Monthly Webex Tag-up, 9 July 2015

<u>Agenda</u>

1. Announcements and opportunities

2. New Data Products

3. Science Presentations

DISCOVER-AQ

FRAPPÉ July-August 2014

Fall AGU 2015 Abstract Submission (Deadline: 5 August)

We have organized two sessions to provide a venue for highlighting DISCOVER-AQ/FRAPPE results.

As in the past, we also expect abstracts to be distributed across more than just these two sessions.

<u>A011: Air Quality Research: From Emissions to Impacts</u>
Conveners: Gabi Pfister, Patrick Reddy, Greg Frost, and Annmarie Carlton

<u>A041: Emergence of a Global Observing System for Air Quality: Integrated Approaches Using Observations and Models of Tropospheric Composition and Pollution to Inform Air Quality Analyses and Applications</u>
Conveners: Jay Al-Saadi, Caroline Nowlan, Gangwoong Lee, and Henk Eskes

Fall AGU 2015 Abstract Submission (Deadline: 5 August)

A006. Advances in remote sensing of fires, aerosols, and air quality trace gases

A013. Atmospheric boundary layer processes and turbulence

A066. Multi-sensor, Model, and Measurement Synergy: Global Aerosol Characterization

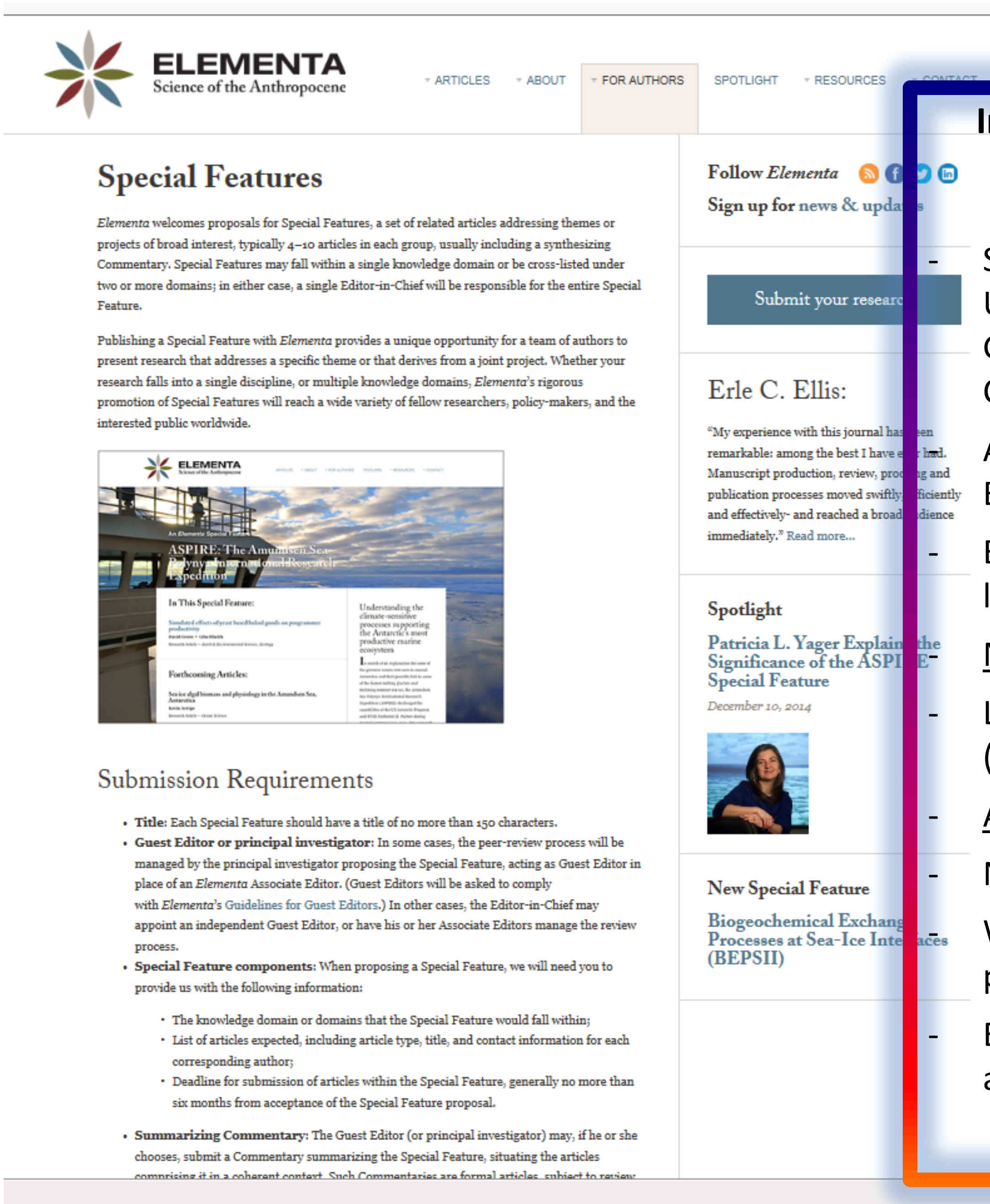
A087. The impacts of energy production and use on air quality and climate

A090. Quantifying methane emissions from the natural gas supply chain

A093. Towards understanding the 3-dimensional distribution of gases, aerosols and clouds via synergistic use of models and satellite, aircraft, and ground based observations.

A097. Understanding and attributing greenhouse gas fluxes from urban systems and major hot-spots: (1) Linking bottom-up data products and top-down observations

A098. Understanding and attributing greenhouse gas fluxes from urban systems and major hot-spots: (2) Attributing sources and sinks for policy and health applications



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Science of the Anthropocene

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Special Features

Elementa welcomes proposals for Special Features, a set of related articles addressing themes or projects of broad interest, typically 4–10 articles in each group, usually including a synthesizing Commentary. Special Features may fall within a single knowledge domain or be cross-listed under two or more domains; in either case, a single Editor-in-Chief will be responsible for the entire Special Feature.

Publishing a Special Feature with *Elementa* provides a unique opportunity for a team of authors to present research that addresses a specific theme or that derives from a joint project. Whether your research falls into a single discipline, or multiple knowledge domains, *Elementa*'s rigorous promotion of Special Features will reach a wide variety of fellow researchers, policy-makers, and the interested public worldwide.

Submission Requirements

- **Title:** Each Special Feature should have a title of no more than 150 characters.
- **Guest Editor or principal investigator:** In some cases, the peer-review process will be managed by the principal investigator proposing the Special Feature, acting as Guest Editor in place of an *Elementa* Associate Editor. (Guest Editors will be asked to comply with *Elementa*'s Guidelines for Guest Editors.) In other cases, the Editor-in-Chief may appoint an independent Guest Editor, or have his or her Associate Editors manage the review process.
- **Special Feature components:** When proposing a Special Feature, we will need you to provide us with the following information:
  - The knowledge domain or domains that the Special Feature would fall within;
  - List of articles expected, including article type, title, and contact information for each corresponding author;
  - Deadline for submission of articles within the Special Feature, generally no more than six months from acceptance of the Special Feature proposal.
- **Summarizing Commentary:** The Guest Editor (or principal investigator) may, if he or she chooses, submit a Commentary summarizing the Special Feature, situating the articles

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"My experience with this journal has been remarkable: among the best I have ever had. Manuscript production, review, proc...g and publication processes moved swiftly, efficiently and effectively- and reached a broad audience immediately." Read more...

Spotlight

Patricia L. Yager Explains the Significance of the ASPIRE Special Feature

December 10, 2014

New Special Feature

Biogeochemical Exchange Processes at Sea-Ice Interfaces (BEPSII)

Invitation for a FRAPPE/DISCOVER-AQ Special Feature in Elementa

- Six Knowledge Domains, all hosted by major US universities (Dartmouth, Univ. Michigan, Georgia Tech., Univ. Washington, Univ. of Colorado)
- Atmospheric Science Domain hosted by CU Boulder (Detlev Helmig Editor-in-Chief)
- Elementa will set up dedicated website with listing of papers and ancillary information
- Non-profit peer-reviewed journal
- Low, discounted flat rate publication fee (~$1,200 for special feature articles)
- All open access
- No page limit
- Well recognized by public, media, and policy makers
- Experienced Associate Editor Board; can appoint Special Feature Guest Editor

<u>Newly available data products:</u>

- ***Profile plots for California and Colorado (under "Analysis" tab)***
- ***California merge (version R4: added 10s DACOM-N2O)***
- ***Texas site flag and profile center bearing in nav data updated***
  - ***Profile flags unchanged***
  - ***Site flags for Moody Tower, Texas Ave, Clinton, and Ship Channel have changed***
  - ***Profile center bearings for Channelview and Deer Park have changed***
  - ***Not yet in the merge!***
  - ***Flight profile summary spreadsheet has been updated to reflect these changes***

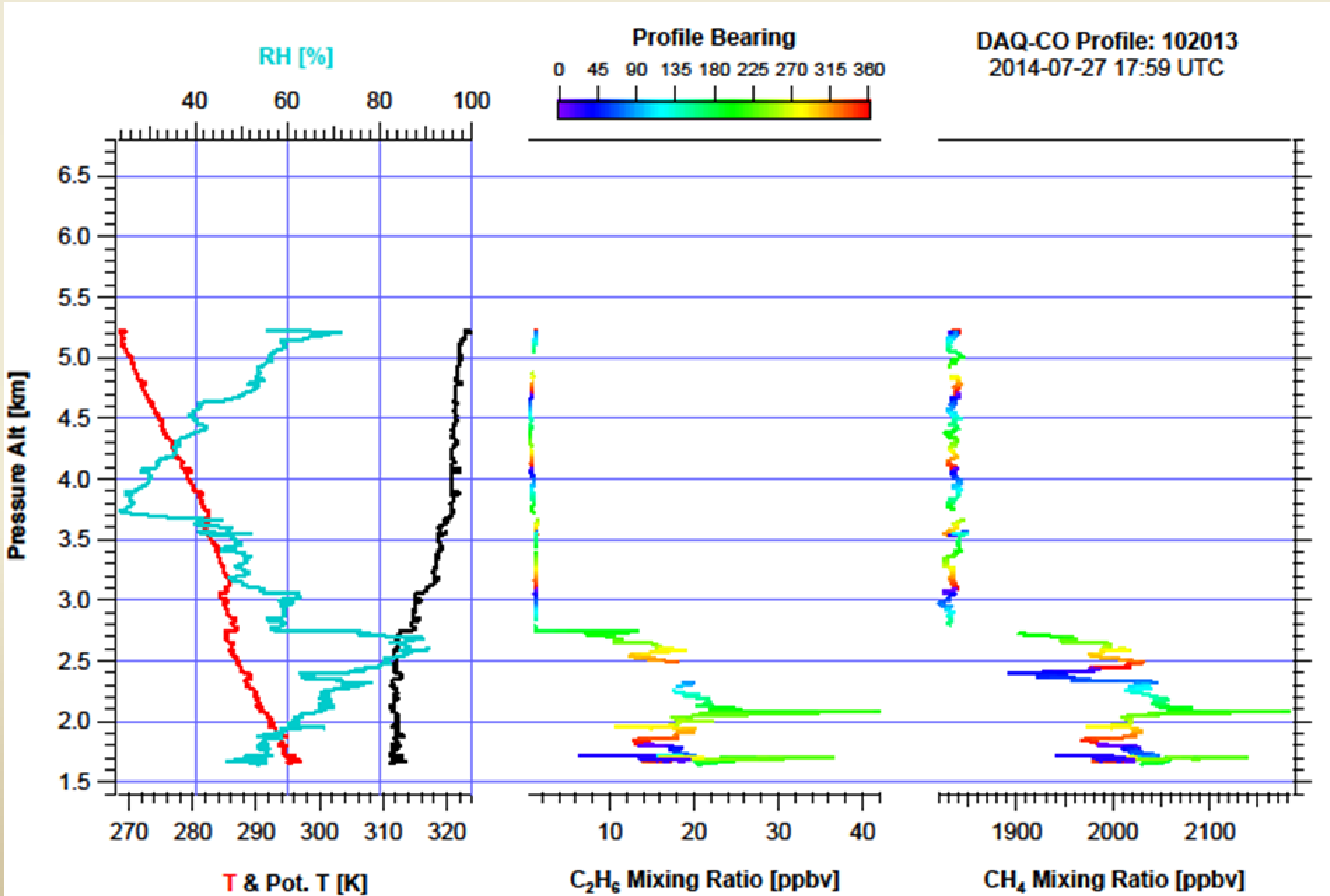
<u>Anticipated data products (in the next month):</u>

