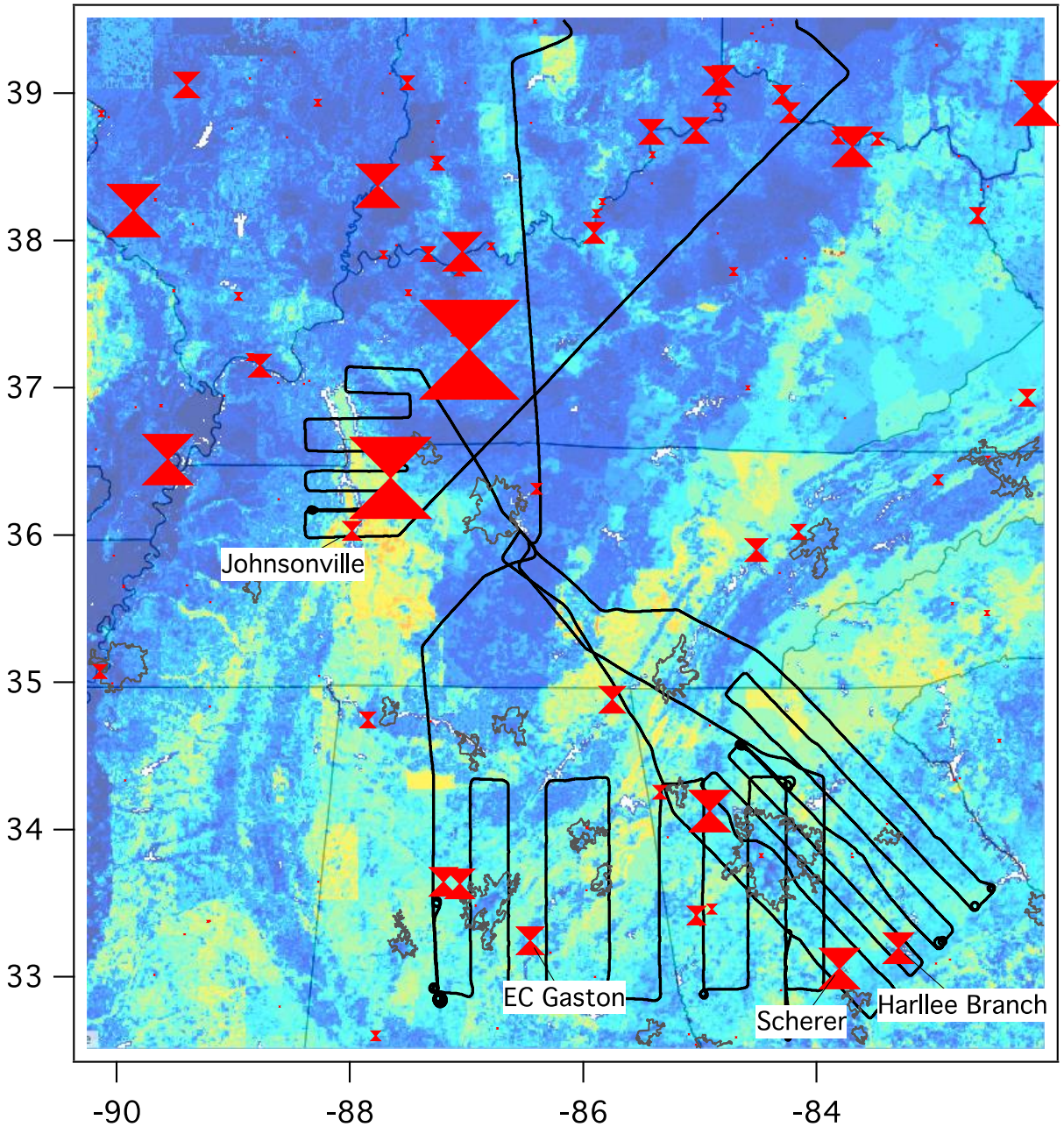
Accumulation of Emissions in the Eastern U.S.



FLEXPART time series for CO and isoprene tracer, color-coded by transport time

Flexpart modeling (Jerome Brioude):

- Urban enhancements come on top of a large regional “background”
- Accumulation of emissions over >10 days needs to be considered
- See Ann Middlebrook’s talk



