Upper Green River Basin Air Quality Citizens Advisory Task Force

Pinedale Library 21 March 2012

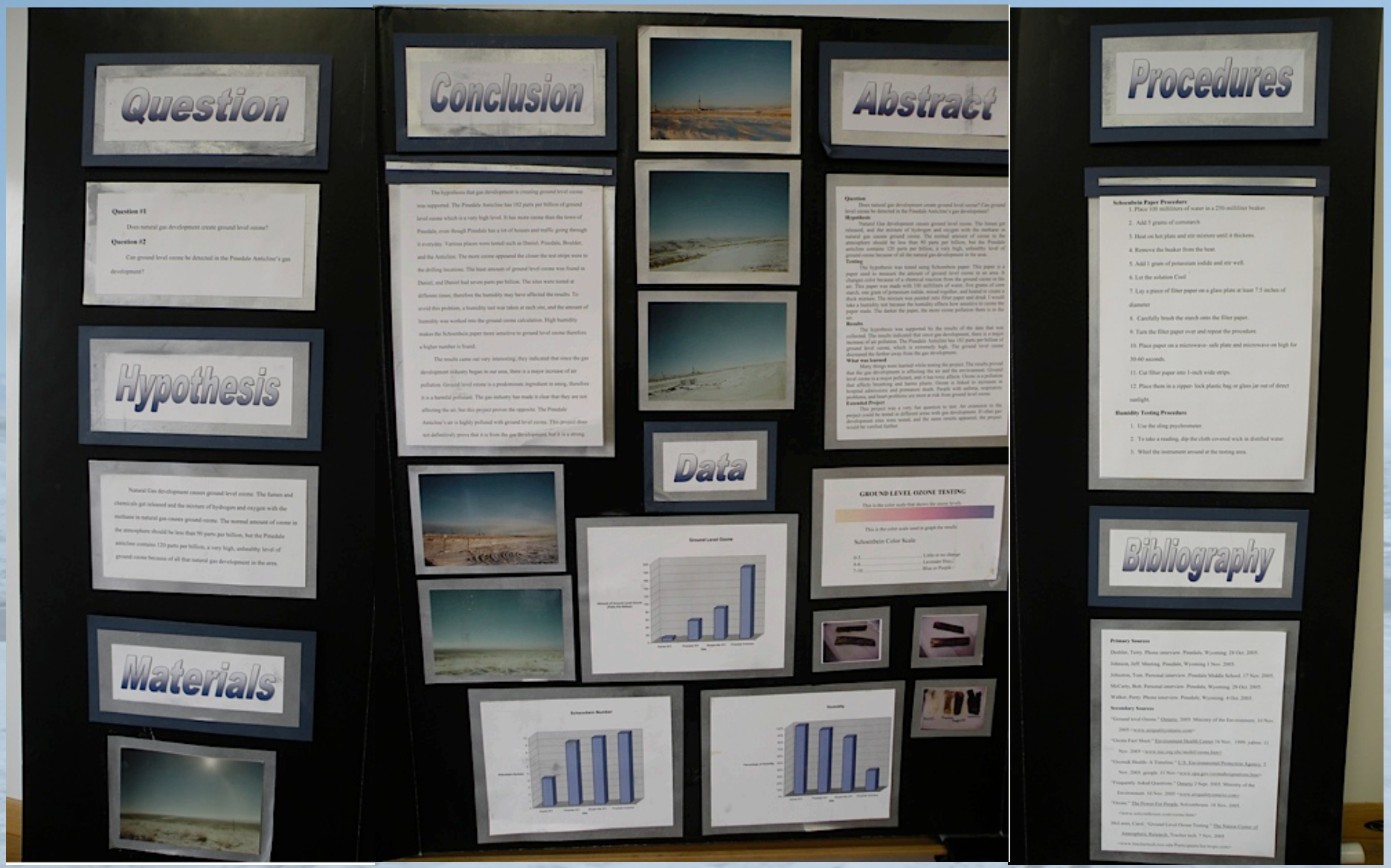
Pinedale Anticline Spatial Air Quality Assessment Updated Preliminary Findings and Provisional Results

DEPARTMENT OF ATMOSPHERIC SCIENCE

FIELD, SOLTIS, MONTAGUE

UNIVERSITY OF WYOMING

Tracy McCarty Middle School 05




UW studies

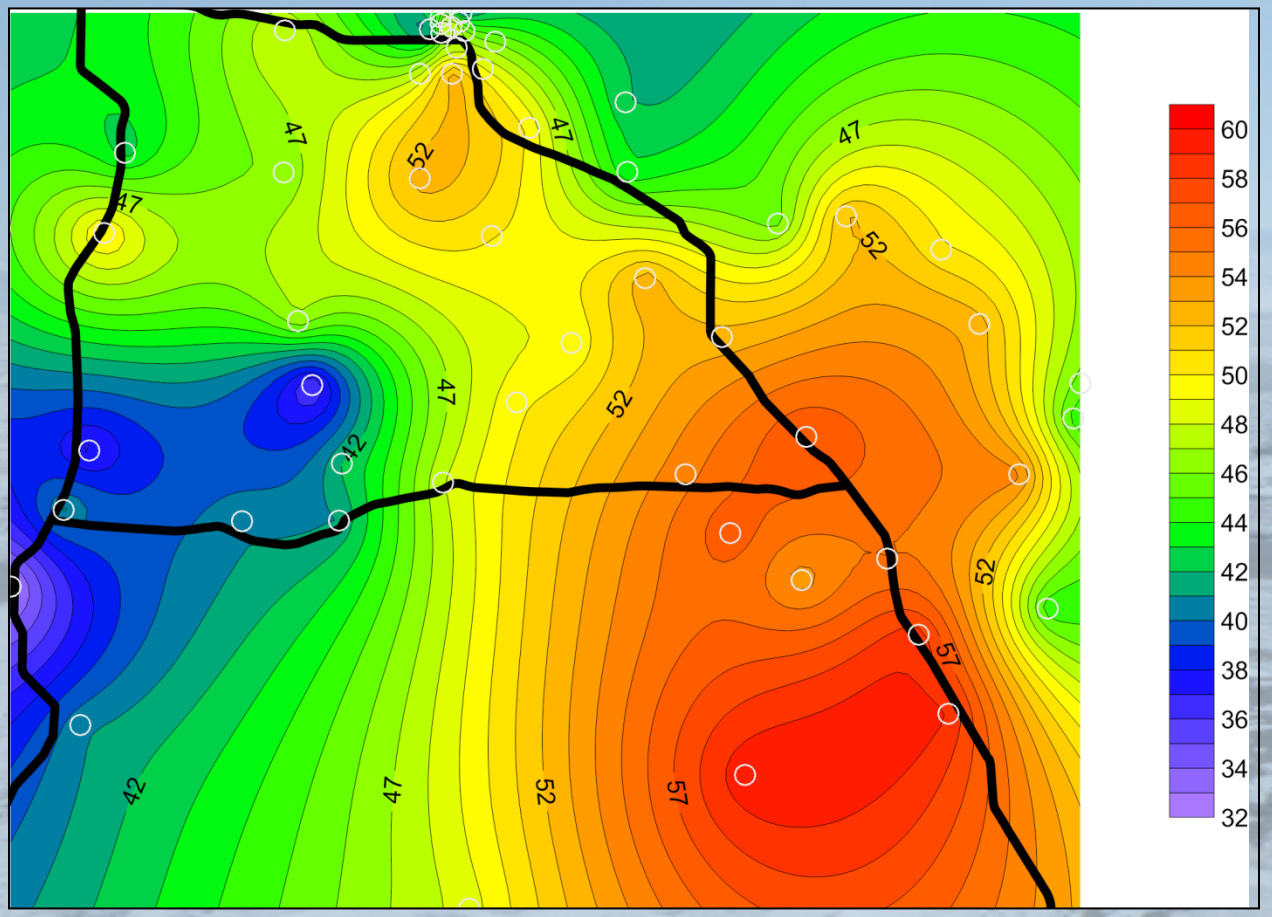
UPPER GREEN RIVER OZONE INVESTIGATION (O3i)

O3i

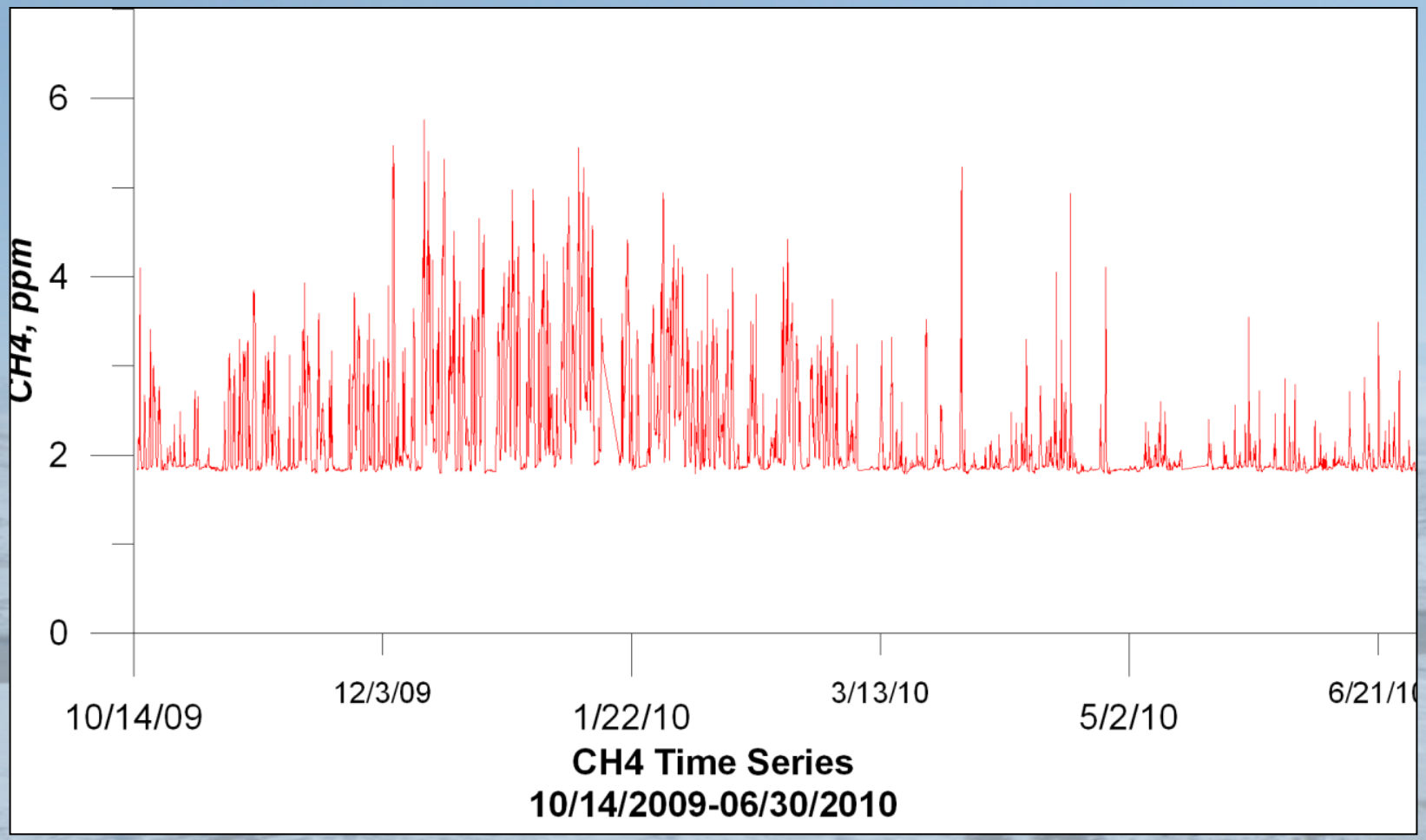
- **2008-09**
  - *Mobile Air Quality Monitoring Lab is Mobile (**Five Locations**)*
    - *Capabilities: O_3, NO-NO_2-NO_x, CH_4, NMHC*
- **2009-10**
  - *Mobile Air Quality Monitoring Lab is Stationary (Olson Ranch)*
    - *Capabilities: Added CO and O_3 Primary Standard*
- **Traffic Survey**

Upper Green River Ozone Investigation (O3i)

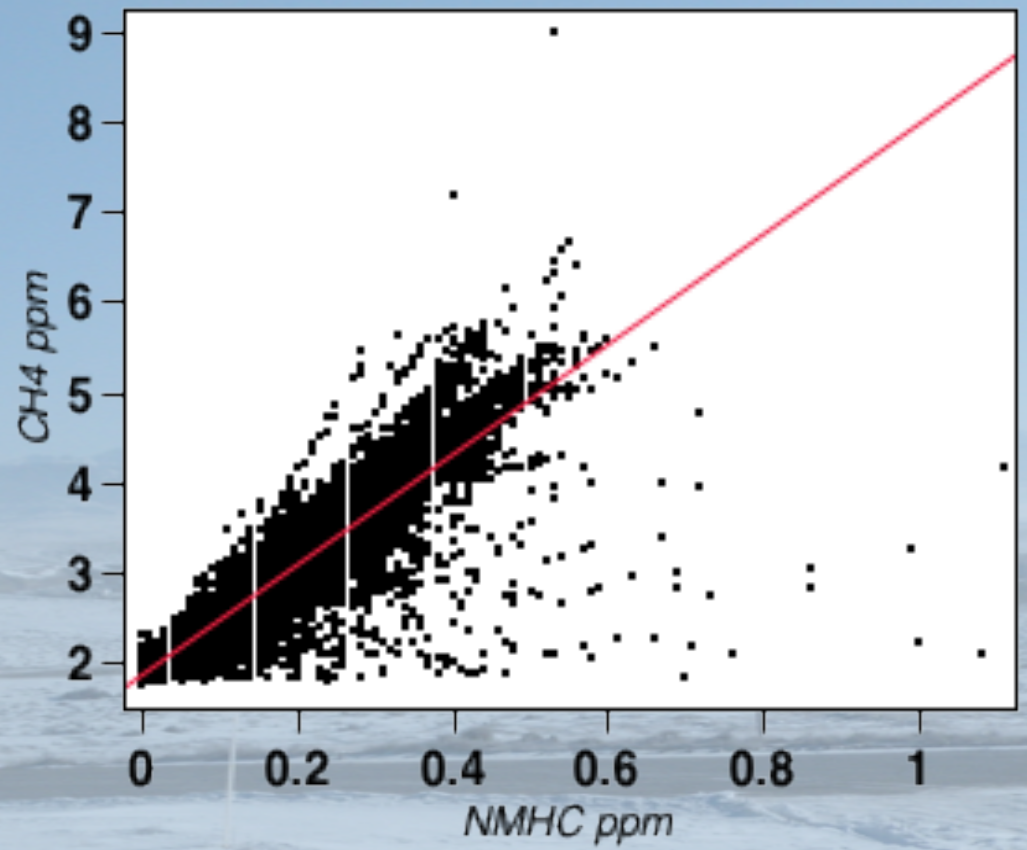
- *Spatial Ozone Survey 22 Feb 2009*



Methane at Olson Ranch



Methane and NMHC



CH4 ppm = 1.8608231 + 6.0973174 × NMHC ppm; Intercept = 1.86.

