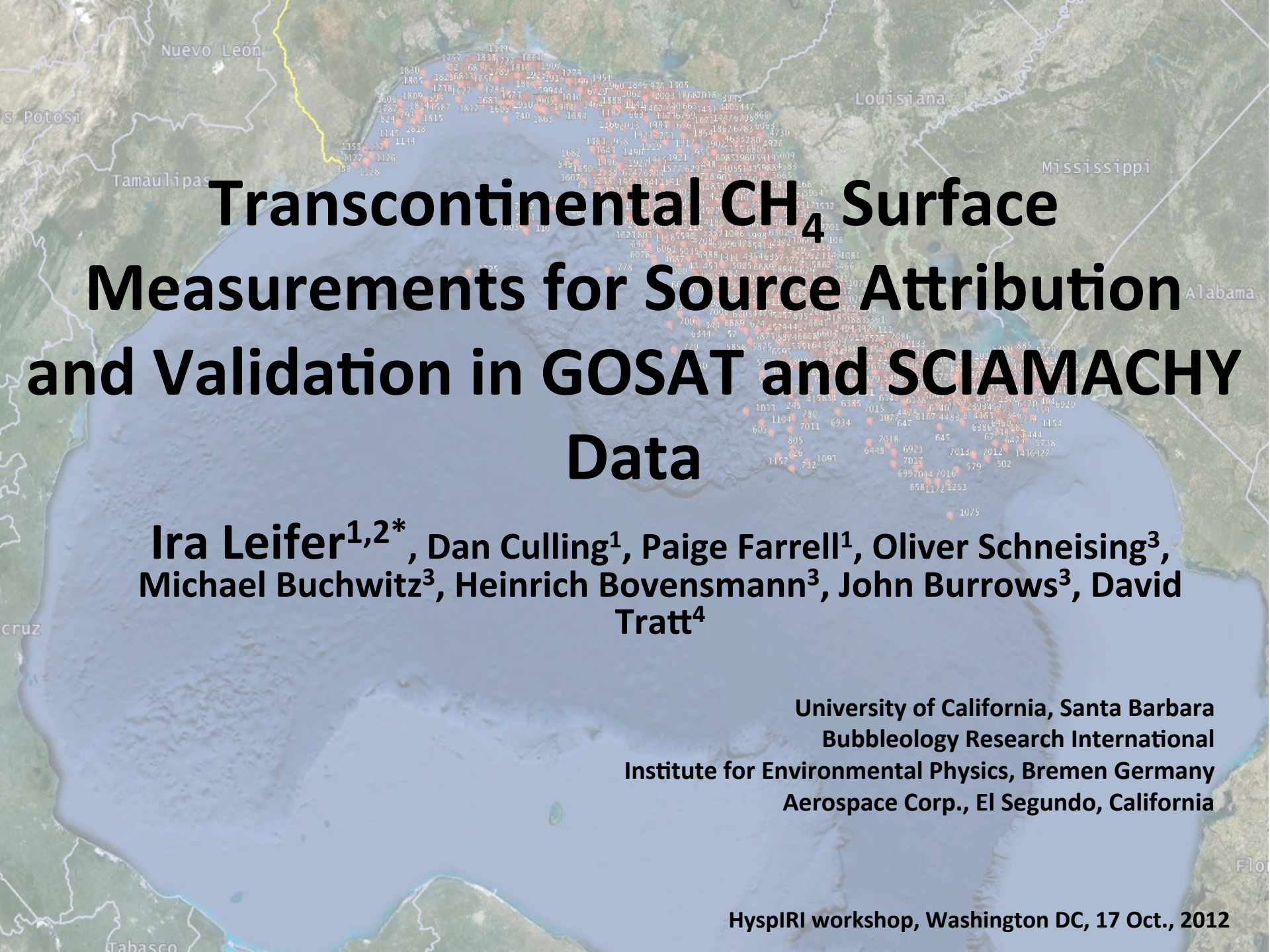

Transcontinental CH_4 Surface Measurements for Source Attribution and Validation in GOSAT and SCIAMACHY Data

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Institute for Environmental Physics, Bremen Germany
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HyspIRI workshop, Washington DC, 17 Oct., 2012

Thanks to the kind support of :

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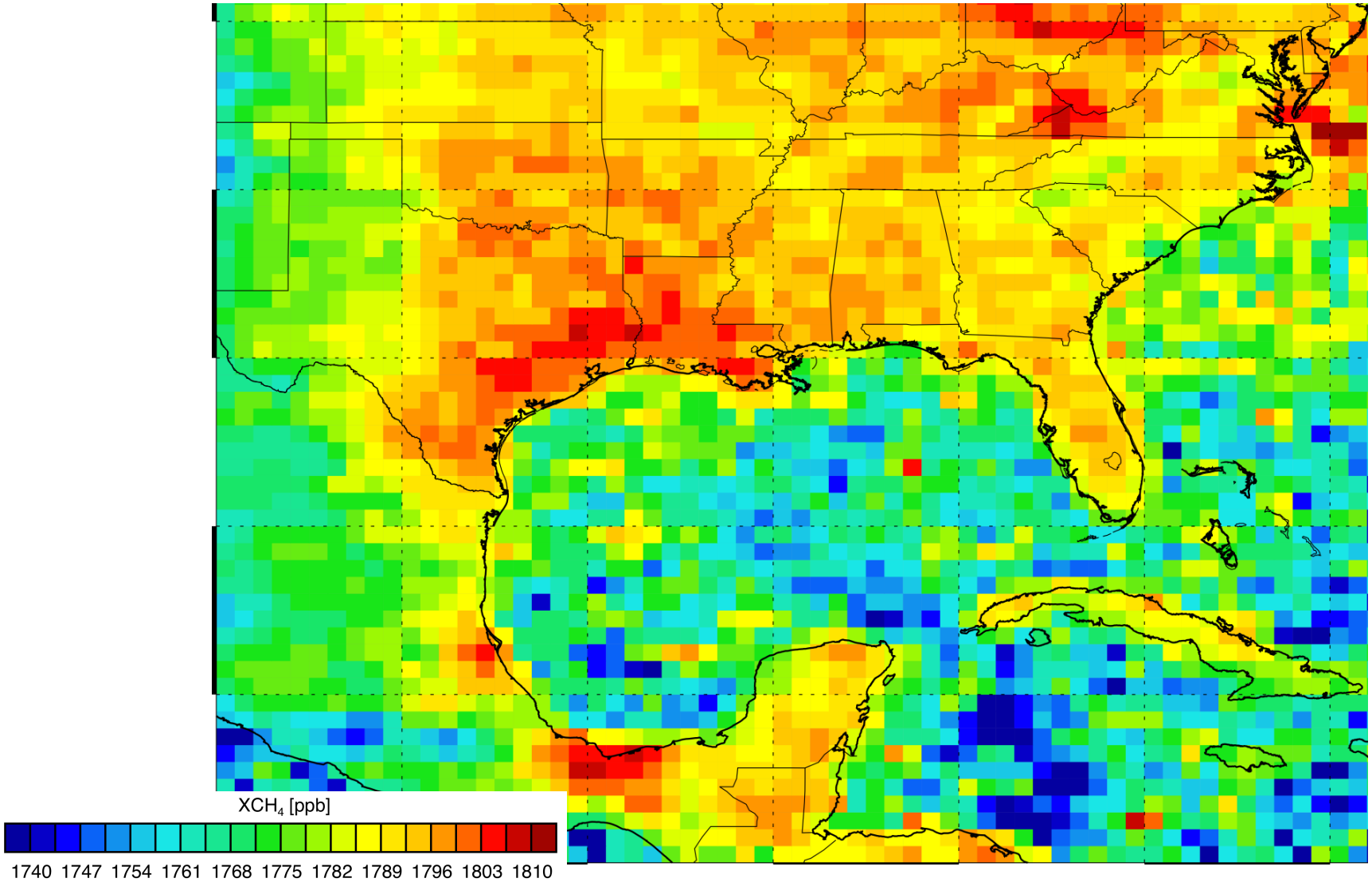
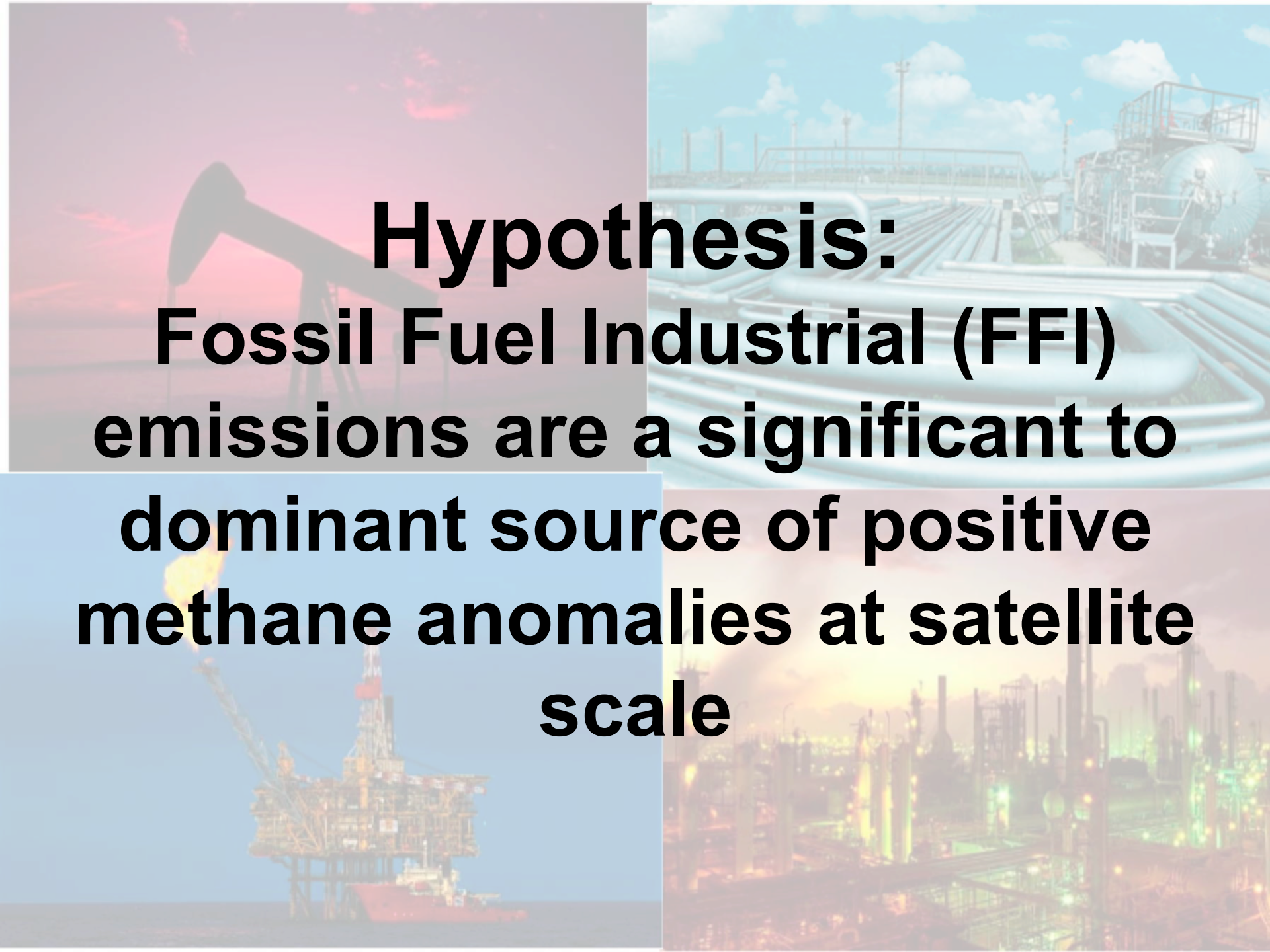
JAXA

