Ozone exceedances in Houston TX: Characteristics and Best Practices

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http://vizuete.web.unc.edu

Jeffries H.E., Rasool Q.

https://www.visittheusa.com/destination/houston

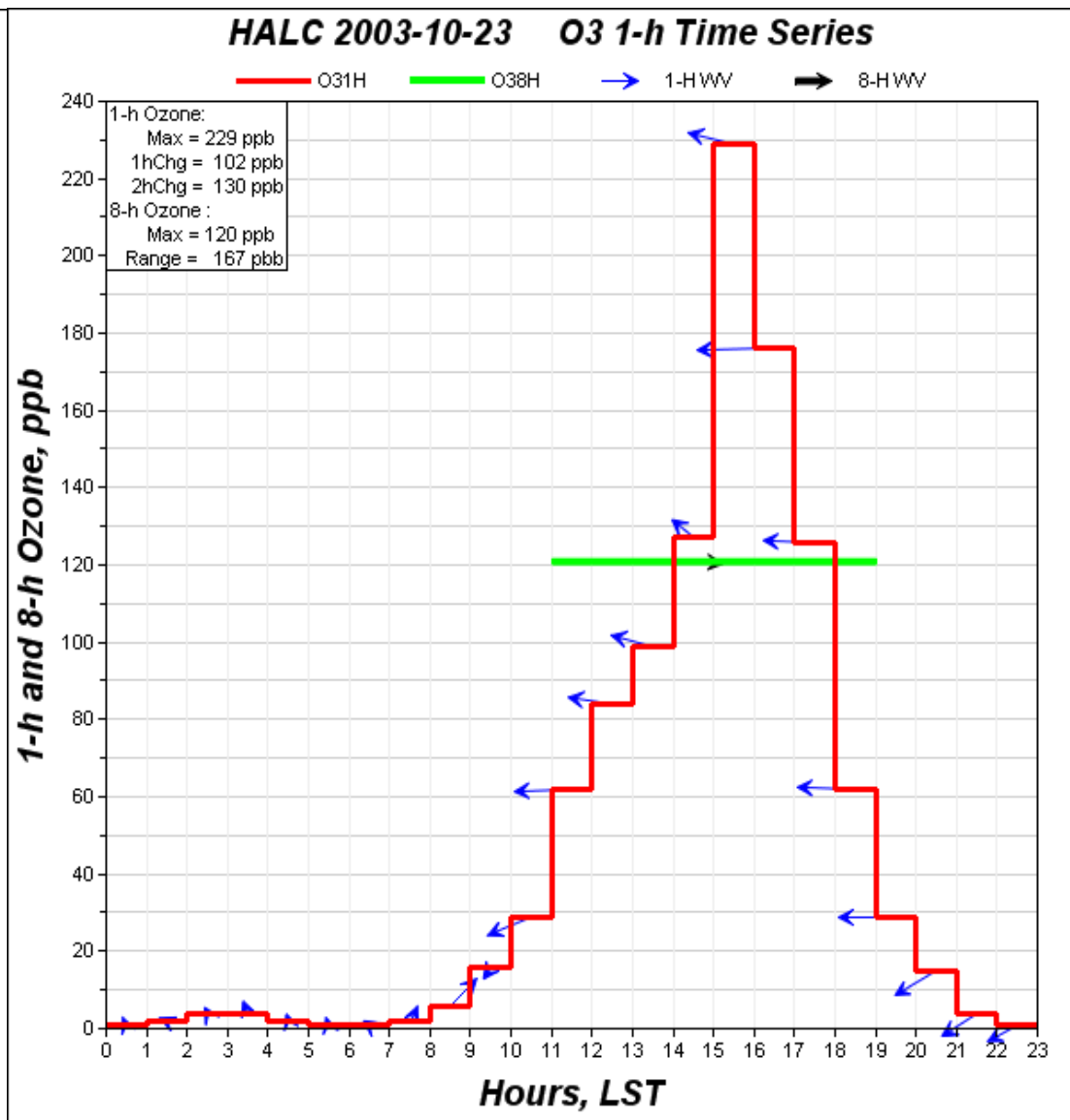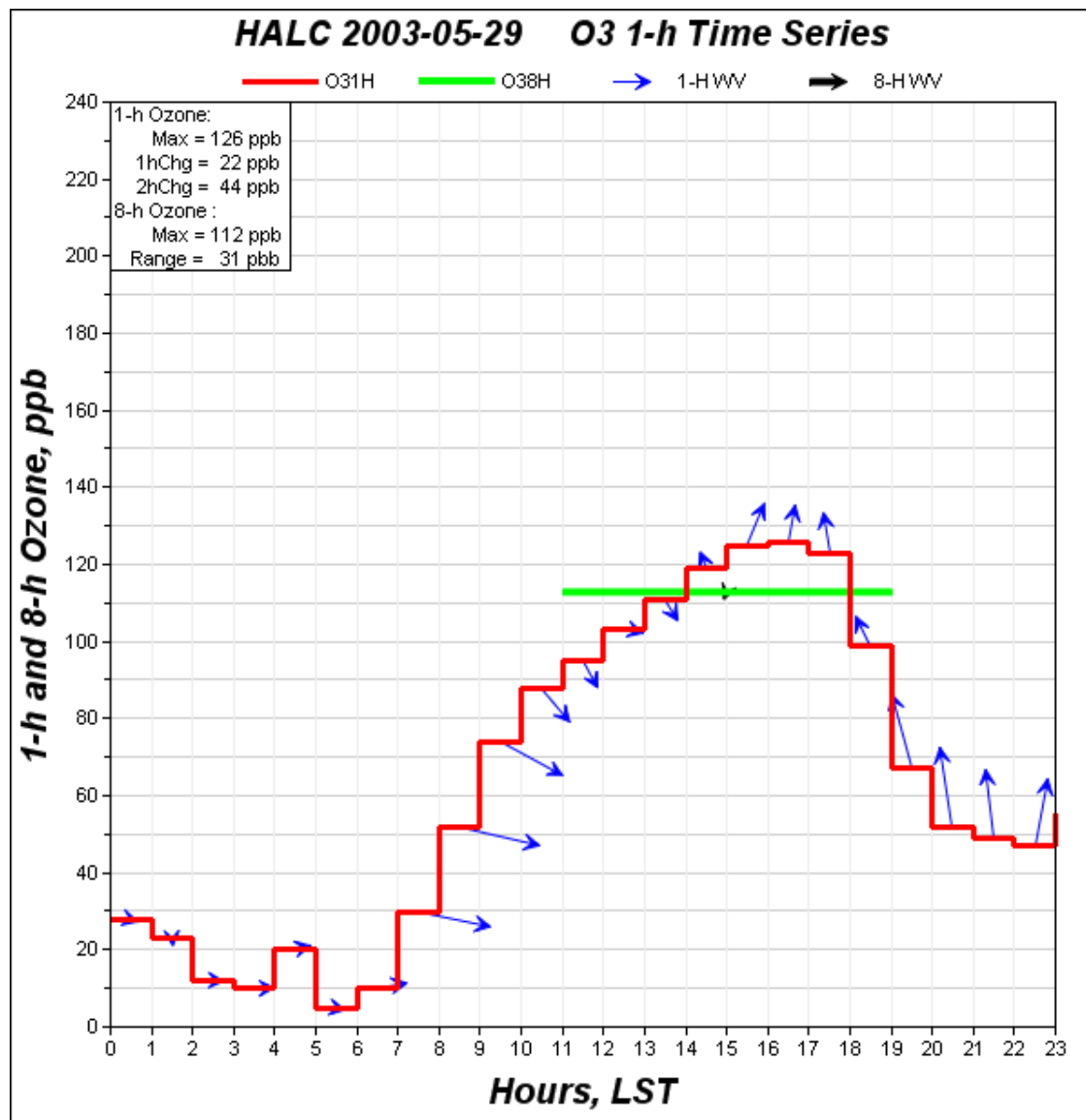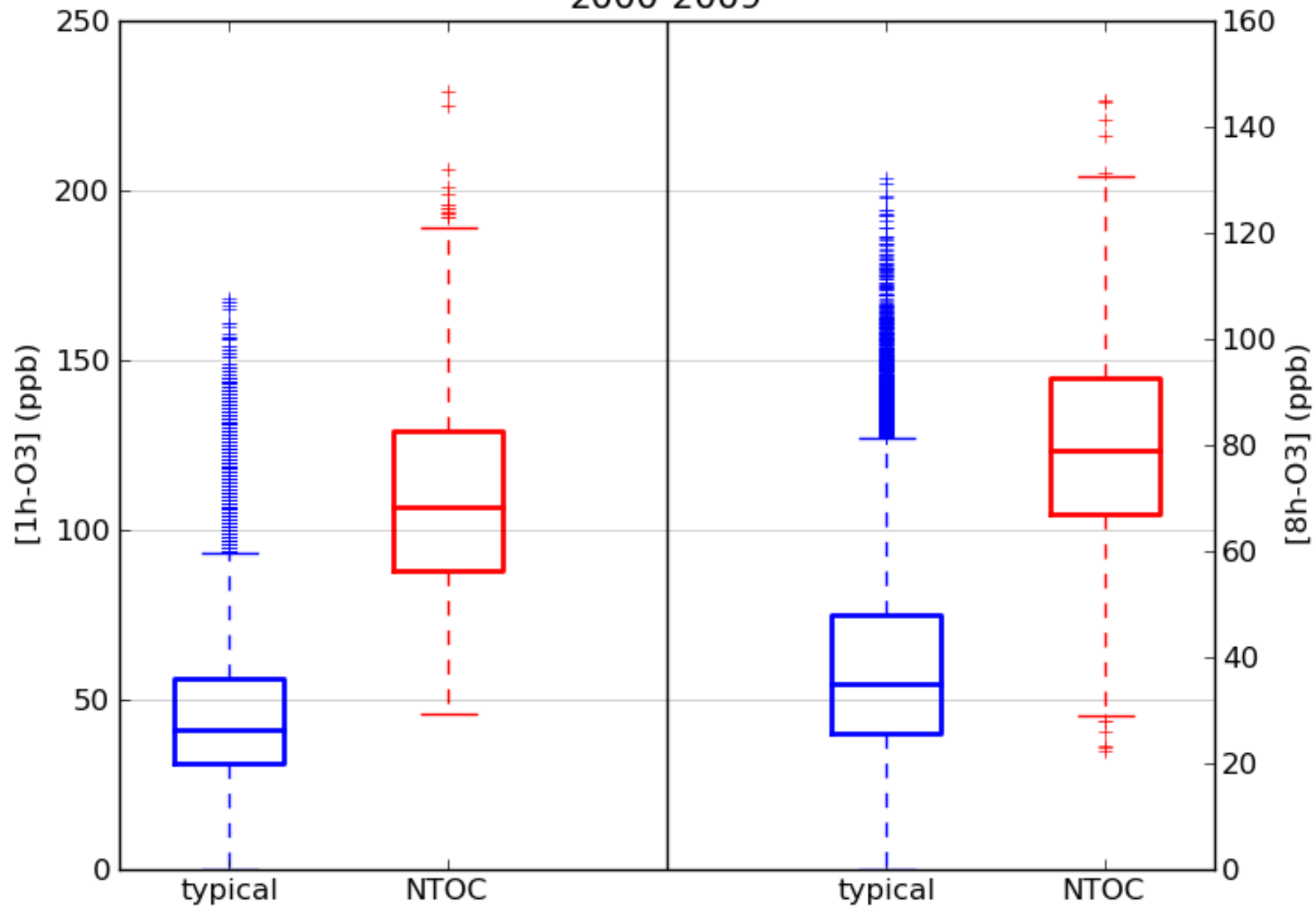https://www.houstoniamag.com/articles/2016/6/20/strange-case-of-port-and-its-city-july-2016