PINEDALE ANTICLINE SPATIAL AIR QUALITY ASSESSMENT

PASQUA 2011

Improved Study Design & Expanded Capabilities

LOCATION:

BOULDER SOUTH ROAD
7019 ft

N42.6840° W109.7083°

O_3

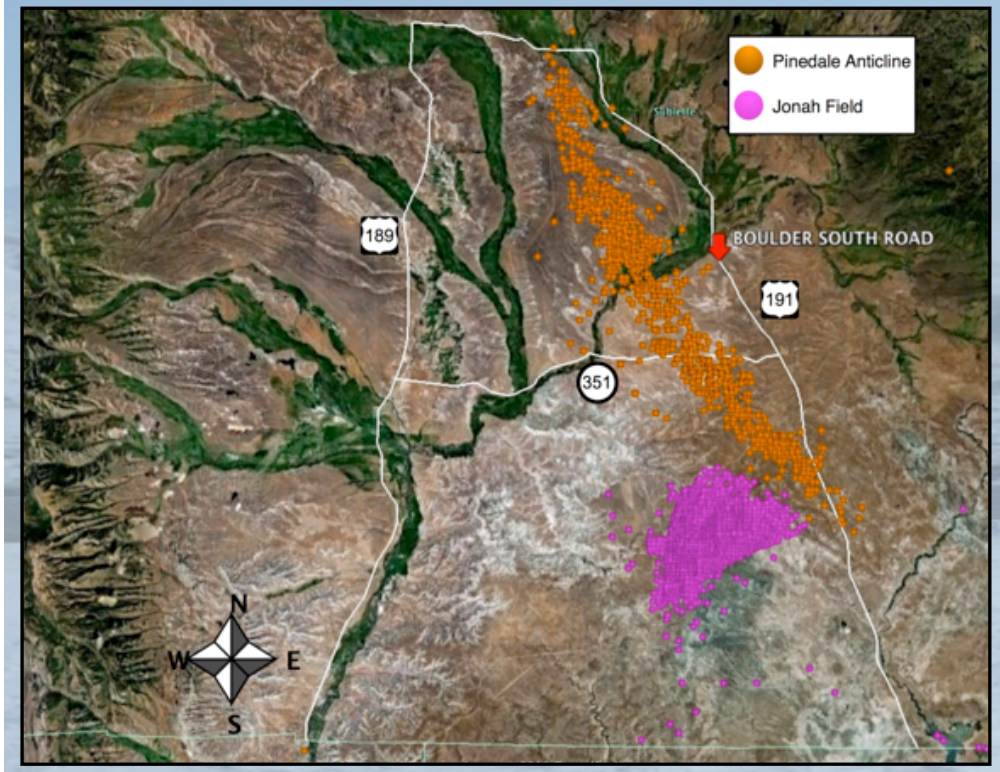
$NO - NO_2 - NO_X$

CO

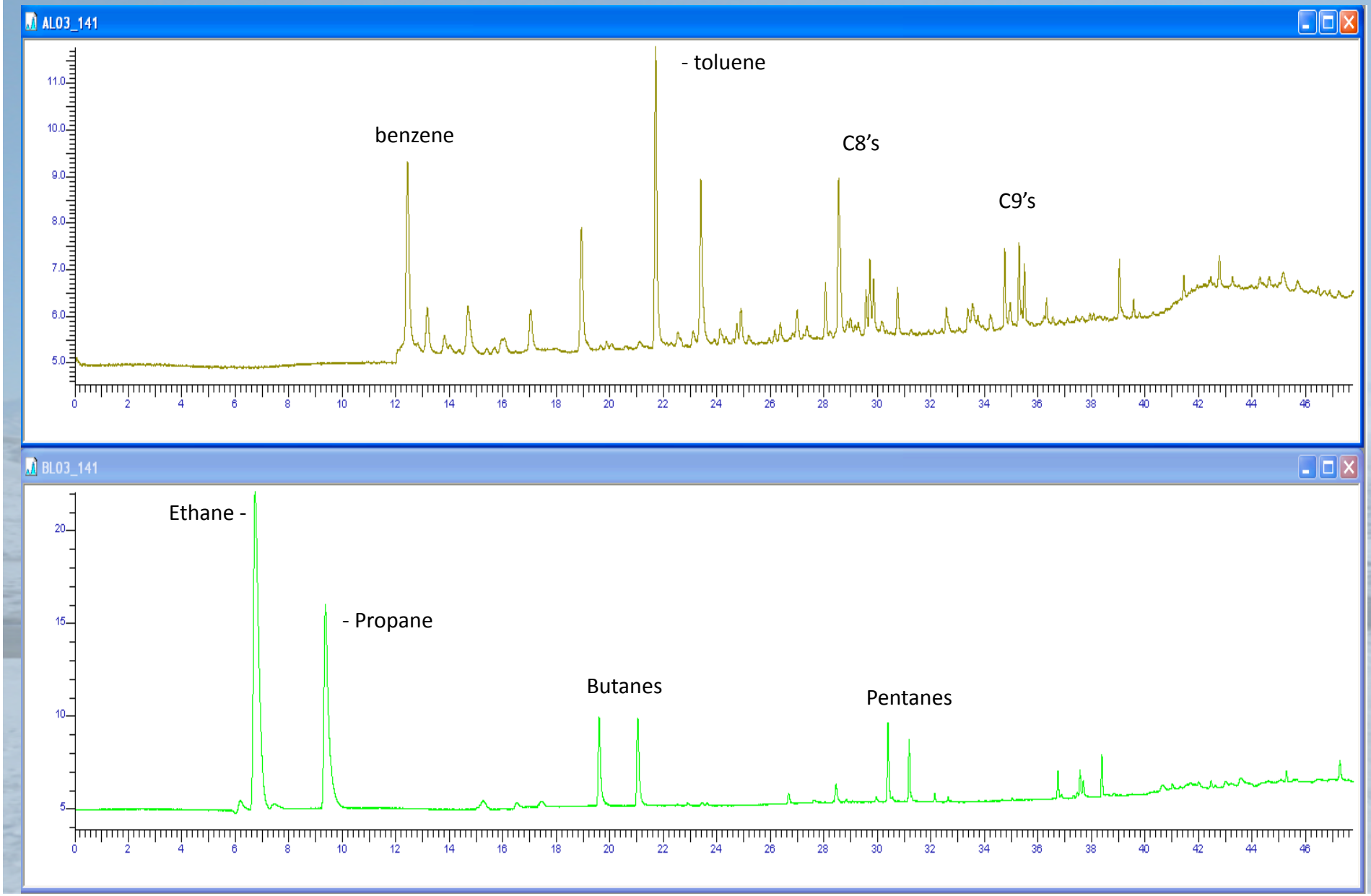
CH_4 & NMHC

VOC

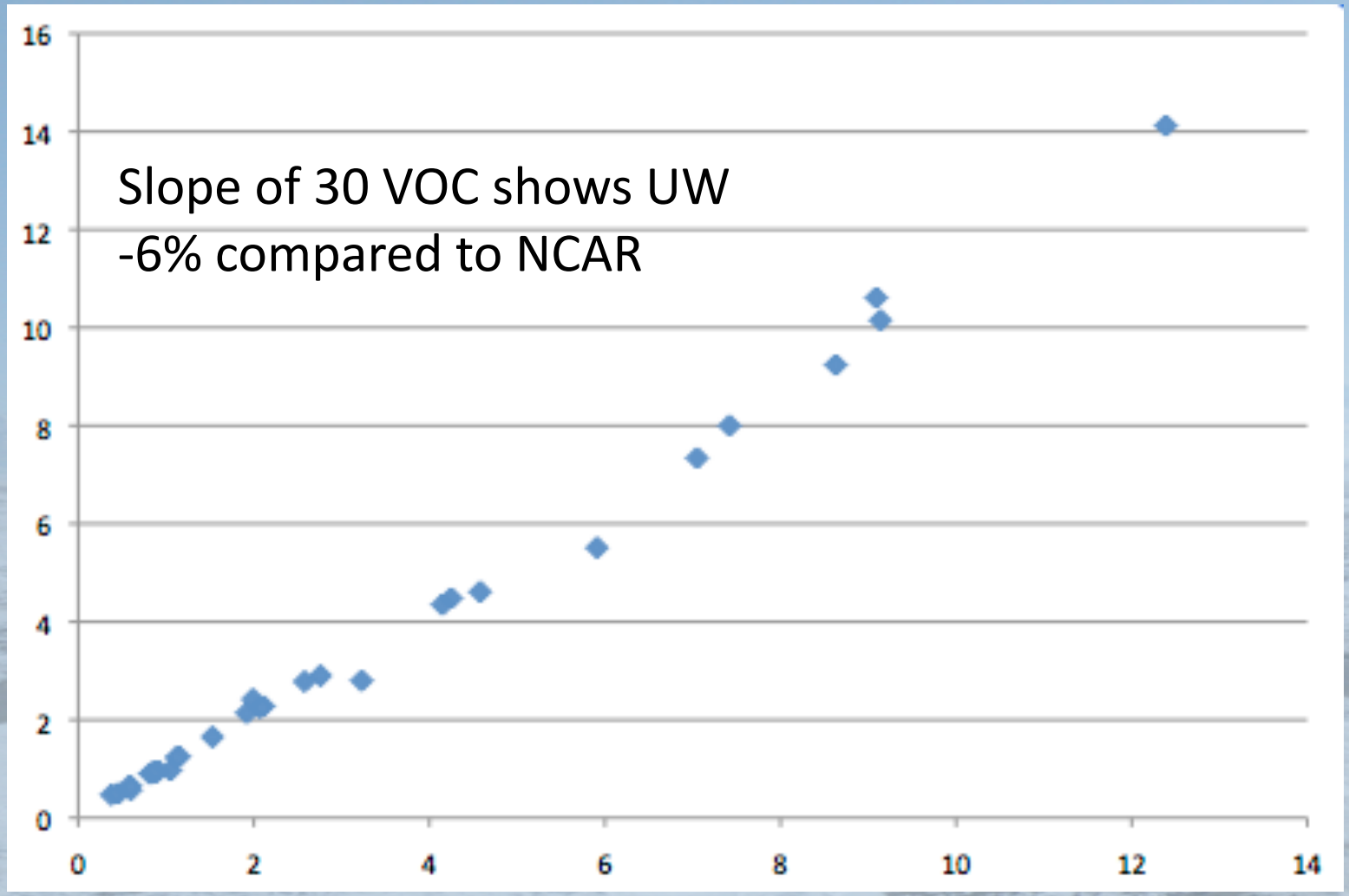
MET

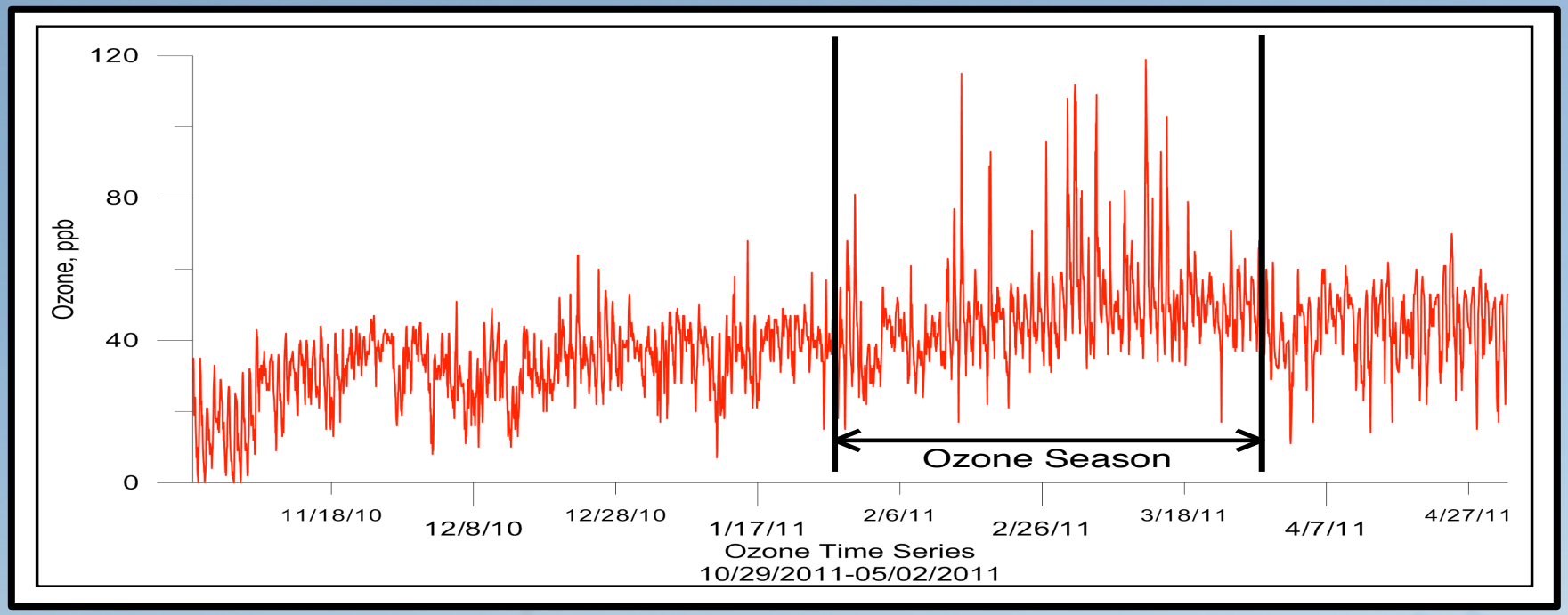


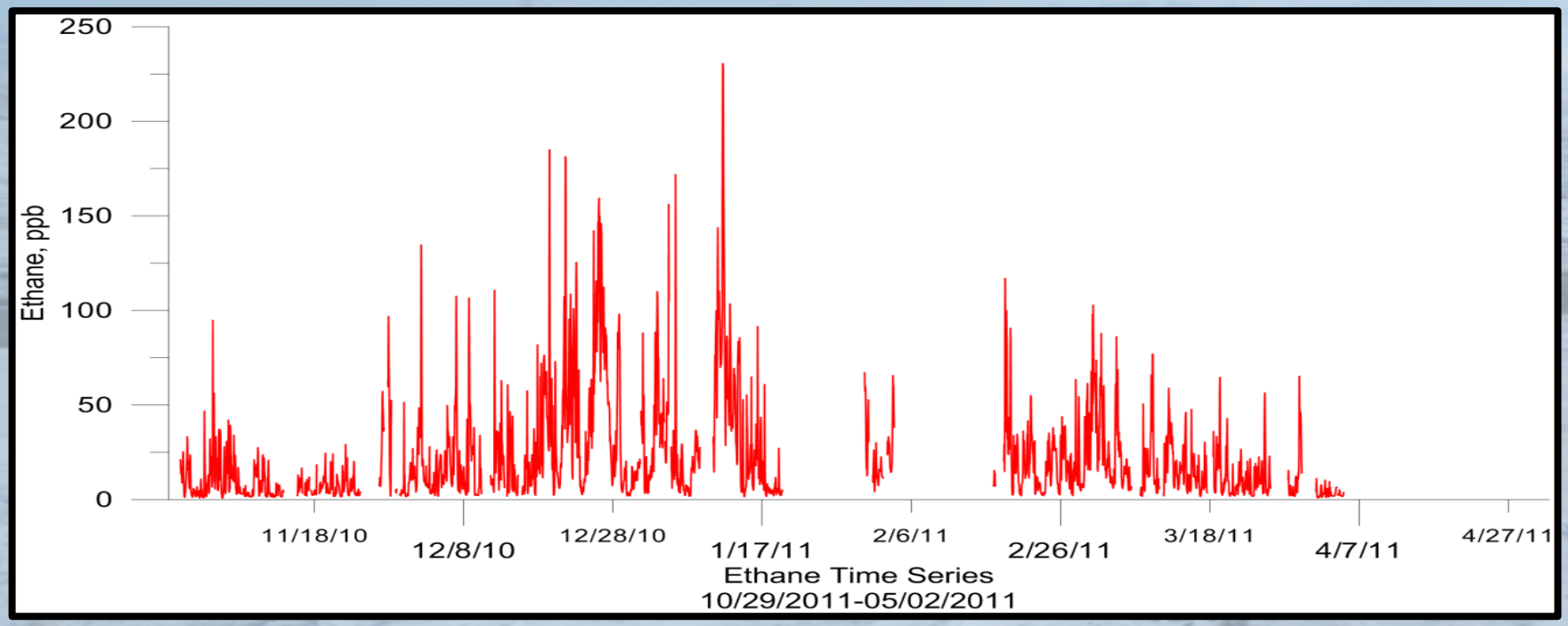
Chromatograms 5/1/2011 12:00



Audit by NCAR 2011




120
80
40
0
Ozone, ppb
Ozone Season
11/18/10
12/8/10
12/28/10
1/17/11
2/6/11
2/26/11
3/18/11
4/7/11
4/27/11
Ozone Time Series
10/29/2011-05/02/2011

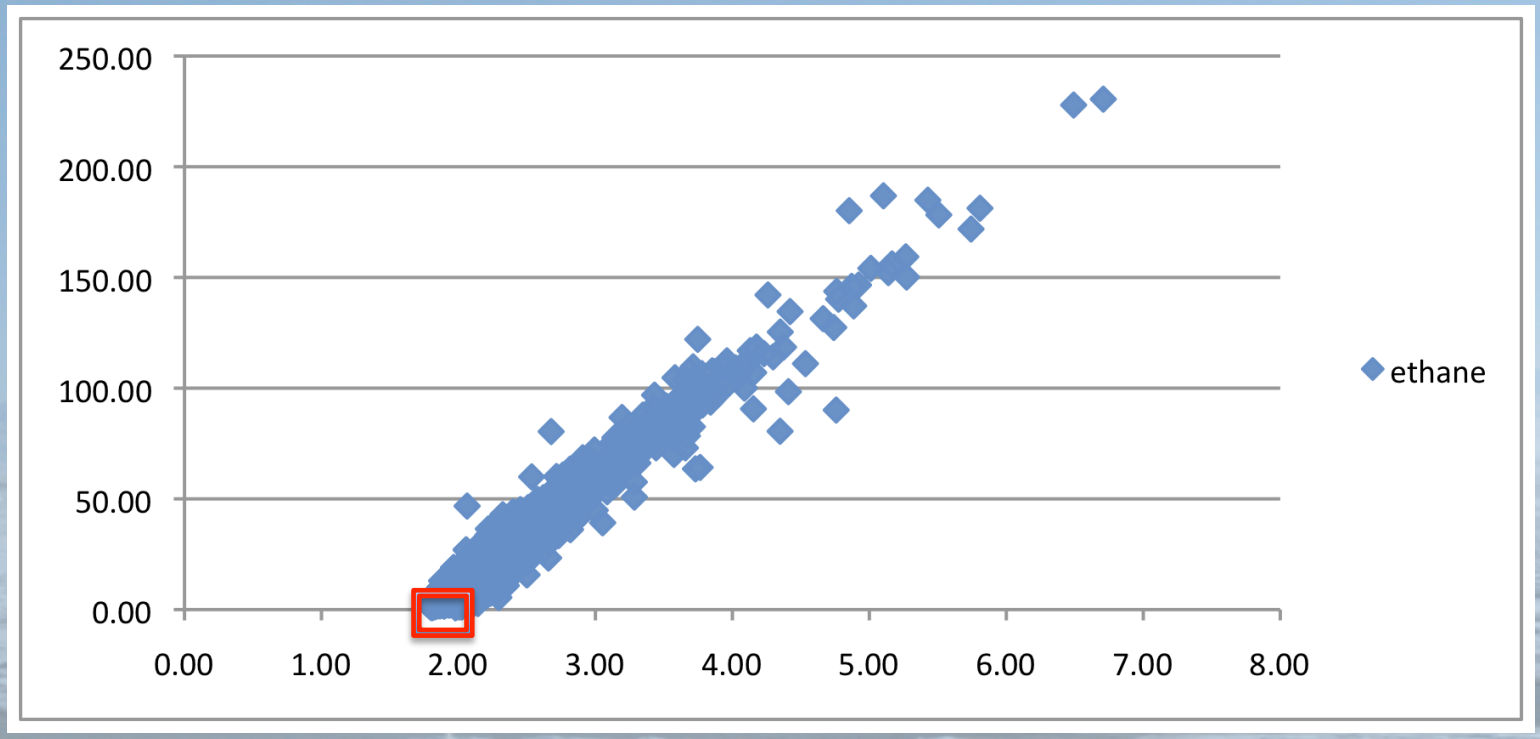

250
200
150
100
50
0
Ethane, ppb
11/18/10
12/8/10
12/28/10
1/17/11
2/6/11
2/26/11
3/18/11
4/7/11
4/27/11
Ethane Time Series
10/29/2011-05/02/2011

Methane vs. Ethane

Nov 2010 to Apr 2011

Perkin Elmer OPA

ethane ppb

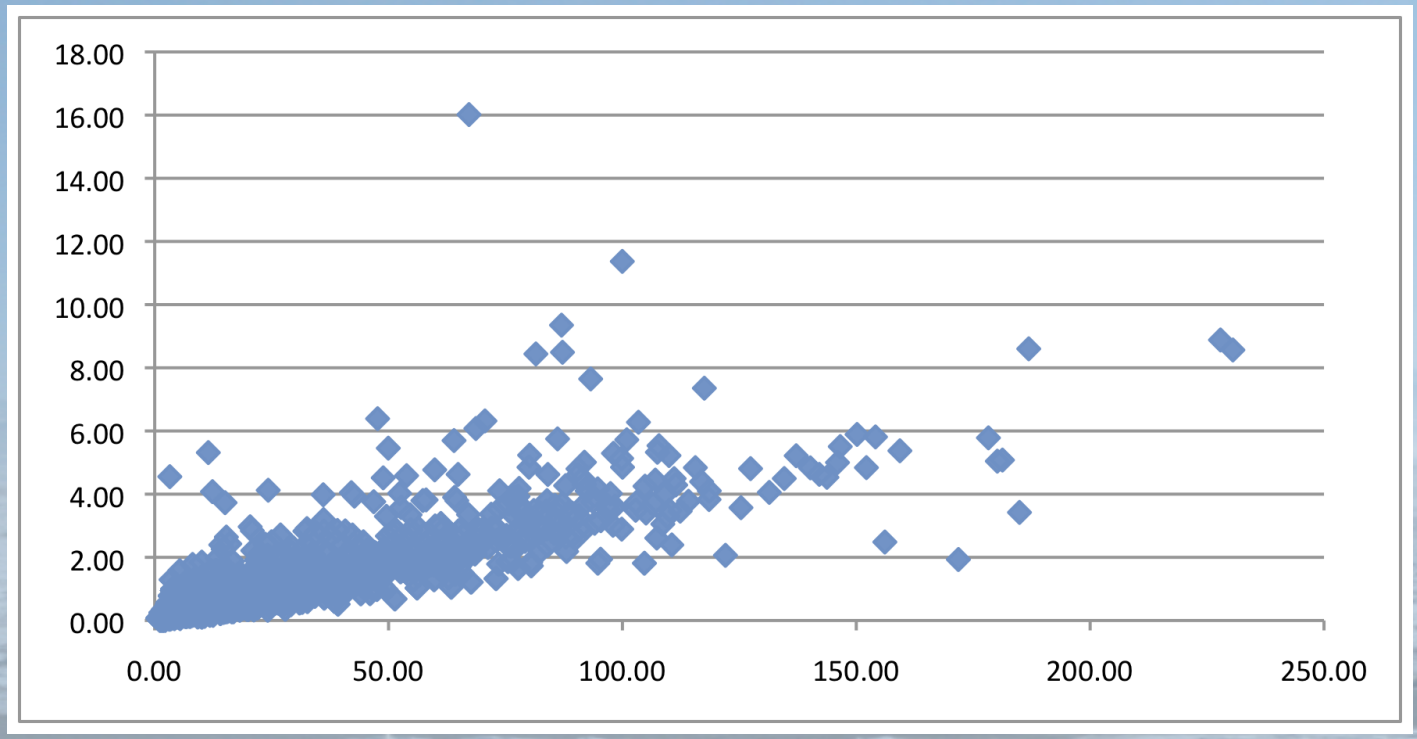


Thermo Scientific 55i Instrument

methane ppm

Benzene vs. Ethane

Nov 2010 to Apr 2011



PAPA Wet Gas vs. Ambient air

% contribution based on ppb

PAPA		UW
51.6	Ethane	51.0
22.7	Propane	18.9
7.0	i-Butane	5.2
6.1	n-Butane	5.4
0.4	Cyclopentane	0.2