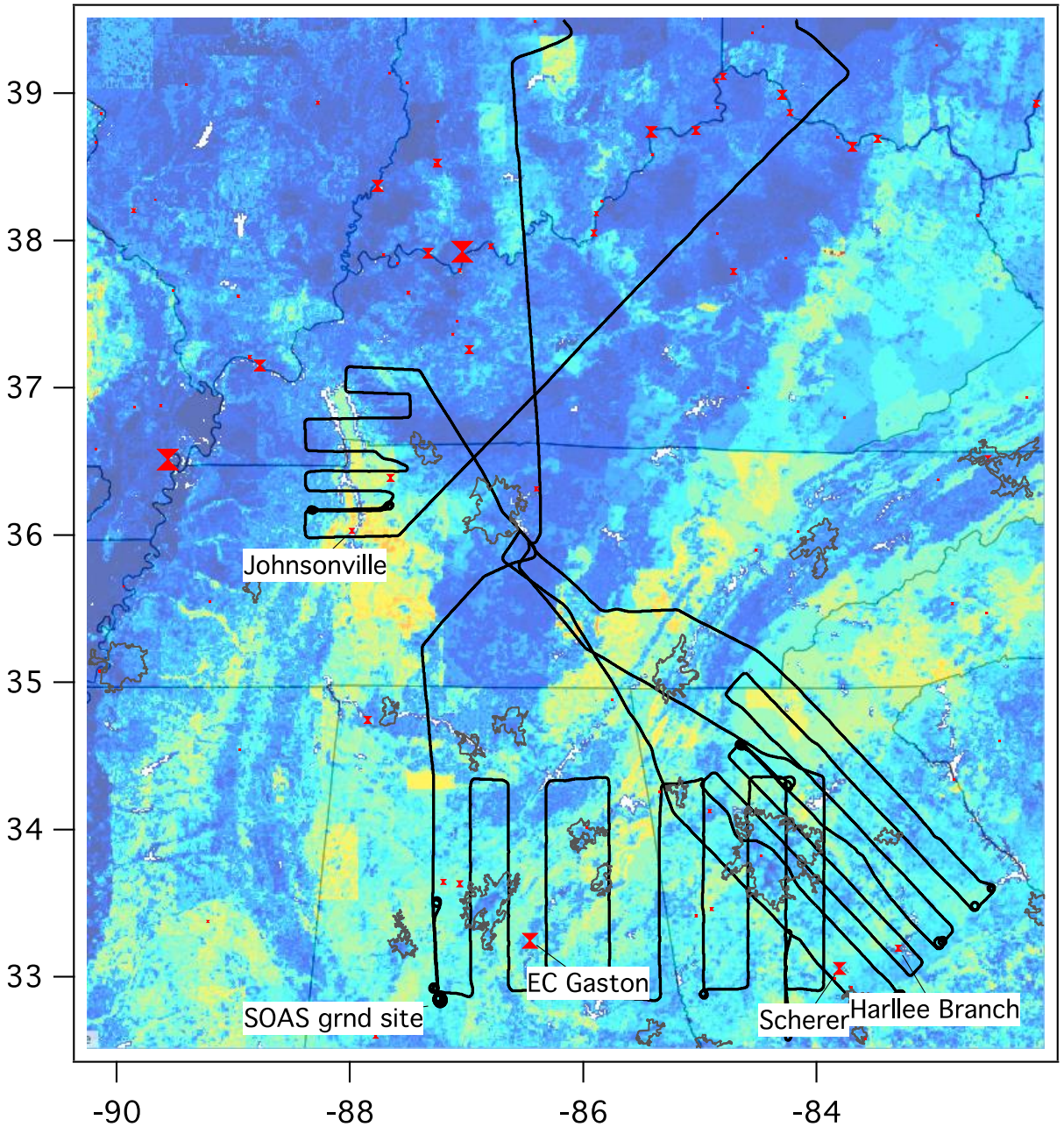
Power plants scaled by **1999** NOx emissions from CEMS

Background colored by isoprene emission

Sample flight tracks from SENEX

Why look at power plants?

- Large emission sources
- Perturbation experiments: how does system respond to injection of NOx and SO_2?