Monica Leifer*

SCIAMACHY xCH_4 (2002-2005)
Florida & Texas Wetlands are extensive
> minimal population centers





Hypothesis:

Fossil Fuel Industrial (FFI) emissions are a significant to dominant source of positive methane anomalies at satellite scale

Vicarious Ground Reference
Return from Louisiana cruise via Florida (Fall 2010, early October) and Southern California Vacation (Winter, 2012)

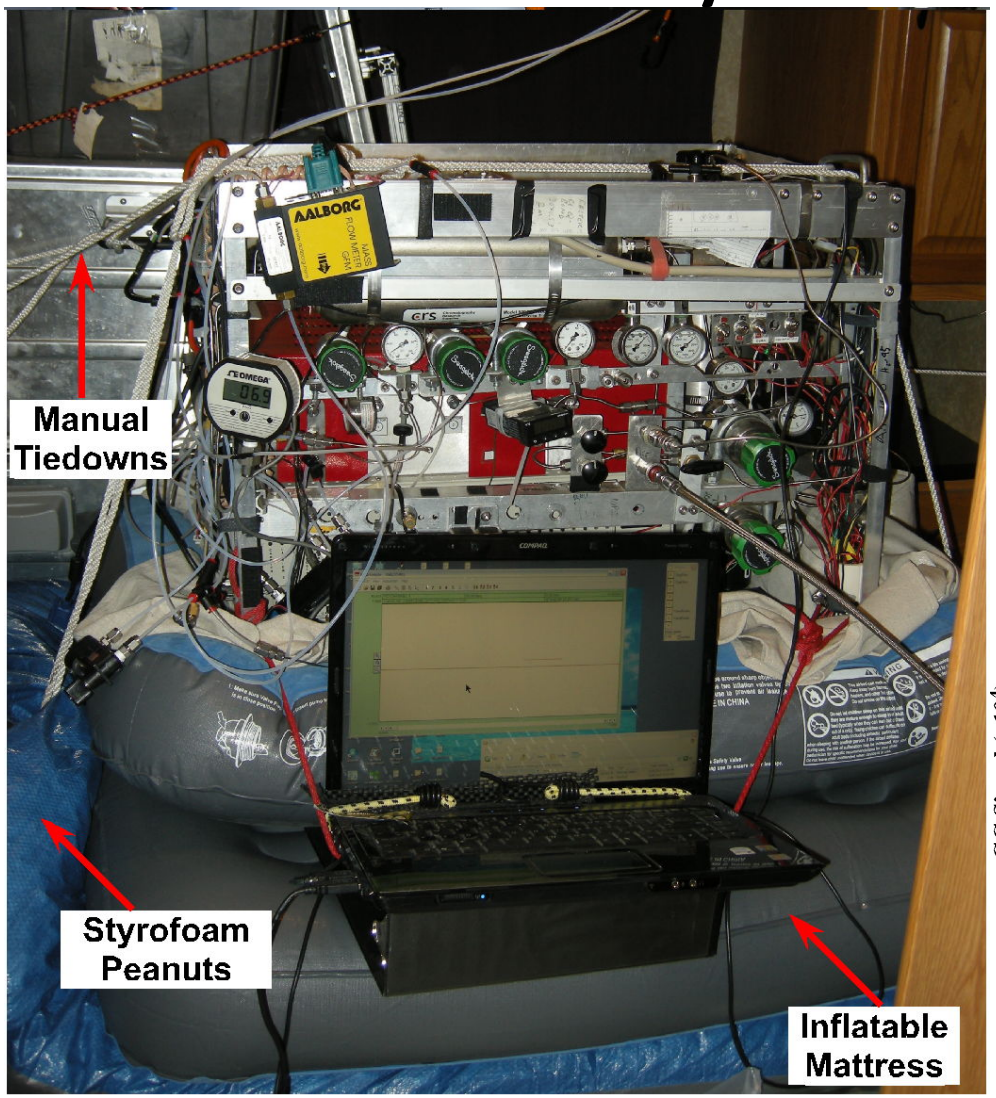
Farrell et al., 2012 in press

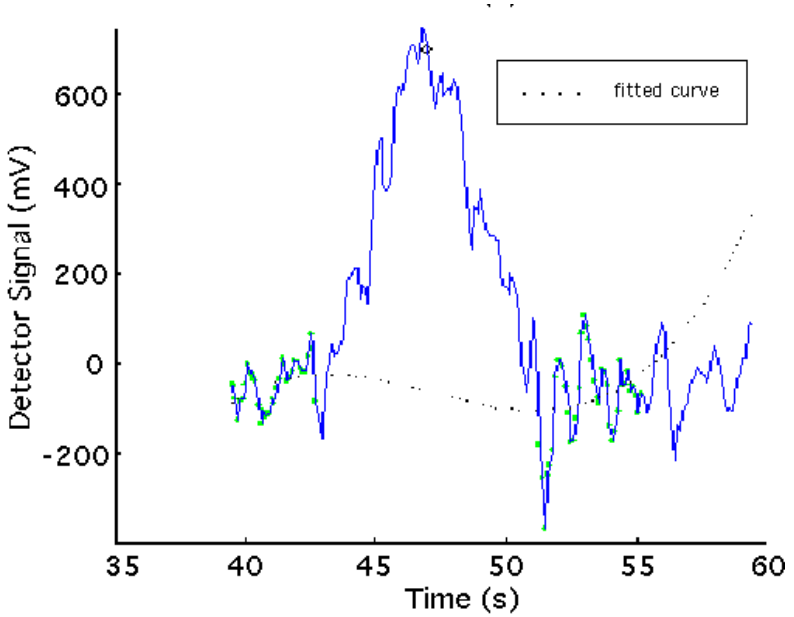
RV-based, mobile GC measurements (2012 w/Picarro)

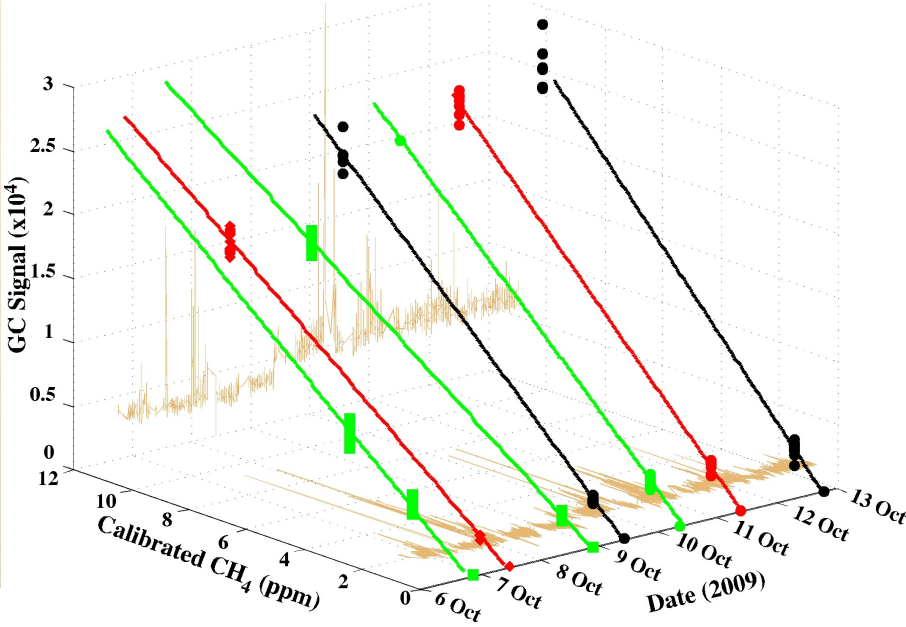
Farrell et al., 2012 in press

RV-based, mobile GC measurements

Vibrations – The enemy







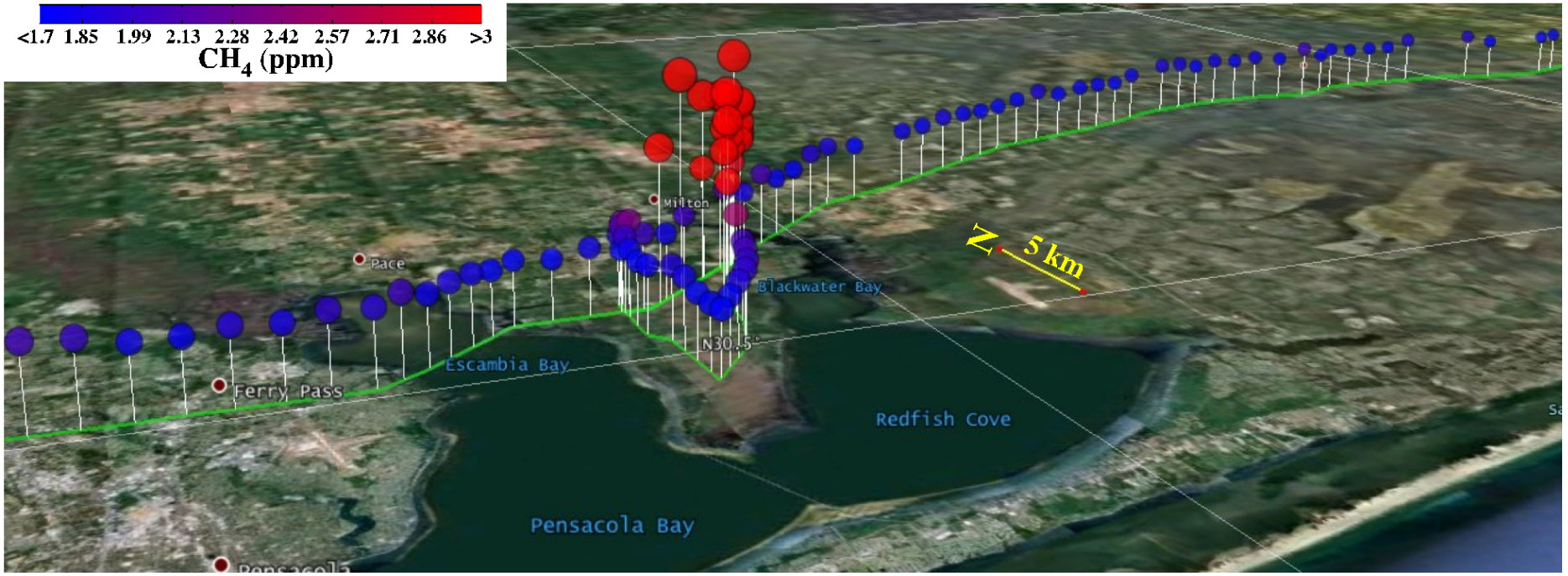
Farrell et al., 2012 in press

Round-the-Clock Data

Nocturnal collection avoids road biases, shallower boundary layers, and less traffic (freedom of motion)