Case Study:
Emission Event Driven Ozone

- Characterization
  - Emission source
  - Spatial/Temporal impacts on air quality
- Modeling best practices
- Observational data best practices

A "Non Typical" Ozone Change

HALC 2003-05-29   O3 1-h Time Series

1-h Ozone:
Max = 126 ppb
1hChg = 22 ppb
2hChg = 44 ppb
8-h Ozone :
Max = 112 ppb
Range = 31 pbb

HALC 2003-10-23   O3 1-h Time Series

1-h Ozone:
Max = 229 ppb
1hChg = 102 ppb
2hChg = 130 ppb
8-h Ozone :
Max = 120 ppb
Range = 167 pbb

Couzo et al., Environ. Chem. 2013

Distribution of Observed Daily 1h-O3, 8h-O3 Max Concentrations
2000-2009

Couzo et al., Environ. Chem. 2013

Harris, Galveston, Chambers, and Brazoria Counties
VOC Event Emissions
as Reported Jan 31 - Dec 31, 2003

Event Emissions
2001 Annual Avg

64,860 lbs/hr   53,983 lbs/hr   86,557 lbs/hr   64,539 lbs/hr
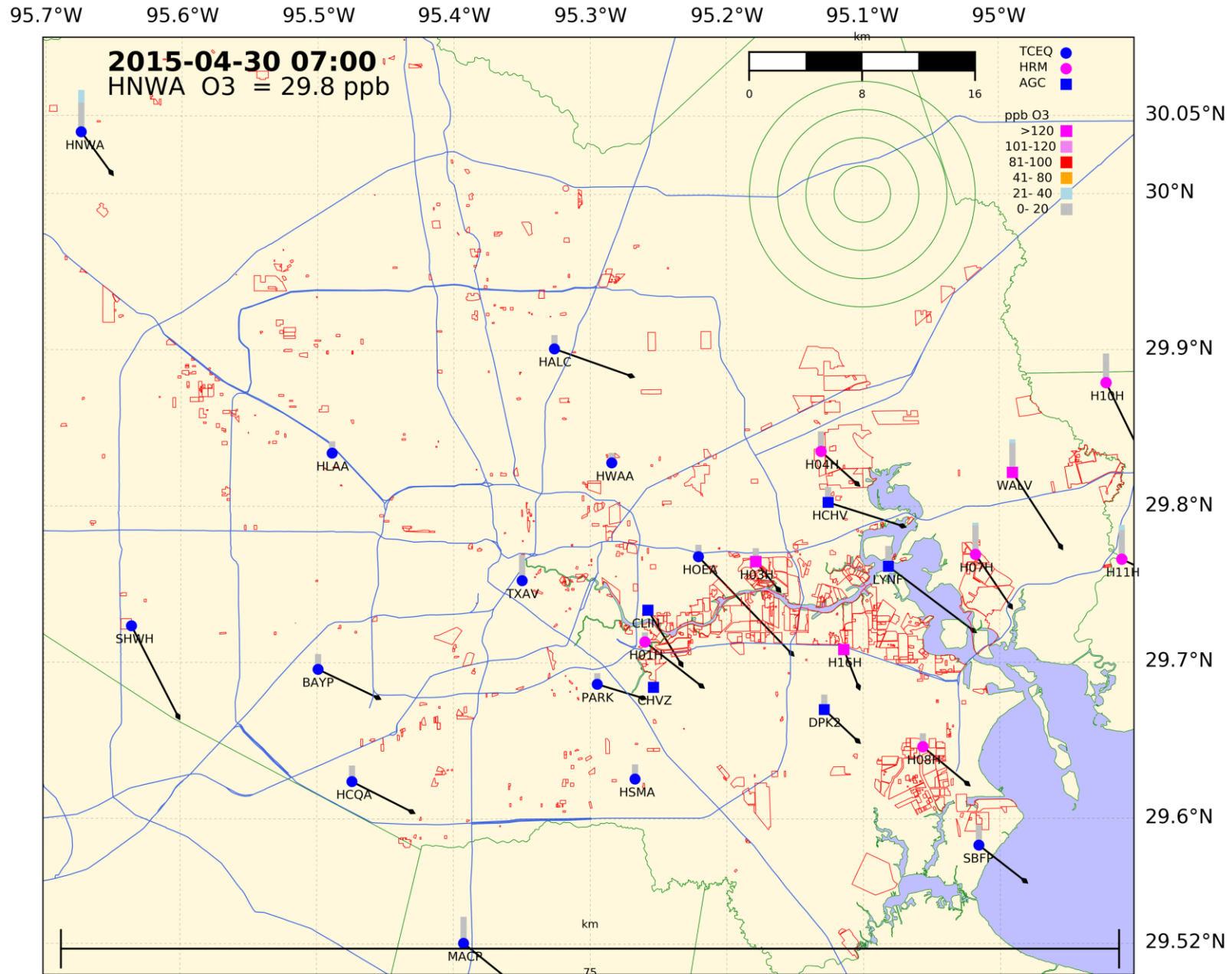
VOCs
4,000,000 lb

10,359 lbs/hr
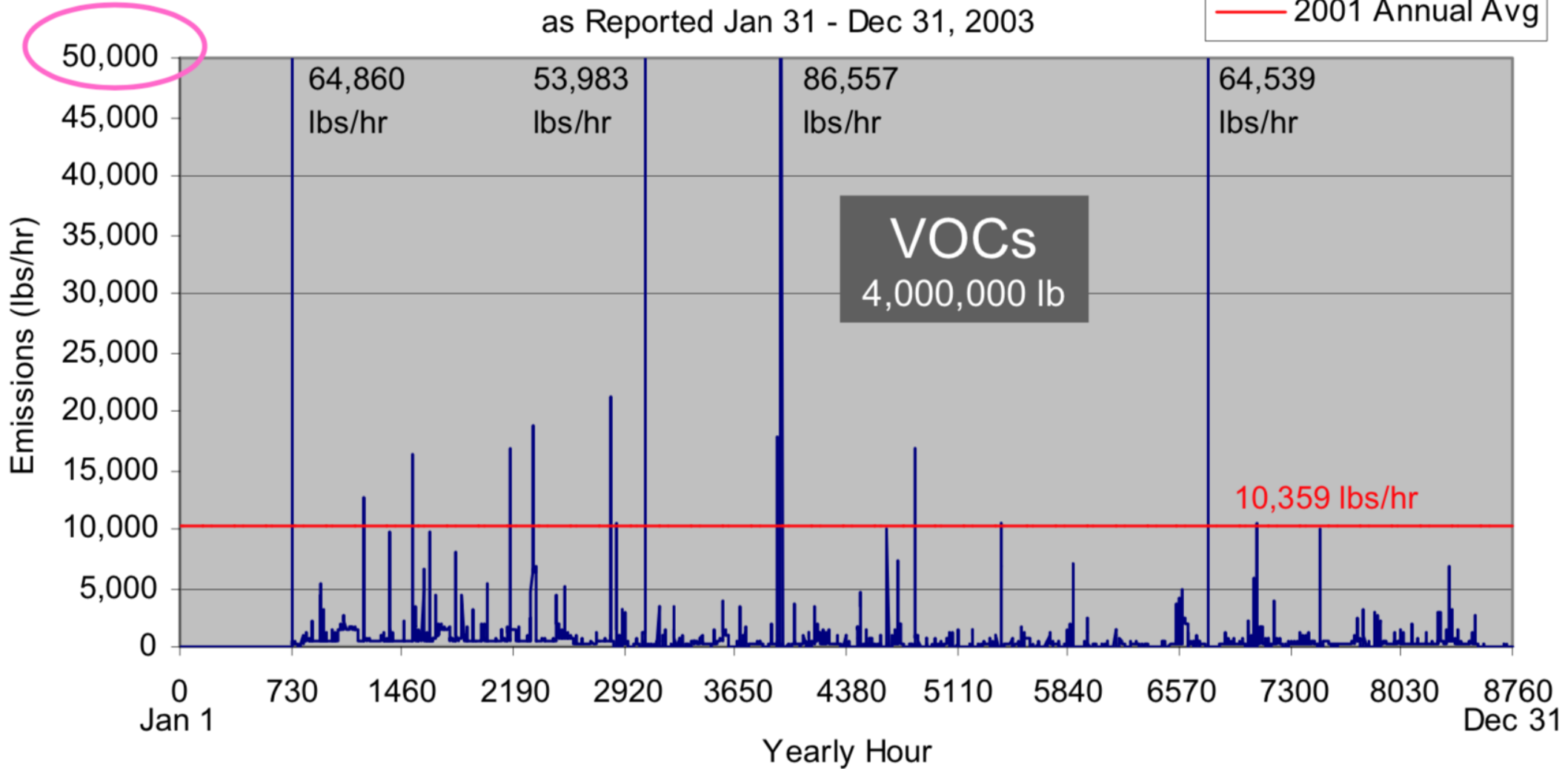
Total Event Emissions = 4,035,322 lbs