Power plants scaled by **2013** NOx emissions from CEMS

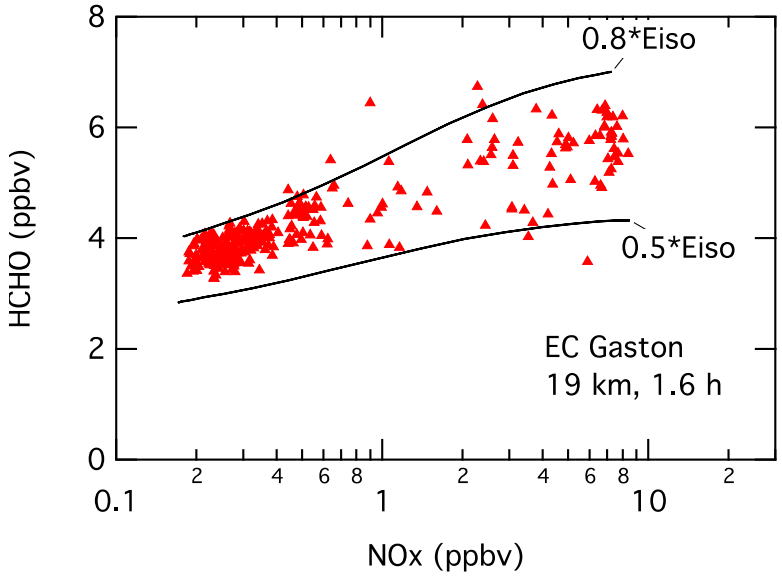
Background colored by isoprene emission

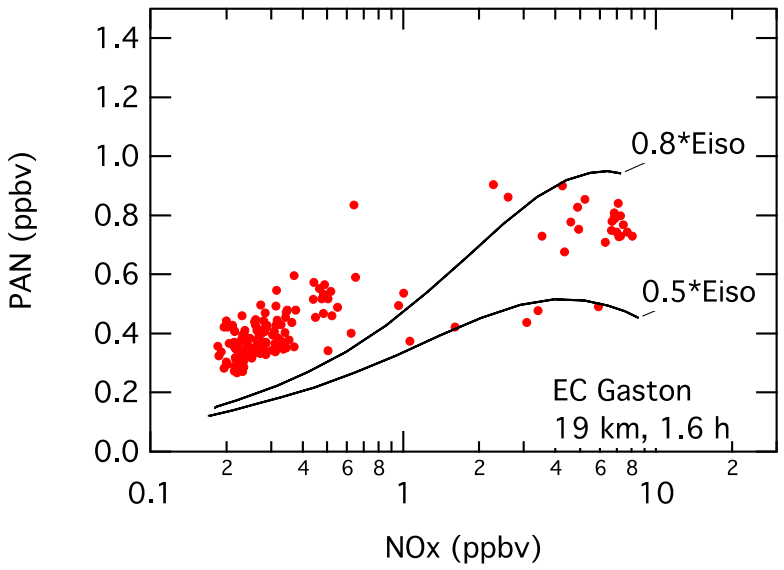
Sample flight tracks from SENEX

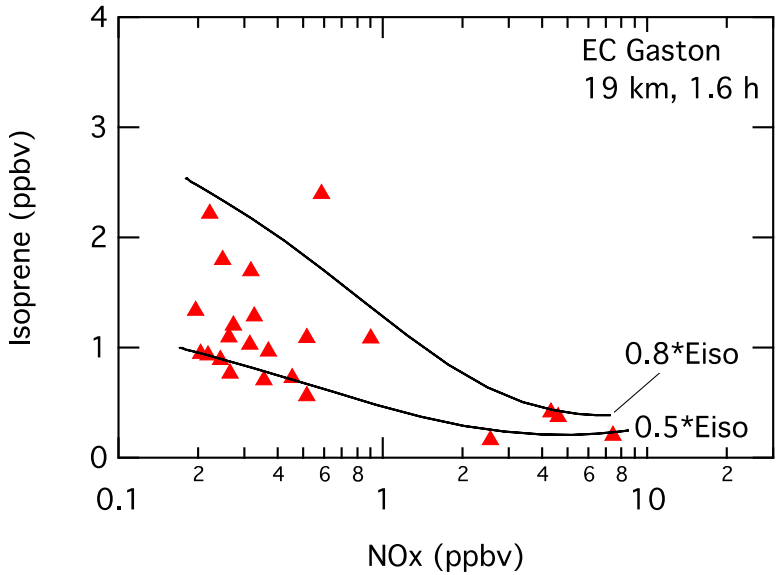
Why look at power plants?

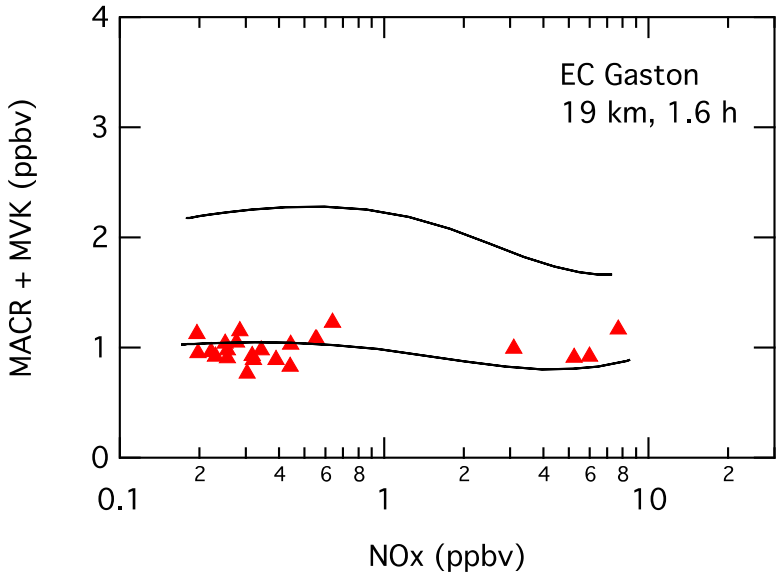
- Large emission sources
- Perturbation experiments: how does system respond to injection of NOx and SO_2?