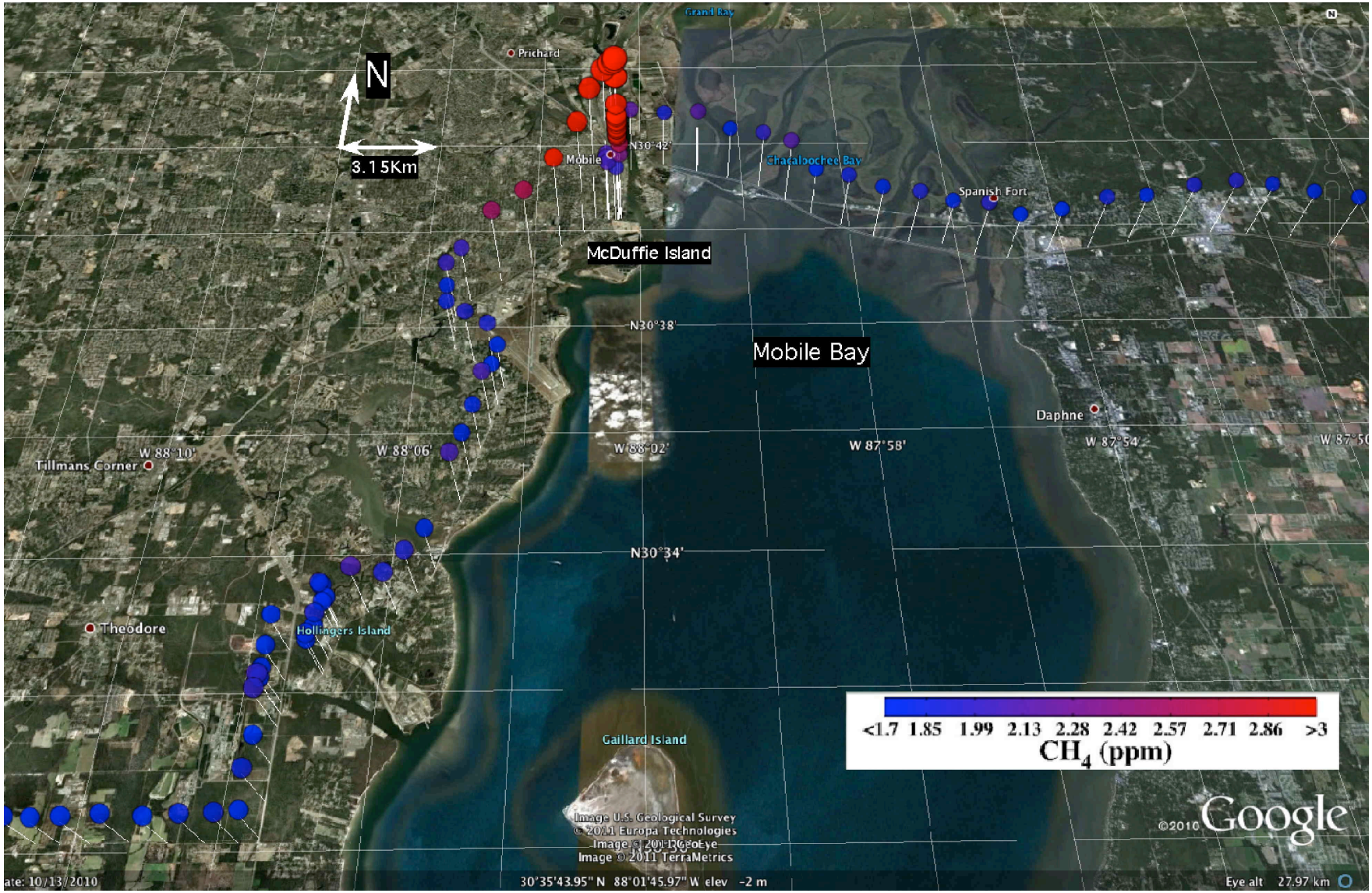
Blue - Night

Farrell et al., 2012 in press



Possible Florida Pipeline Leak

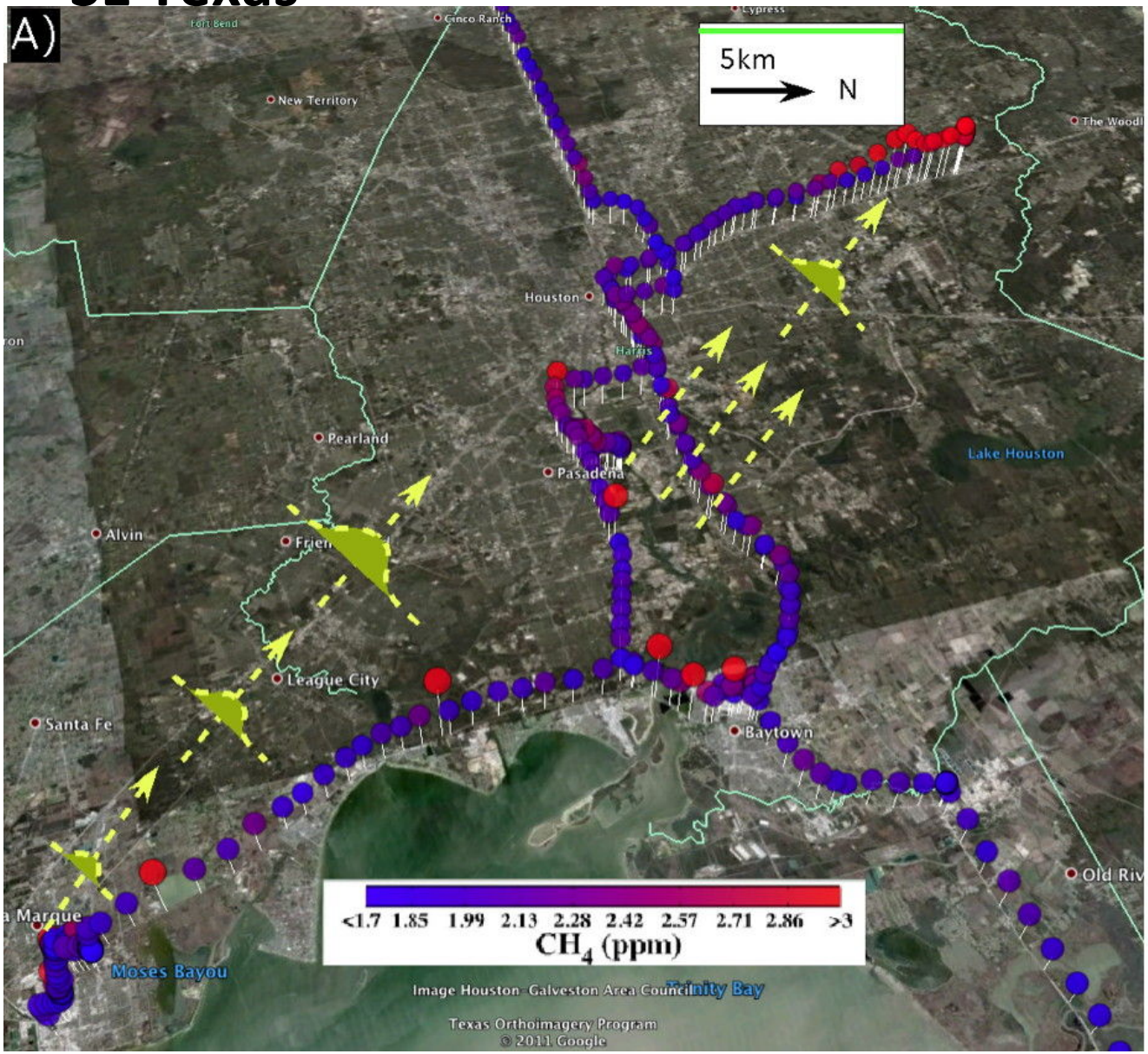
Coal Loading Port, Mobile AL

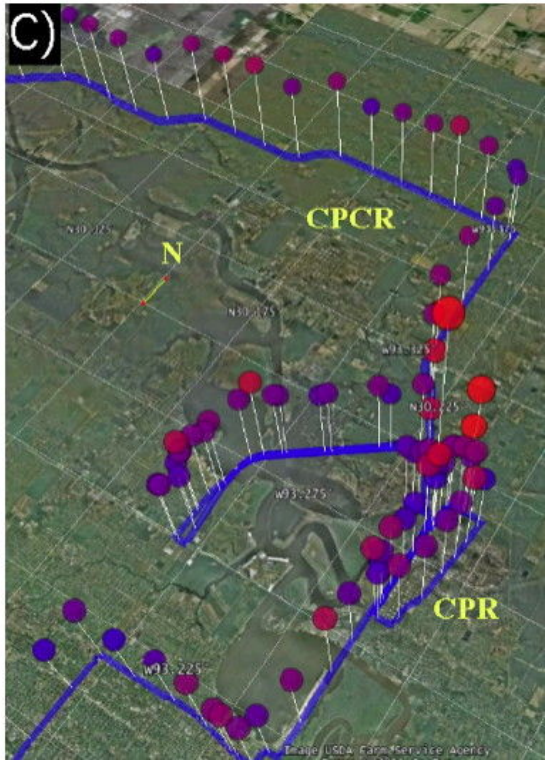


Leifer et al., 2012 submitted

SE Texas

Baton Rouge, LA



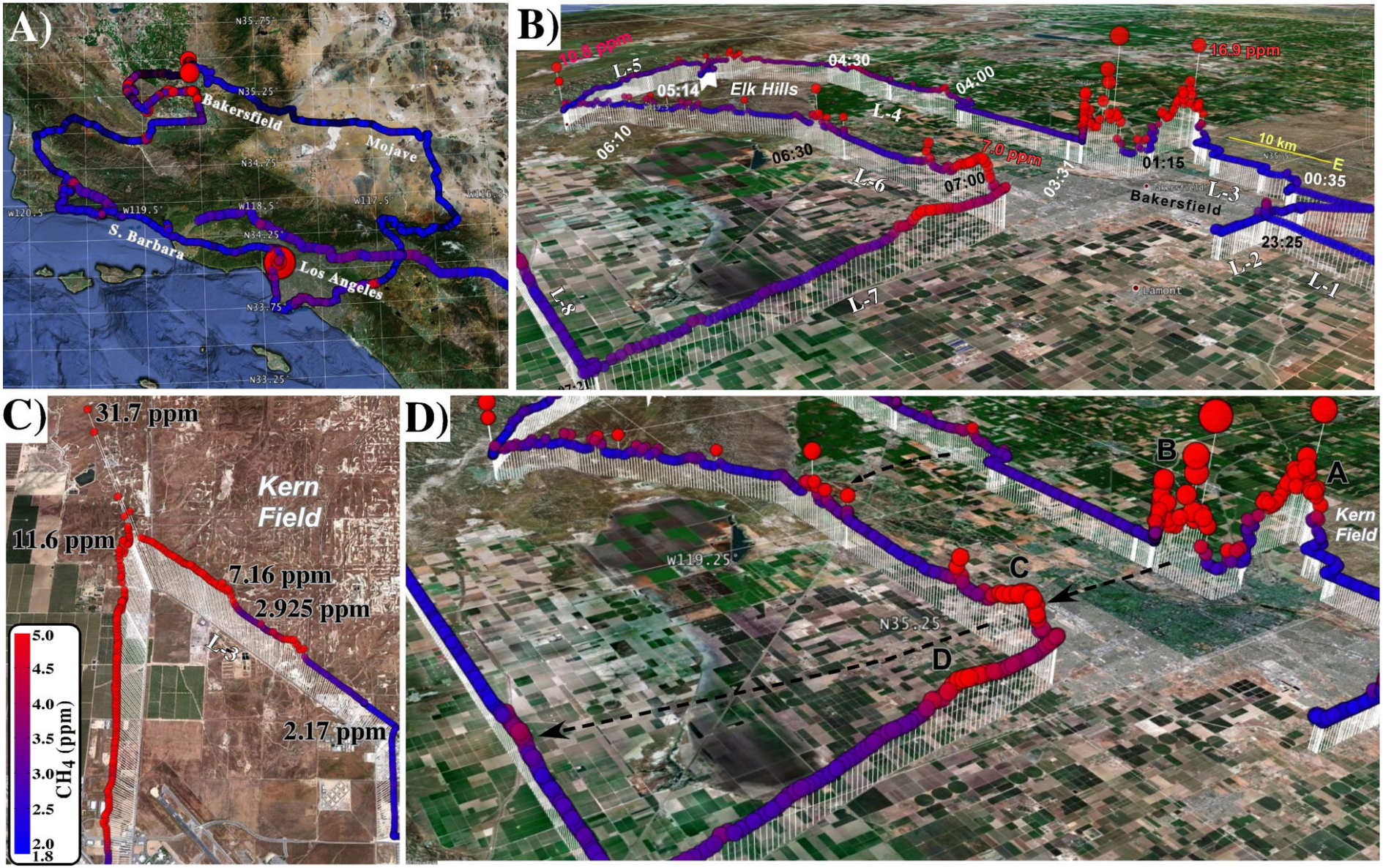


L Charles, LA

Refineries

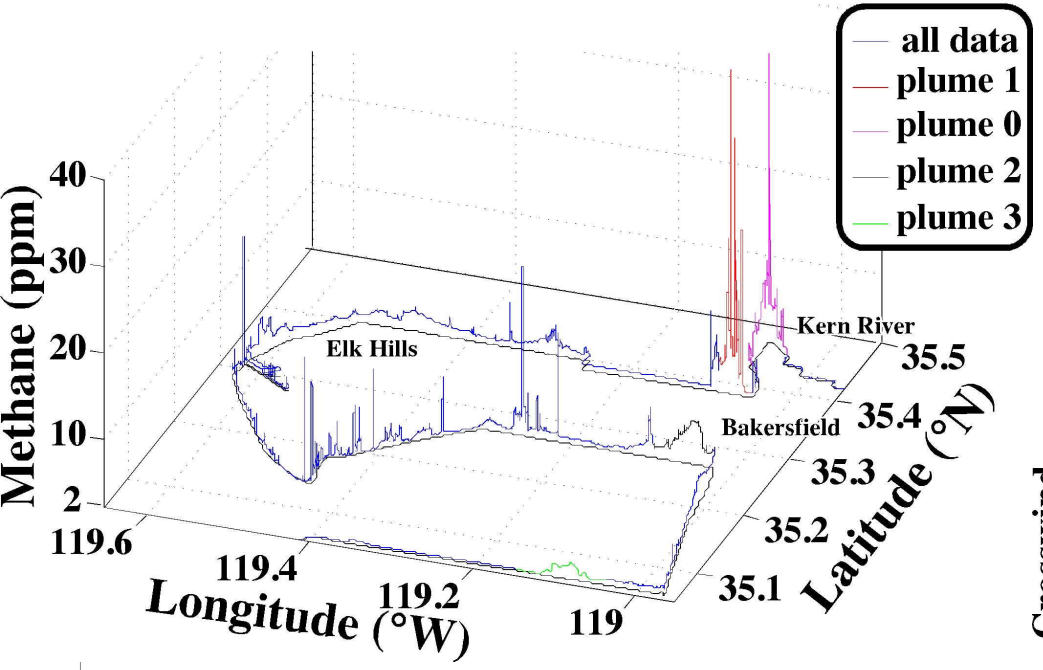