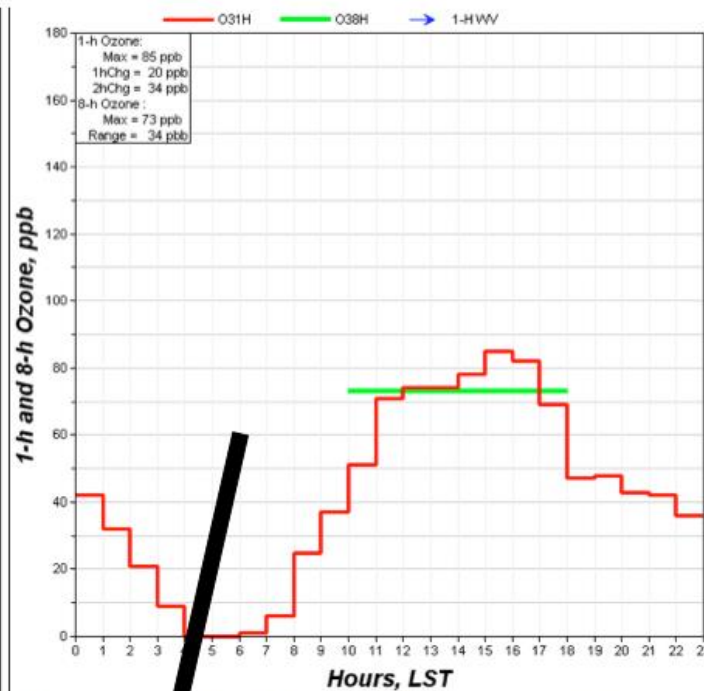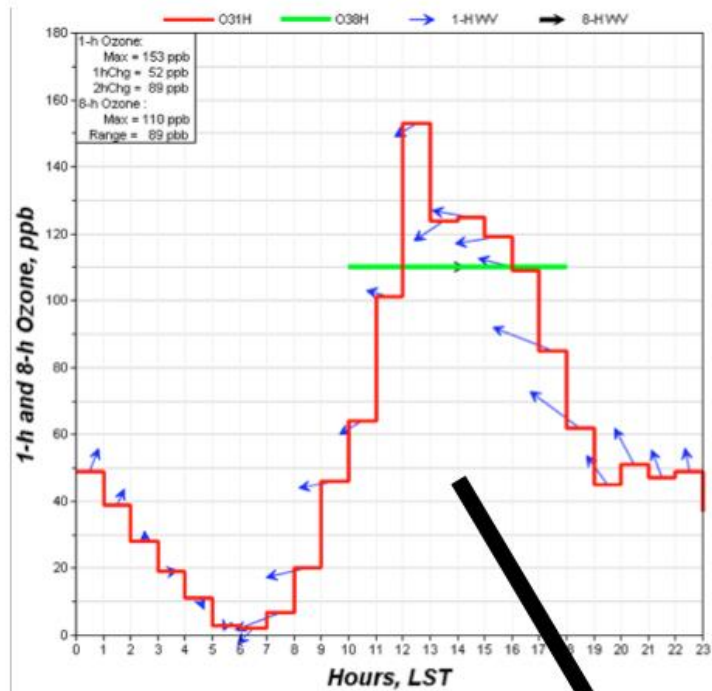First 11 Months of reporting

Murphy er atl ??

6

Ozone and Attainment

- Identified a consistent presence of elevated concentrations of VOCs
- 2000's – Alkenes > 40 ppb/hr
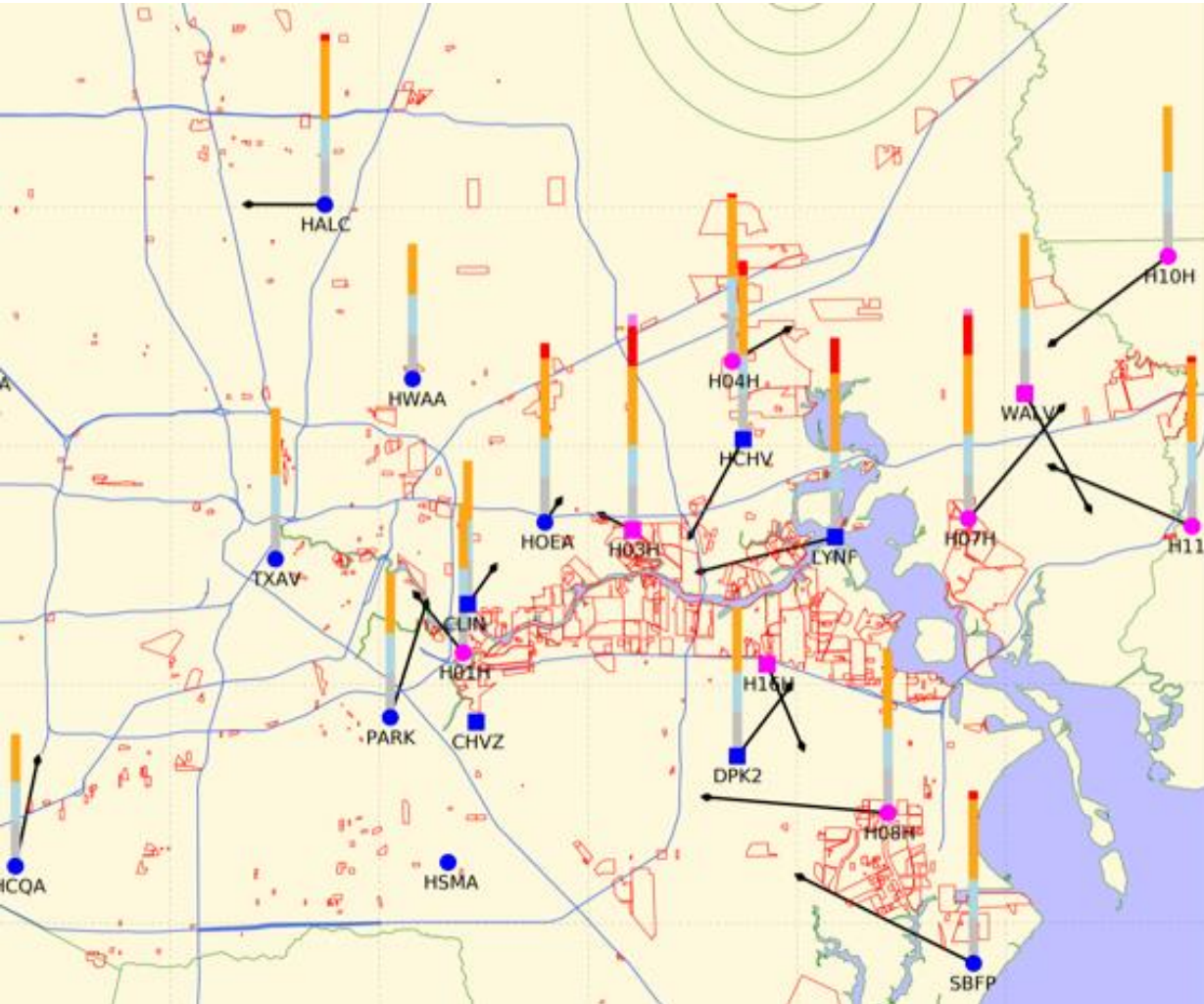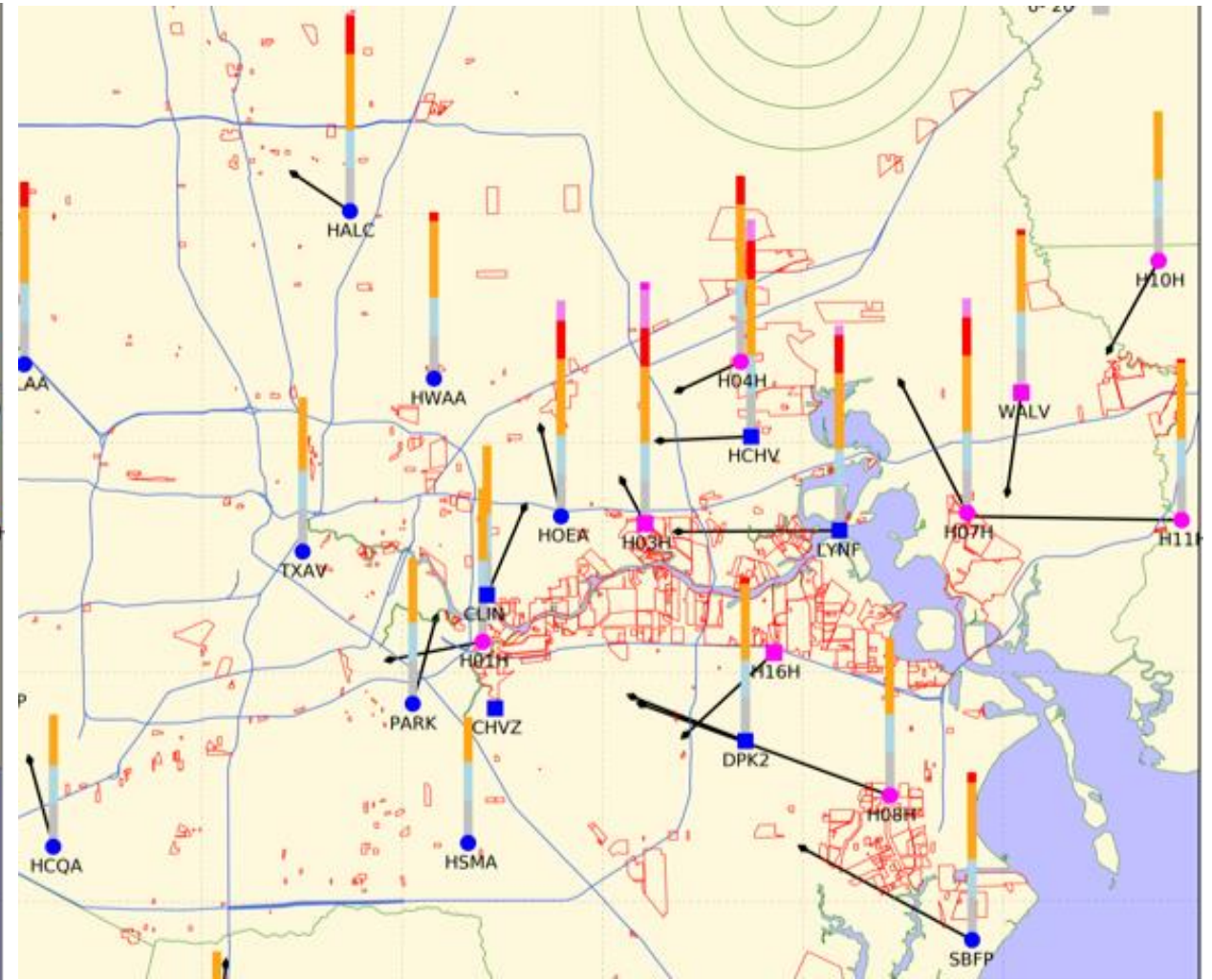- 2010's - primarily alkanes and aromatics > 20 ppb/hr