Modulation of Isoprene Chemistry in Plume from EC Gaston (Michael Trainer)





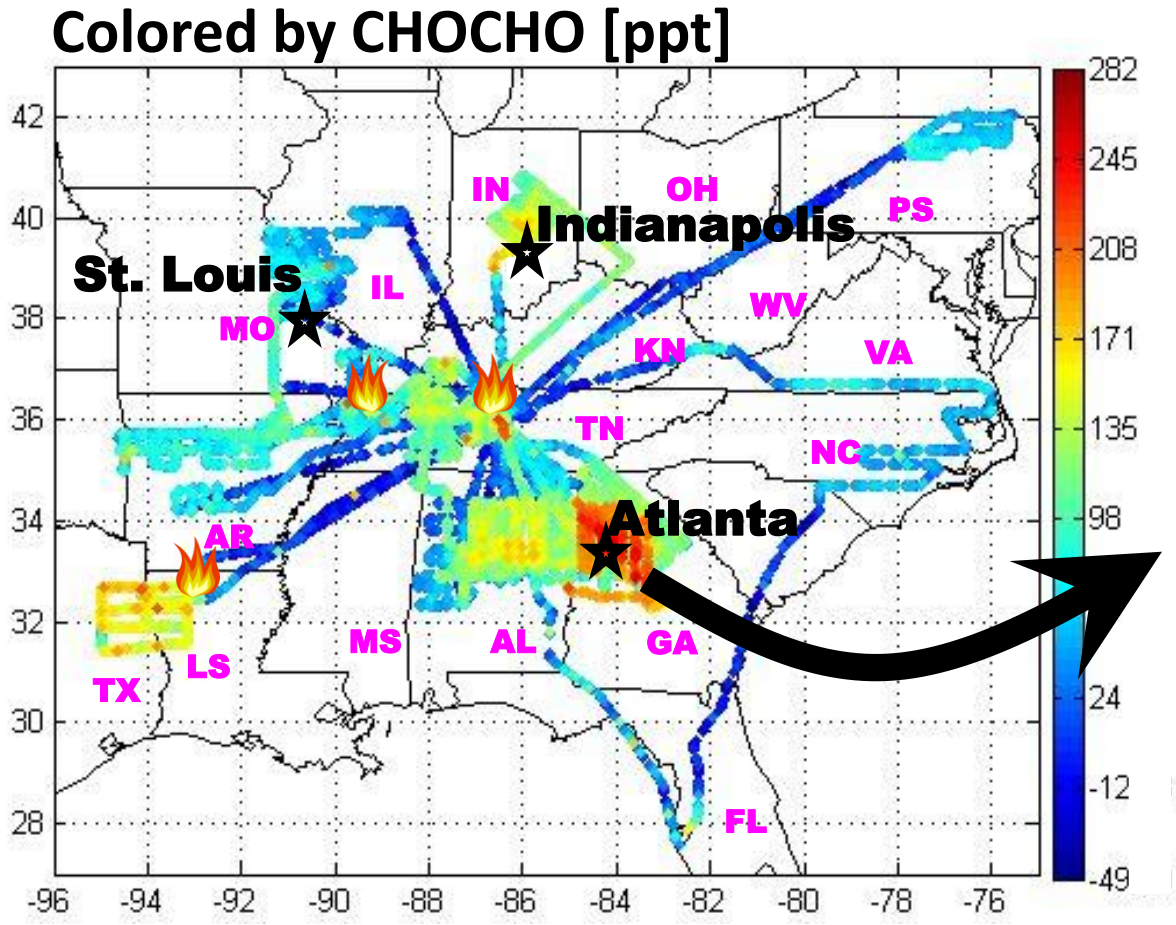


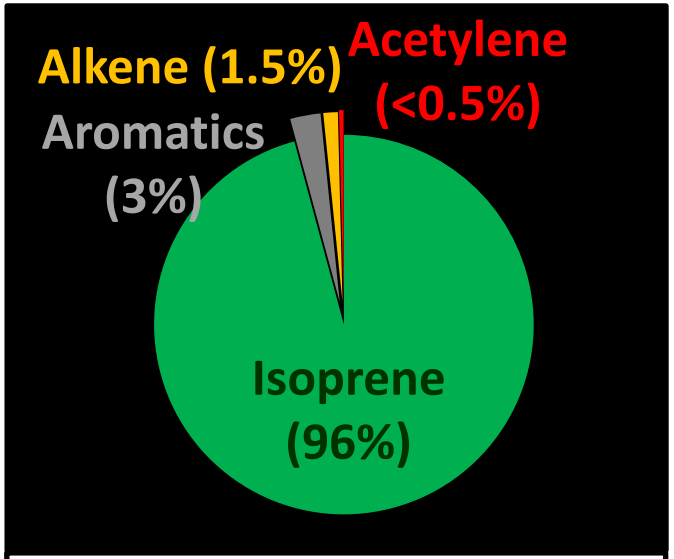


PAN: Patrick Veres, Jim Roberts
NOx: Ilana Pollack, Tom Ryerson
HCHO: Jennifer Kaiser, Glenn Wolfe
Lagrangian Plume Model
Isoprene: Martin Graus et al.