- ***Texas merge (will include new DACOM and nav data)***
- ***Profile plots for Texas (after the new merge)***

DISCOVER-AQ

FRAPPÉ July-August 2014

Example profile plot over Platteville



SCIENCE PRESENTATIONS

Aerosol Variability in Baltimore

Aerosol Composition and Variability in the Baltimore-Washington D.C. Region

- Andreas Beyersdorf (NASA LARGE, andreas.j.beyersdorf@nasa.gov)
- Expected submittal to ACP in July 2015
- Utilizing airborne aerosol and water vapor measurements (DLH, G. Diskin)

Satellite measurements can be related to surface conditions

- Satellites measure optical properties
  - Aerosol optical depth (passive)
  - Extinction (active)
- Ground monitoring of particulate mass (PM)

$$Extinction_{ambient} = PM \cdot MEE \cdot \left[1 + SSA \cdot \left(\left[\frac{100 - RH}{80}\right]^{-\gamma} - 1\right)\right]$$

$$AOD = \int Extinction_{ambient}$$

MEE = mass extinction coefficient
SSA = single scattering albedo
γ = hygroscopicity (water-uptake potential)
RH = relative humidity

Aerosol Variability in Baltimore

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  - Extinction (active)
- Ground monitoring of particulate mass (PM)

$$\boldsymbol{Extinction_{ambient}} = f(\boldsymbol{Aerosol\ Loading}, \boldsymbol{Composition}\ and\ \boldsymbol{RH})$$

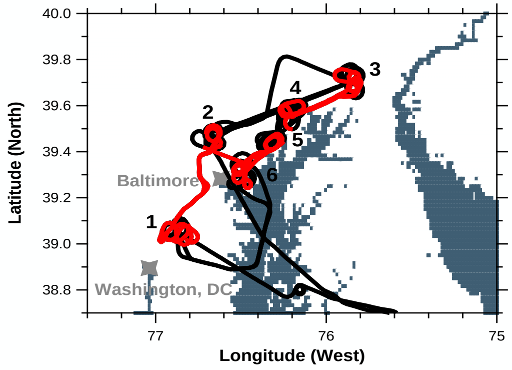
$$\boldsymbol{AOD} = f(\boldsymbol{Aerosol\ Loading}, \boldsymbol{Composition}, \boldsymbol{RH}\ and\ \boldsymbol{Vertical\ Distribution})$$

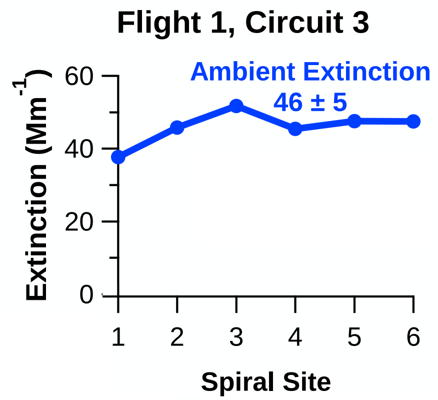
Which of these factors (loading, composition, RH) control variability in extinction?

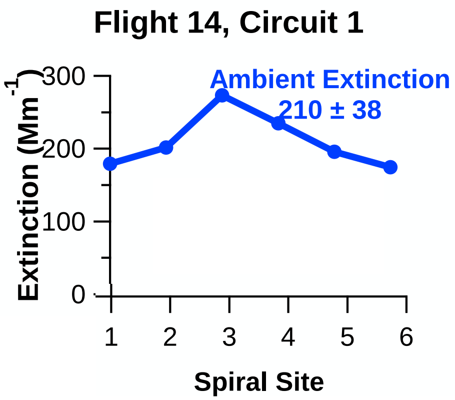
Aerosol Variability in Baltimore

Two Cases

- Extinction$_{ambient}$ varies by 10-18% (highest at Fairhill)





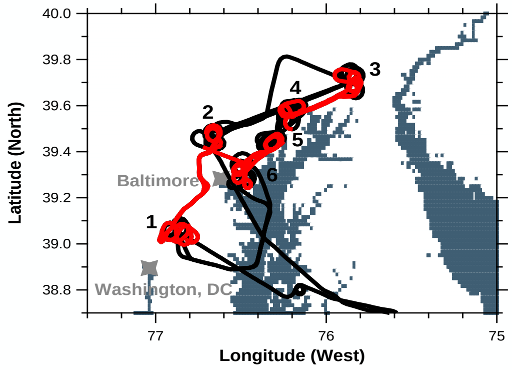


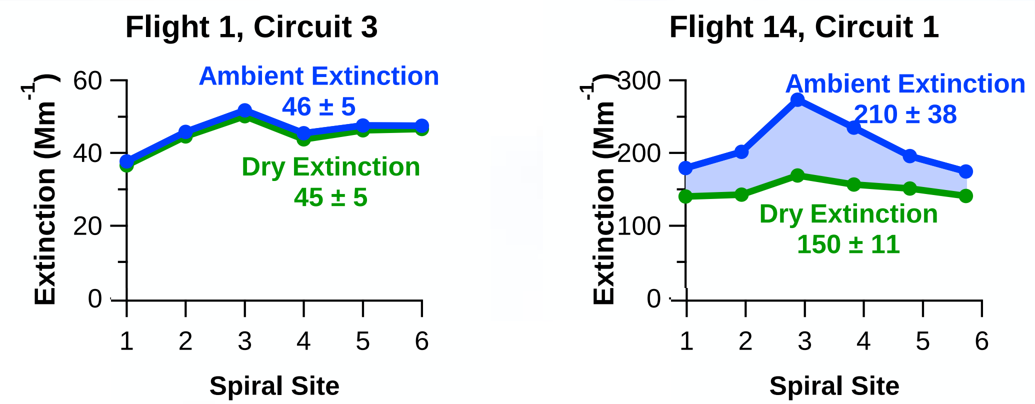
Airborne measurements in the boundary layer (<1 km) over each site.

Aerosol Variability in Baltimore

Two Cases

- Extinction$_{ambient}$ varies by 10-18% (highest at Fairhill)
- Extinction$_{dry}$ is a measure of aerosol loading
  - Case 1: variability in Extinction$_{ambient}$ is controlled by variability in aerosol loading
  - Case 2: variability in Extinction$_{ambient}$ is greater than variability in aerosol loading



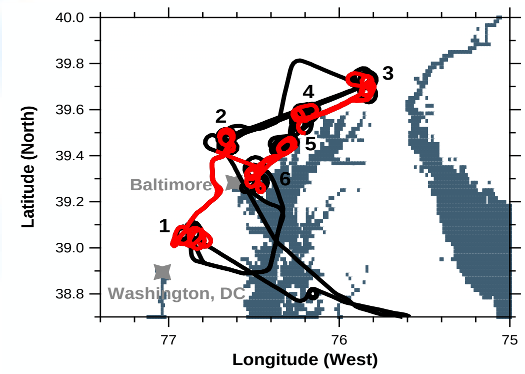


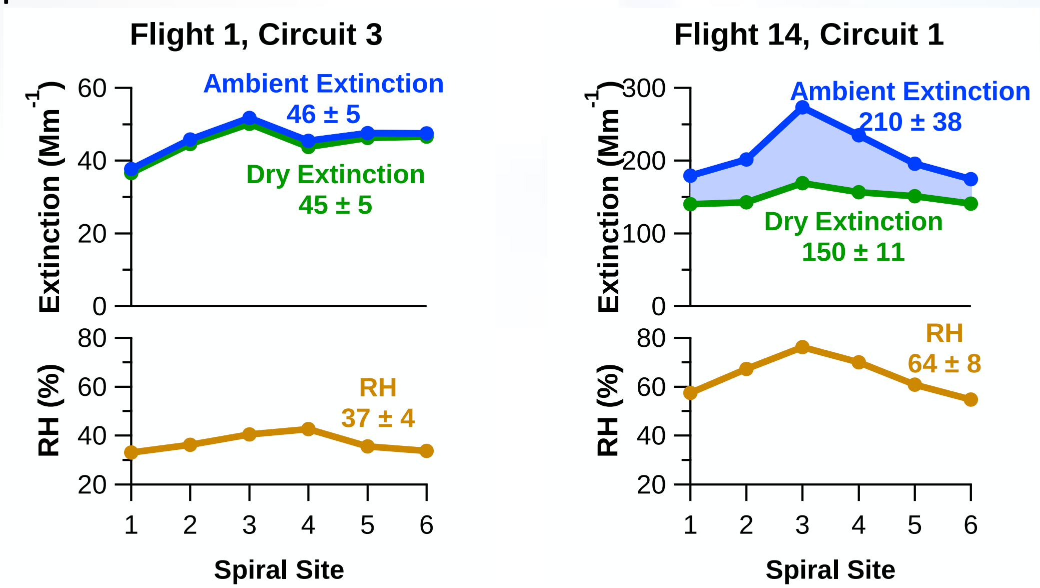
Airborne measurements in the boundary layer (<1 km) over each site.

Aerosol Variability in Baltimore

Two Cases

- Extinction$_{ambient}$ varies by 10-18% (highest at Fairhill)
- Extinction$_{dry}$ is a measure of aerosol loading
  - Case 1: variability in Extinction$_{ambient}$ is controlled by variability in aerosol loading
  - Case 2: variability in Extinction$_{ambient}$ is greater than variability in aerosol loading
    - RH is high and variable resulting in variable water uptake





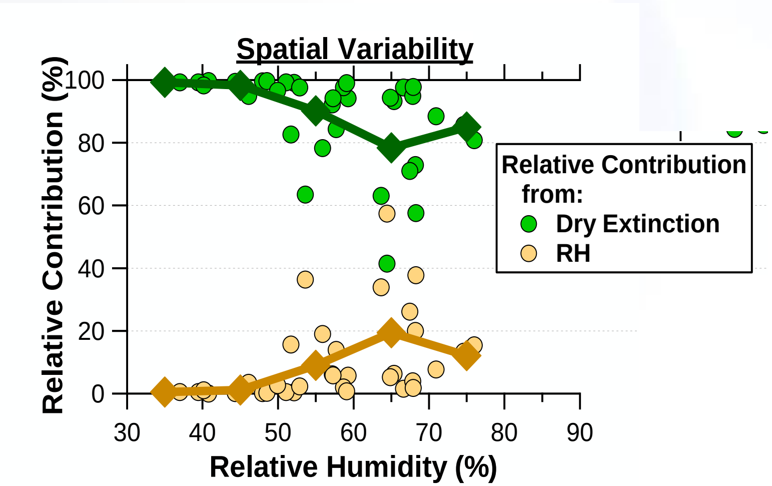
Airborne measurements in the boundary layer (<1 km) over each site.