Ozone Plumes

Ozone Spatially Limited

Couzo et al., Environ. Chem. 2013

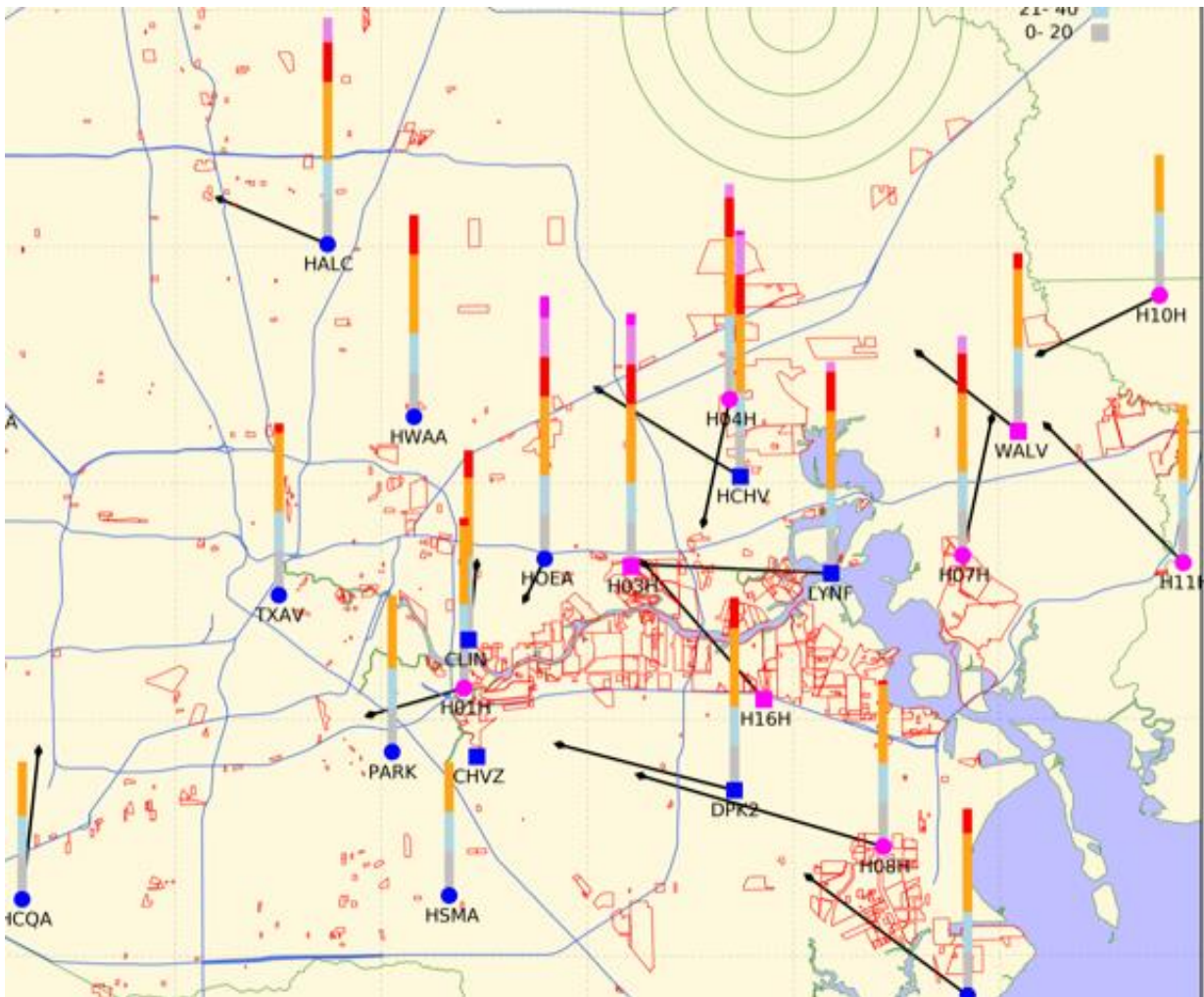9
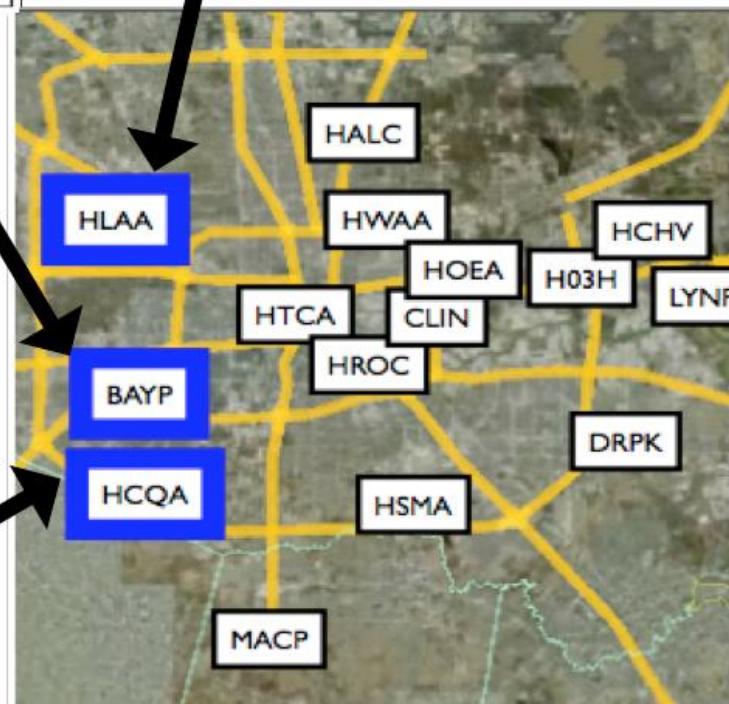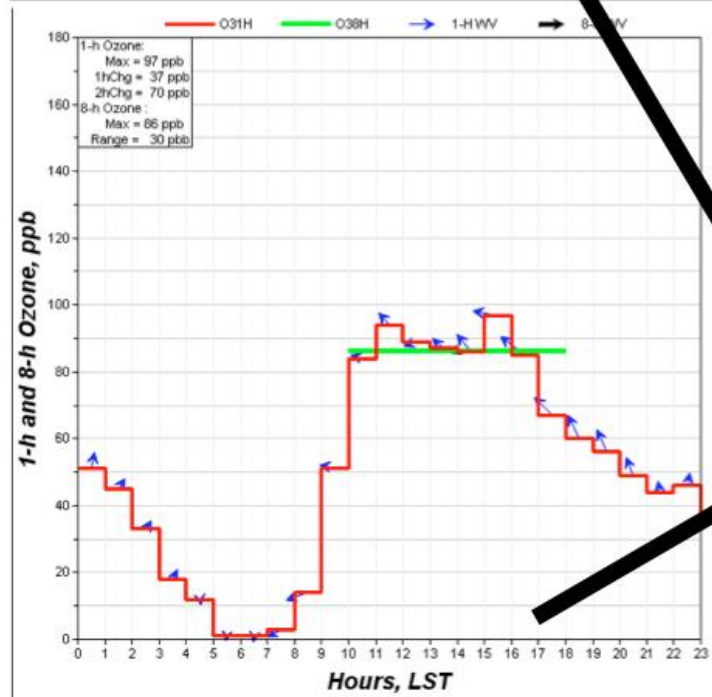
Spatially limited Ozone Plumes
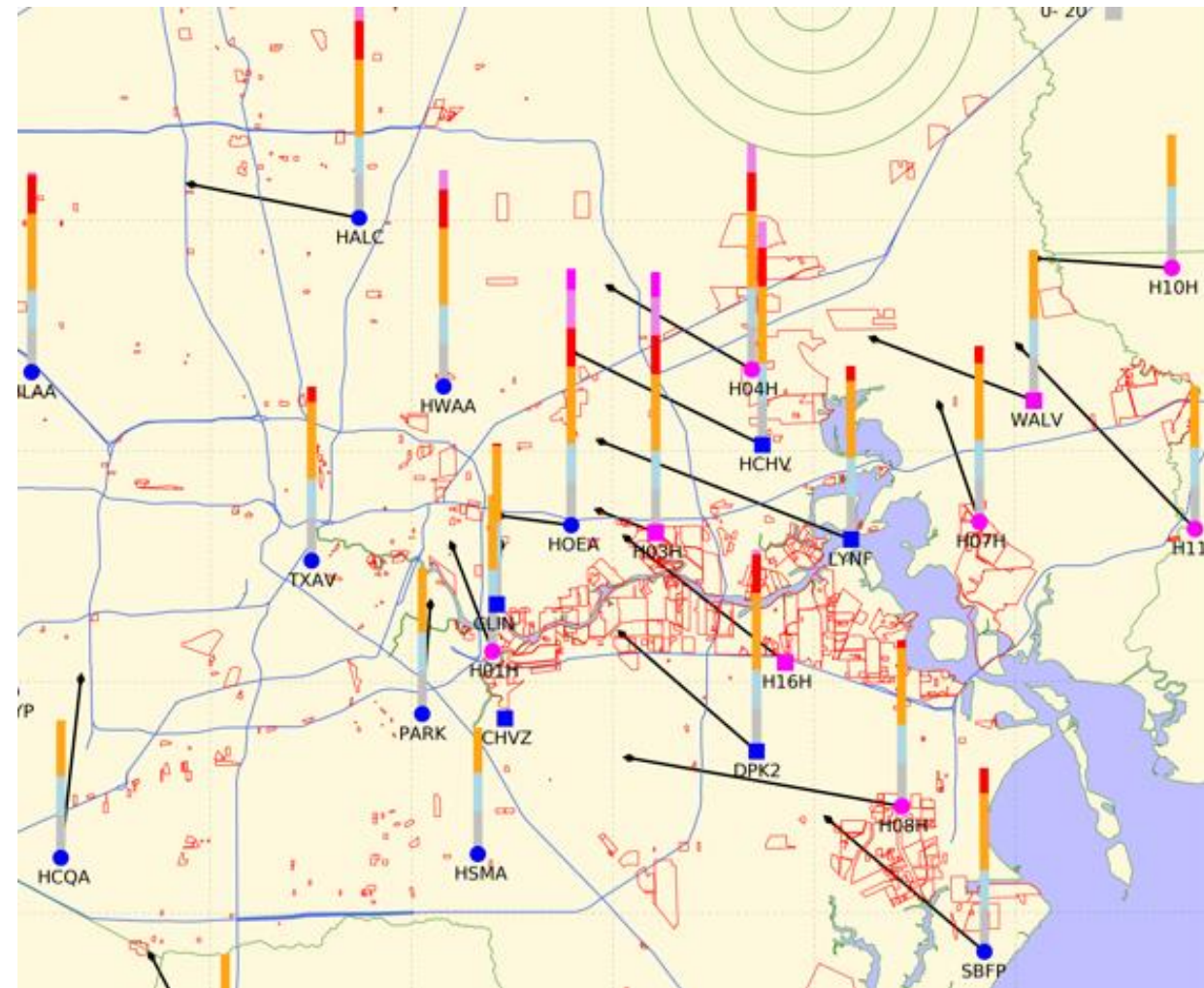