How do other products behave?

New Measurements: Glyoxal (Kueng-Eun Min)





CHOCHO Budget

: 0.27% *[Thalman, Ph.D. Thesis, 2013]*

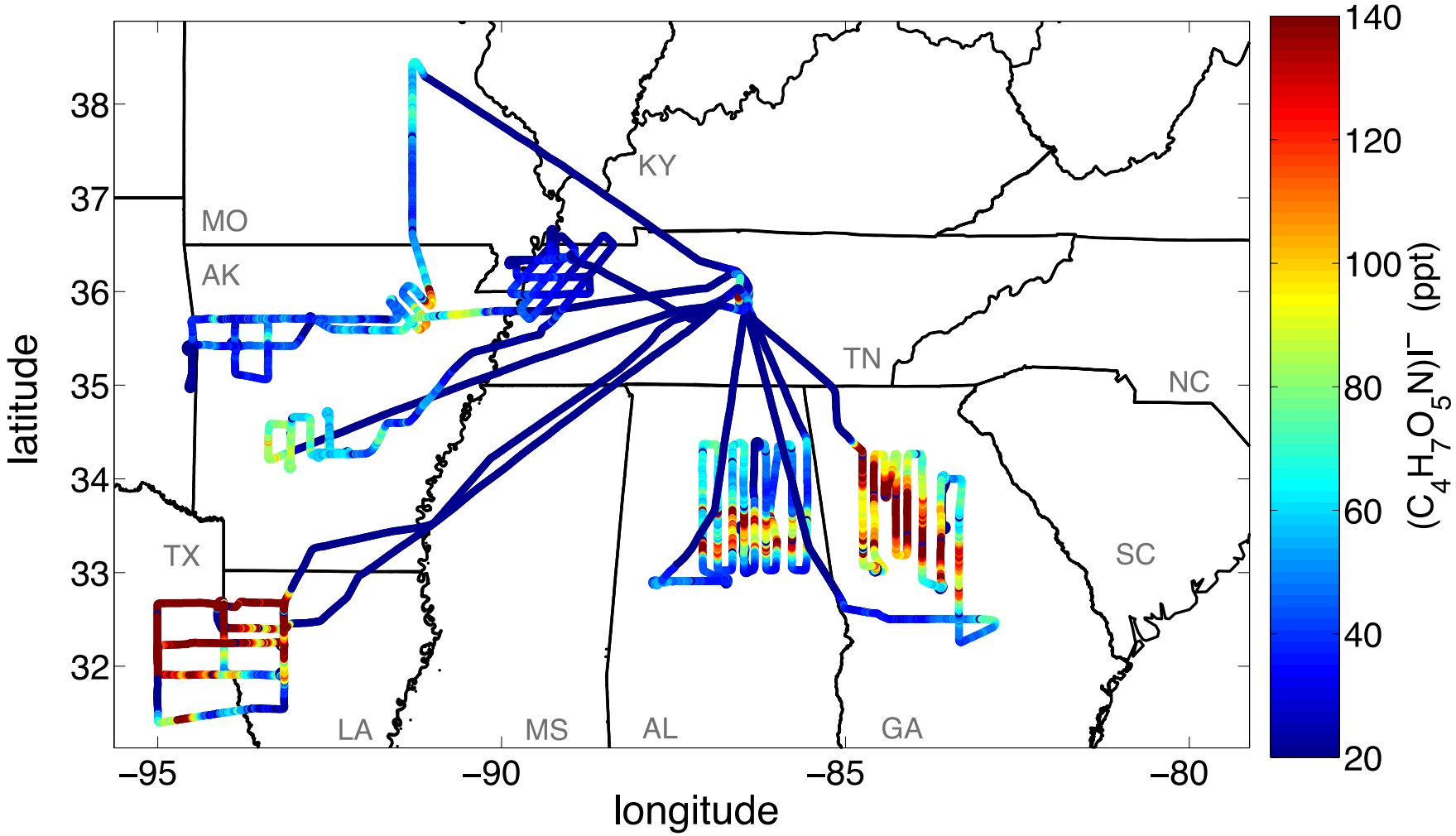
Kyung-Eun Min and Steve Brown

[Glyoxal] : 0-300ppt within boundary layer

Glyoxal enhancements observed over fire/power plant & urban plumes