Aerosol Variability in Baltimore

$$Extinction_{ambient} = Extinction_{dry} \cdot \left[1 + SSA \cdot \left(\left[\frac{100 - RH}{80}\right]^{-\gamma} - 1\right)\right]$$

What factors control variability in aerosol extinction?

- Look at each circuit individually
- Spatial Variability:
  - Aerosol loading – responsible for over 80% of the spatial variability
  - RH – highest contribution at high RH (up to 62%)
  - SSA – negligible contribution (less than 1%)
  - γ – negligible contribution (less than 1%)

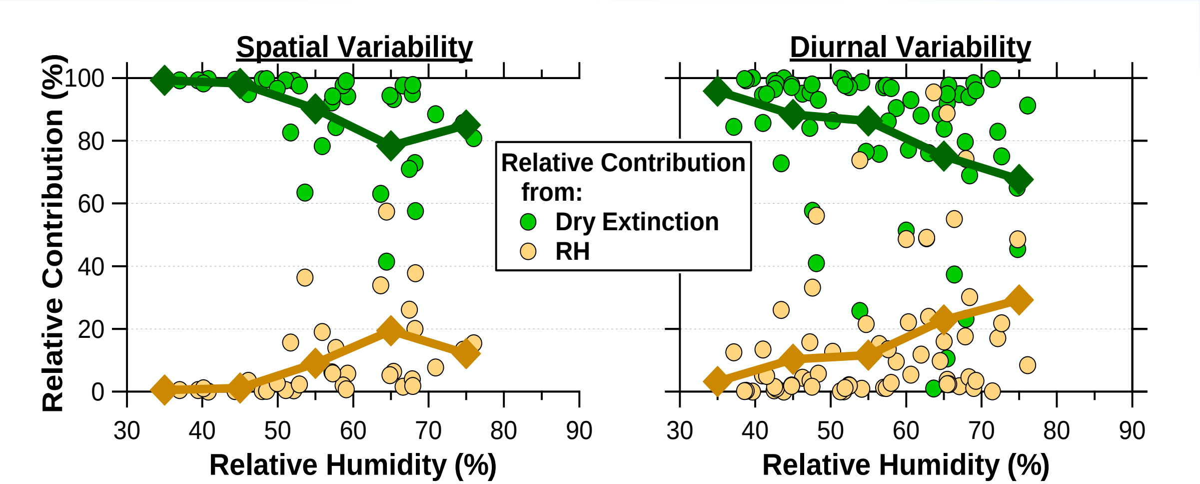


Aerosol Variability in Baltimore

$$Extinction_{ambient} = Extinction_{dry} \cdot \left[1 + SSA \cdot \left(\left[\frac{100 - RH}{80}\right]^{-\gamma} - 1\right)\right]$$

What factors control variability in aerosol extinction?

- Look at each site individually
- Diurnal Variability:
  - Aerosol loading – responsible for over 60% of the spatial variability
  - RH – highest contribution at high RH (up to 95%)
  - SSA – negligible contribution (less than 1%)
  - γ – negligible contribution (less than 1%)



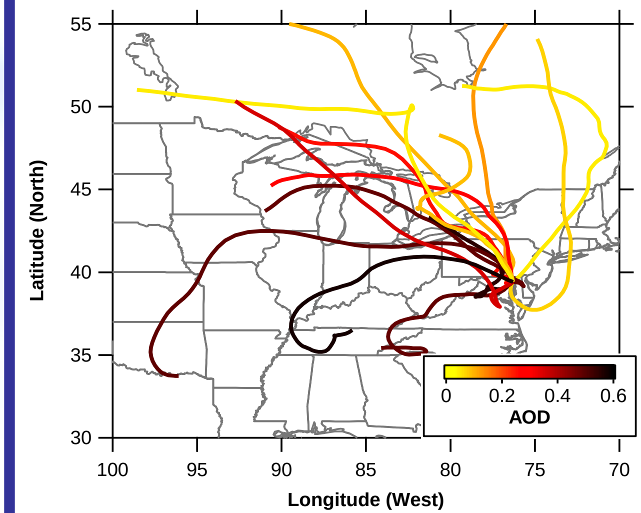
Aerosol Variability in Baltimore

Aerosol composition and loadings varied with back trajectories

- Highest loadings when airflow from the WNW

Variability in aerosol extinction controlled primarily by aerosol loading

- But at high RH, variability in RH is important



Back-trajectories and AODs measured at Edgewood for the first circuit of each flight.

Aerosol composition variability is small enough that it is not a large controlling factor in aerosol extinction

- Both spatially and diurnally
- But, day-to-day changes in γ were large enough that utilization of a monthly average would result in error of up to 27% for high aerosol loading days
- Thus, daily measurement of γ at one location is enough to provide information for the entire study region

First full maps indicating San Joaquin Valley Pollution

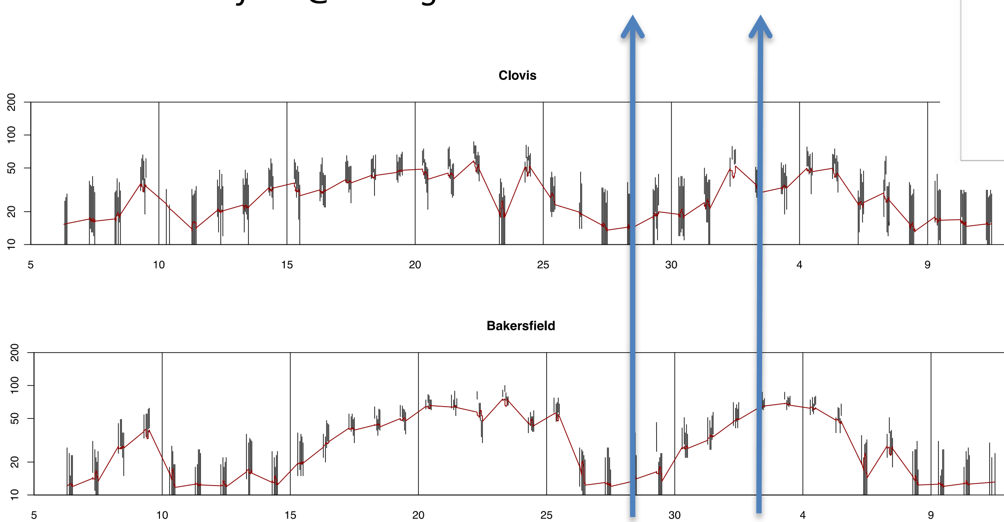
Use of the AOT / WV-column technique

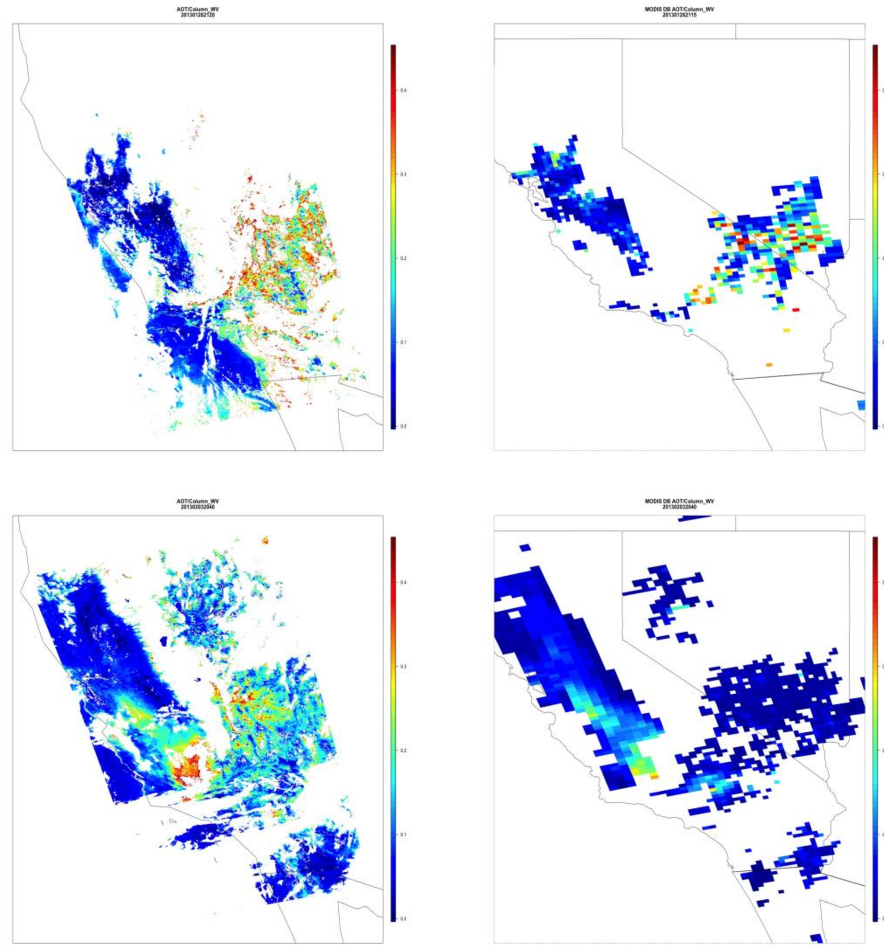
- *Unifies MAIAC and Deep Blue*
- *Should help normalize Mixed Layer depth for $PM_{2.5}$*

Chatfield and Esswein
NASA Ames R.C
Robert.B.Chatfield@nasa.gov

Clean Day Jan 28

Pollution In Whole Valley Feb 3





MAIAC

Deep Blue v 6 (!)

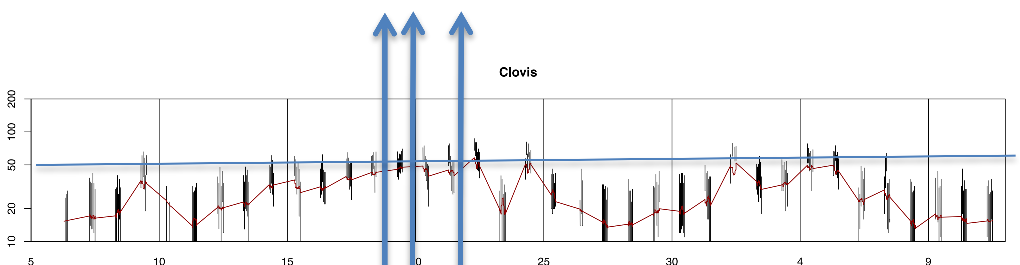
(Raw column ratios) of AOT / WV

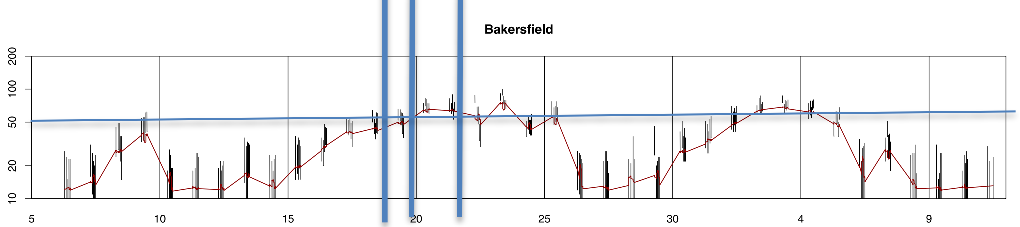
First full maps indicating San Joaquin Valley Pollution