11 am
106 ppb H03H

12 pm
124 ppb H03H

June 3, 2015

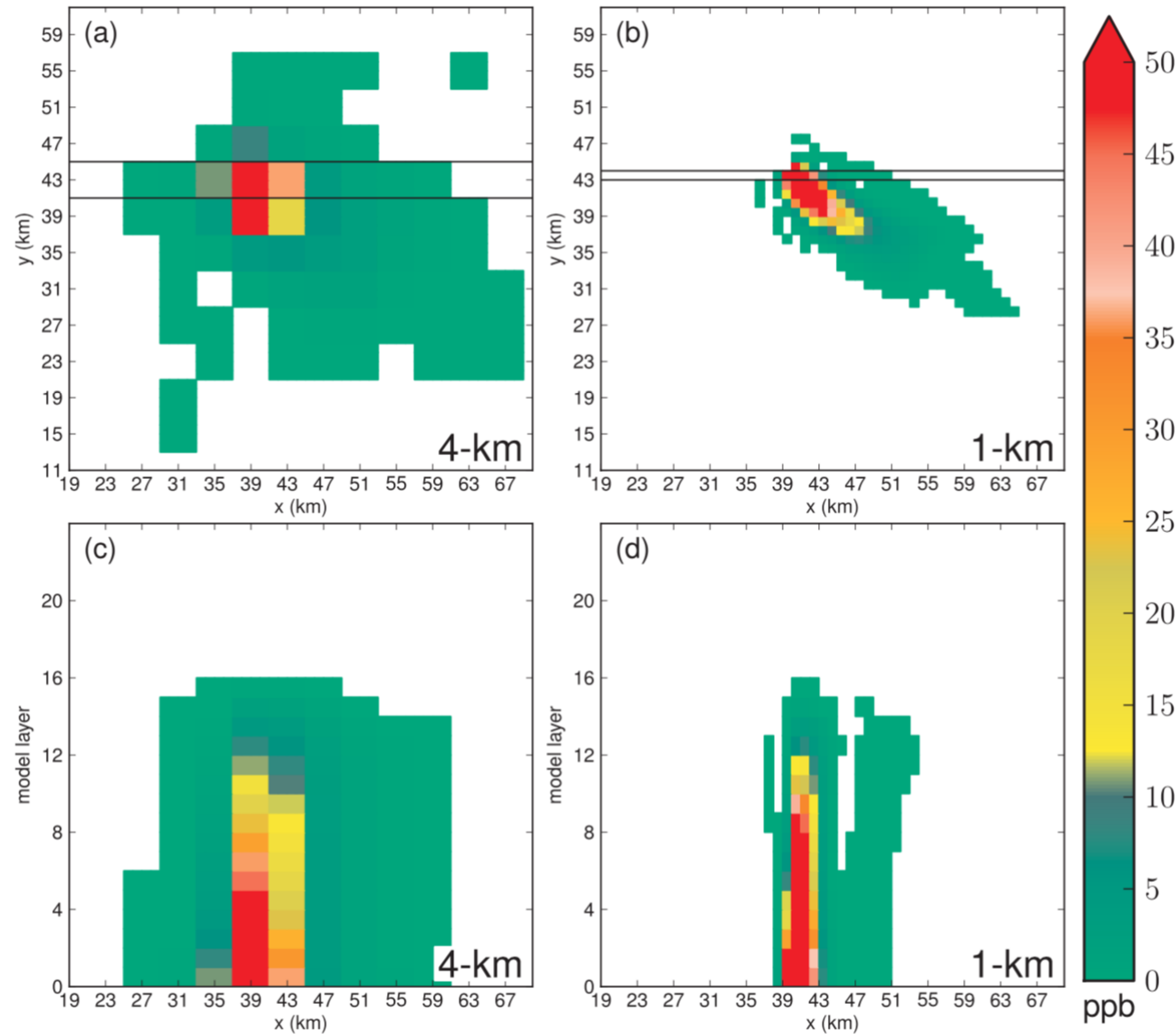# Spatially limited Ozone Plumes
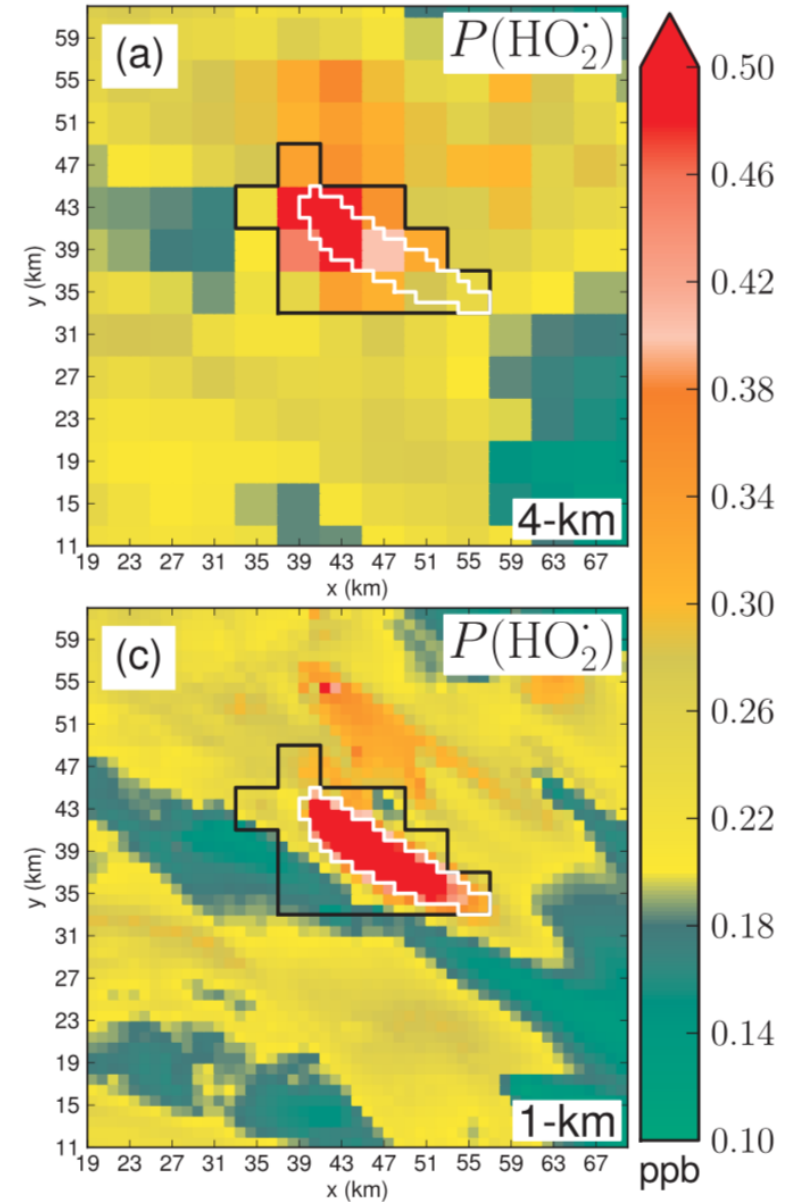

1 pm
131 ppb H03H

June 3, 2015

2 pm
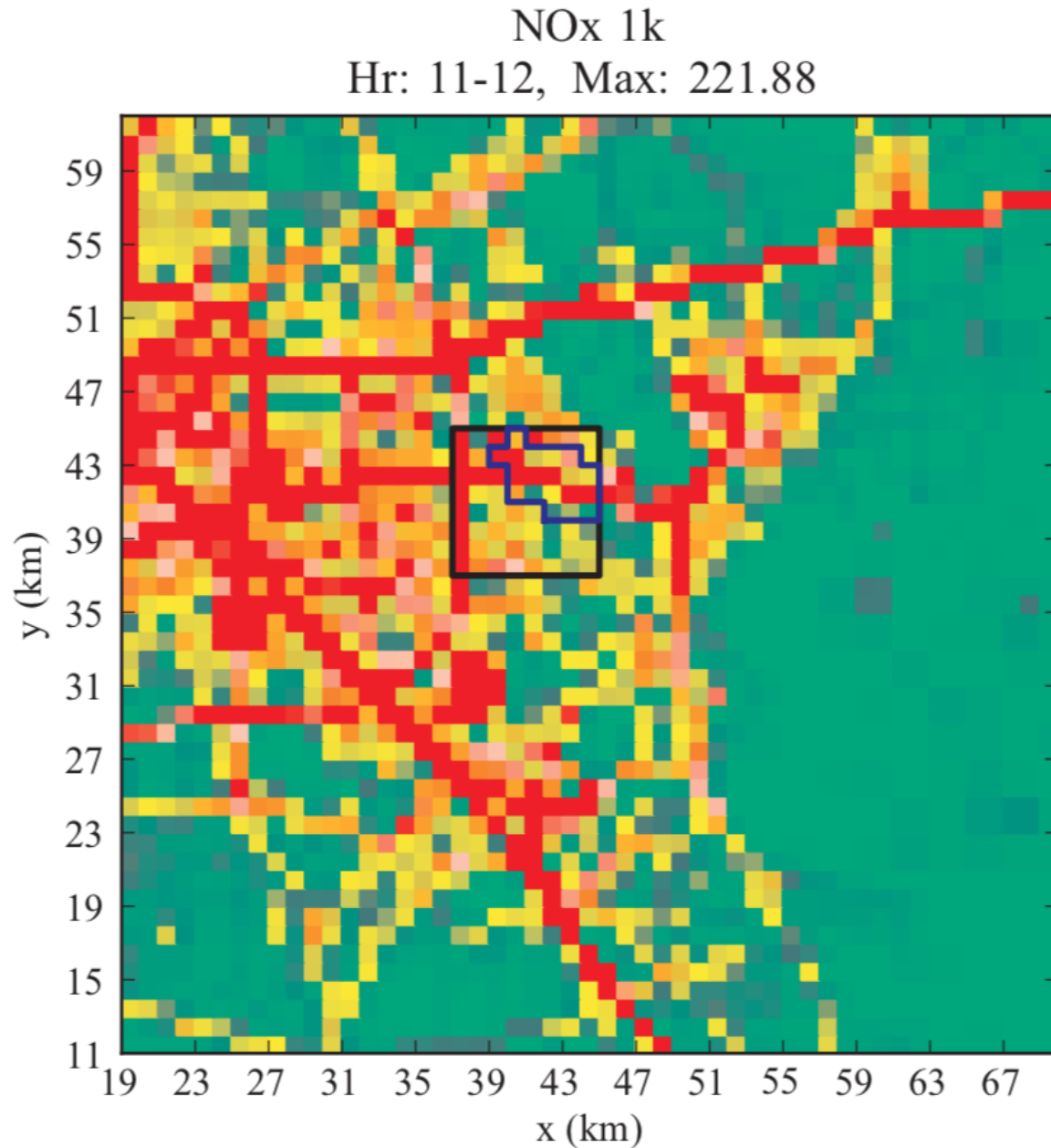133 ppb H03H

Model Tools

Grid Resolution - Chemistry

Predicted VOC

Production of HO2 Radicals

Henderson et al., JAWMA 2010

Grid Resolution - Emissions

NOx 1k
Hr: 11-12, Max: 221.88

Henderson et al., JAWMA 2010

Grid Resolution – Model Performance

6 a.m.

8 a.m.

GOT IT!