Farrell et al., 2012 in press

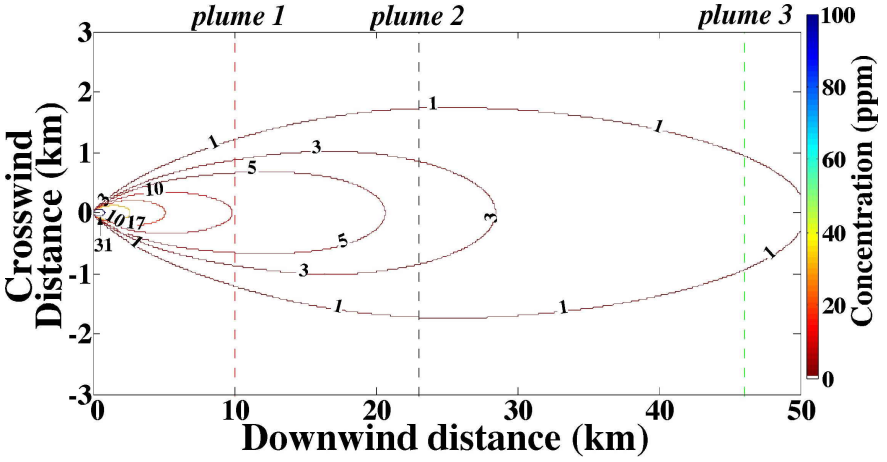
Kern River and Elk Hills Oil Fields

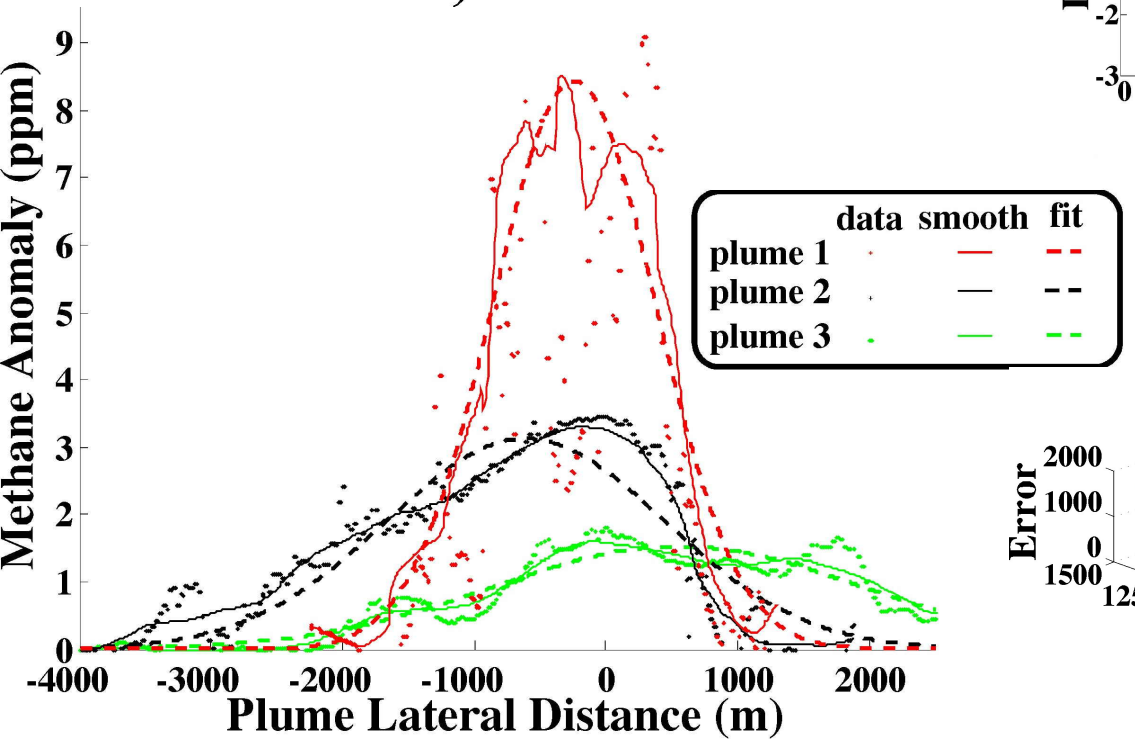


Leifer et al., 2012 submitted

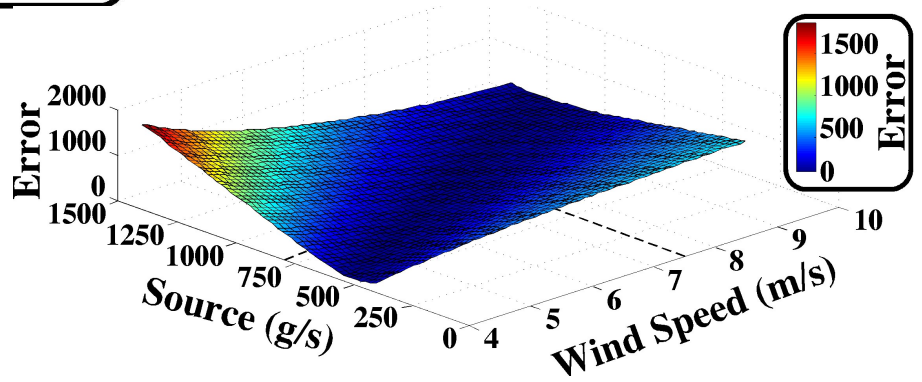
Kern River Field Plume Modelling



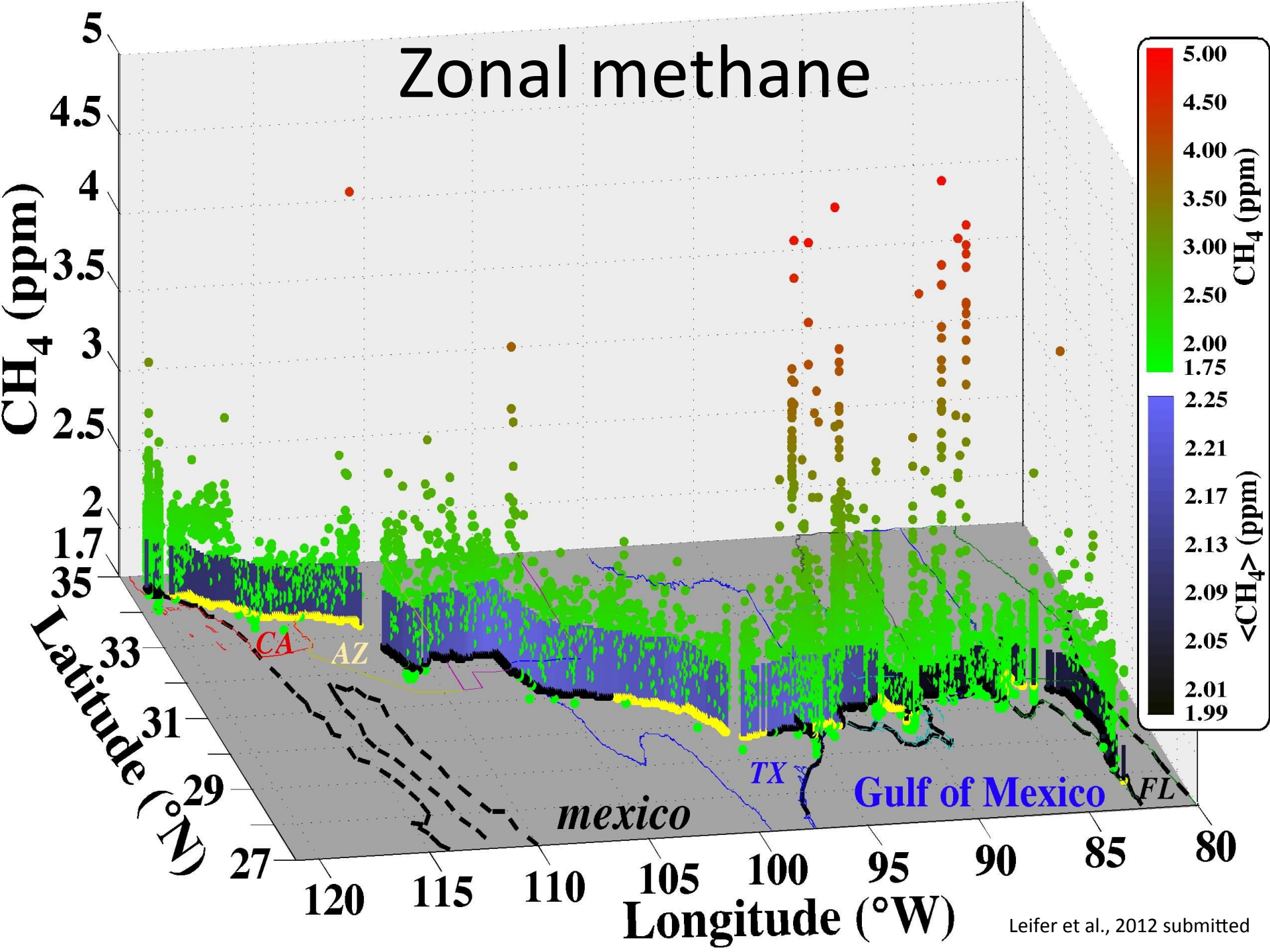




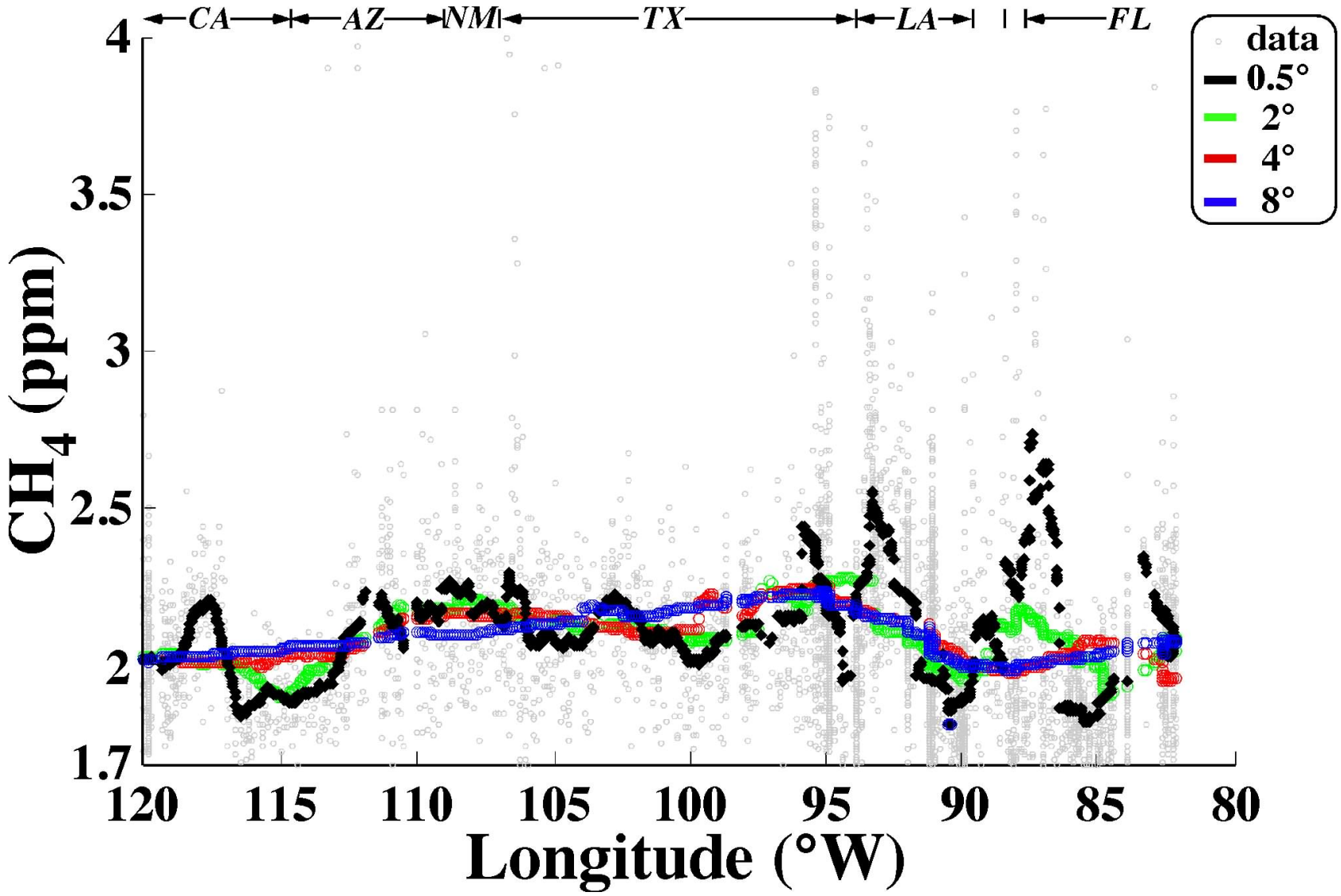
Best Fit = 0.18 kton/yr