3.4	i-Pentane	2.6
1.6	n-Pentane	1.8
	2-methylpentane	0.7
	3-methylpentane	0.4
1.1	n-Hexane	1.0
0.4	Benzene	2.0
1.0	Cyclohexane	1.1
2.6	Heptanes	1.0
0.1	i-octane	0.3
0.3	Methylcyclohexane	
0.7	Toluene	4.1
0.6	n-octane	0.9
0.0	Ethylbenzene	0.4
0.4	Xylenes	2.8

Positive Matrix Factorization (PMF) UW 2011 Data

A two factor solution:

1. Wet gas fugitive short chain VOC
2. Aromatic and long chain VOC*

*in March 2011 factor 2 tracks ozone rise during episode conditions

Ozone Production Potential based on OH reactivity and UW Ambient Air concentrations

% contribution based on ppb March 2011

Number of Compounds	Group	Carbon Number	% Contribution
n=1	Methane	C1	7.9
n=8	Alkenes	C2 to C5	8.7
n=11	NG Short Chain Alkanes	C2 to C6	25.8
n=8	Aromatics	C6 to C9	43.4
n=4	Long Chain Alkanes	C7 to C10	13.8

LOCATION, LOCATION LOCATION (vs. Canisters)

Ozone Production Potential
Biggest Targets
% contribution based on ppb March 2011

Compound(s)	% Contribution
Toluene	~10
Xylene isomers	~15
Trimethylbenzene isomers	~15
Total	40

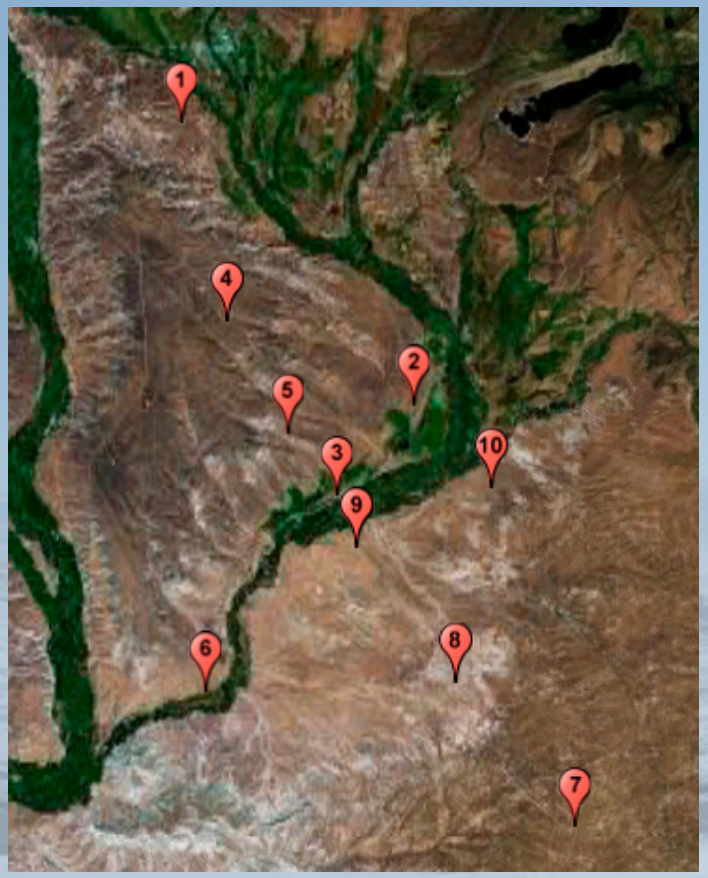
Biggest Target (B)TEX-TMB

Do we know the relative importance of contributing emission sources for these compounds?