MISSED IT!

Couzo et al., JAWMA 2012

Model Got it...

Couzo et al., JAWMA 2012
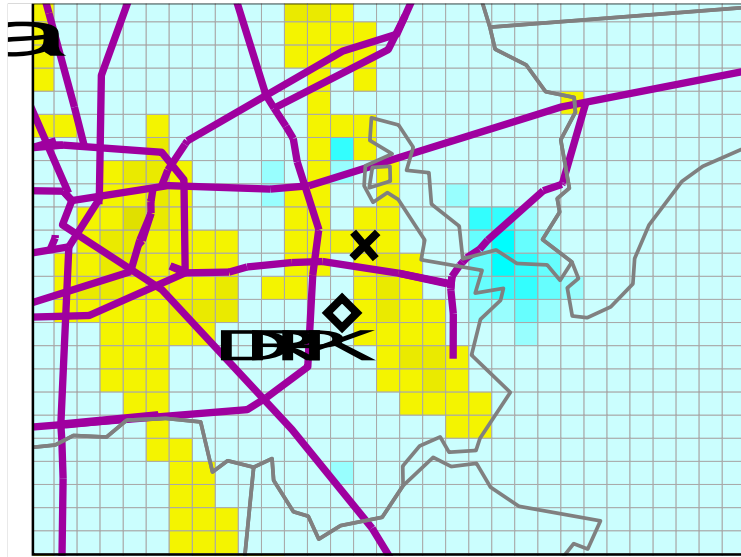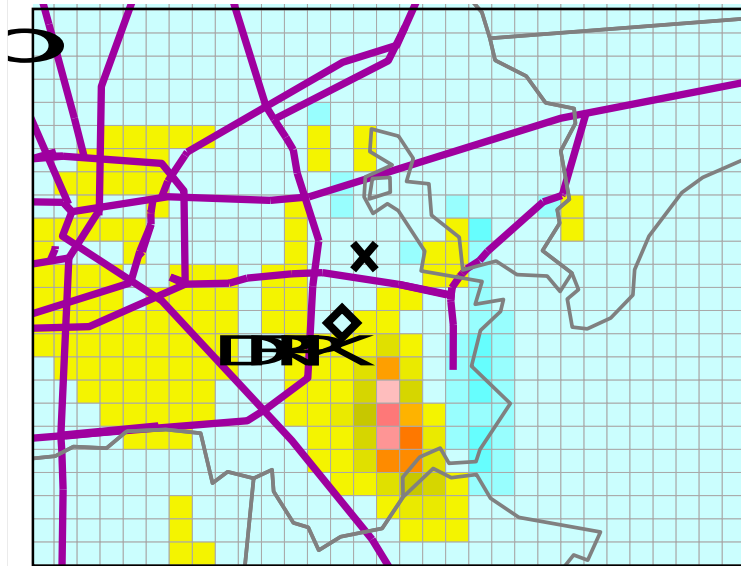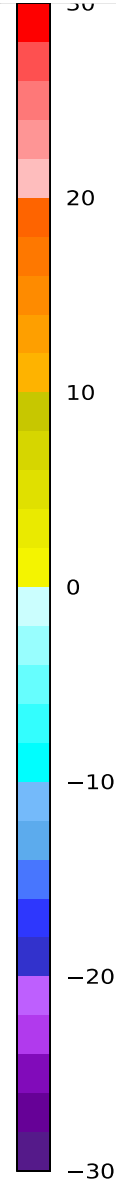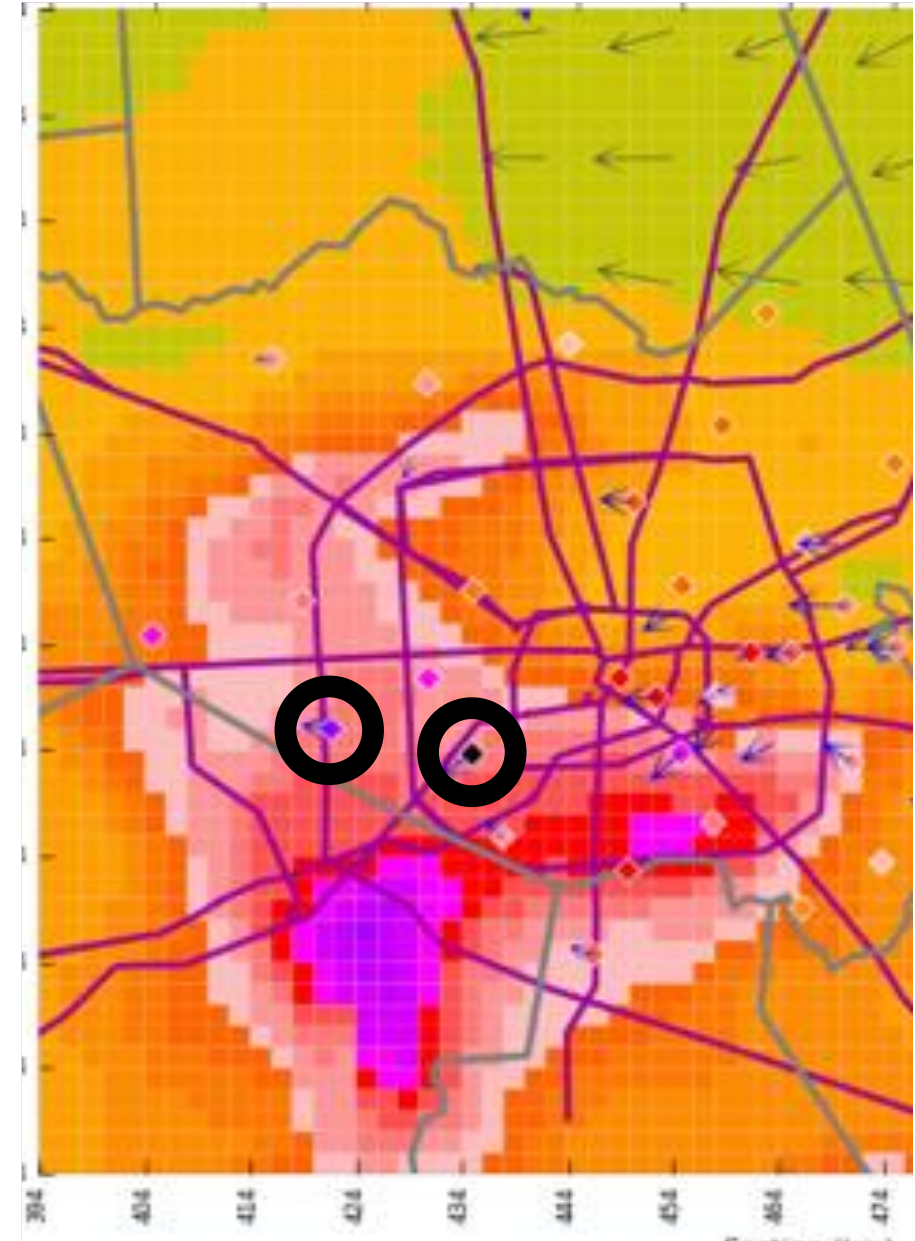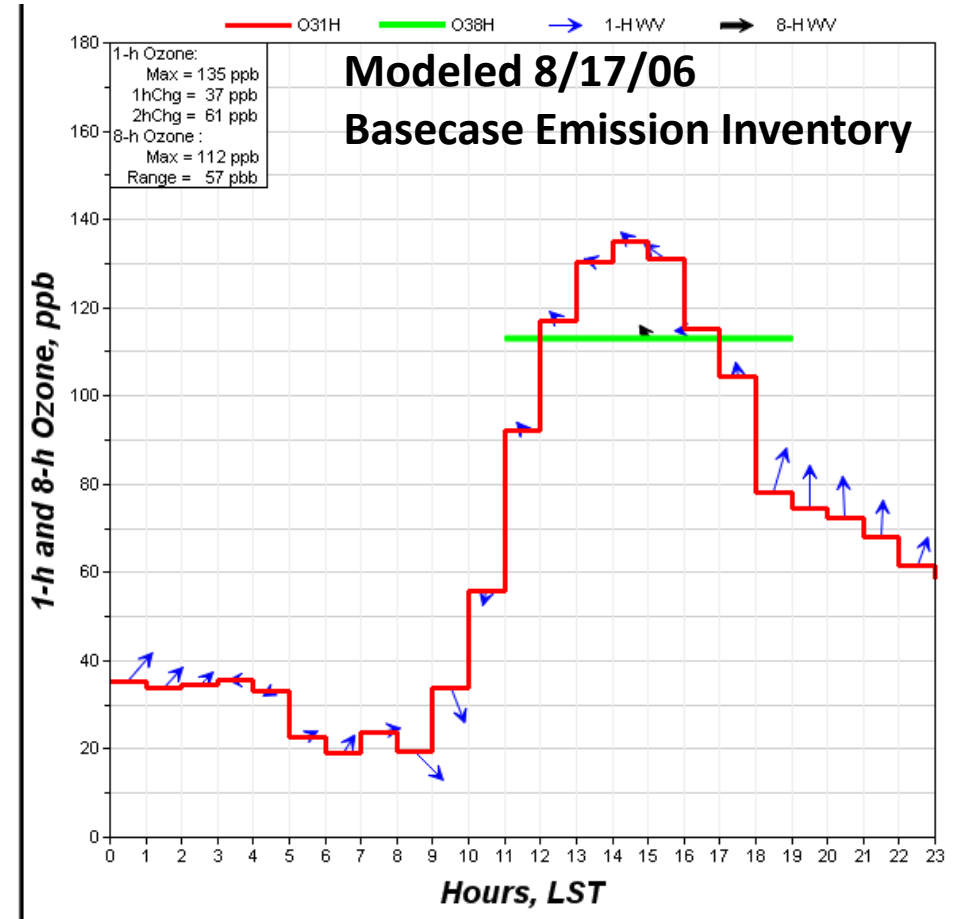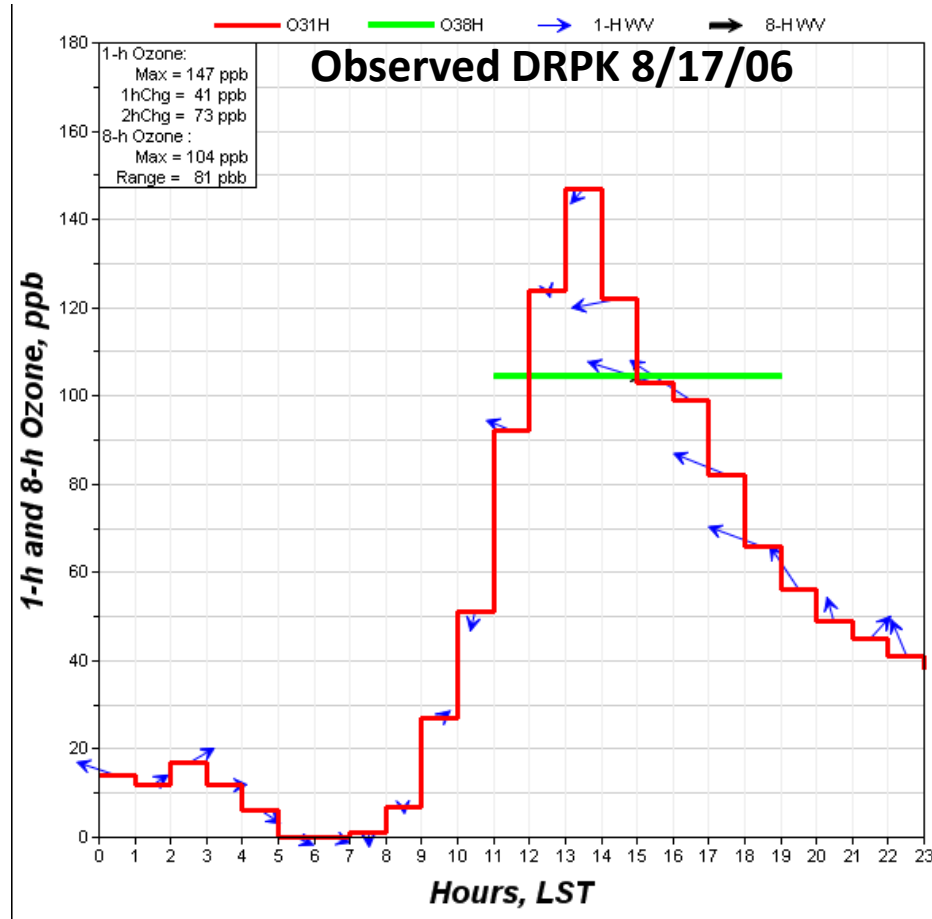
Model Misses Location