Use of the AOT / WV-column technique removes several sources of "noise"

- *Unifies MAIAC and Deep Blue Retrievals*
- *Should help normalize Mixed Layer depth for $PM_{2.5}$*
- *Next: compare quantitatively to surface and airborne measurements as in Sorek-Hammer et al. 2015.*
- *Expand analysis to the MODIS Aqua Record*

Notice: $PM_{2.5}$ Pollution increases, moving to the South Valley, Jan 18, 19, 21 2013





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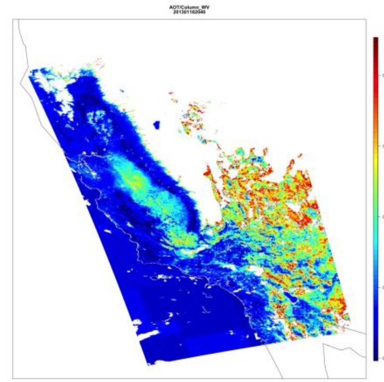
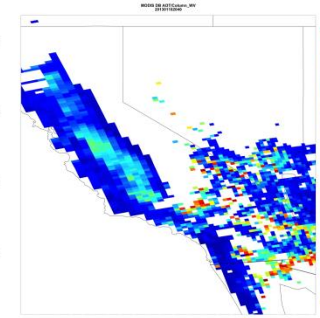
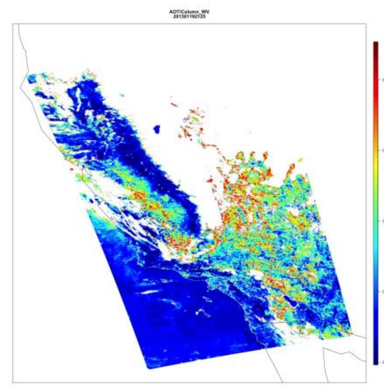




Deep Blue v 6

19



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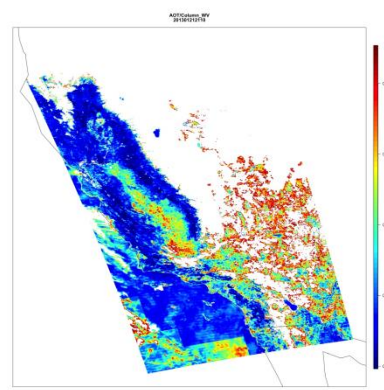


MAIAC

Houston Texas During the 2013 DISCOVER-Campaign

Alan Fried, James Walega, Petter Weibring, & Dirk Richter
Institute for Arctic & Alpine Research
The University of Colorado

Chris Loughner & Ken Pickering, NASA Goddard Space Flight Center, Greenbelt, MD

Melanie Follette-Cook
Morgan State University

Focus of Presentation Today

1. **CMAQ-Measurement Comparisons**

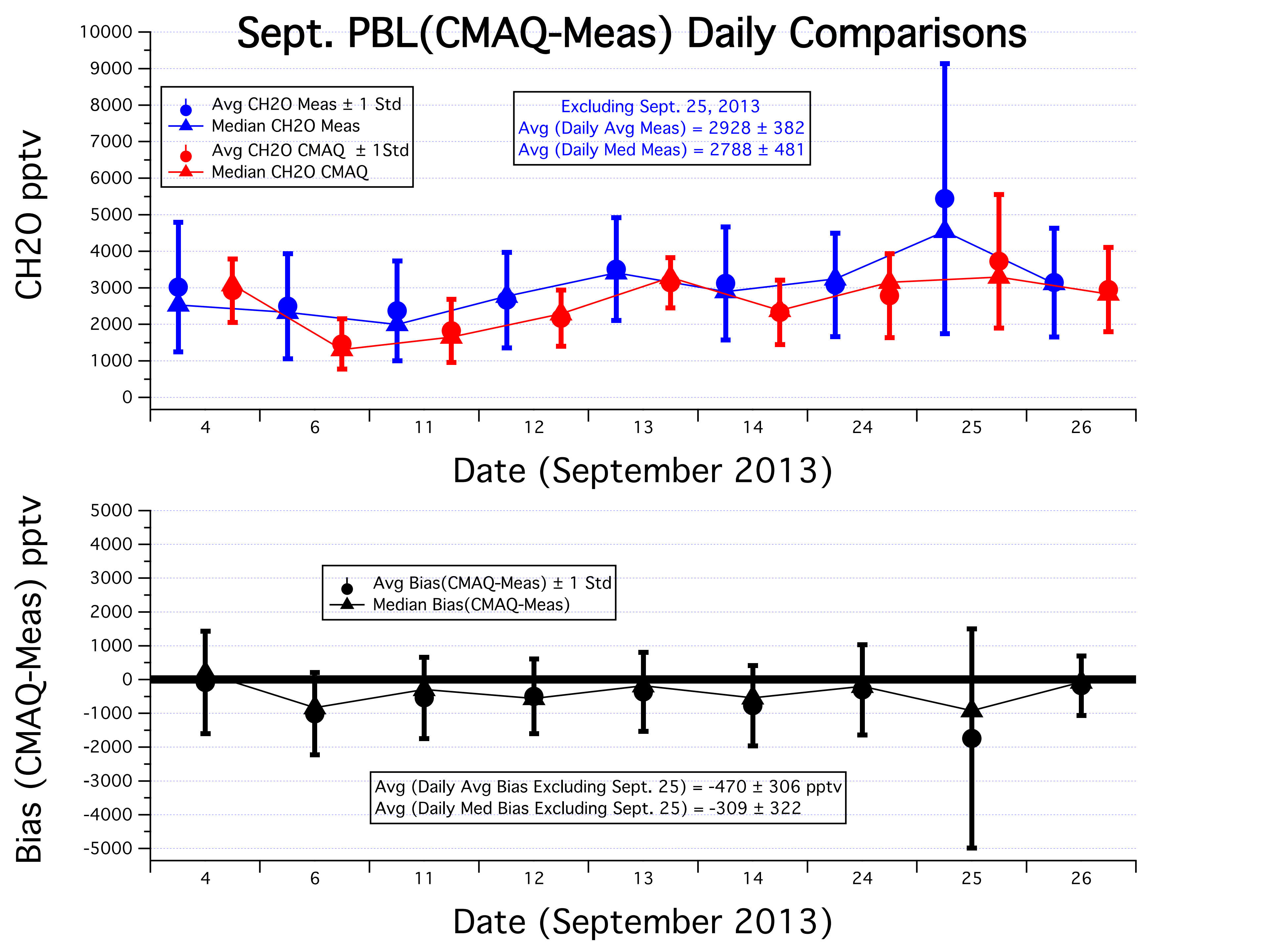
Model Allows

- Extends Observations Temporally & Spatially
- Yields PBL Mixing Heights
- Yields Back Trajectories
- Yields OH Concentrations
- Probe Model for Source Attribution (Process Analysis Mode)
- Integrate over 24-hours for DNPH comparisons