90+ % of JPDA Condensate consists of C7 and above compounds


PASQUA 2012

12 CANISTER SURVEYS 2012

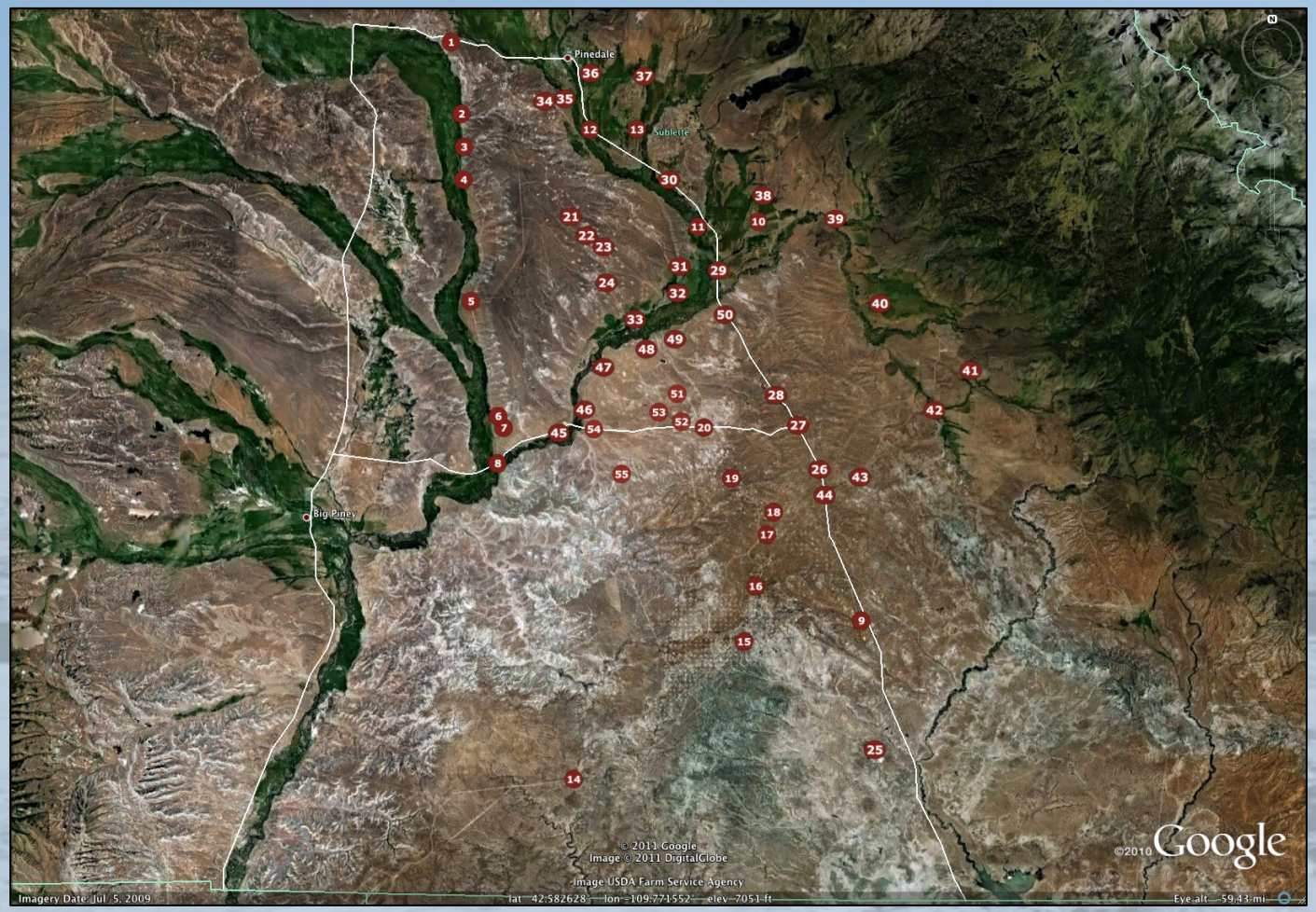


12 Canister Surveys **One a week** **January to March 2012**

SPATIAL SURVEYS BTEX AND NO_X

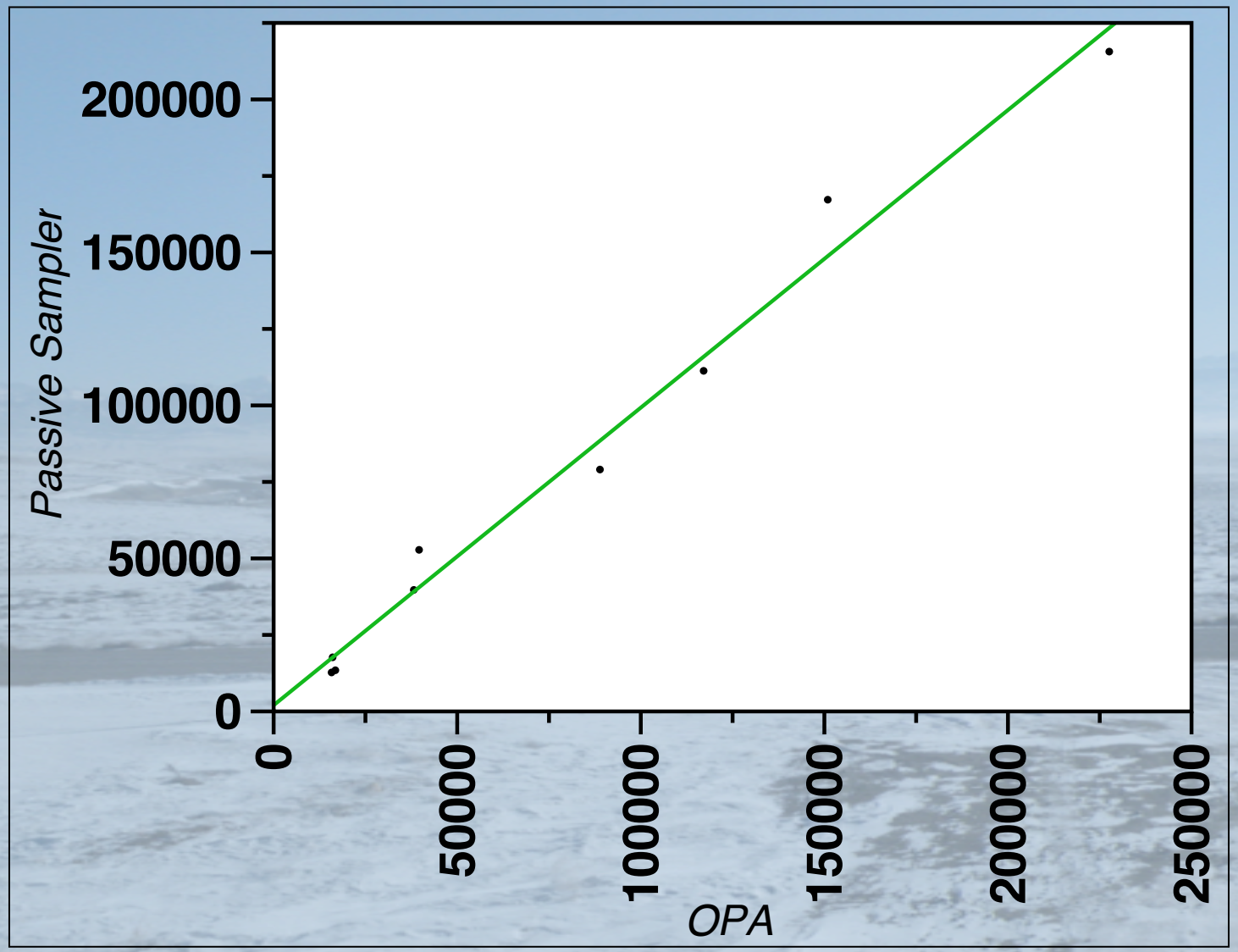
(March 2011)
November 2011
February 2012