Leifer et al., 2012 submitted

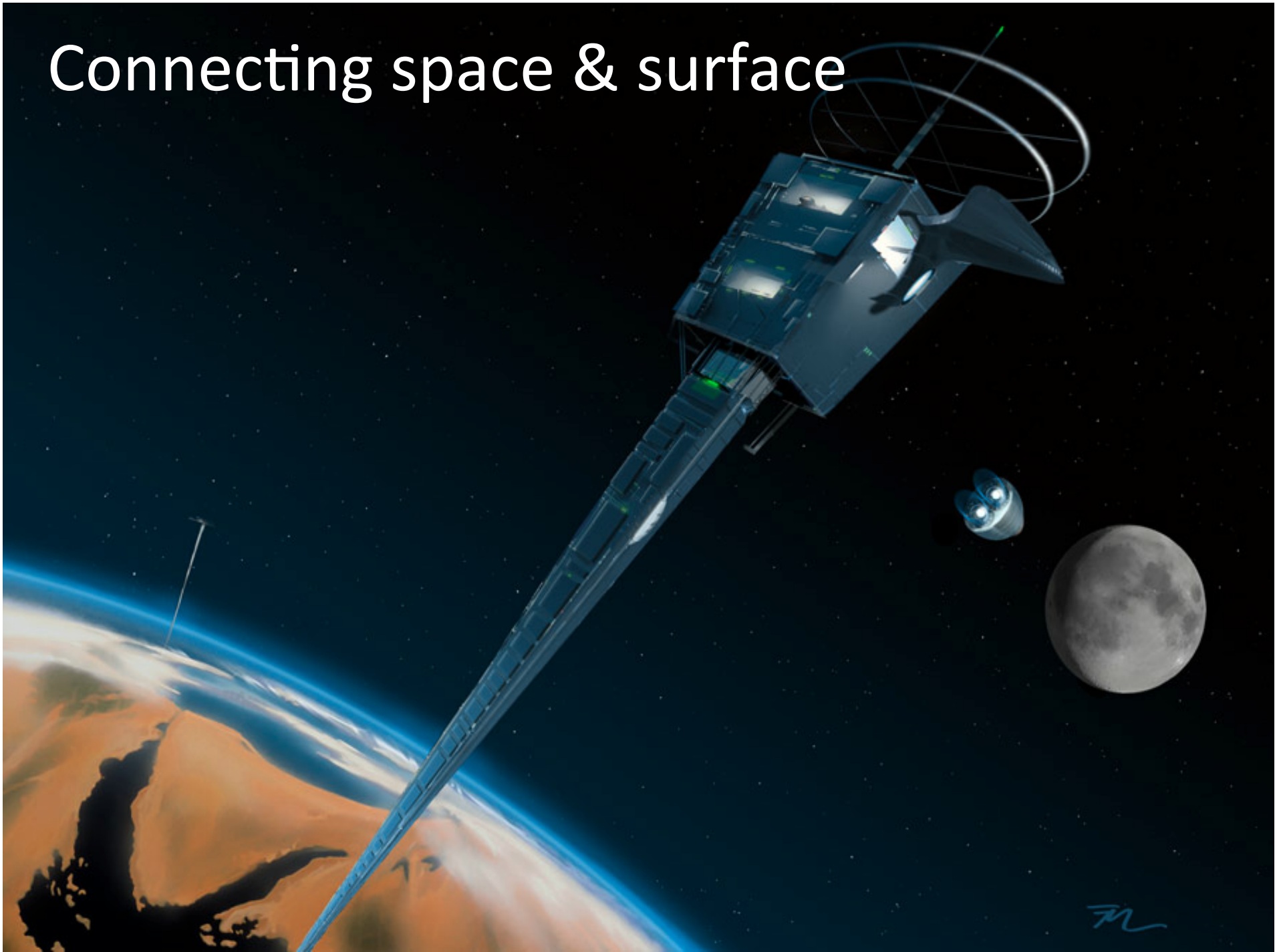

Zonal methane
CH4 (ppm)
5
4.5
4
3.5
3
2.5
2
1.7
Latitude (°N)
35
33
31
29
27
120
115
110
105
100
95
90
85
80
Longitude (°W)
CA
AZ
TX
FL
mexico
Gulf of Mexico
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.75
CH4 (ppm)
2.25
2.21
2.17
2.13
2.09
2.05
2.01
1.99
<CH4> (ppm)
Leifer et al., 2012 submitted

