

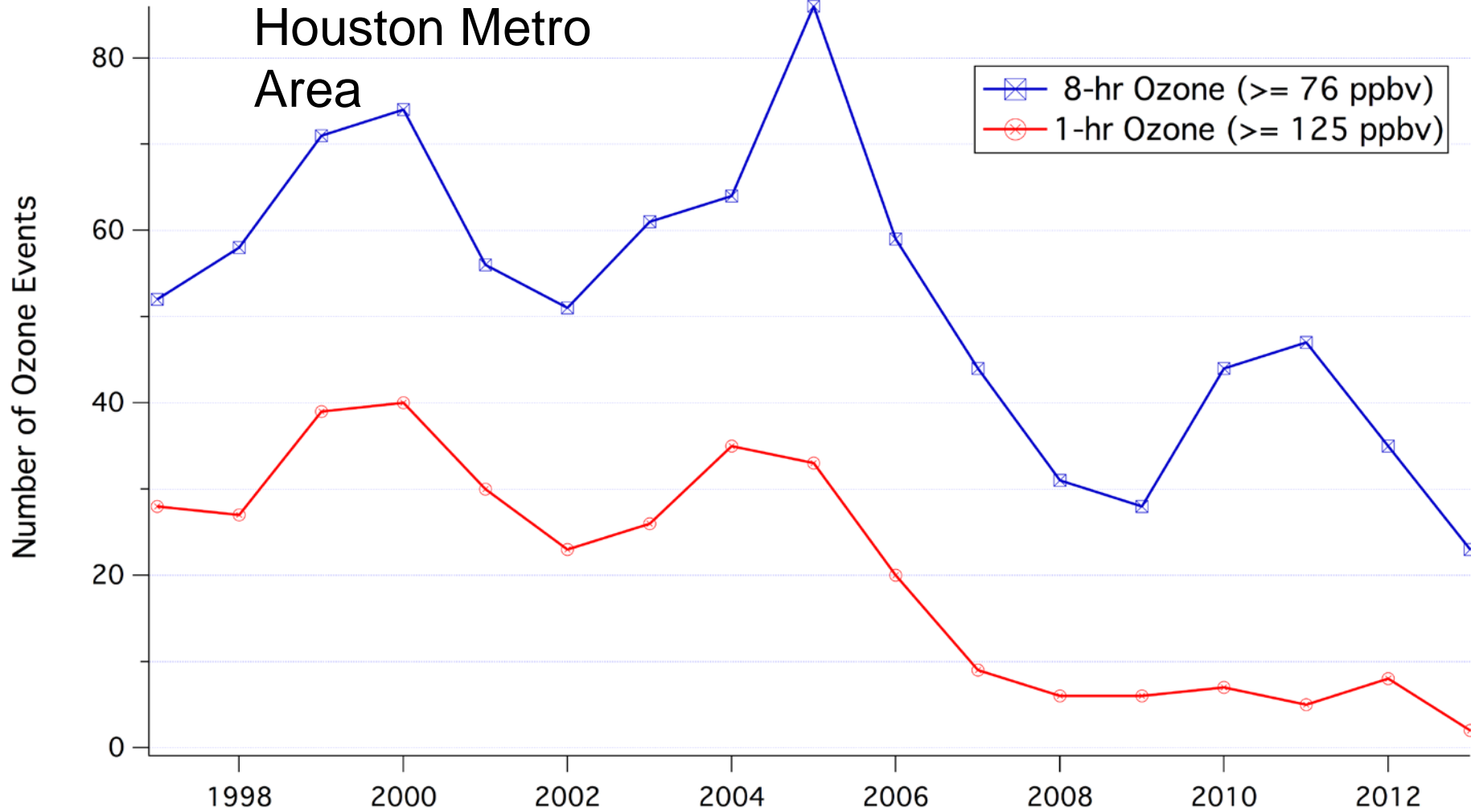


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# Surface Measurements of PM, VOCs, and Photochemically Relevant Gases in Support of DISCOVER-AQ.