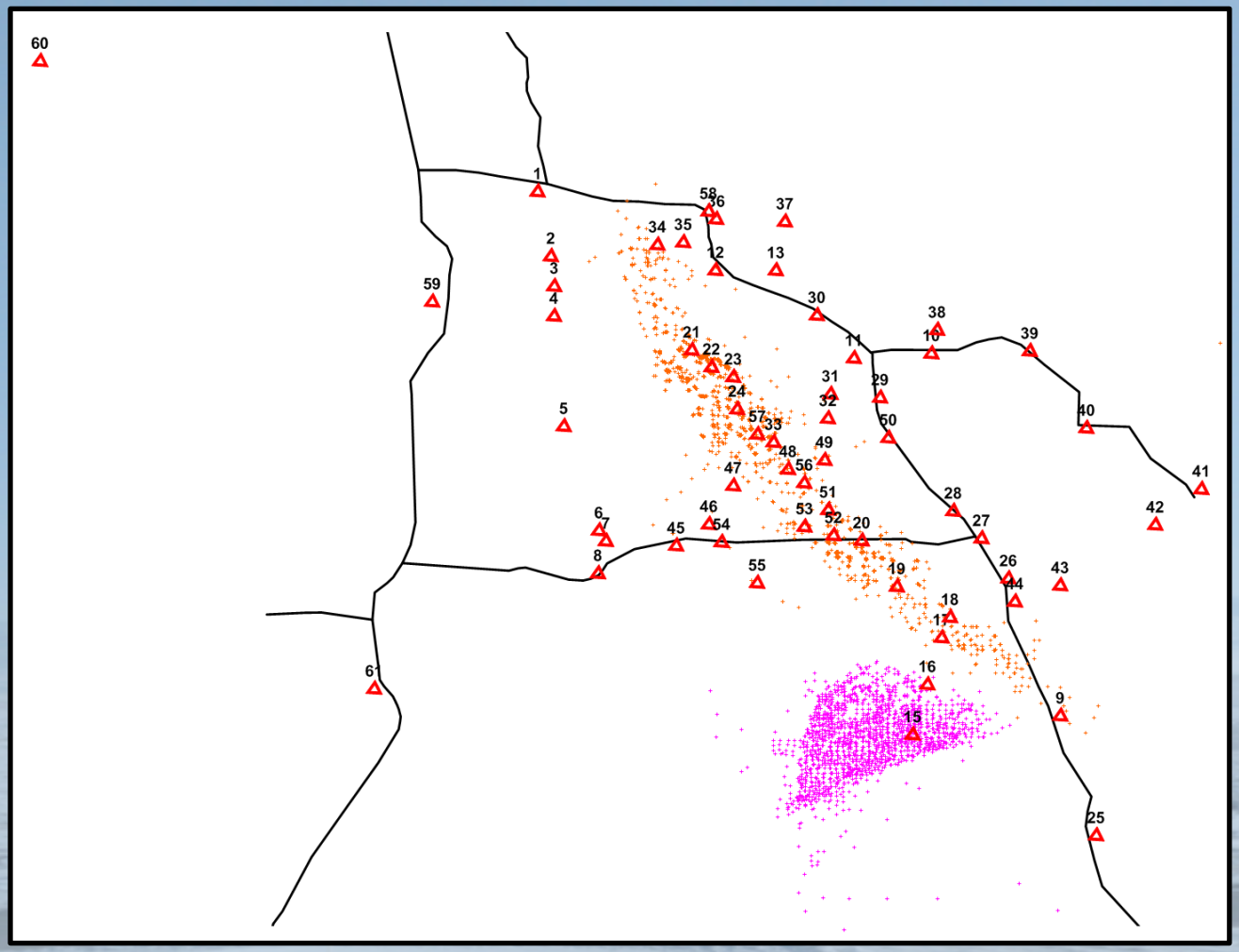
LOCATIONS: BTEX & NO_X SURVEYS



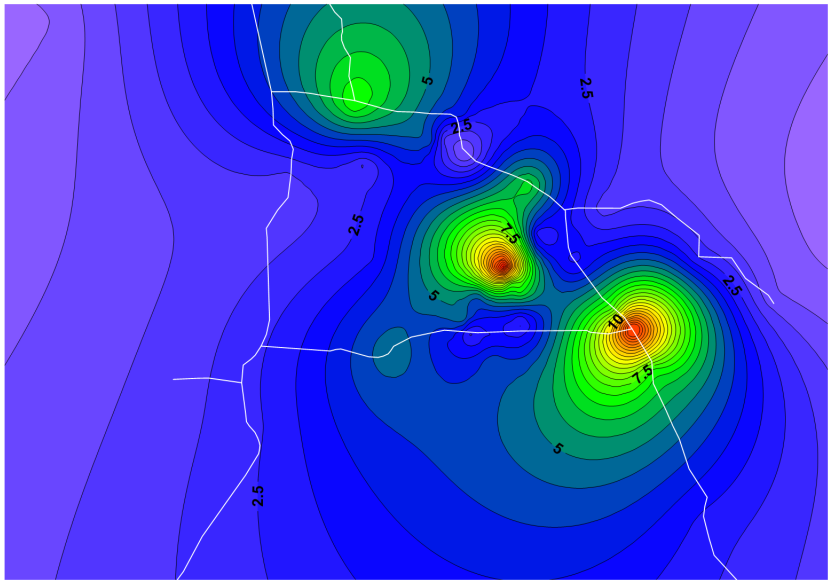
11 CO-LOCATED SITES 2011

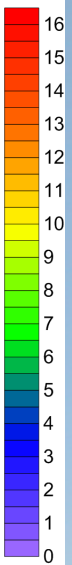
RAW BENZENE RESPONSE



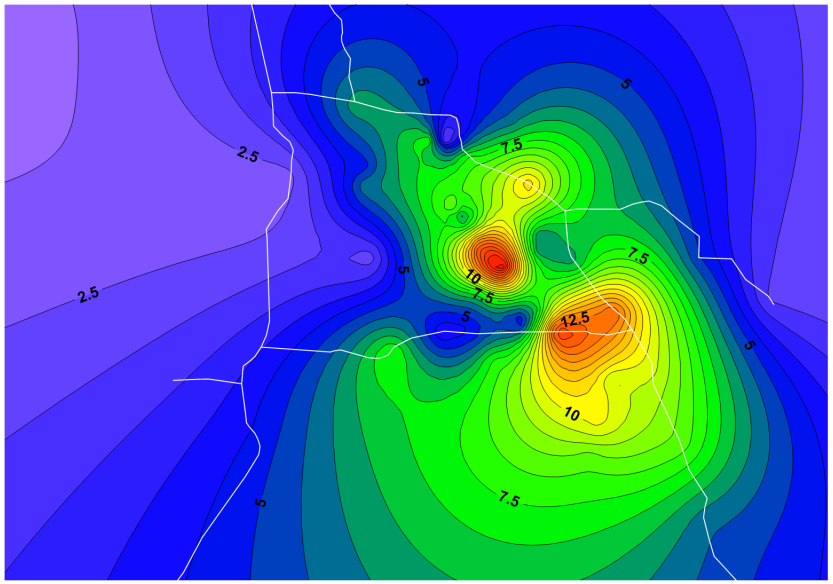


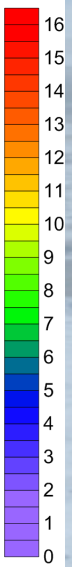
2011-12 PASQUA BTEX–NOx Sites





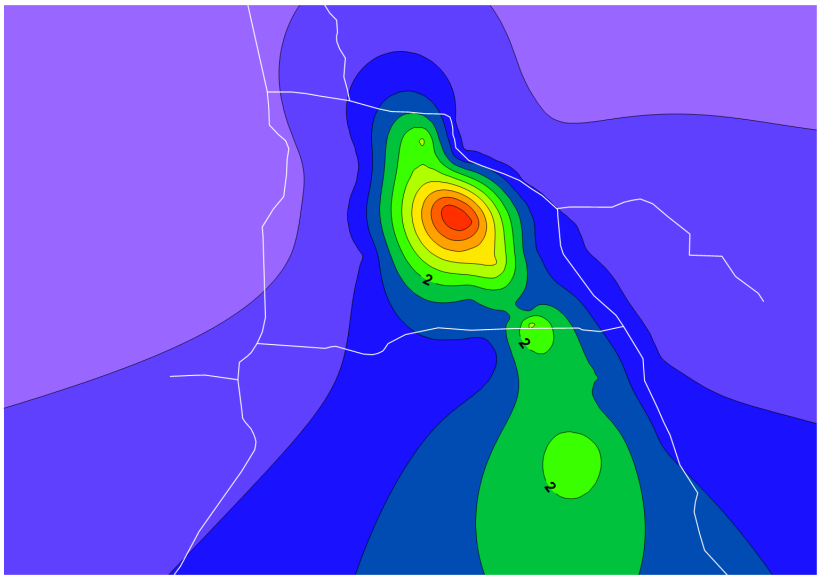
November 2011 NO_x ppb

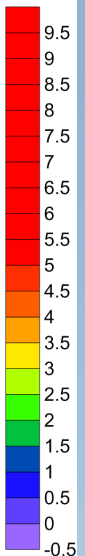




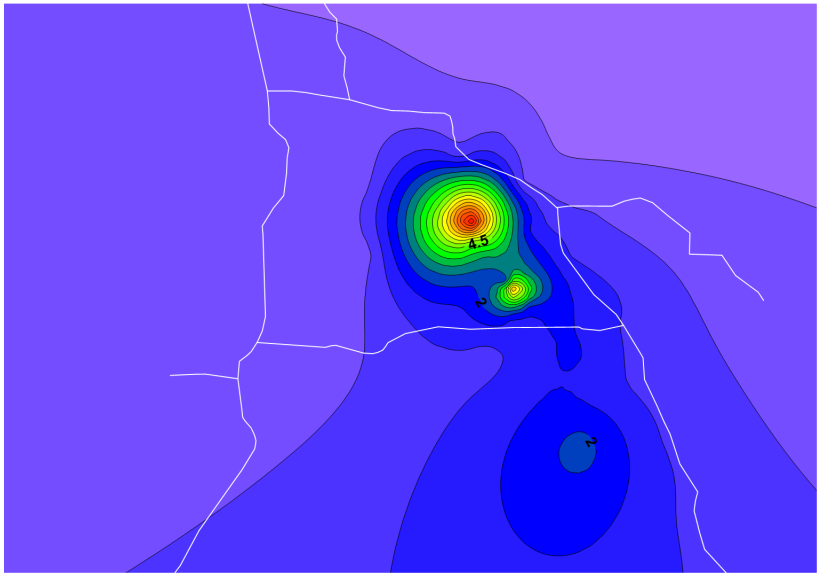
February 2012 NO_x ppb

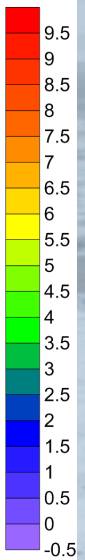
Traffic and Compressor Stations





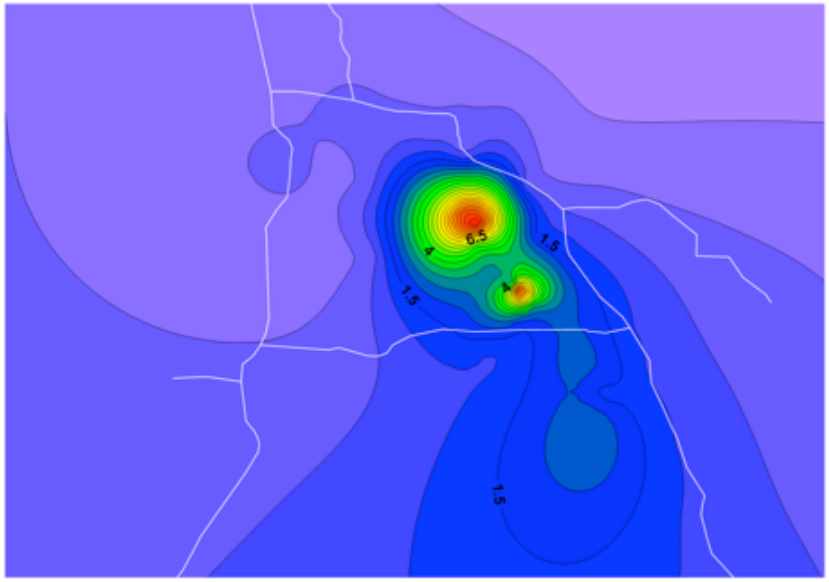
November 2011 benzene ppb

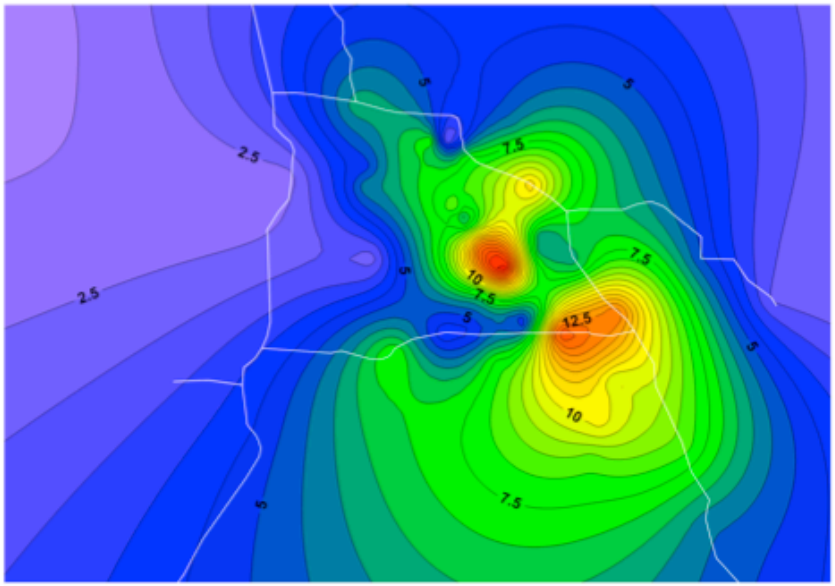




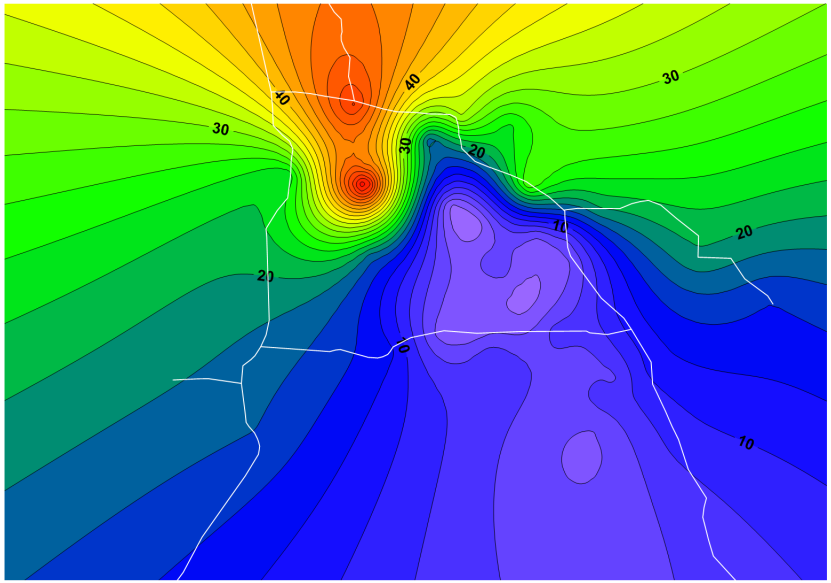
February 2012 benzene ppb

Production and Handling





February 2012
NO_x : Toluene



Ozone production zone

UW ATSC Results:

On-going:
Seinfeld and Carter (2012) published
Field et al (2012) in preparation
Rappenglueck and Field (2012) in preparation
And…

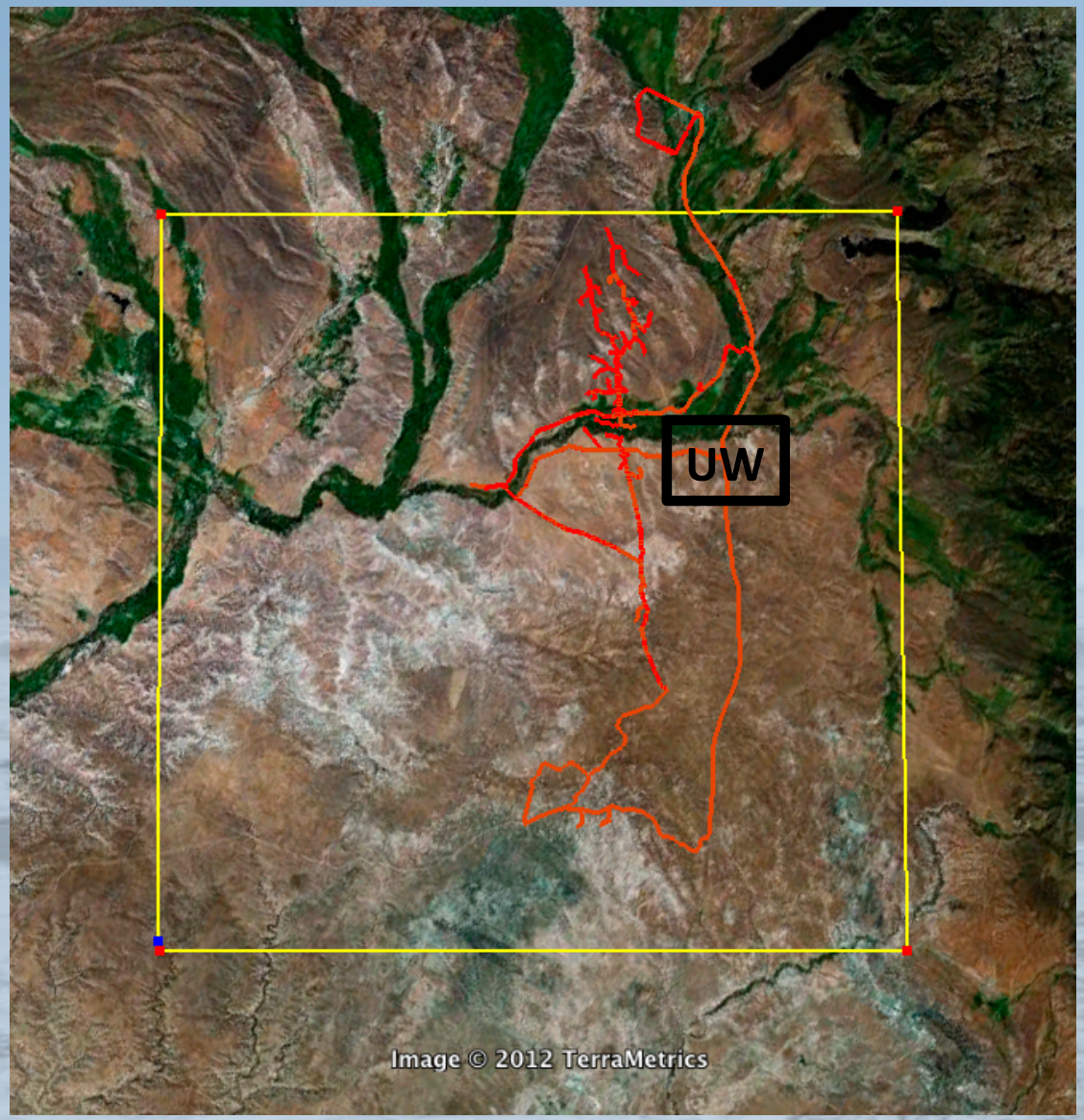
Ozone Control Big Picture
EI Validation First Steps
Key work

OZONE Control

1. NO_x starvation (Derwent pc)
- engines in major sources
- reduce traffic in key areas

2. Reduce reactive VOC (Field pc)
- targeted at (B)TEX-TMB
  -production & handling

EI Validation and Refinement



Selected VOC Emission Rates: WDEQ Emission Inventory Estimate vs. UW Ambient Box Calculation March 2011 (r^2 = 0.97)

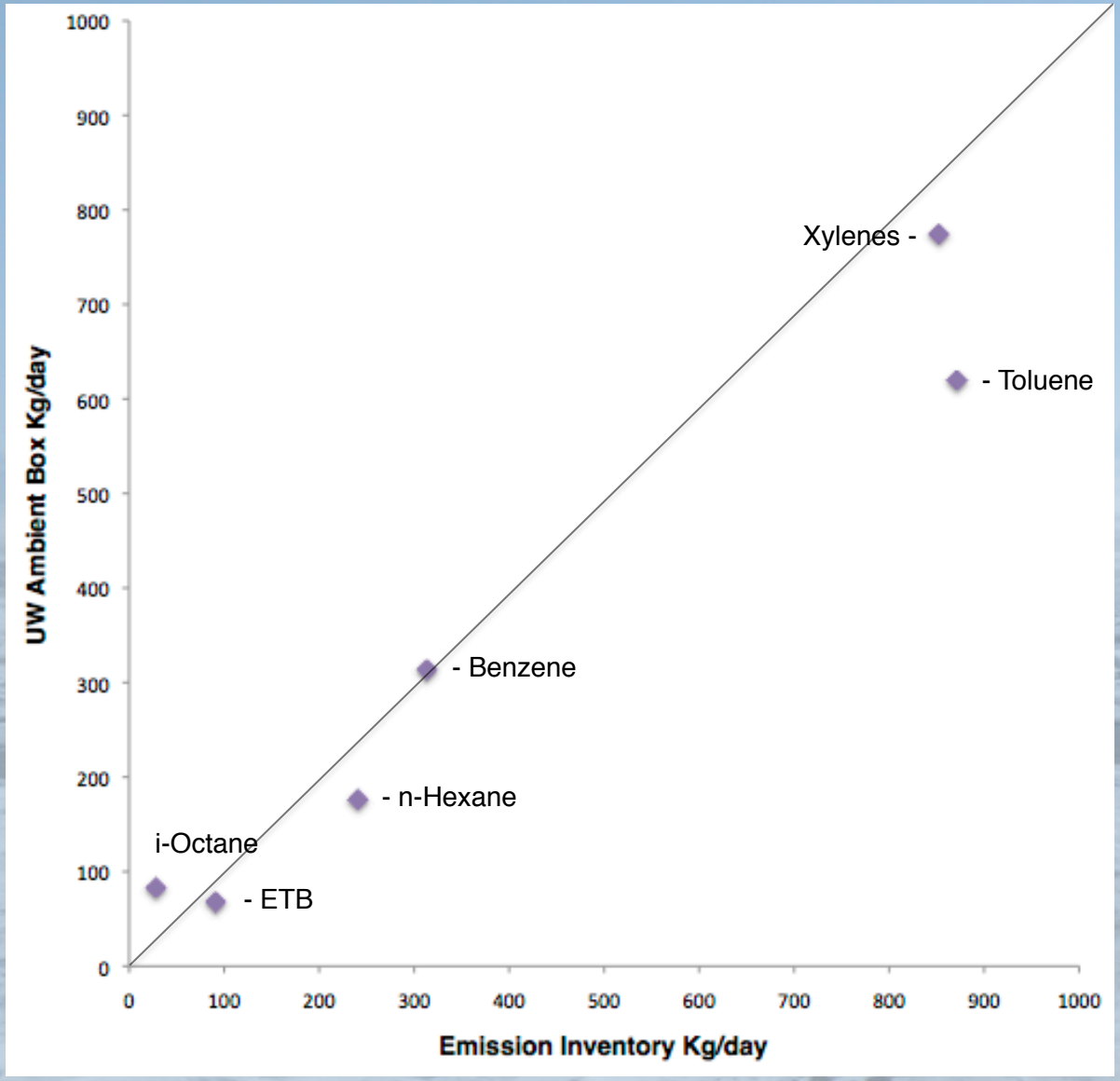
Case 1: Slope 1.2 simple base case

Case 1: Slope <0.3 box is unrealistic Reasons……

Case 1: Slope >0.3 EI is unrealistic Reasons…….