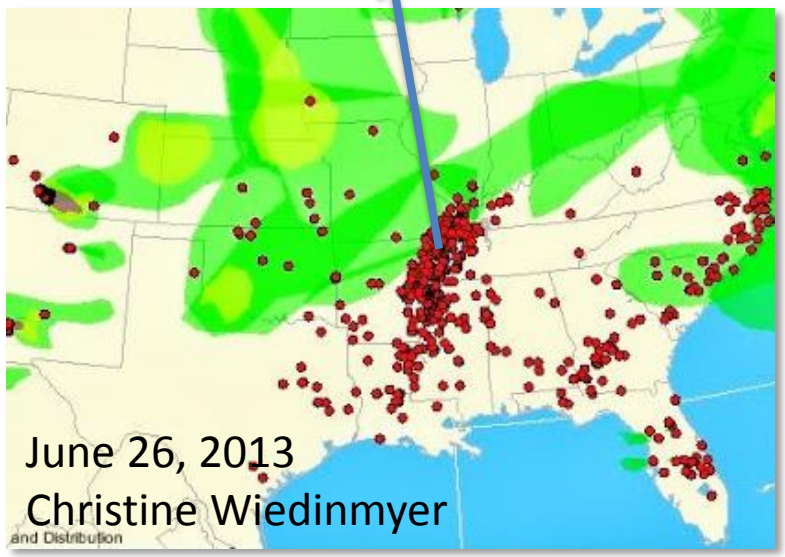
Glyoxal over Atlanta (June 12th) is mainly from isoprene oxidation

New Measurements: I^- CIMS (Lee, Hilfiker-Lopez, Thornton)

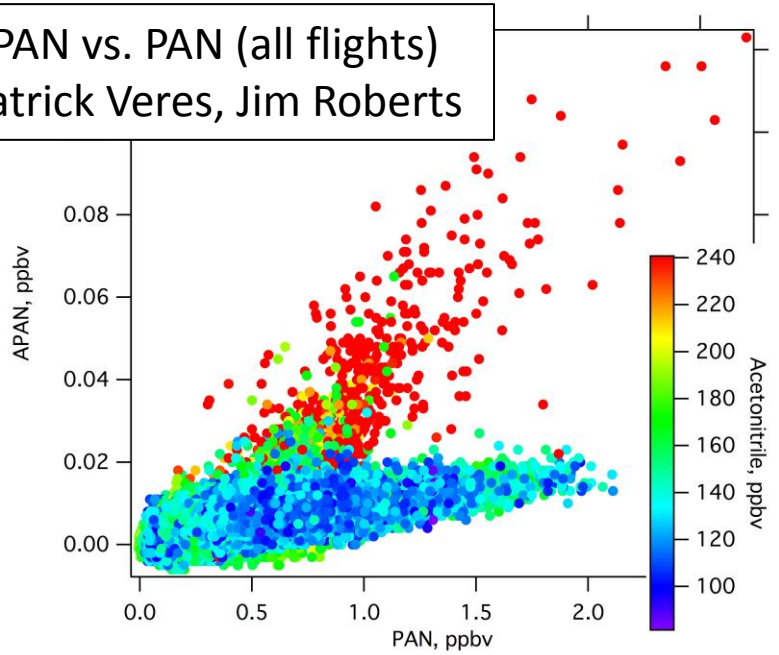


I^- CIMS allows measurements of a series of high- and low-NOx oxidation products from biogenic and anthropogenic hydrocarbons