Zonal methane

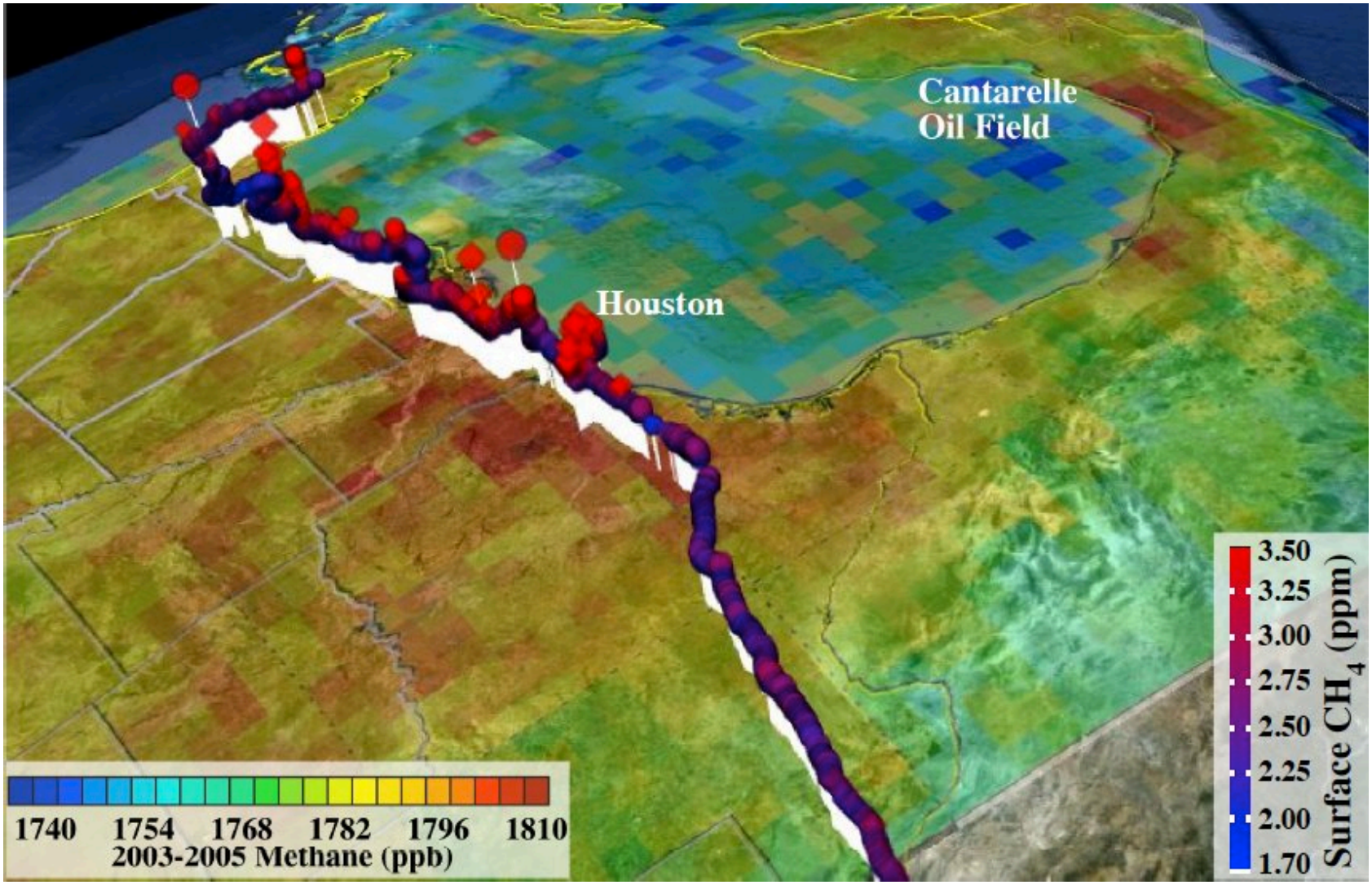


Leifer et al., 2012 submitted

Connecting space & surface

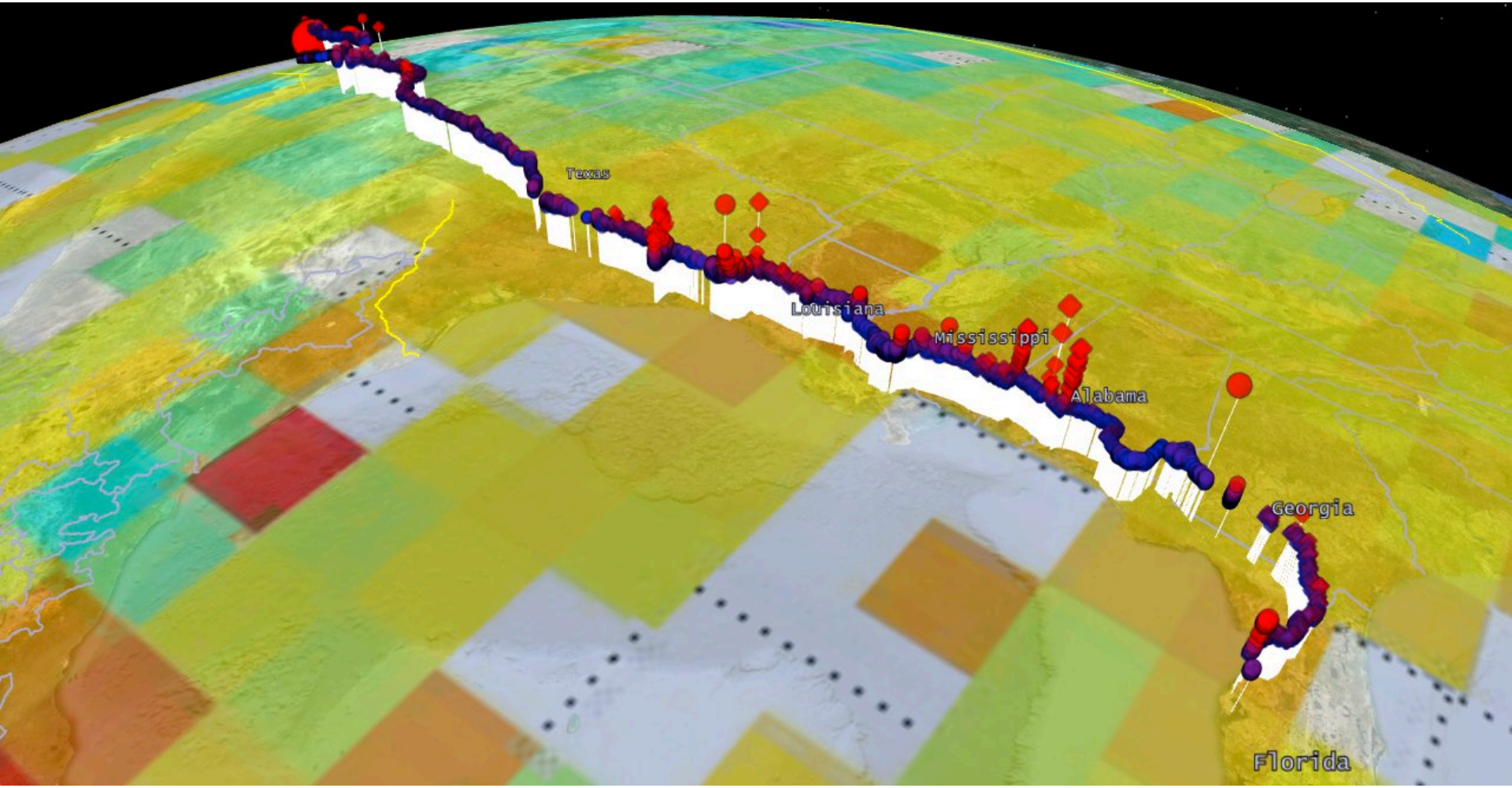


Surface CH_4 (2010) and SCIAMACHY (2003-2005)