Lucky?

Guessing game! vs. systematic science



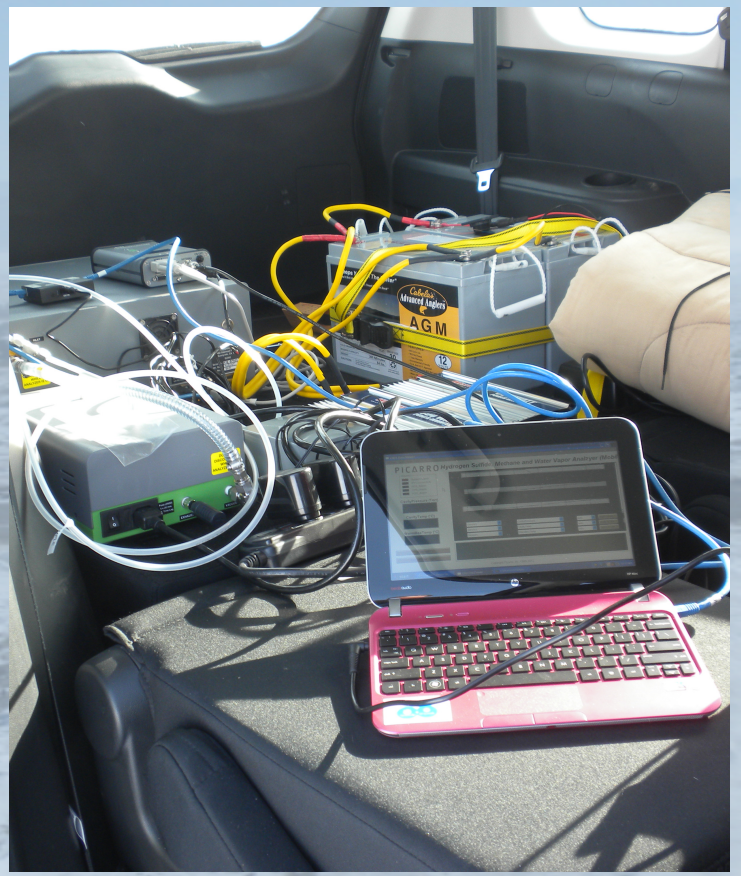
Selected Emission Rates:

WDEQ Emission Inventory Estimate vs. UW Ambient Box Calculation March 2011

	WDEQ EI Kg/day	UW Ambient Box Kg/day
VOC	12,549	10,784
CO	3,606	5,000
NMHC		16,399
NO_x	9,151	1,165
CH_4		26,500

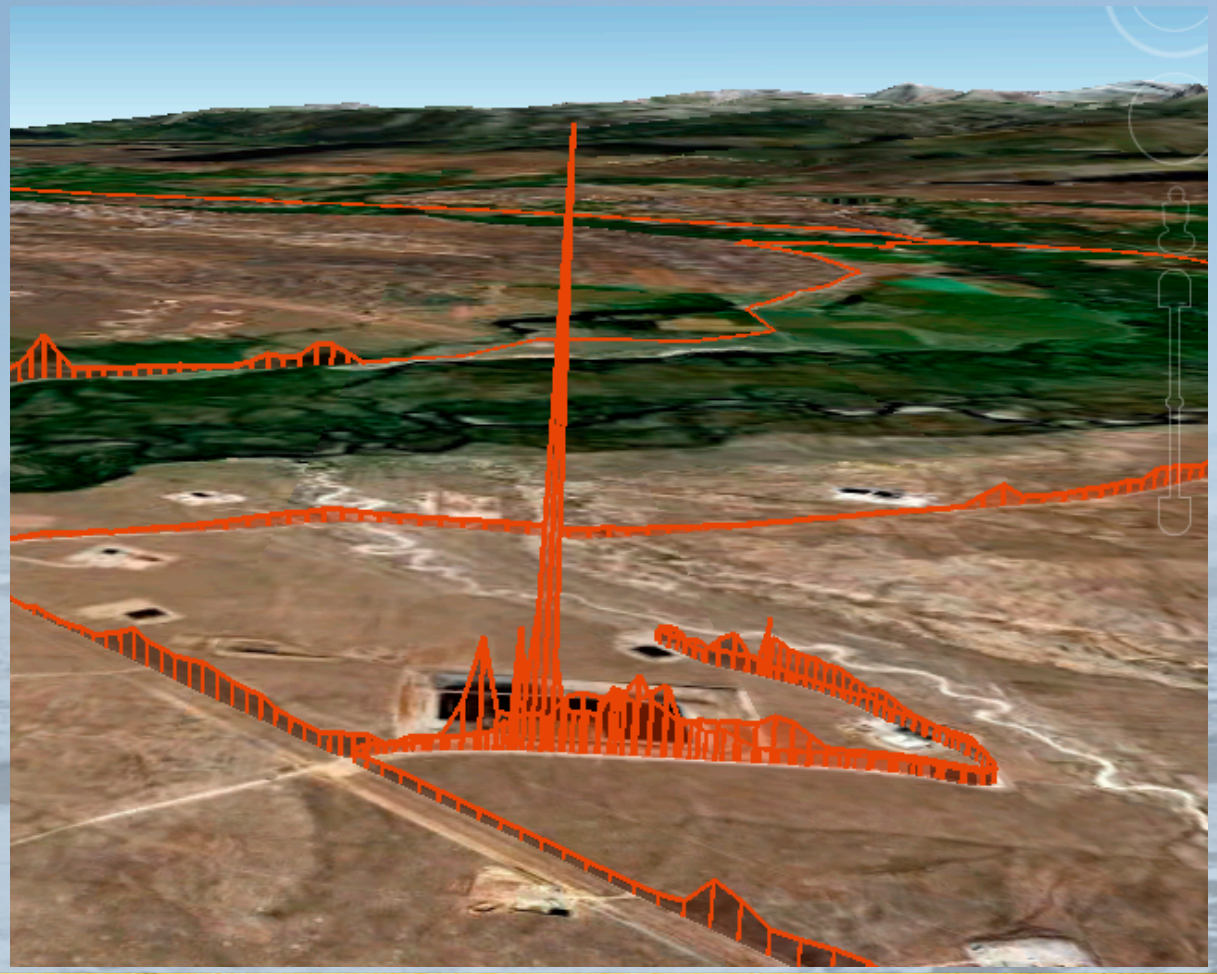
A Paradigm Shift for Air Quality

Real-time Highest Quality Mobile Monitoring



Picarro CH_4 & H_2S

Methane February 7th 2012 Water Treatment Facility



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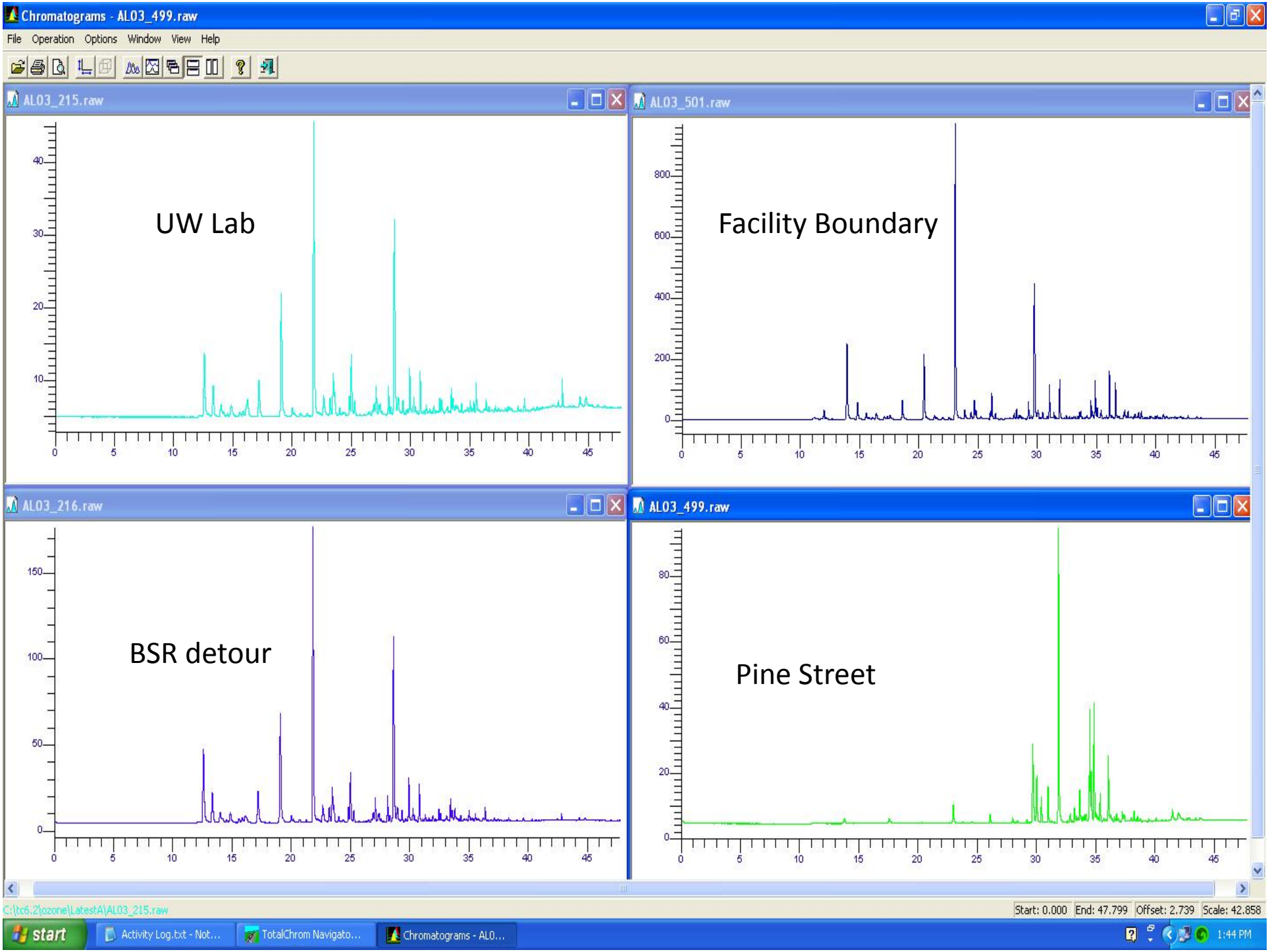
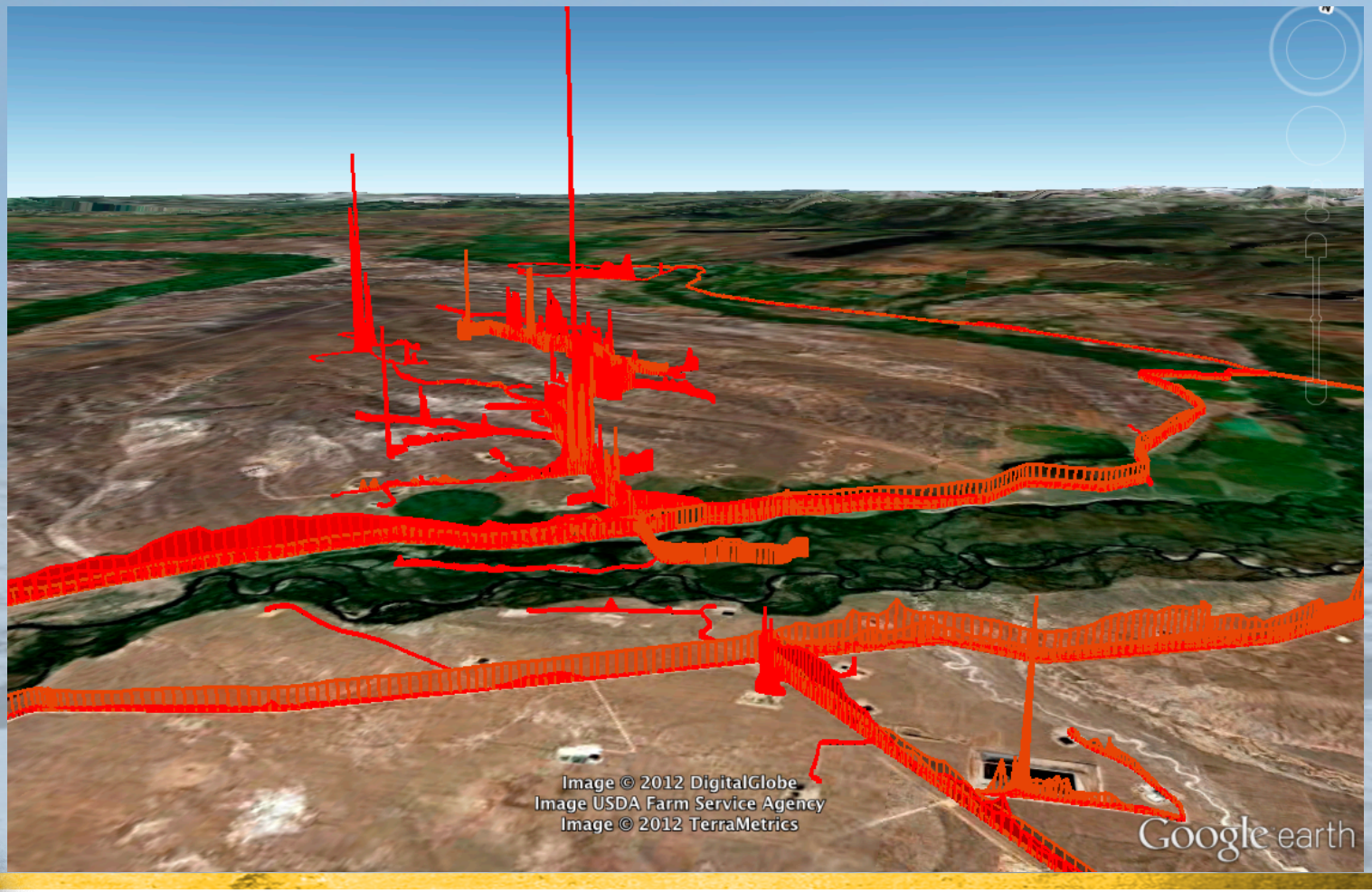
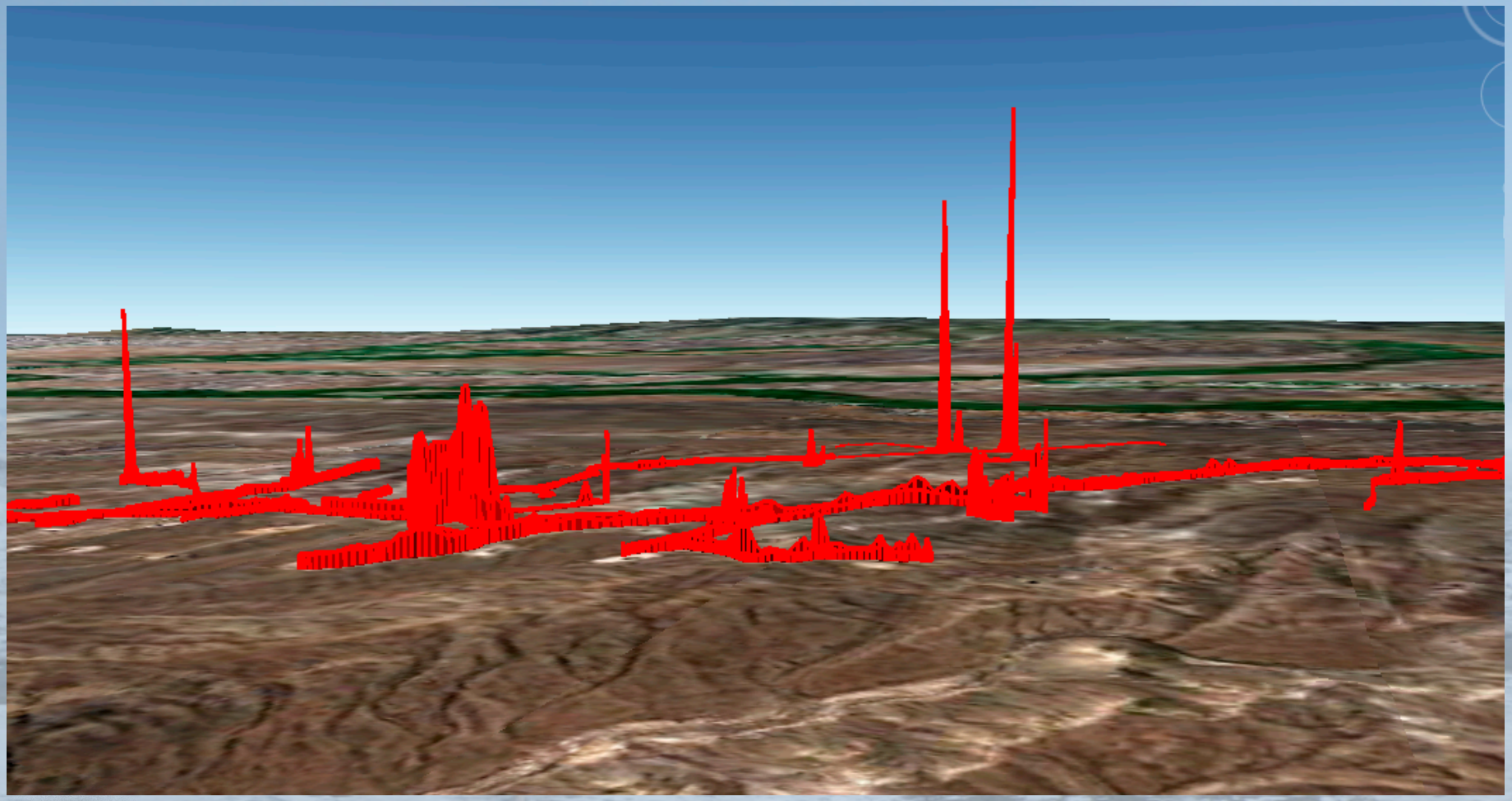