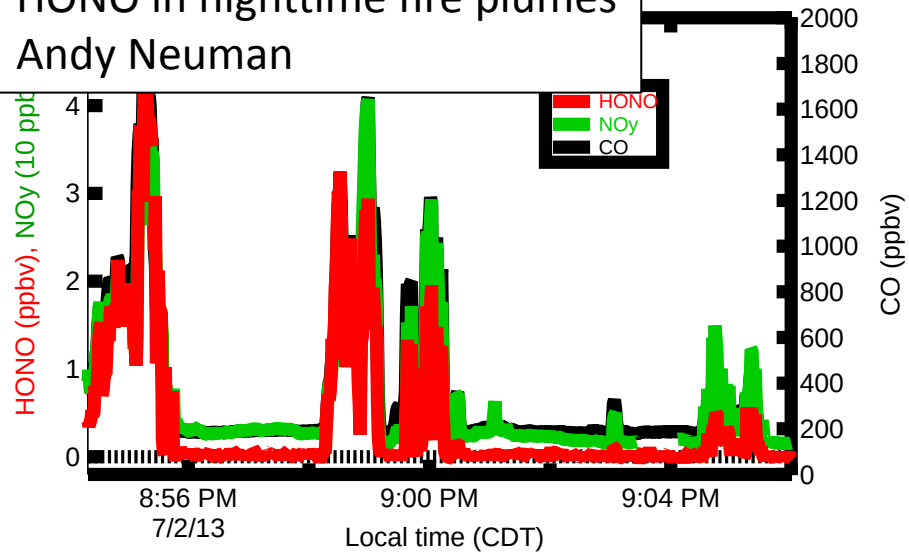
Emissions: Biomass Burning



APAN vs. PAN (all flights)
Patrick Veres, Jim Roberts



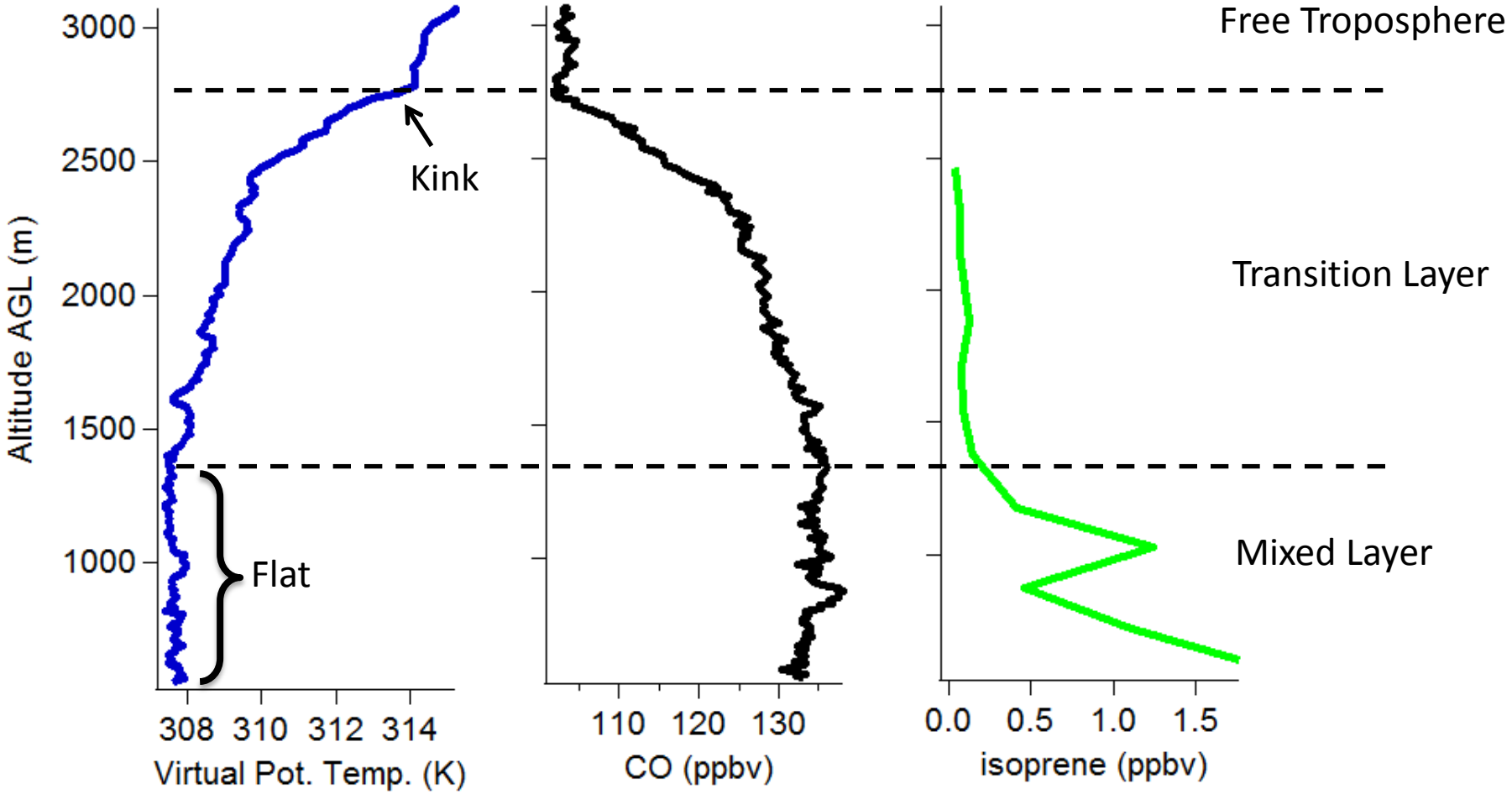
HONO in nighttime fire plumes
Andy Neuman



How important is biomass burning?