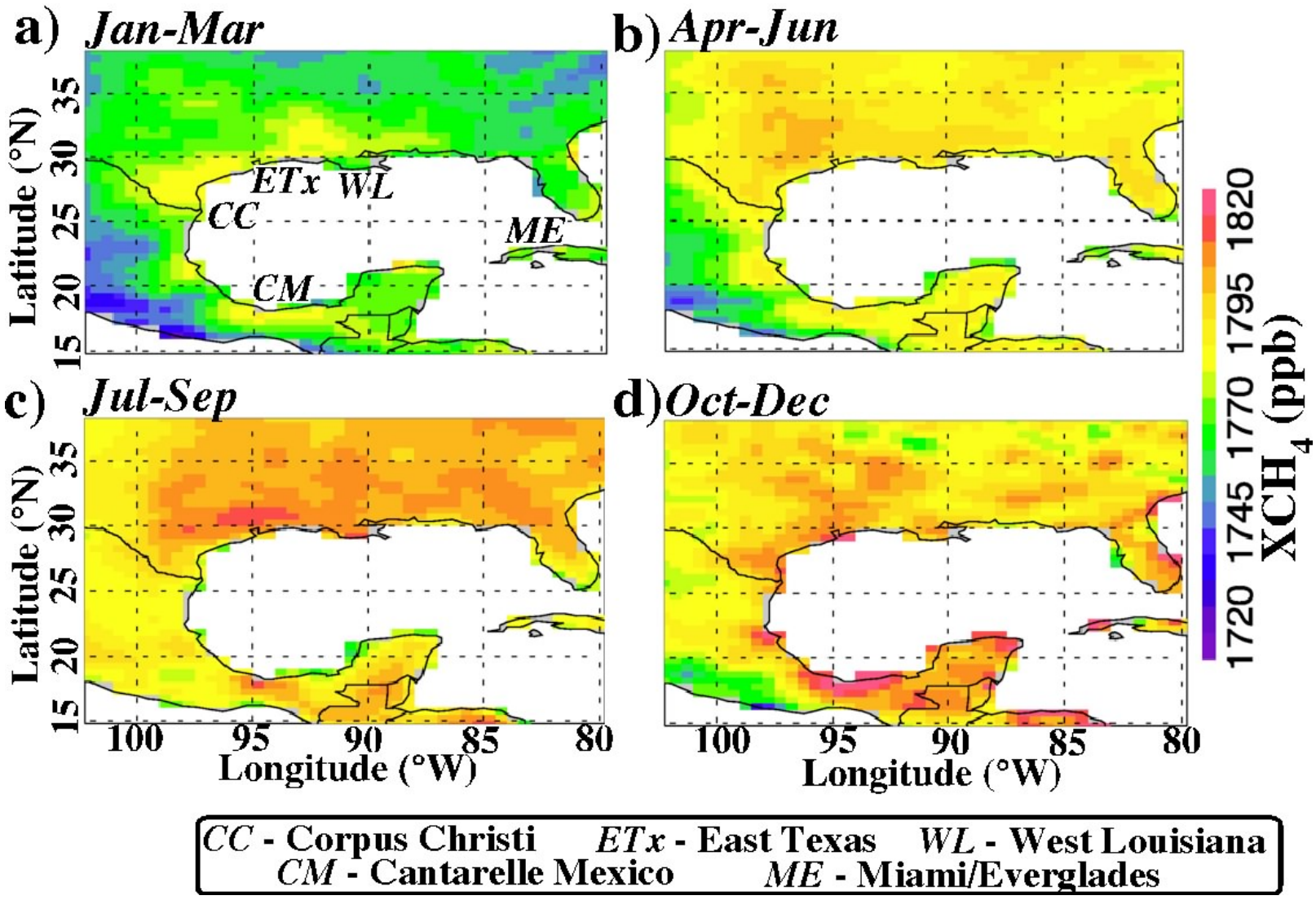
Leifer et al., 2012 submitted

Surface methane (2010) and GOSAT (2009-2011)



Leifer et al., 2012 submitted

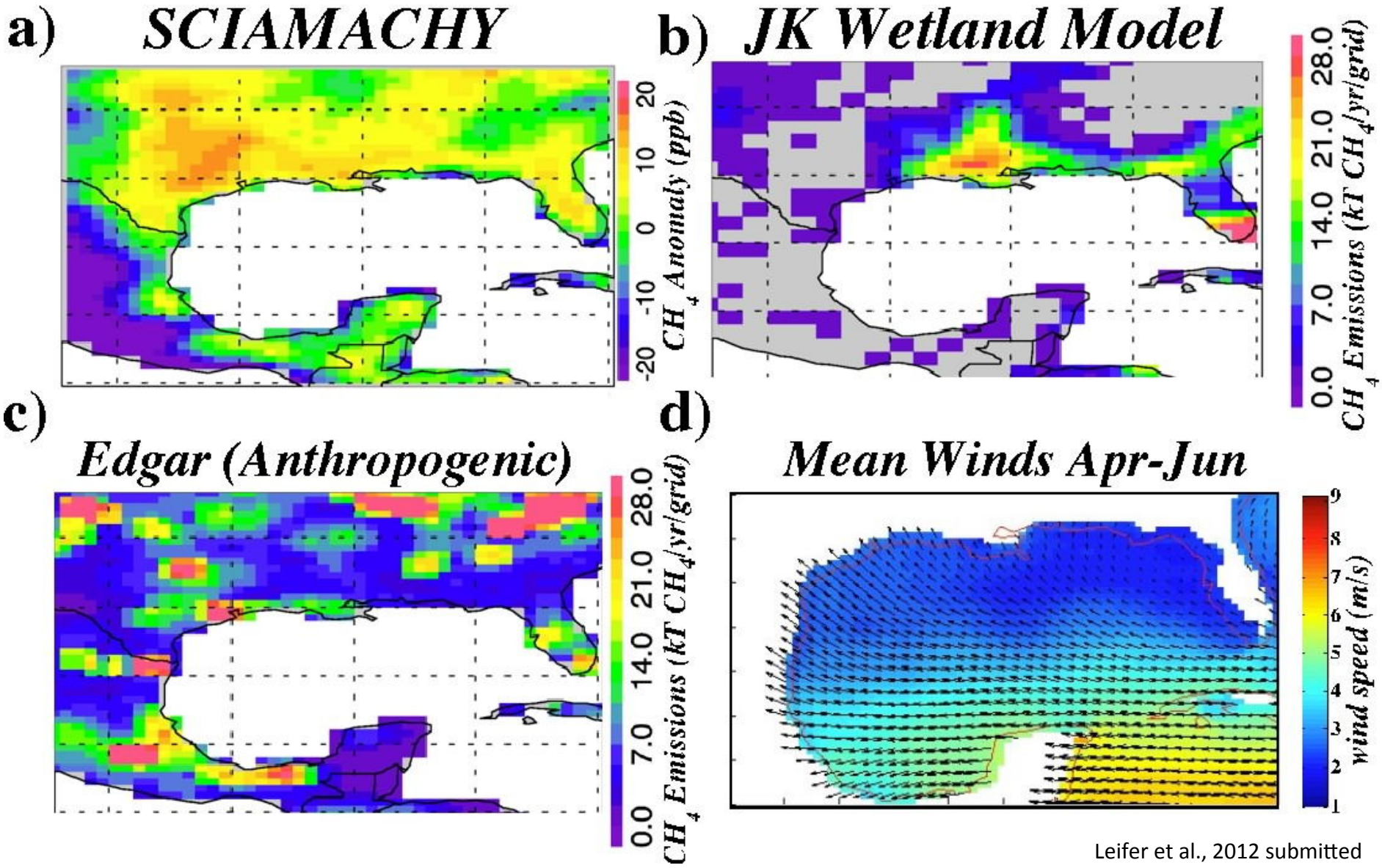
Seasonal SCIAMACHY



CC - Corpus Christi *ETx* - East Texas *WL* - West Louisiana
CM - Cantarelle Mexico *ME* - Miami/Everglades