Focus of Presentation Today

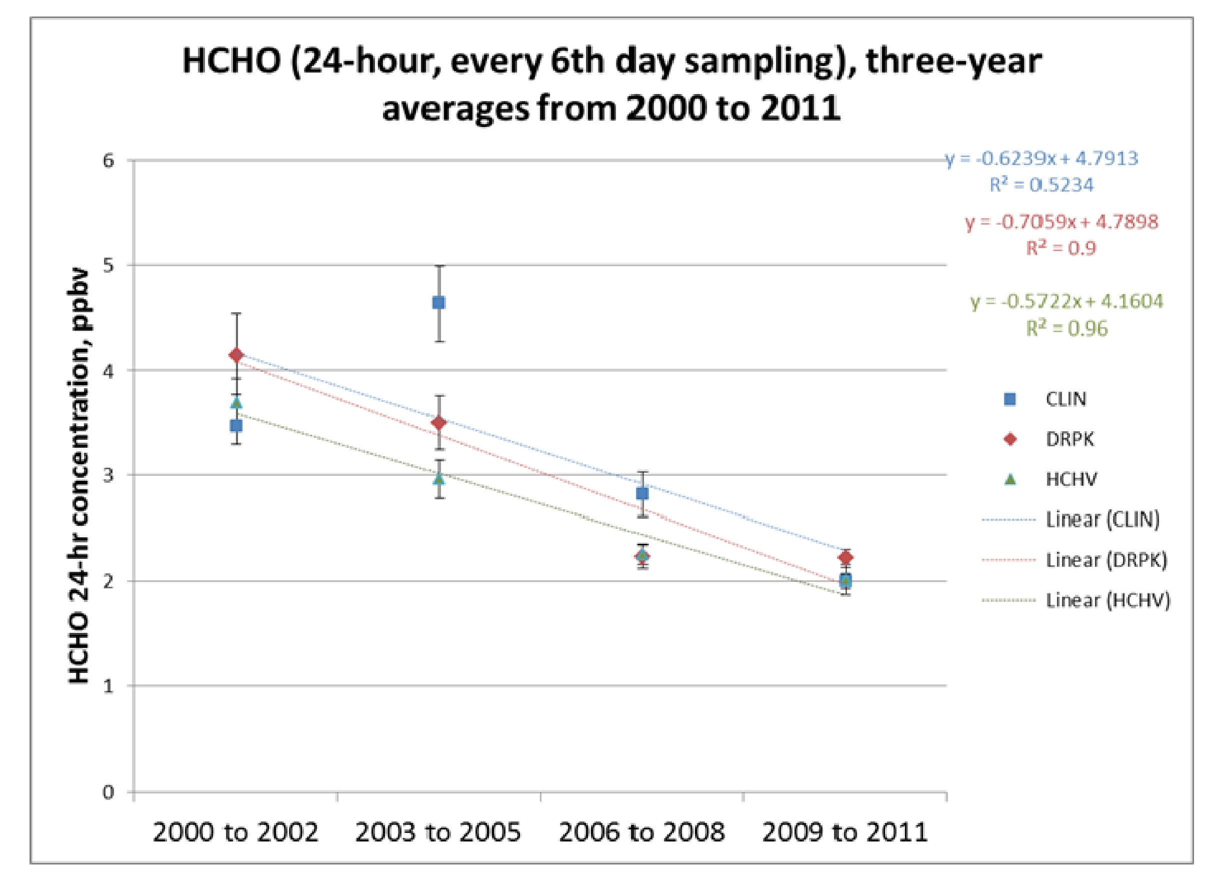
2. Validation of DNPH TCEQ Measurements

3. Start Process of Assessing Primary vs 2nd Sources of CH_2O

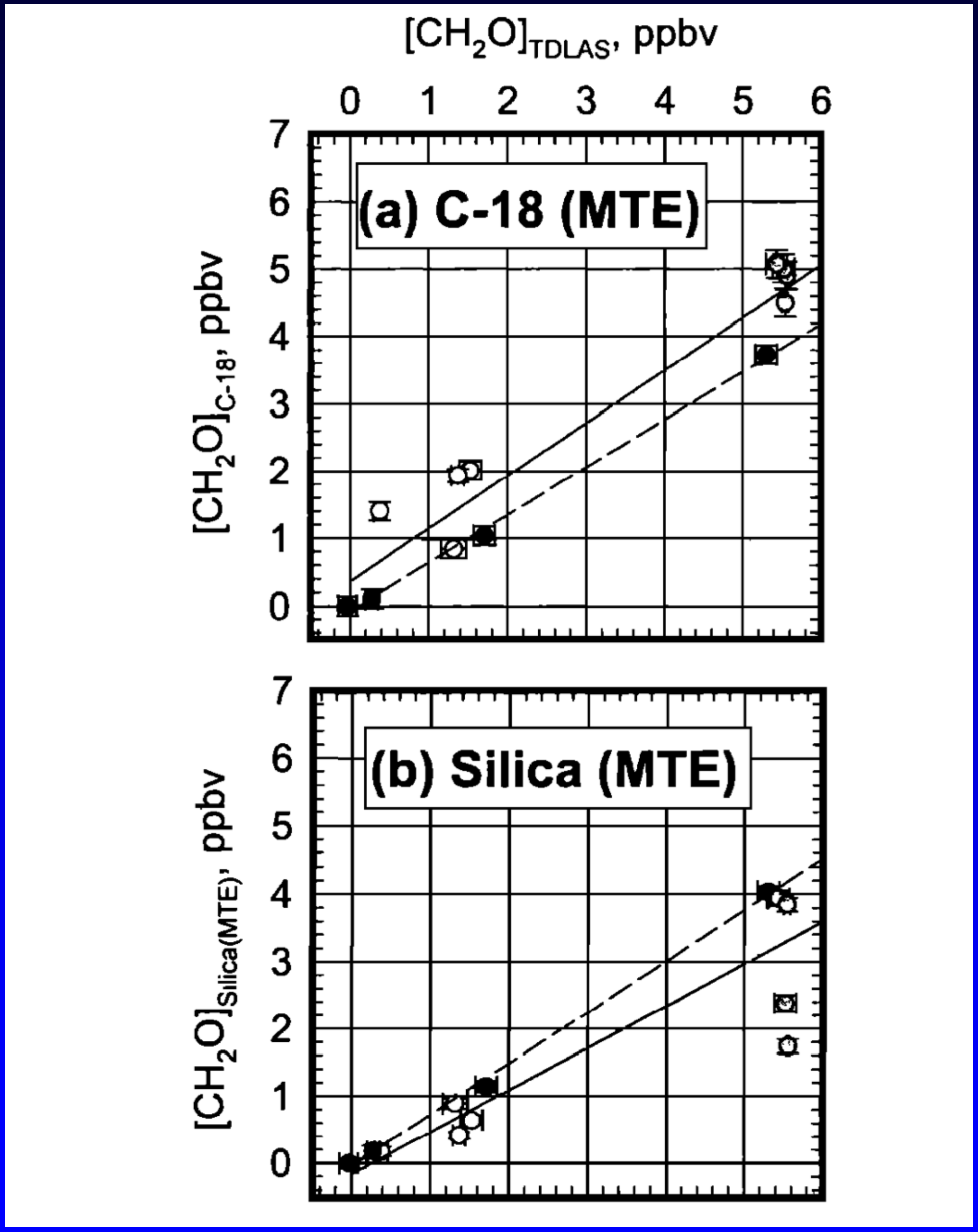

Sept. PBL(CMAQ-Meas) Daily Comparisons
CH2O pptv
Avg CH2O Meas ± 1 Std
Median CH2O Meas
Avg CH2O CMAQ ± 1Std
Median CH2O CMAQ
Excluding Sept. 25, 2013
Avg (Daily Avg Meas) = 2928 ± 382
Avg (Daily Med Meas) = 2788 ± 481
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
4
6
11
12
13
14
24
25
26
Date (September 2013)
Bias (CMAQ-Meas) pptv
Avg Bias(CMAQ-Meas) ± 1 Std
Median Bias(CMAQ-Meas)
Avg (Daily Avg Bias Excluding Sept. 25) = -470 ± 306 pptv
Avg (Daily Med Bias Excluding Sept. 25) = -309 ± 322
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
-5000
4
6
11
12
13
14
24
25
26
Date (September 2013)

2^{nd} Focus

DNPH Sampling Systems at Deer Park & Clinton Providing Long Time Histories of Surface CH_2O



Gilpin, Apel, Fried, Wert, Calvert et al.
JGR 102, page 21,161, 1997



Slopes

0.78 ± 0.02 (All Data)

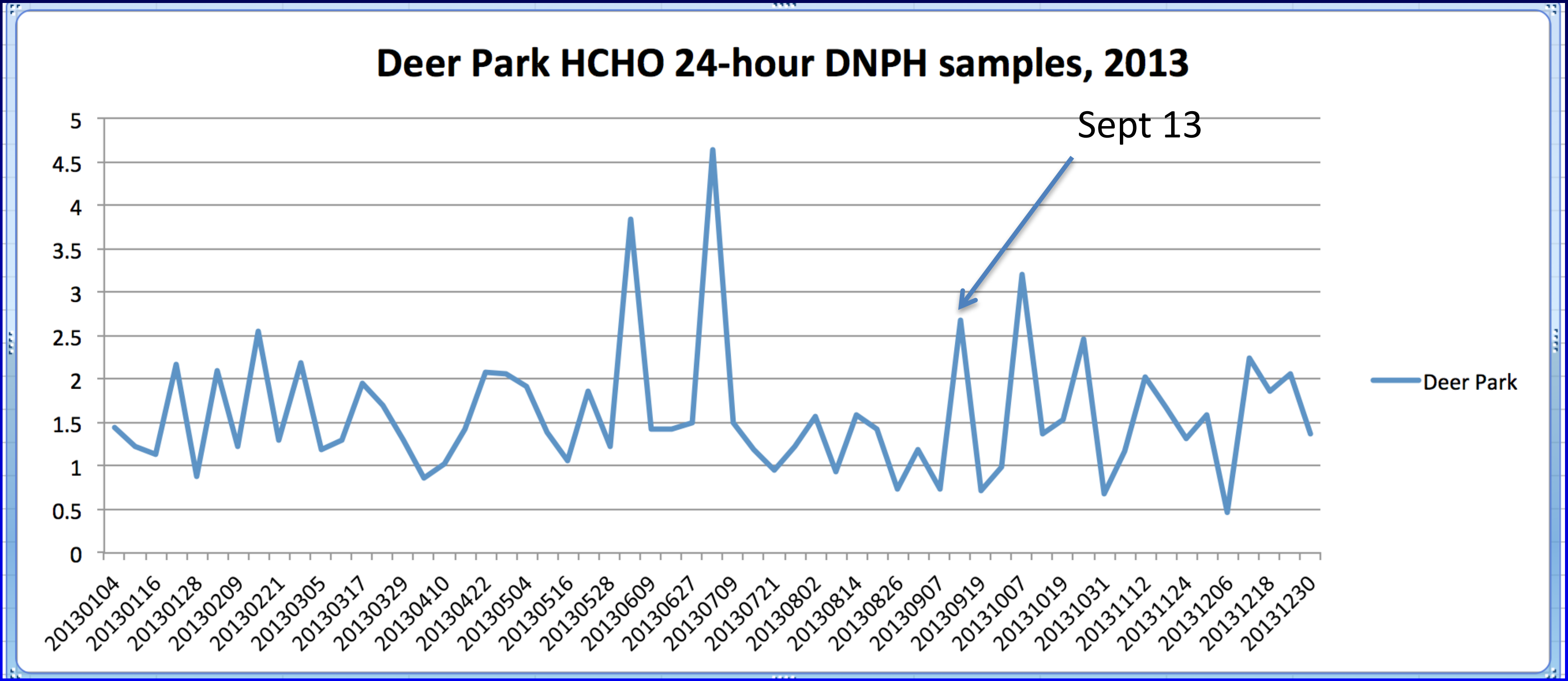
0.71 ± 0.04 (Pure CH_2O Only)

Slopes

0.63 ± 0.01 (All Data)

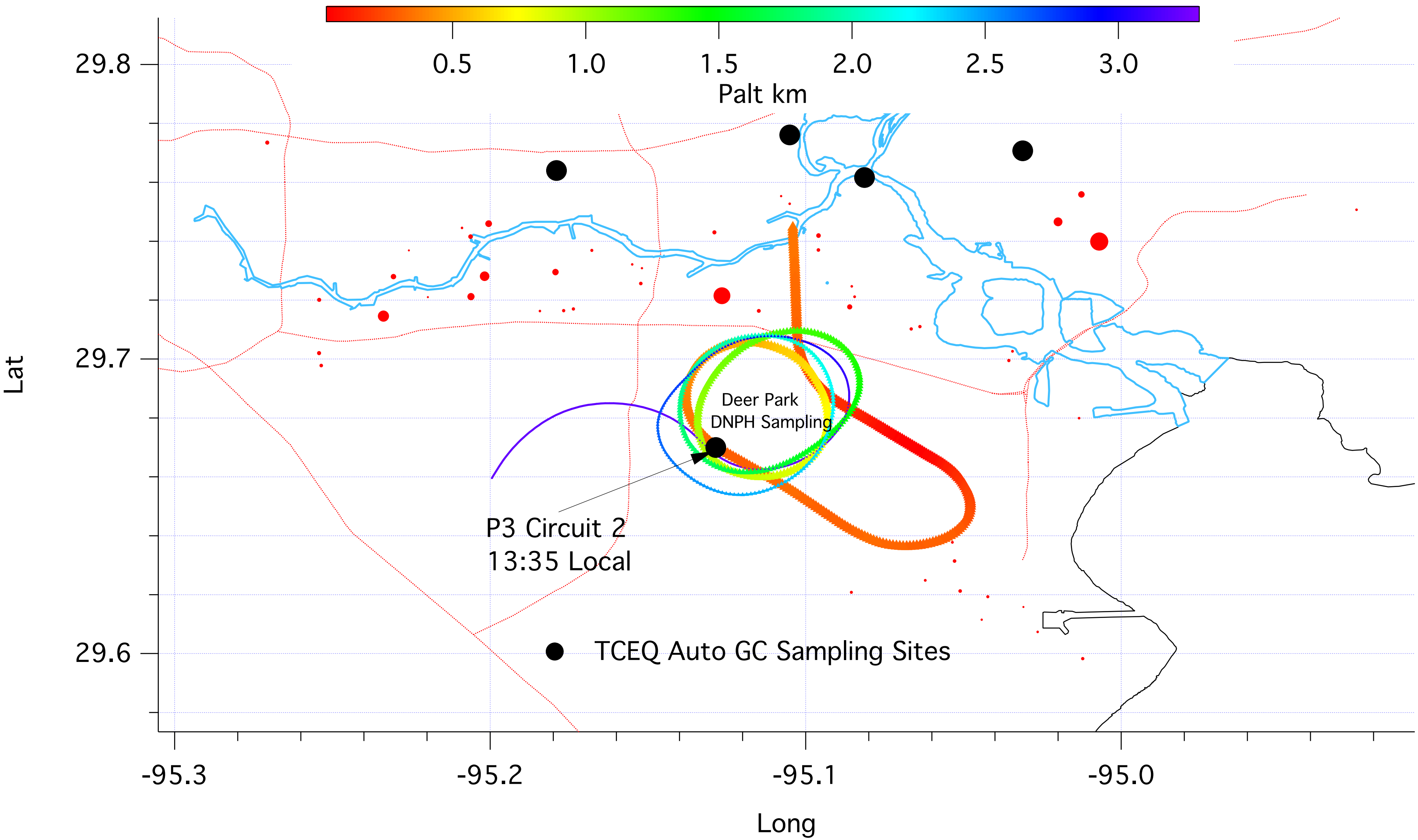
0.76 ± 0.03 (Pure CH_2O Only)

Objectives/Science Drivers (Cont.)