Vertical Distribution Of Trace Gases and Aerosol

- Southeast of Birmingham, AL at 3:20 pm local time, June 11th



CO Lifetime = months

Isoprene Lifetime < 1 hour

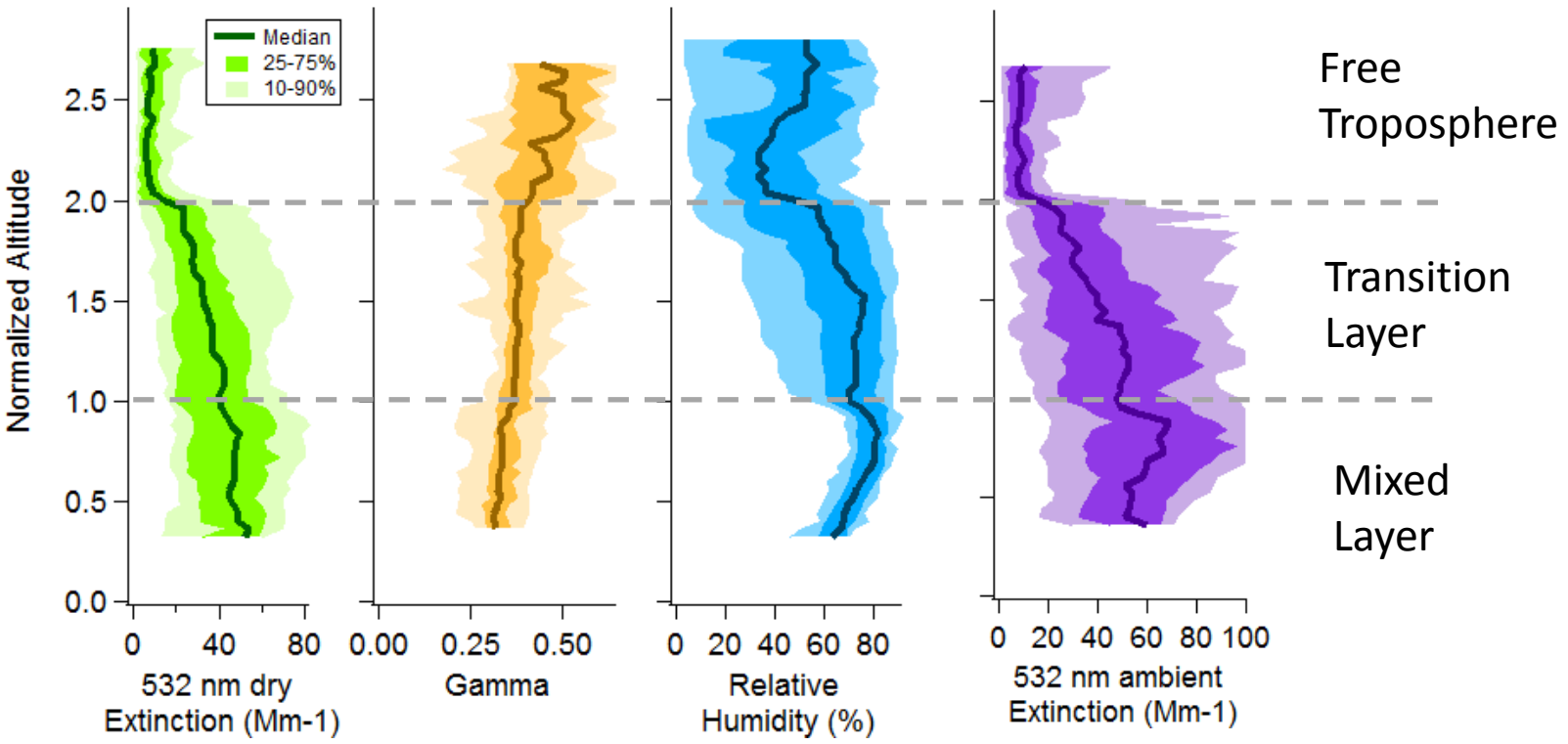
Vertical Distribution Of Trace Gases and Aerosol

Extinction:

- Proxy for submicron aerosol mass.
- Optical property comparable to satellite-based measurements.

Hygroscopic growth model: used to interpolate or extrapolate to ambient conditions.

- $b_{ext}(RH) = b_{ext}(dry) \cdot \left(\frac{100}{100 - RH} \right)^{\gamma}$



SENEX Contributions at this meeting:

1. Andy Neuman — HONO sources and distribution
2. Patrick Veres — APAN in biomass burning plumes
3. Jeff Peischl — Methane from shale gas production
4. Jessica Gilman — VOCs from shale gas production
5. Ann Middlebrook — Aerosol composition and formation
6. Steve Brown — Nighttime oxidation of biogenic VOCs
7. Ben Lee — NO3-driven alkyl nitrate formation
8. Jingqiu Mao — Nighttime chemistry and daytime ozone
9. Wayne Angevine — Meteorology
10. Chuck Brock — Particles in nighttime power plant plumes
11. Milos Markovic — Aging of black carbon

+9 posters