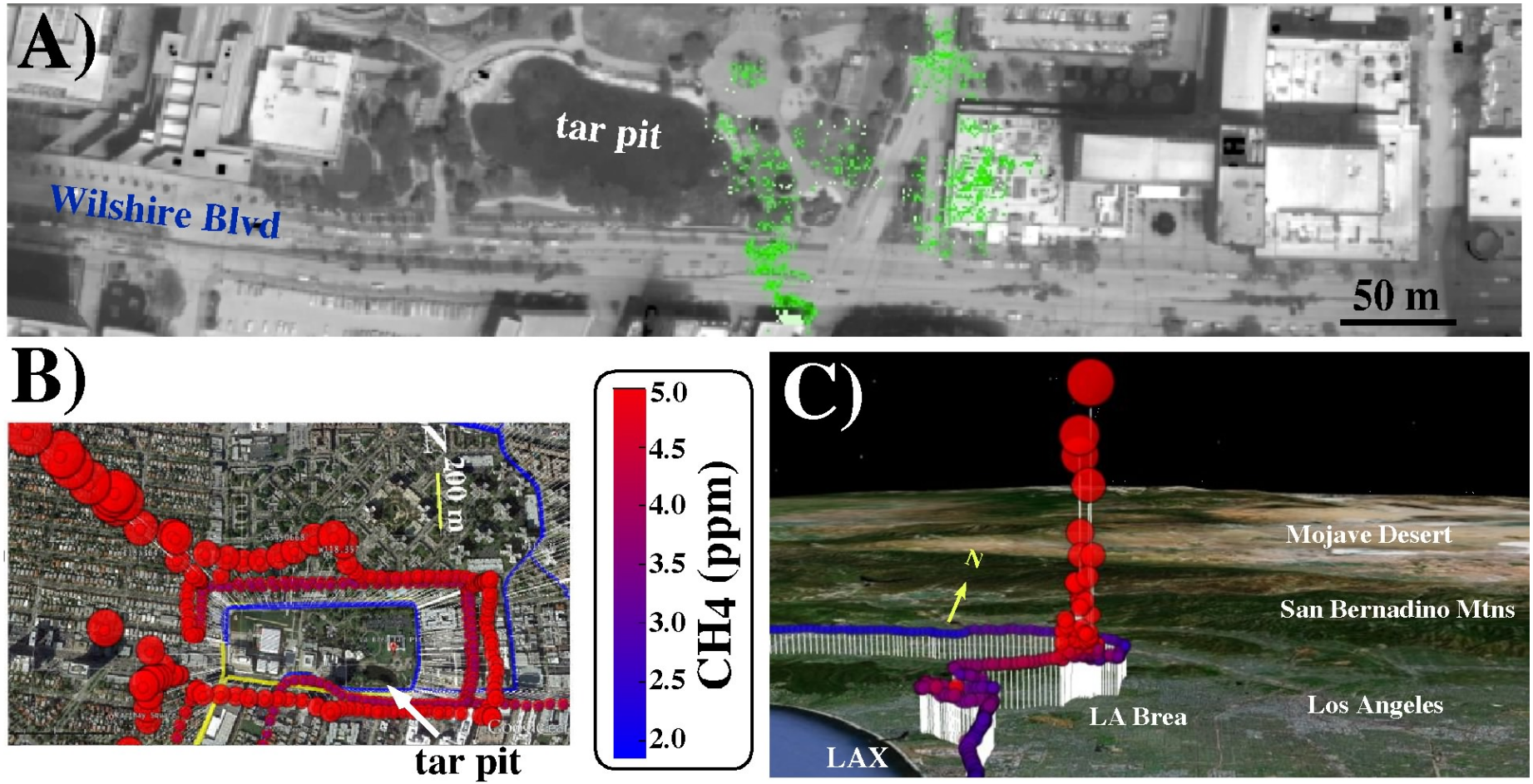
Leifer et al., 2012 submitted

Spring Comparison



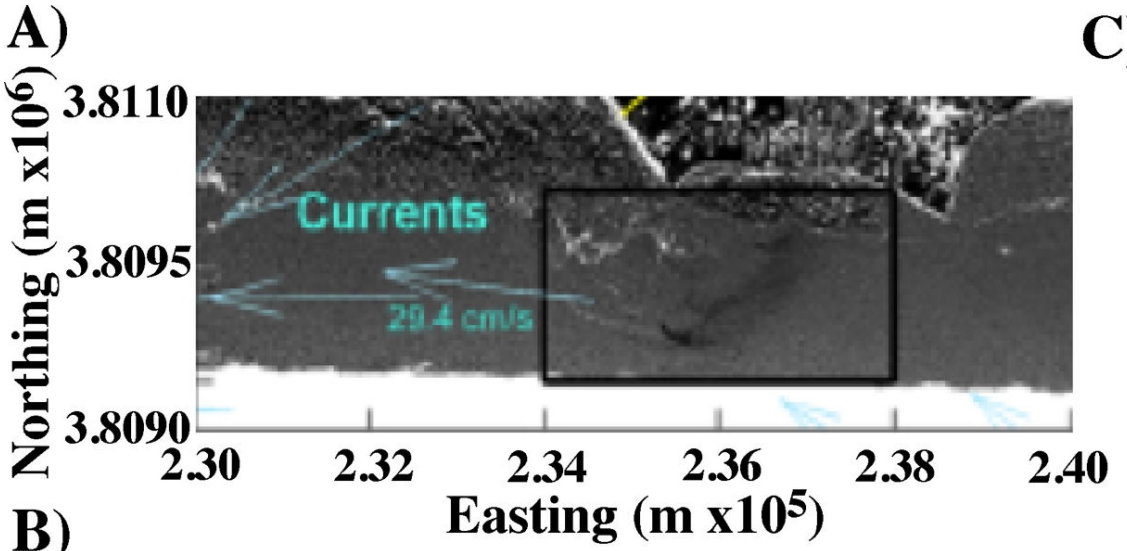
Leifer et al., 2012 submitted

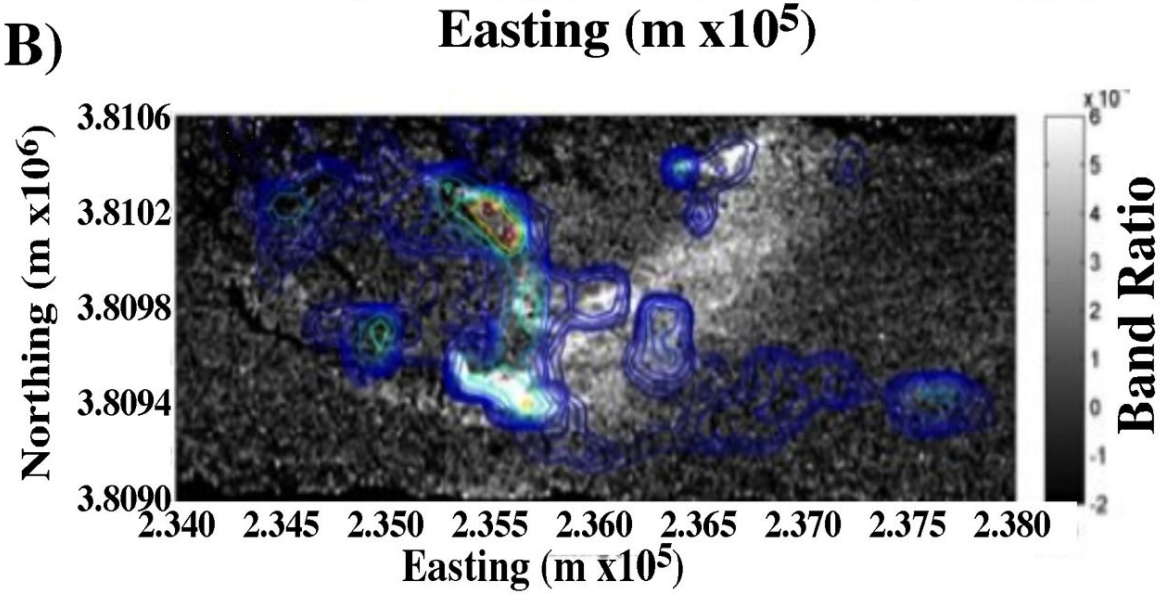
La Brea, LA

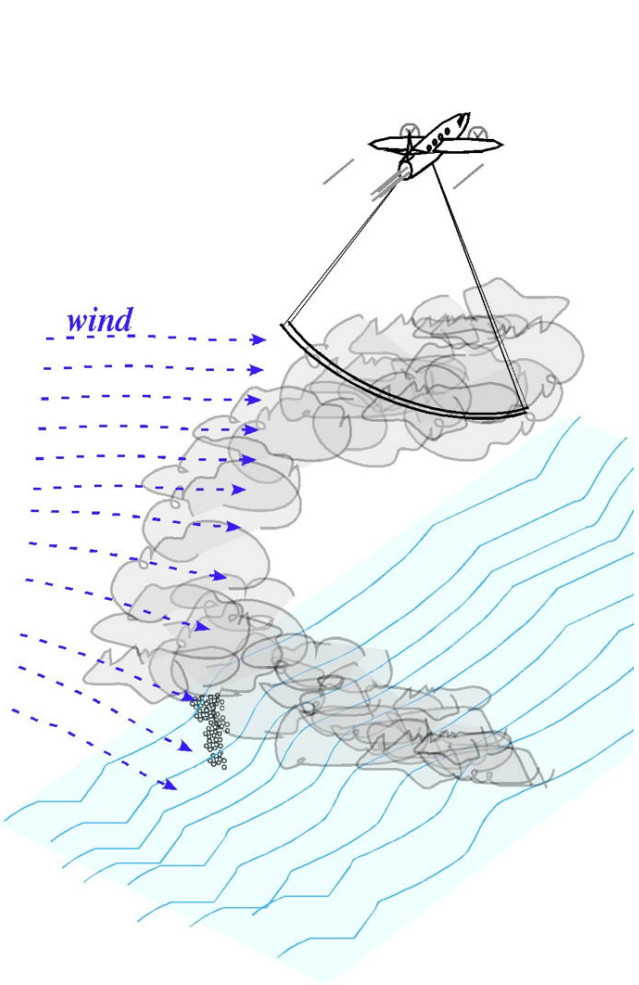


Leifer et al., 2012b in press

SWIR and TIR fusion for trace gas detection improves interpretation





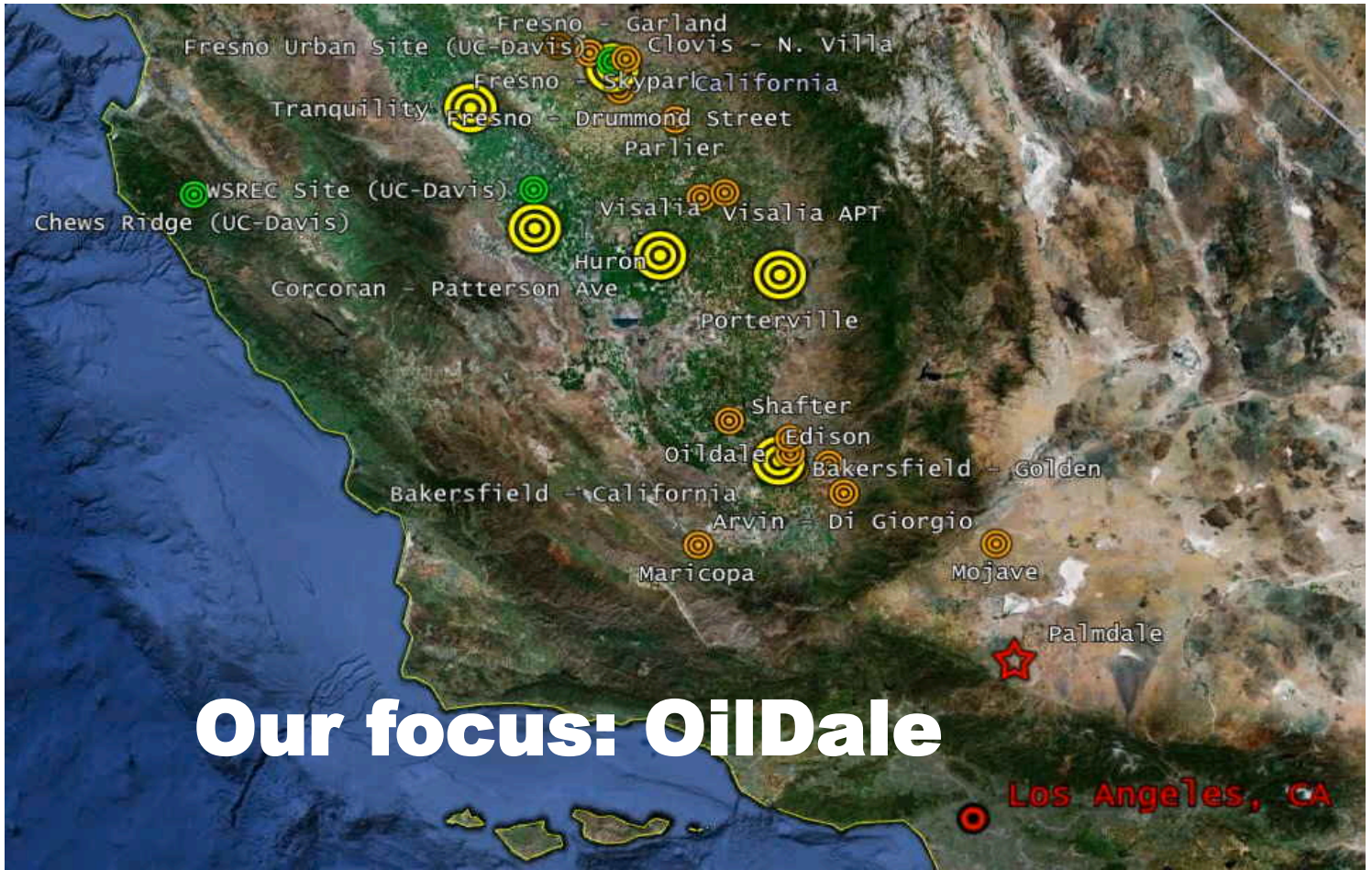


Leifer et al., 2012b accepted

DISCOVER AQ Jan 2013 Study Sites

Airborne and ground air quality measurements

http://www.nasa.gov/mission_pages/discover-aq/



The New MACLab

Citations

- Farrell, P., Leifer, I., Culling, D., 2012. Transcontinental methane measurements: Part 1. A mobile surface platform for source investigations. *Atmospheric Environment*, *In Press*.

- Leifer, I., Culling, D., Schneising, O., Farrell, P., Buchwitz, M., Bovensmann, H., Burrows, J.P., 2012. Transcontinental methane measurements: Part 2. Mobile surface investigation of fossil fuel industrial fugitive emissions. *Atmospheric Environment*, *Submitted*.

- Leifer, I., Tratt, D.M., Realmuto, V.J., Gerilowski, K., Burrows, J.P., 2012. Infrared hyperspectral imaging of atmospheric trace gases. *EOS (American Geophysical Union Transactions)*, *In Press*.

Findings:

- Transcontinental surface and satellite trends were similar with anomalies centered on FFI activity areas, particularly near Houston.
- Kern River oil field produced far more methane (and higher alkanes) than the Elk Hills oil field, likely from the different Enhanced Oil Recovery techniques.
- The La Brea (Geologic) tar pit area is a surprisingly strong LA Basin methane source.
- Coal loading port was a surprise CH_4 source.
- Comparison with JK Wetlands and EDGAR anthropogenic, and winds shows that in some seasons and locations, inventories significantly underestimate FFI emissions.

Findings:

- Surface data collection on satellite scale allows detailed source investigation and through comparison with inventories, source evaluation.

Next (Last) Steps (This Effort):

- Quantitative rather than qualitative emission estimates requires sophisticated modeling efforts including wetlands emissions to evaluate on a regional and extrapolate to global scale the true FFI contribution to methane budgets.