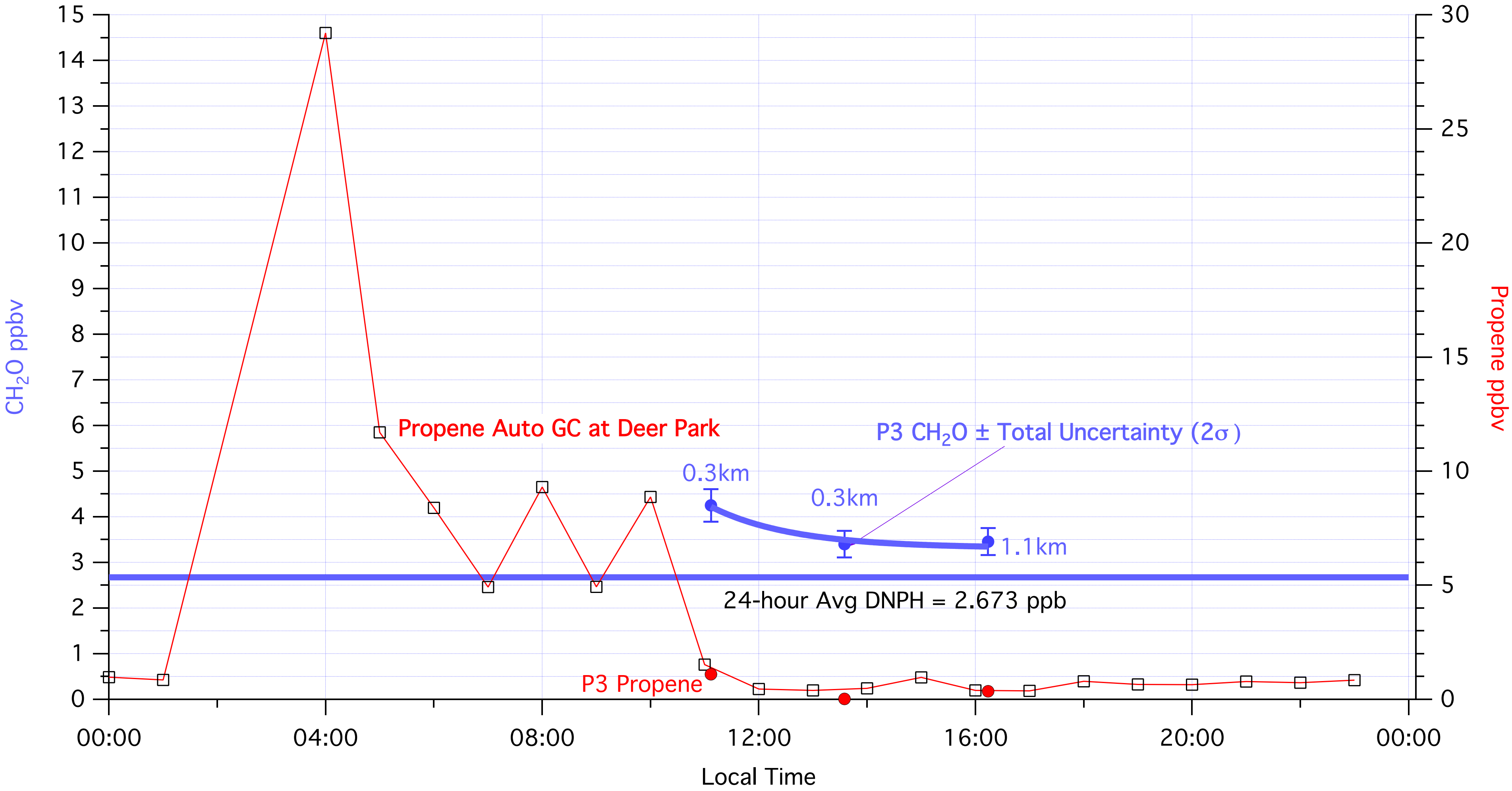


Sept. 13, 2013 P3 CH_2O Measurements Over Deer Park DNPH Site

Support of DNPH Results

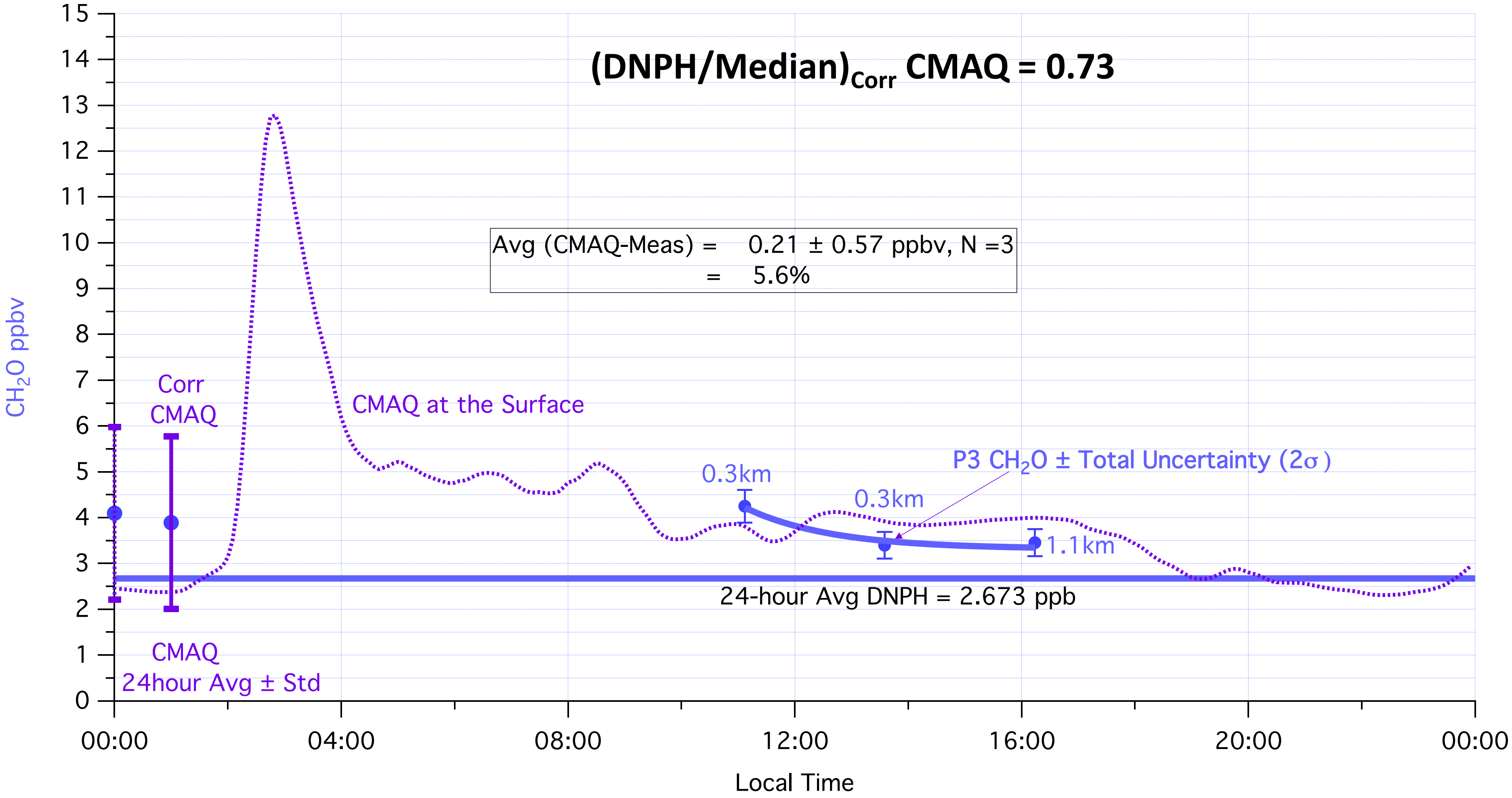


Sept. 13, 2013 Sampling Over Deer Park
P3, 24-hour DNPH & Auto GC Measurements



Propene: PTRMS M. Müller & A. Wisthaler

Sept. 13, 2013 Sampling Over Deer Park
P3, 24-hour DNPH & Auto GC Measurements
CMAQ Modeling

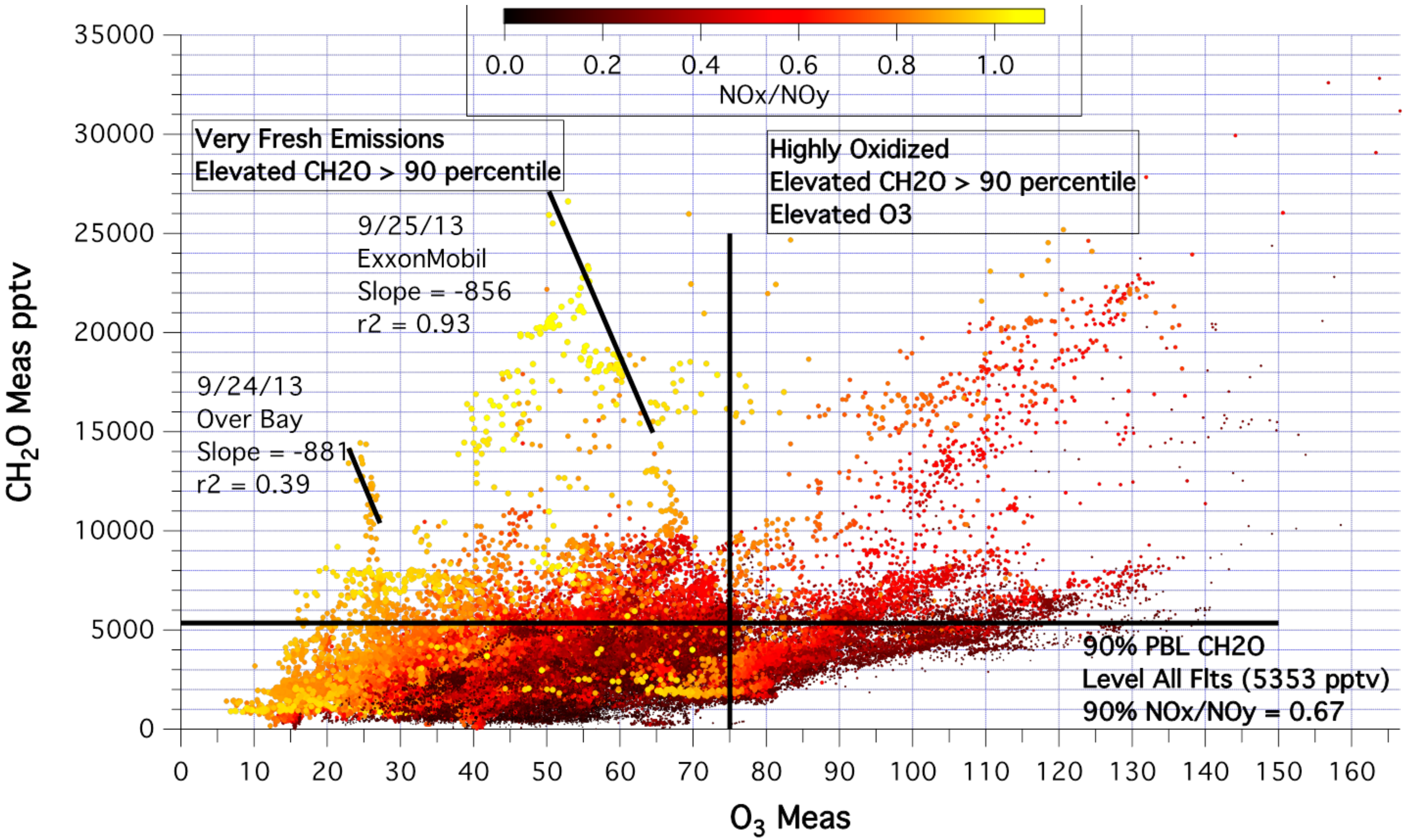


3rd Focus

Start Process of Assessing Primary vs 2nd Sources of CH_2O

Analyzing All Days in PBL

(Direct Emissions vs 2nd PC, Alkene PC)



