Ozone exceedances in Houston TX: Characteristics and Best Practices

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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 = 125 ppb
- Min = 22 ppb
- Range = 103 ppb

8-h Ozone:
- Max = 112 ppb
- Range = 31 ppb

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

1-h Ozone:
- Max = 229 ppb
- Min = 102 ppb
- Range = 127 ppb

8-h Ozone:
- Max = 120 ppb
- Range = 167 ppb

Couzo et al., Environ. Chem. 2013
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 Spatially Limited

Couzo et al., Environ. Chem. 2013
Spatially limited Ozone Plumes

June 3, 2015

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
That makes sense in typical O3 paradigm, but not in Houston.

- 18
  - 1-hr O3 difference [ppb]
  - a
  - b
  - DRPK
  - DRPK

• Difference between baseline cases and baseline.
• From 5 am to 6 am, baseline cases protected 25 ppb more O3 as a direct consequence of the HRVOC emissions.
• The difference plot shows a narrow plume of high O3 was created.

6 a.m.
8 a.m.

Couzo et al., JAWMA 2012
Model Got it…

Couzo et al., JAWMA 2012
Model Misses Location

Couzo et al., JAWMA 2012
Observational Data
Auto GC Data
Emission Event Database (STEERS)
STEERS Database (Pink)
Lawyers
Site Ozone, Wind Speed, and Wind Displacements

Missing Emission Events
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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