O3 2006-08-17 14   max120step6shade5 [ppb]

Couzo et al., JAWMA 2012

17
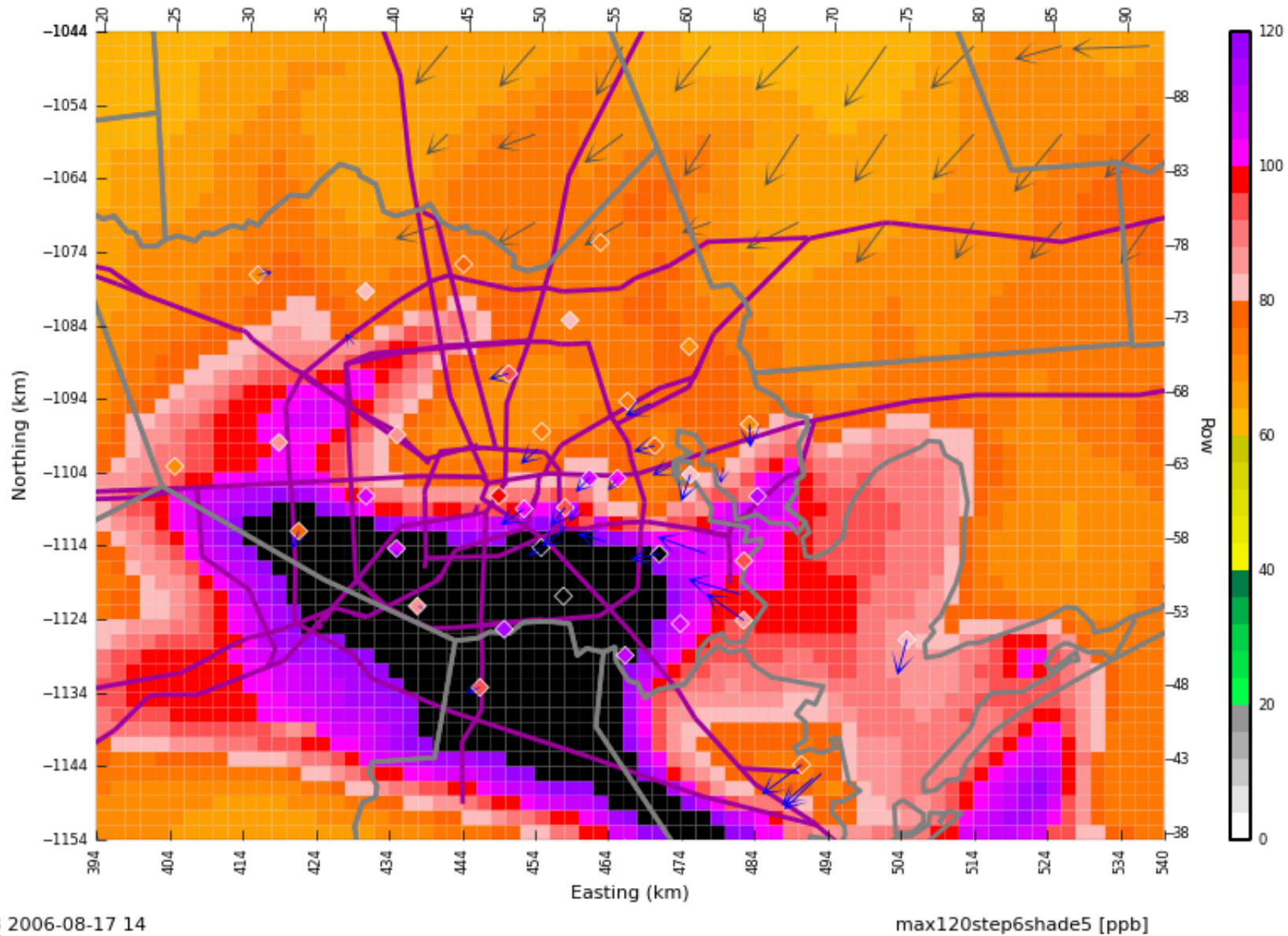
Observational Data

Auto GC Data

Deer Park - Ethylene

- 2005 Concentration (ppb)
- 2010 Concentration (ppb)
- 2015 Concentration (ppb)

S. Smith HRM, 2016
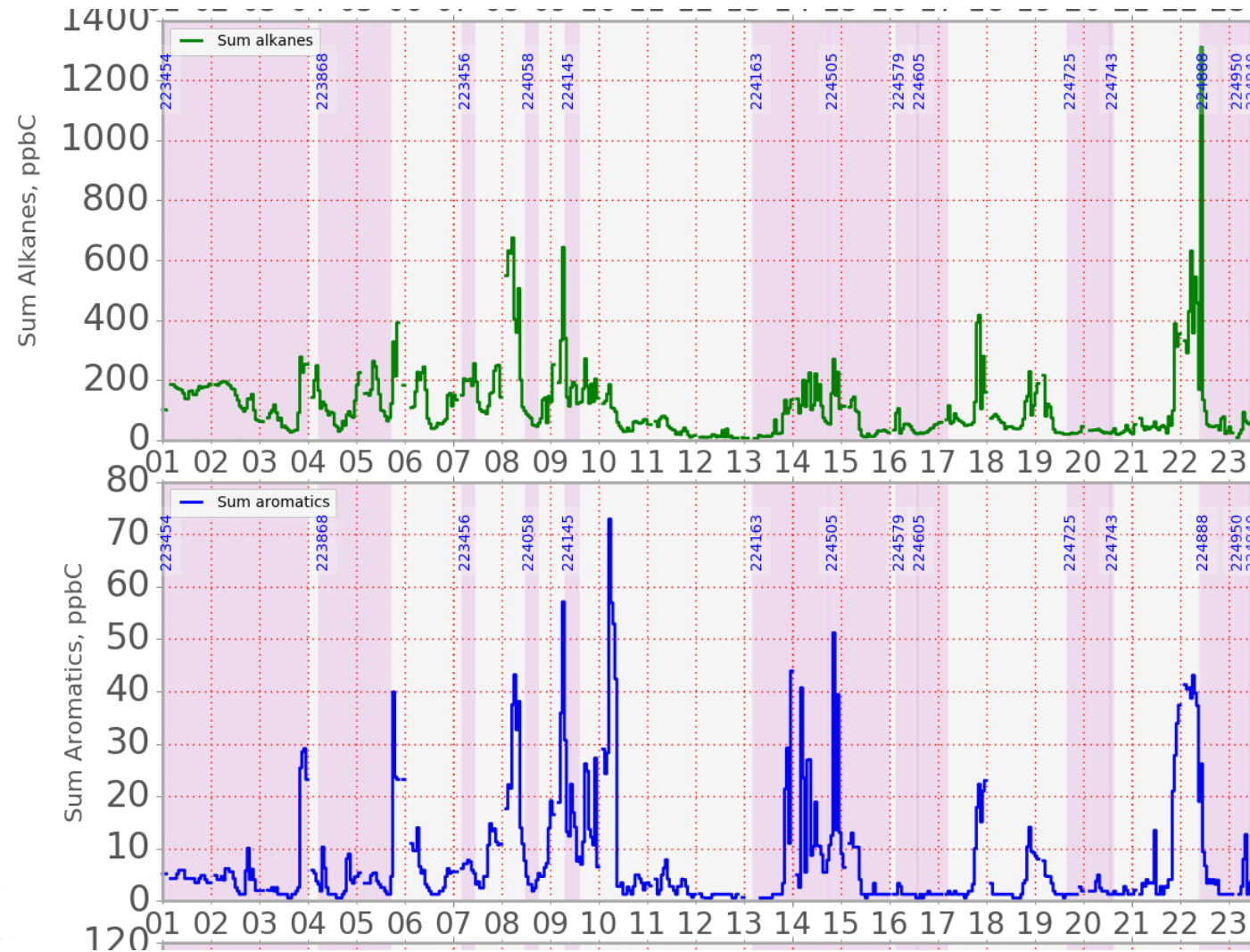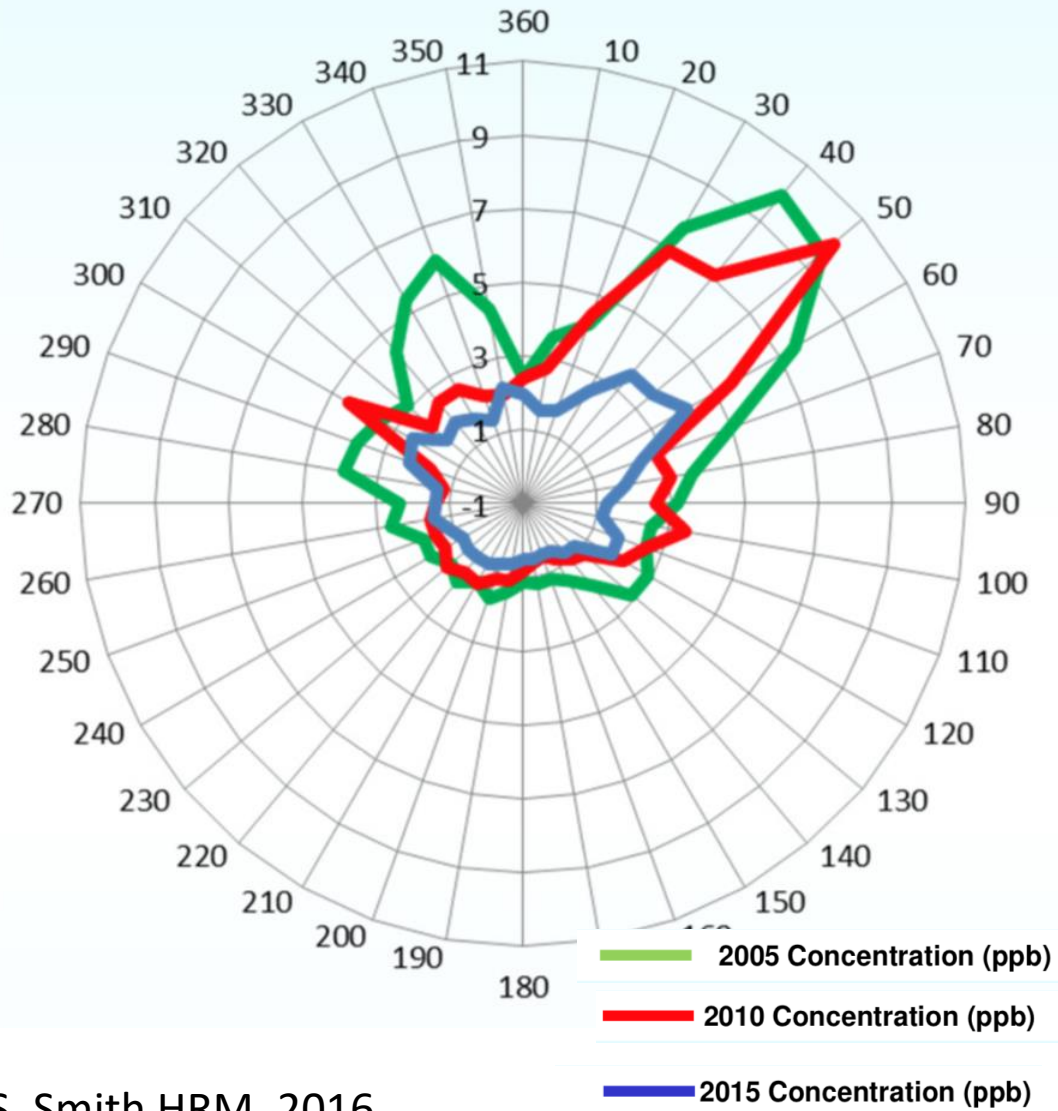
Emission Event Database (STEERS)