O_3 & NO_x/NO_y – A. Weinheimer

What Our Preliminary Analysis Shows

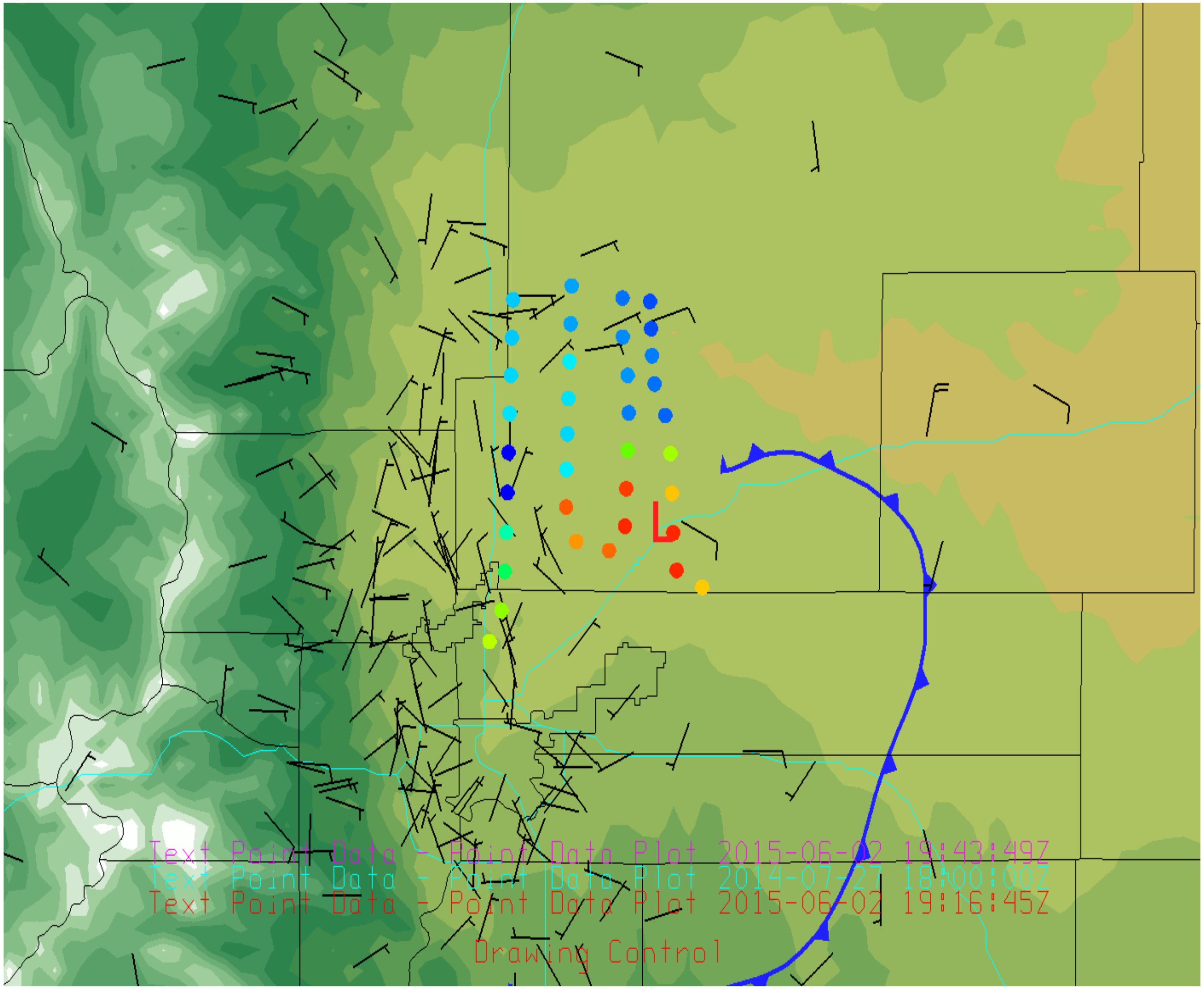
Significant Fraction of Elevated CH_2O & O_3 Associated with Well Aged Air (2^{nd} PC)

But Need Model to Eliminate Sampling Bias

Only Sampled 1/3 of Sept (9/30 days)

Only 1/3 flight day hours (8/24)

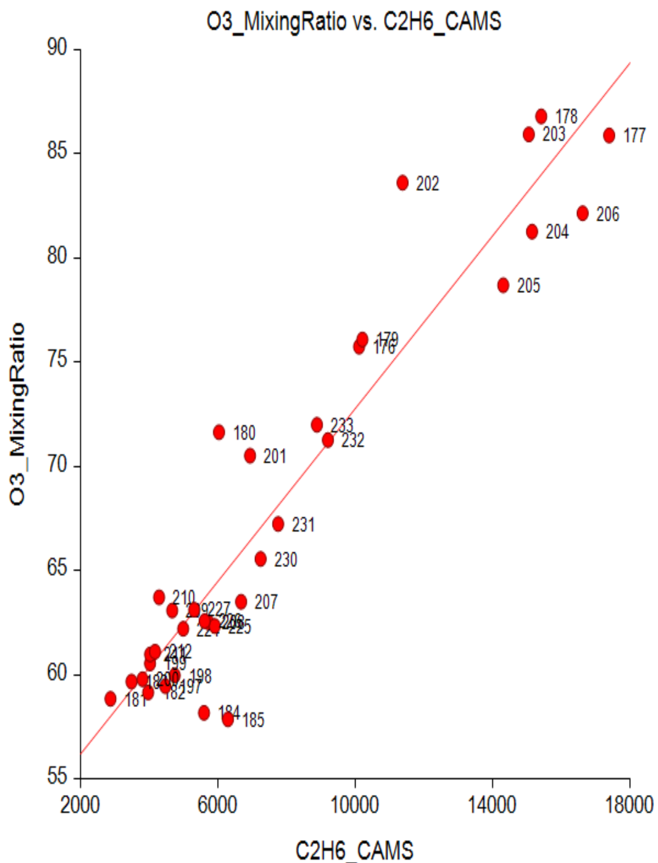
May Not Have Sampled All Emission Sources



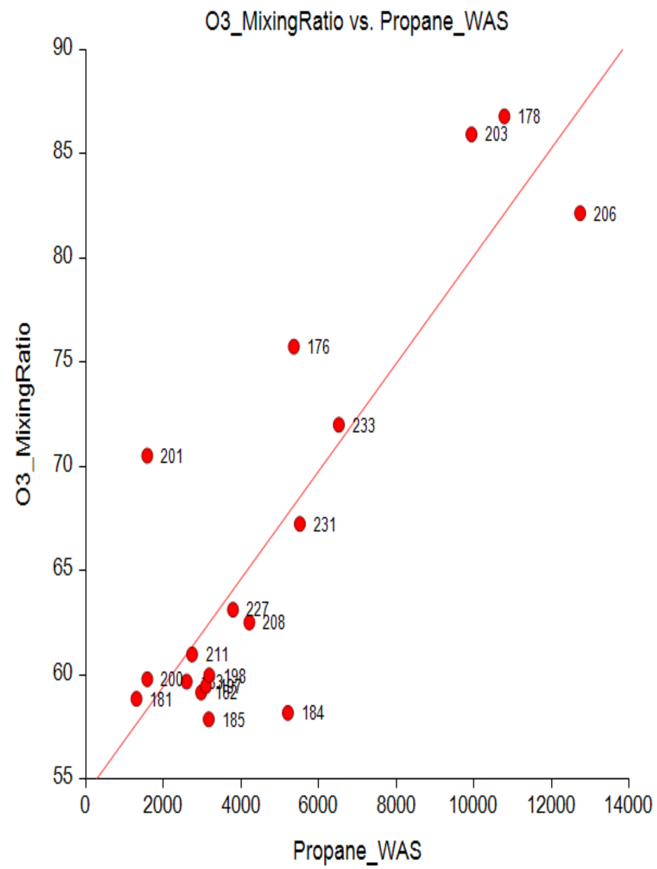
Denver Cyclone surface wind observations: 11 MST July 27, 2014
High O3 (>80 ppb) in red 12 MST; only portion of flight considered here.

Denver Cyclone C130 July 27, 2014:

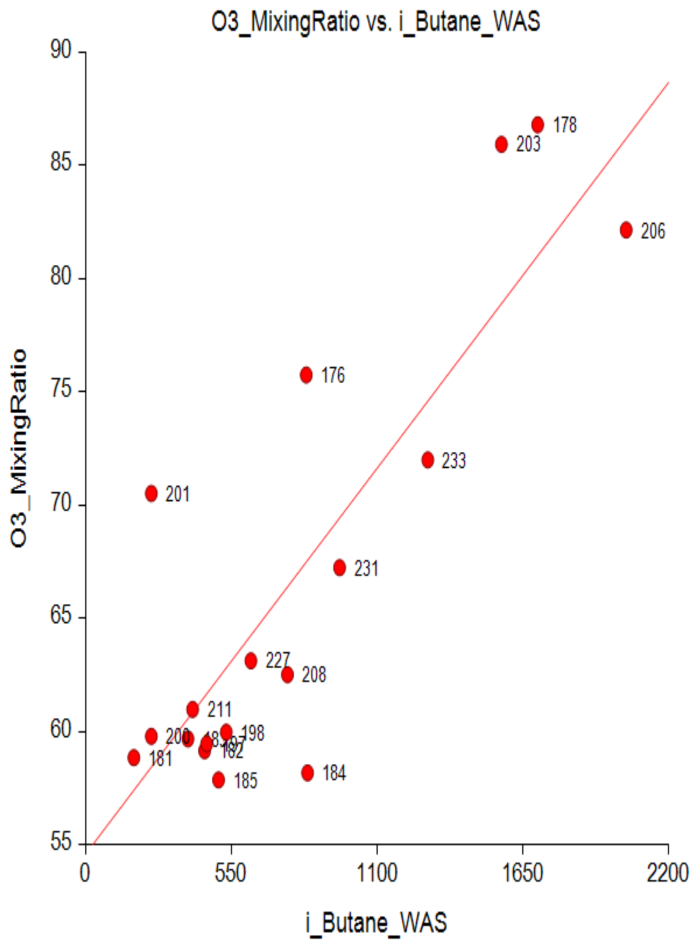
Filter conditions for these analyses: (PRESSURE > 750) AND (LOCAL_SUN_TIME > 12.5) AND ((LATITUDE > 39.7) AND (LATITUDE <= 40.5)) AND ((LONGITUDE > 255) AND (LONGITUDE <= 255.5))