Chromatograms - AL03_499.raw
File Operation Options Window View Help
AL03_215.raw
UW Lab
AL03_501.raw
Facility Boundary
AL03_216.raw
BSR detour
AL03_499.raw
Pine Street
C:\tc6.2\ozone\LatestA\AL03_215.raw
Start: 0.000 End: 47.799 Offset: 2.739 Scale: 42.858
start
Activity Log.txt - Not...
TotalChrom Navigato...
Chromatograms - AL0...
1:44 PM

Combination Plot 3 hour runs

February 7th, 9th and 23rd; March 4th and 5th



Methane on the Mesa
March 4th 2012



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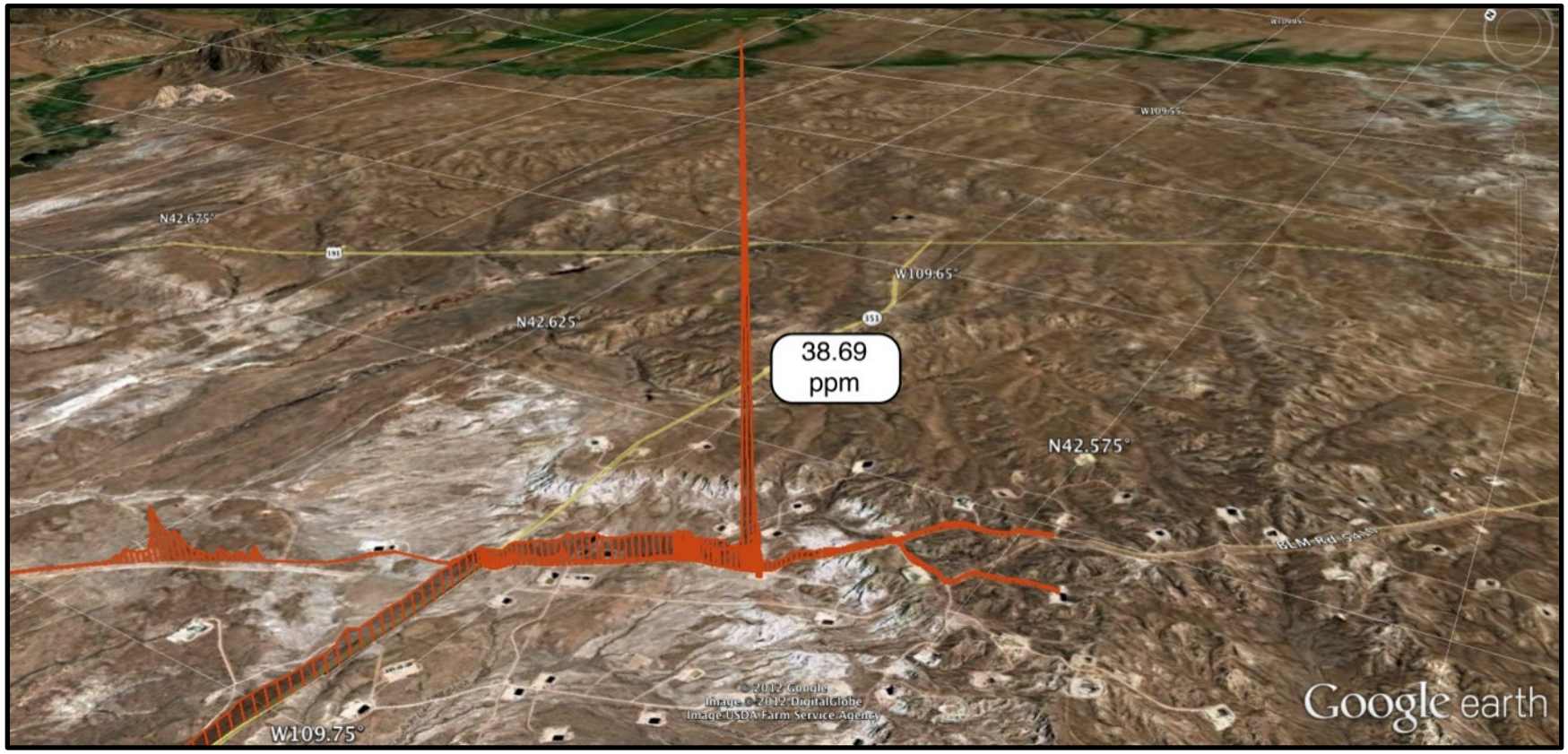
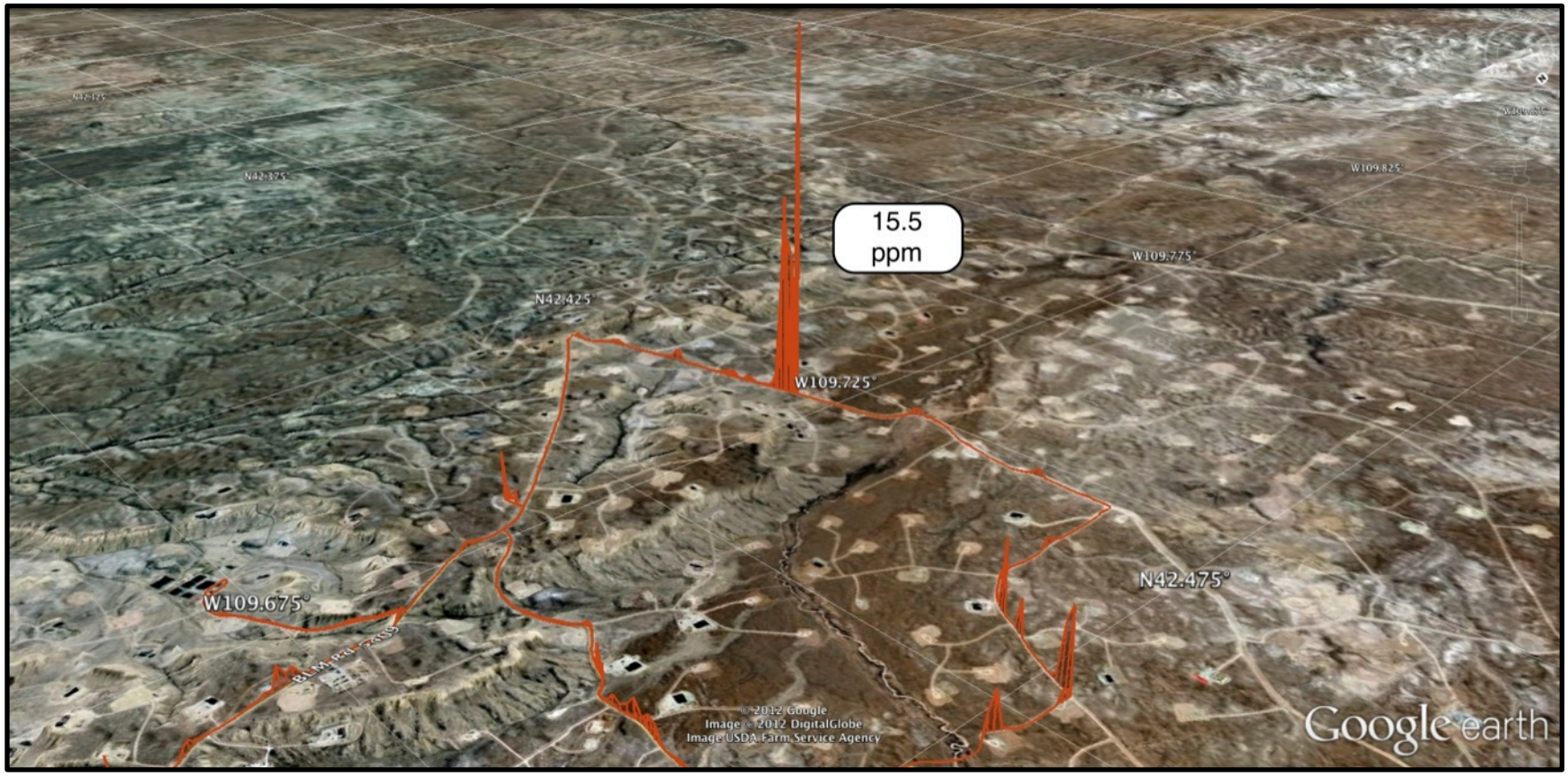