STEERS Database (Pink)

Lawyers
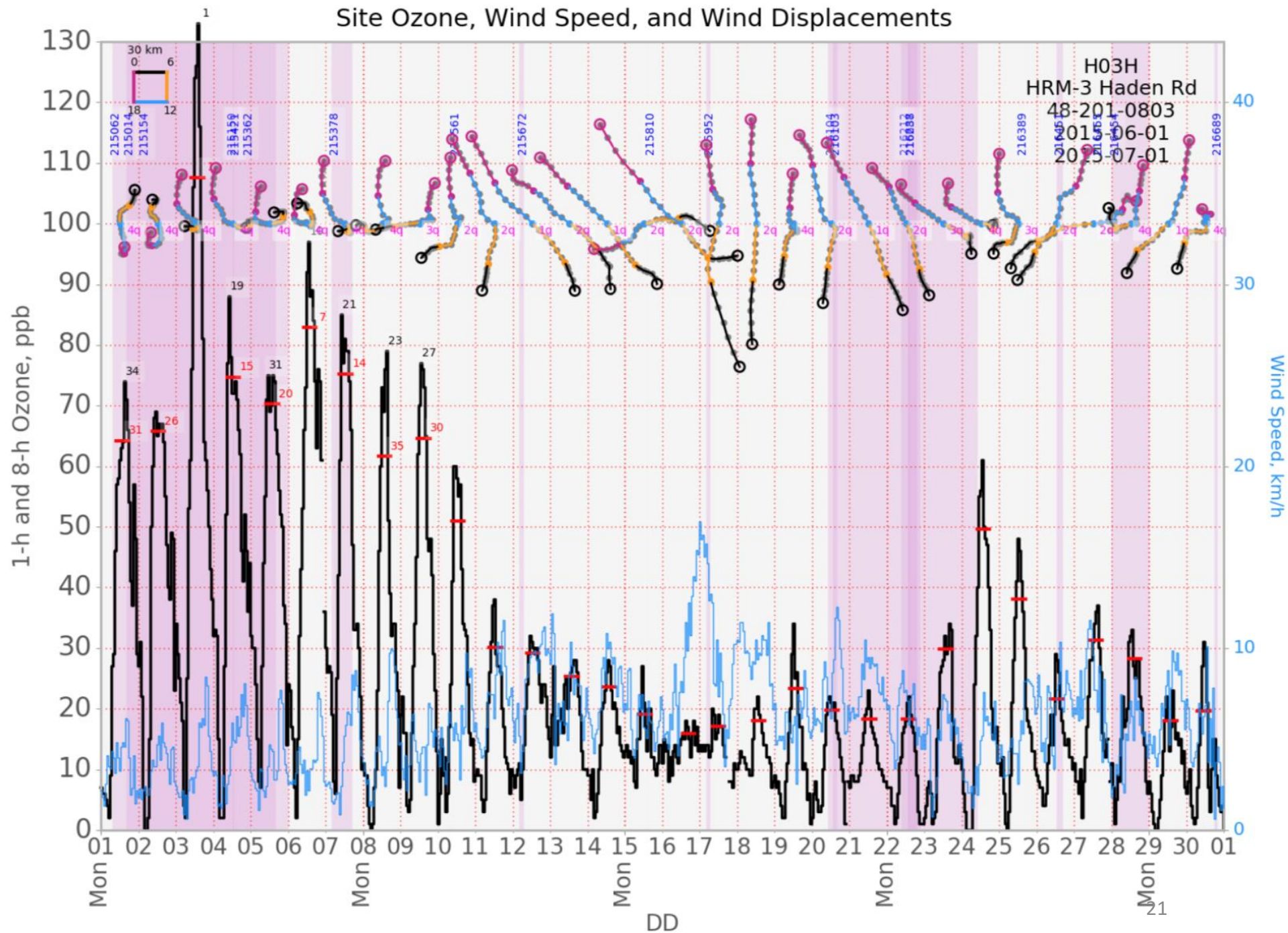
Missing Emission Events

Site Ozone, Wind Speed, and Wind Displacements

H03H
HRM-3 Haden Rd
482201-0803
2015-08-01
2015-08-05
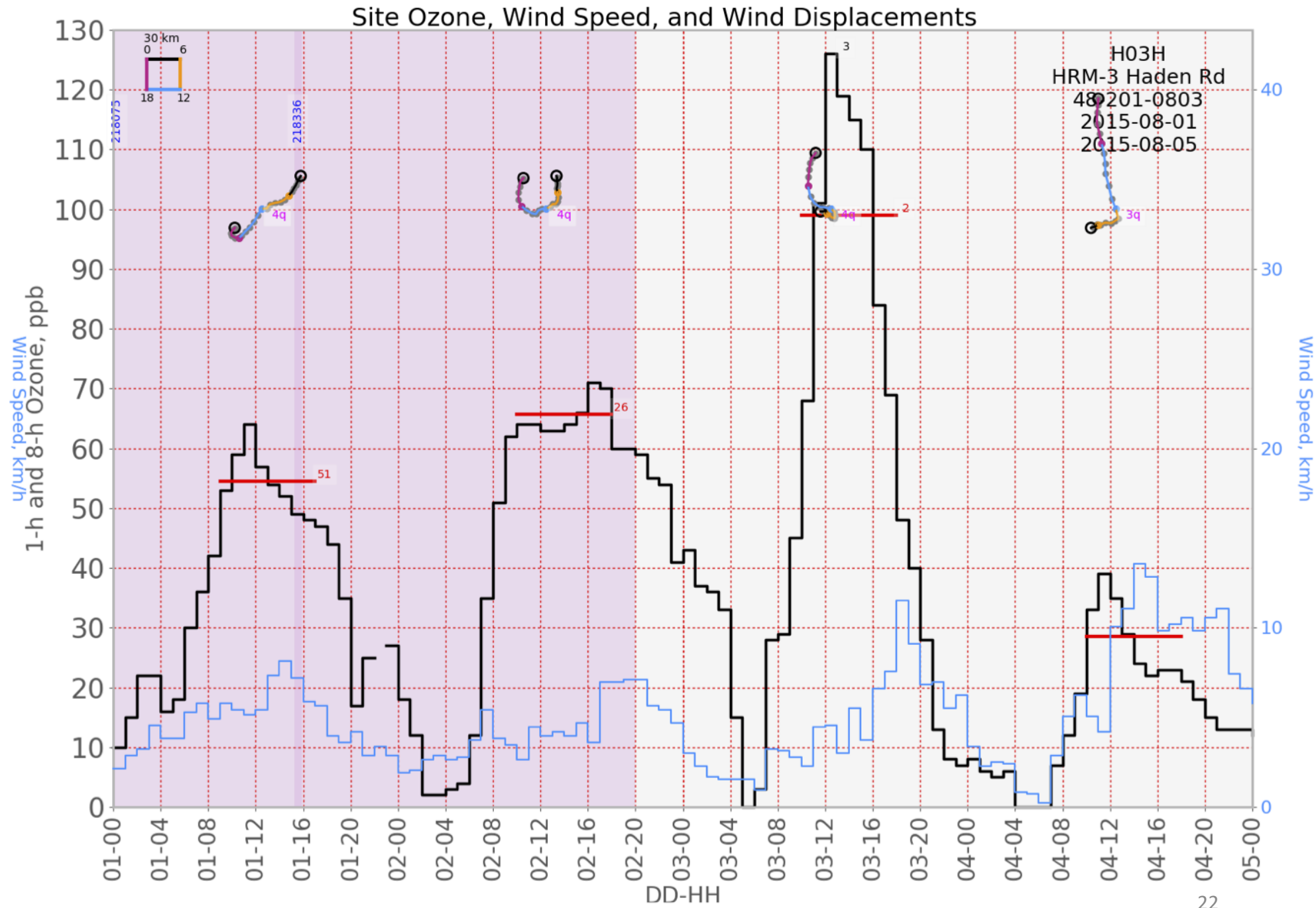
Final Thoughts

- Dilution versus Chemistry
- Mindful of space and time
- Model Resolution key
- Inventory Inventory Inventory
- FLAIR Camera
- New sources - alkanes?
- Stochastic emission in a forecasting/regulatory model?

Questions

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