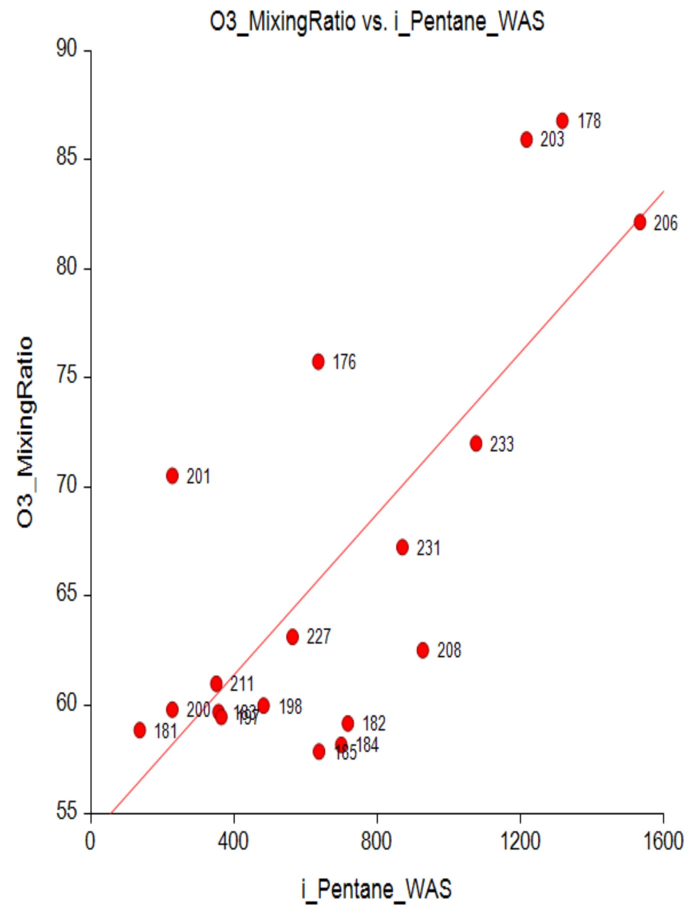


Intercept	52.0156
Slope	0.0021
R-Squared	0.8903
Correlation	0.9436
Coefficient of Variation	0.0464



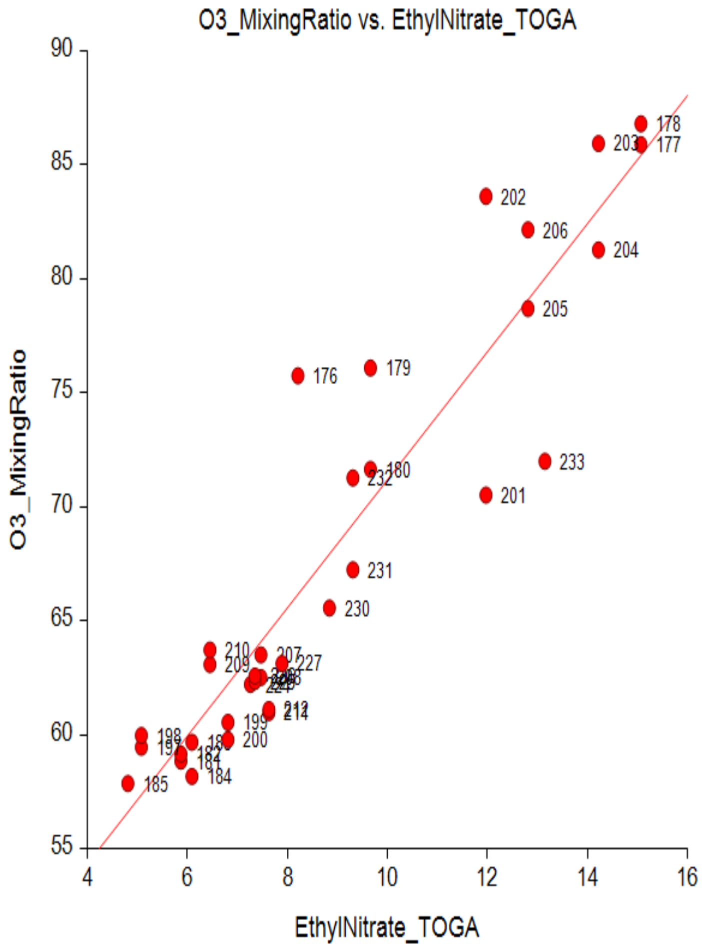
Intercept	54.2973
Slope	0.0026
R-Squared	0.7364
Correlation	0.8581
Coefficient of Variation	0.0786

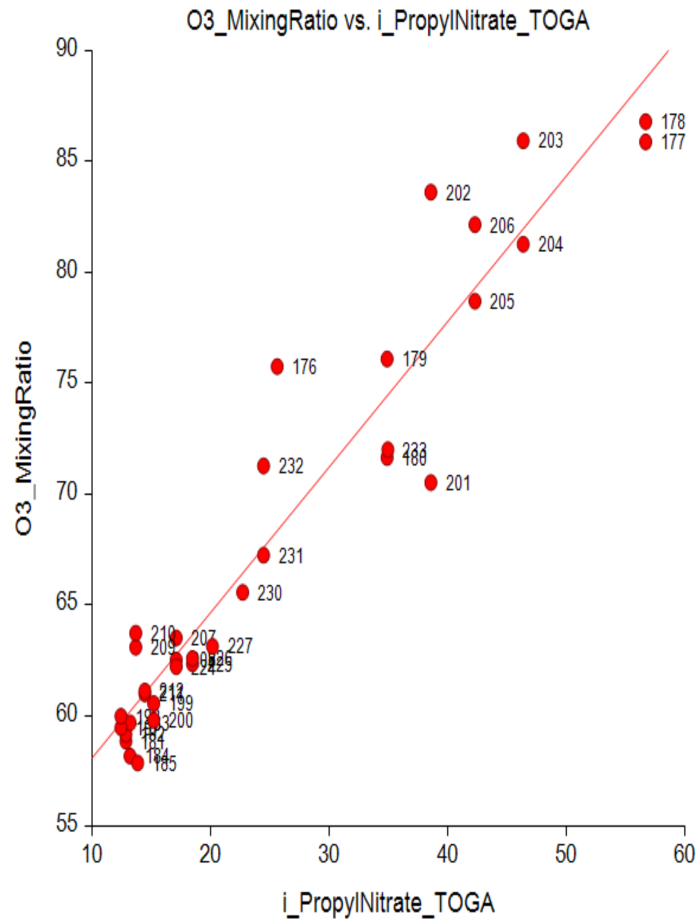




Intercept	**54.6021**
Slope	**0.0155**
R-Squared	**0.7157**
Correlation	**0.8460**
Coefficient of Variation	**0.0816**

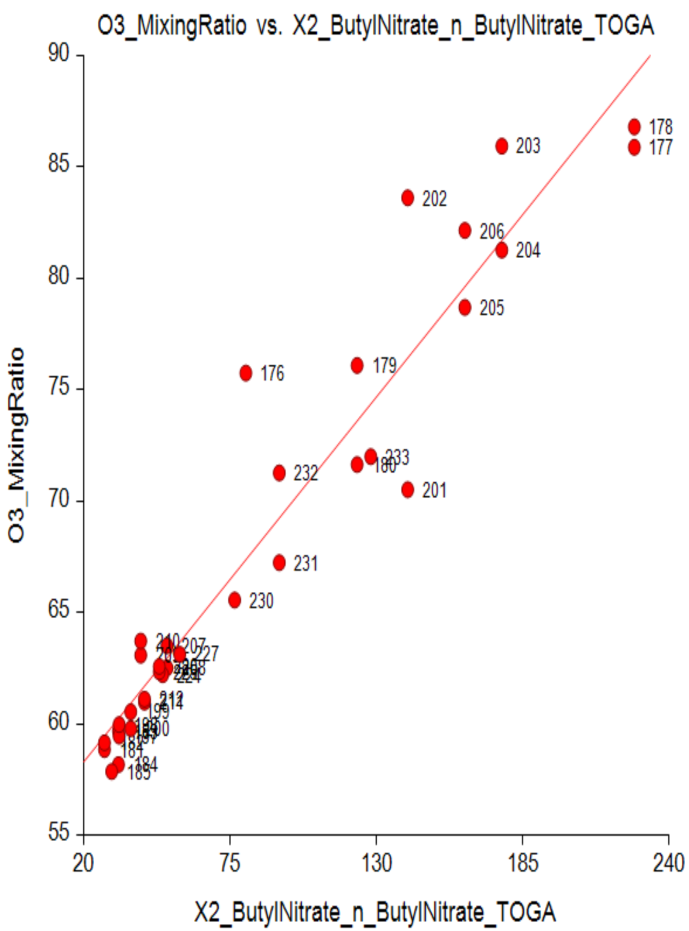
Intercept	**53.9972**
Slope	**0.0185**
R-Squared	**0.5648**
Correlation	**0.7515**
Coefficient of Variation	**0.1010**



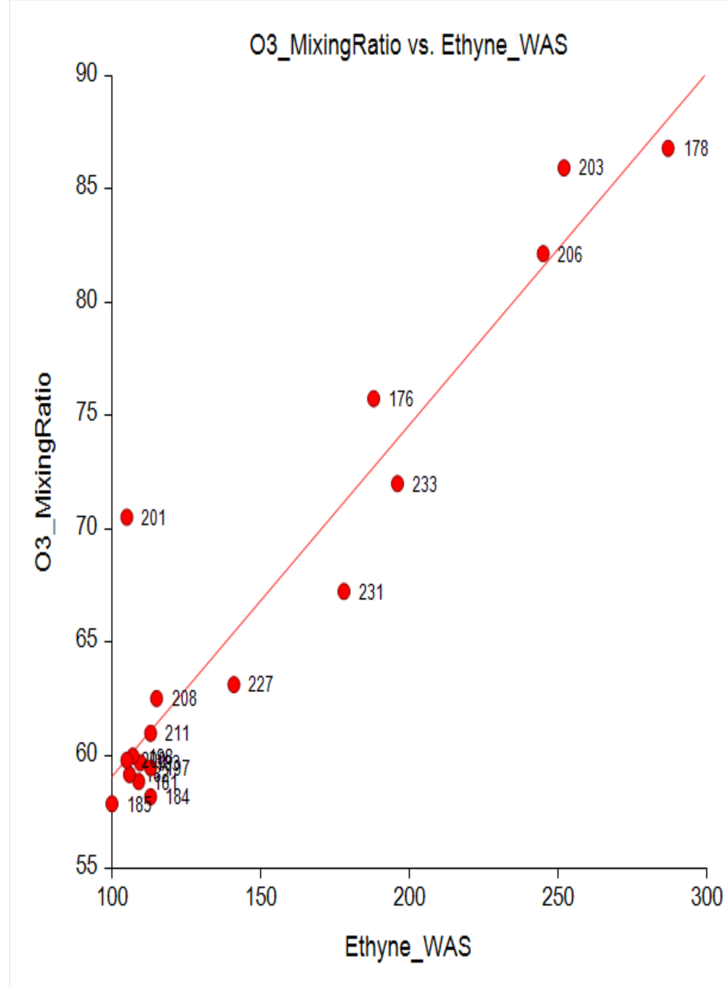


Intercept	**43.0768**
Slope	**2.8118**
R-Squared	**0.8662**
Correlation	**0.9307**
Coefficient of Variation	**0.0513**

Intercept	**51.5078**
Slope	**0.6566**
R-Squared	**0.9141**
Correlation	**0.9561**
Coefficient of Variation	**0.0411**



Intercept	**55.3059**
Slope	**0.1490**
R-Squared	**0.9161**
Correlation	**0.9571**
Coefficient of Variation	**0.0406**



Intercept	**43.5026**
Slope	**0.1554**
R-Squared	**0.8928**
Correlation	**0.9449**
Coefficient of Variation	**0.0501**