07 FEB 2012

Venting a Well

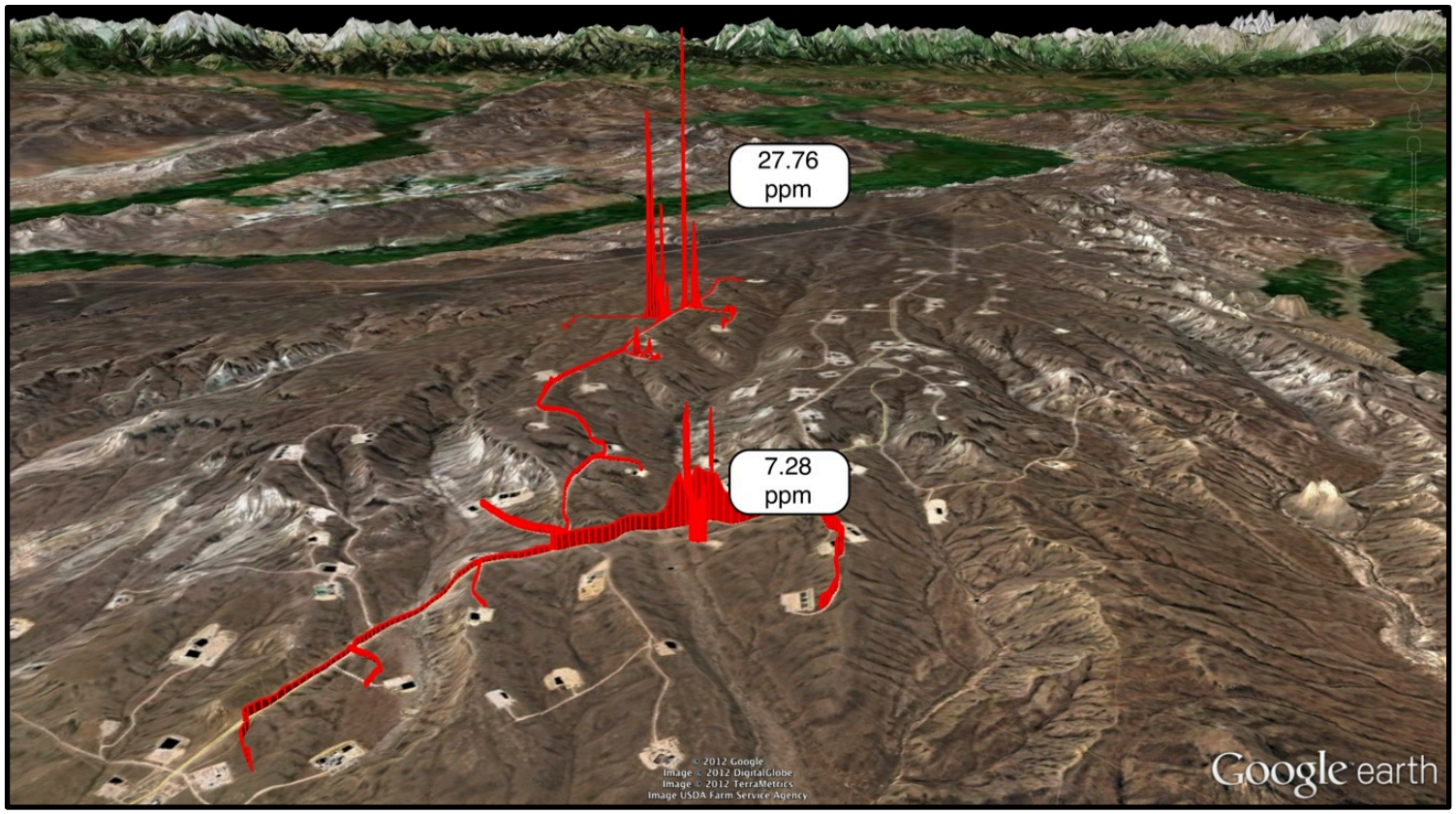


23 FEB 2012

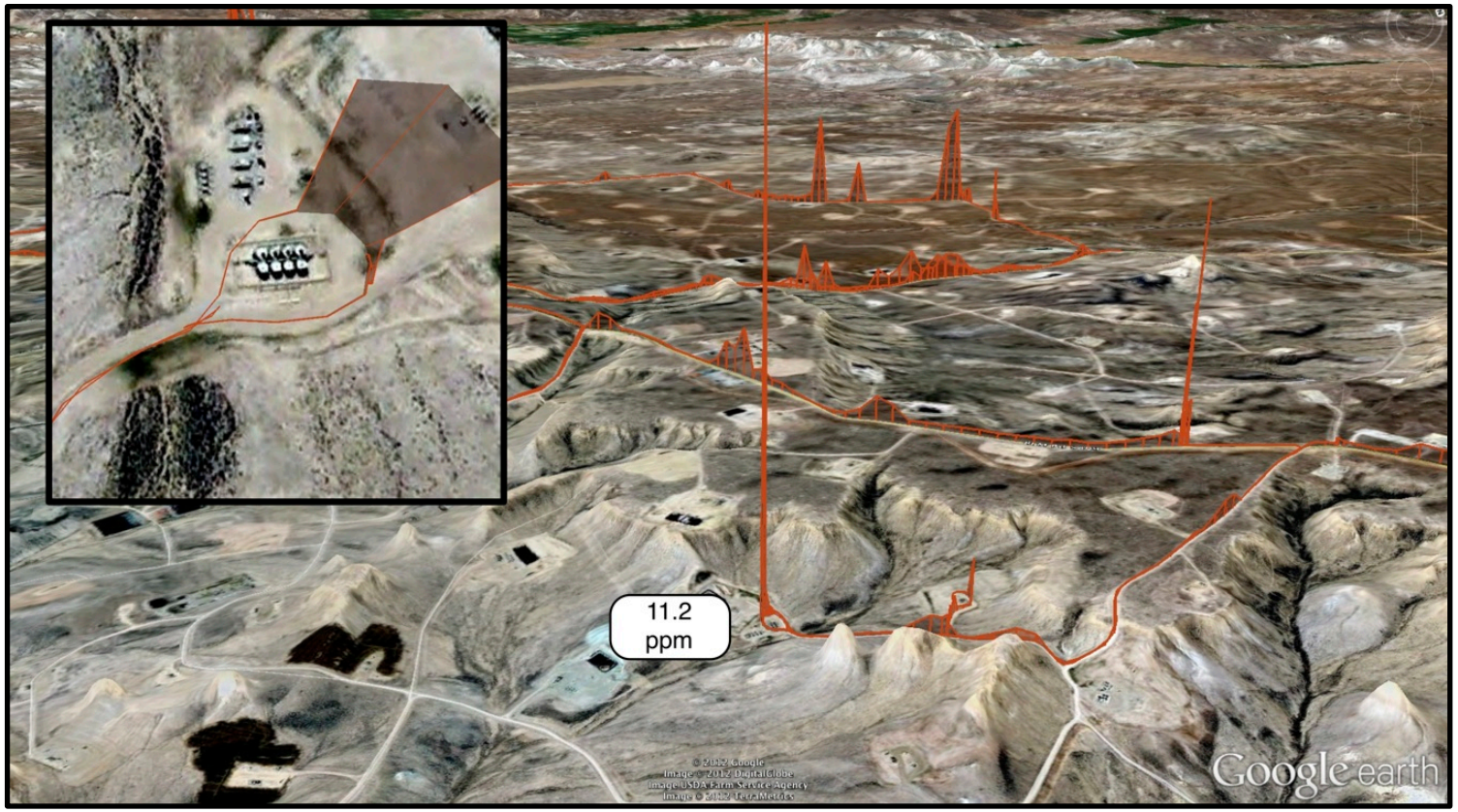
Well Closed Due to Mishap

04 MAR 2012

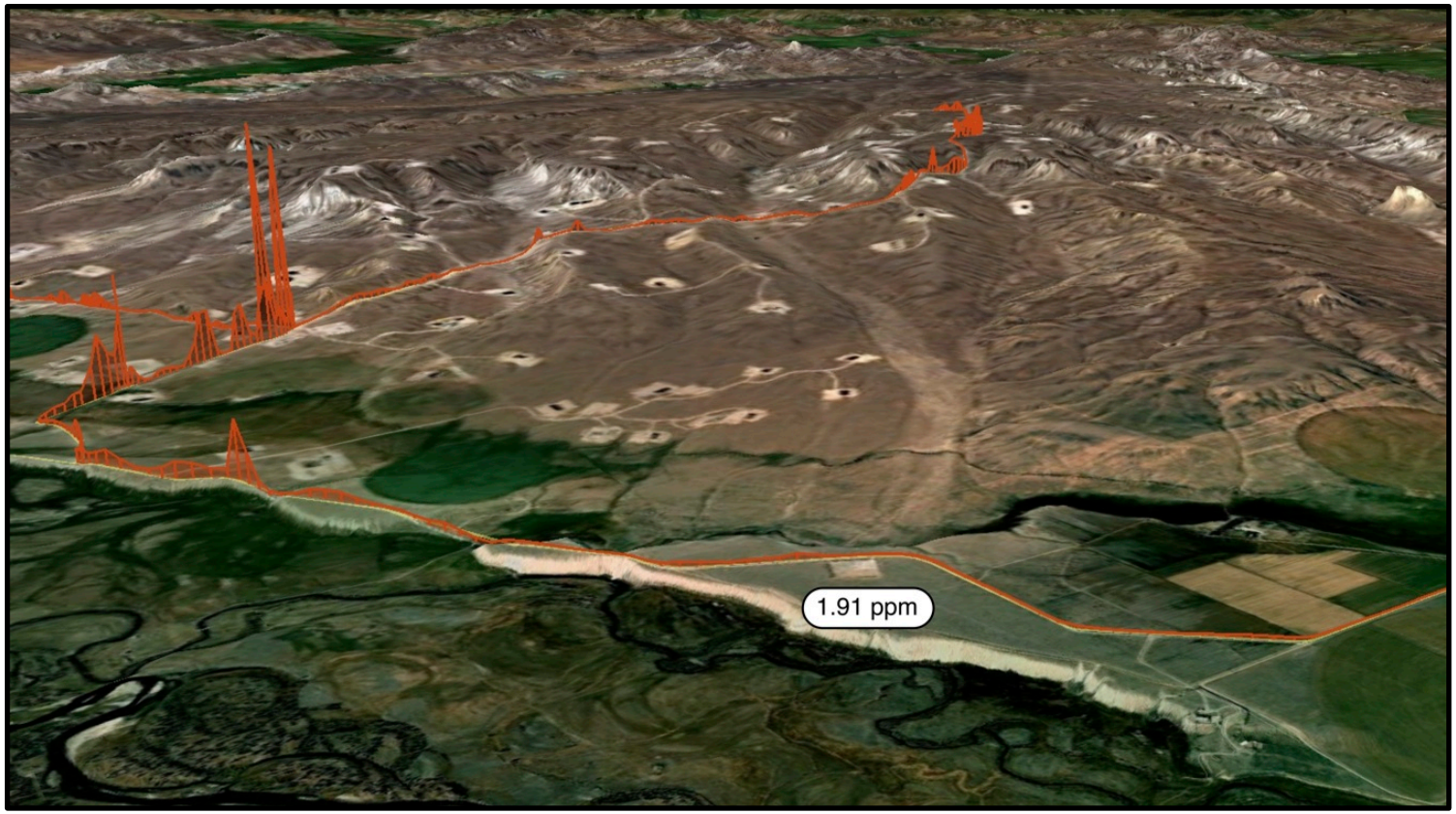
Well drilling activity



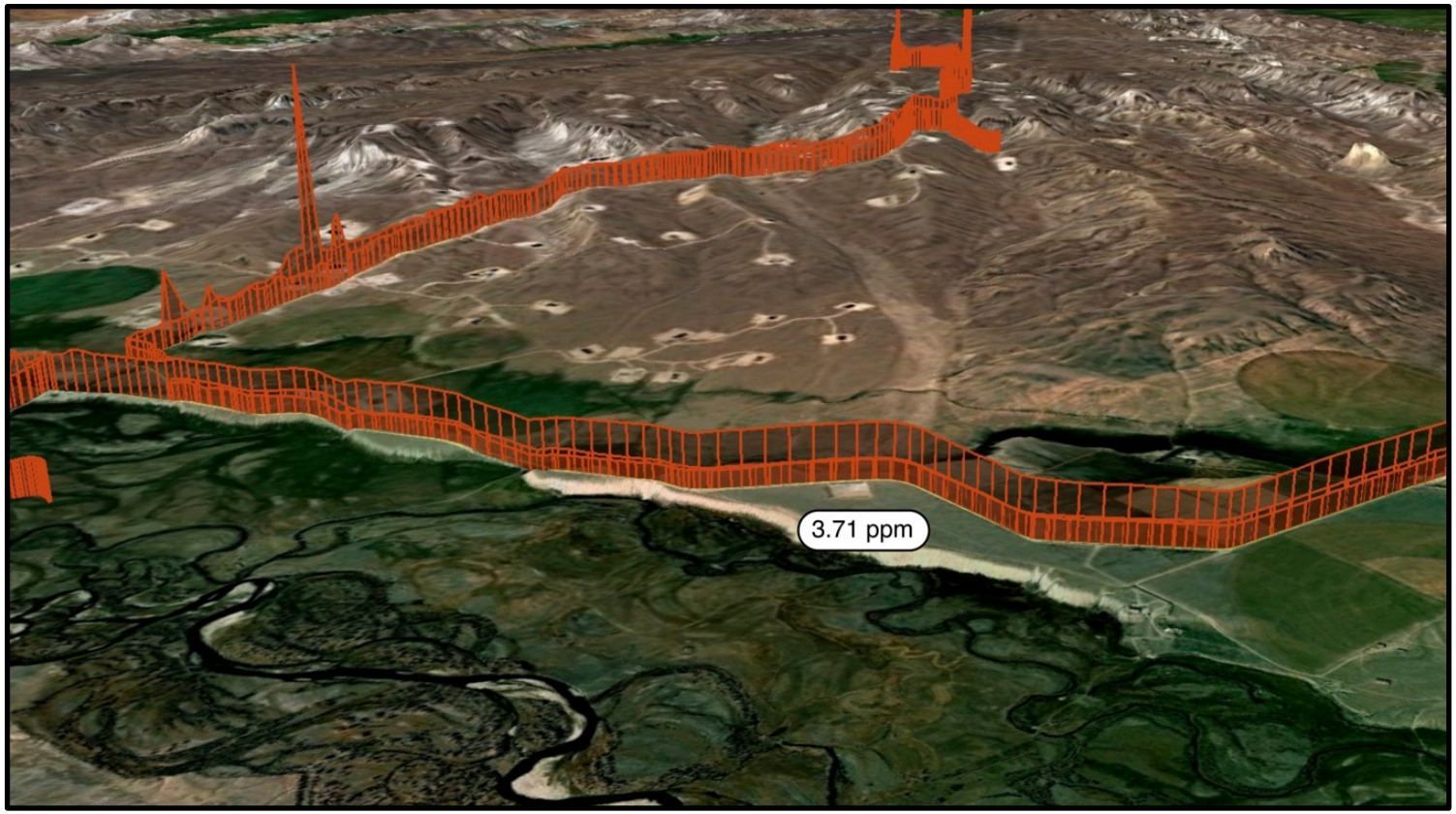
Drainage Flow from Previous Slide Drilling Activity



23 FEB 2012
Very Windy days
Isolated spikes easy to identify sources



23 FEB 2012
Windy conditions show peaks on background baseline



07 FEB 2012
Same journey but very different conditions leading to accumulation

What new work is needed for Problem Resolution?

Photochemical Grid Model

Emission Inventory Refinement and Validation

What can UW ATSC contribute?

Two Linked Projects:

"PAPA Mobile methane and NOx assessment"

"Targeted VOC canister source measurements"

Why? To identify opportunities with developers for emission reduction and to identify mitigation routes to eliminate the ozone problem without relying on the weather

Also because an emission inventory is a tool not reality! ..

Thank You & Questions?

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