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J. H. Flynn, R. W. Talbot, P. L. Laine, B. C. Sive,  
X. Lan, D. Anderson, Y. Zhou, M. Camp

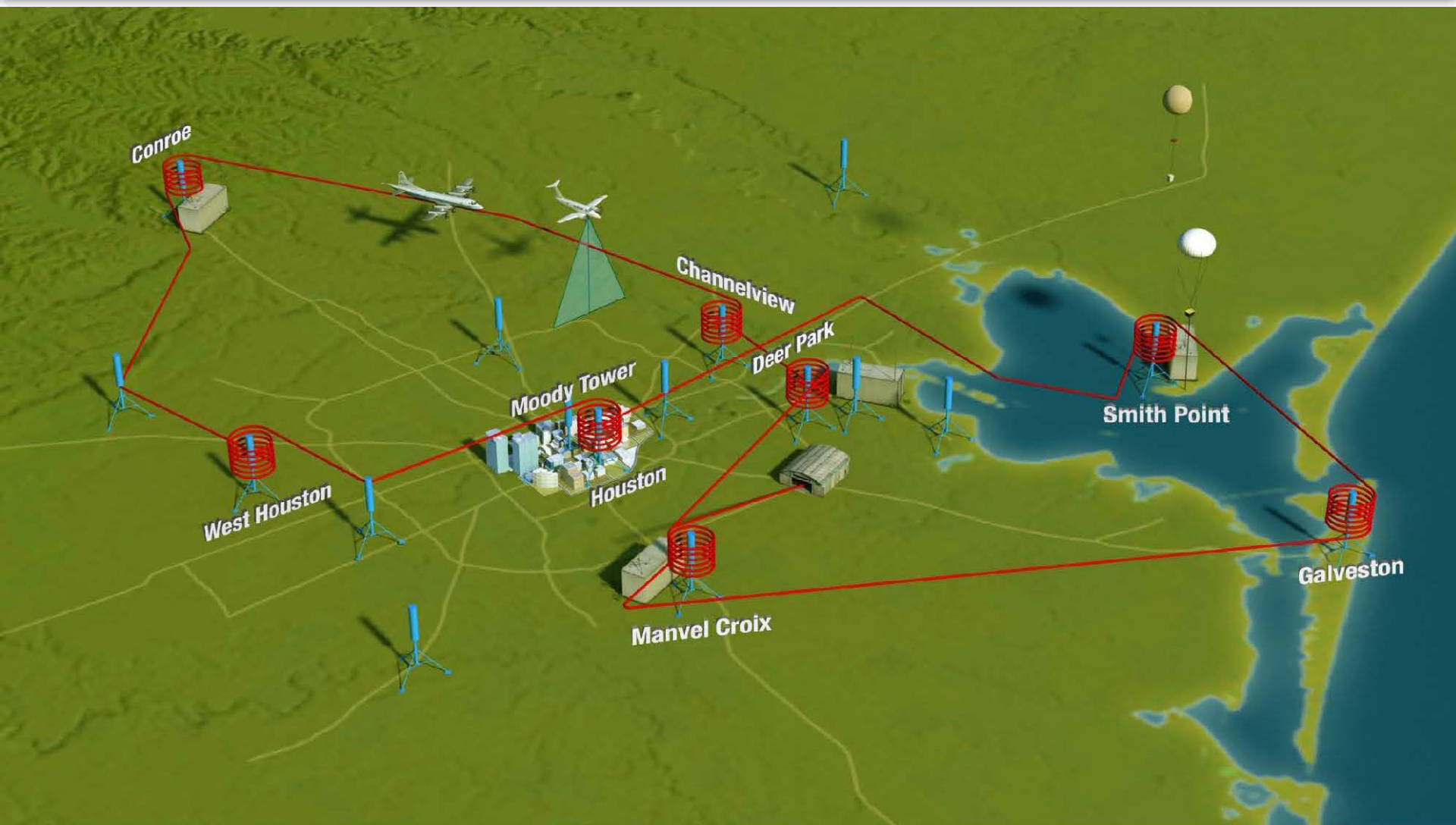




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# Motivation – Support NASA Discover-AQ





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# DISCOVER-AQ





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# Mobile Laboratory Instrumentation

- **Basic instrumentation:**

- High-resolution marine GPS
- RM Young meteorological station (T, P, RH, WS/WD)
- RM Young translator (calculates true winds from vehicle motion and measured winds)
- NO<sub>2</sub> photolysis rate
- Common PC based data acquisition
- Fore, aft, port, starboard, and sky cameras

- **Mission instrumentation (DISCOVER-AQ Houston):**

- UH - O<sub>3</sub>, CO, CO<sub>2</sub>, SO<sub>2</sub>, NO, NO<sub>2</sub>, NO<sub>y</sub>, particle size distribution, PAH on soot
- Rice – Aerosol composition (HR-ToF-AMS, Magee Scientific Mini Aethalometer),
- UH and Appalachian State – VOCs (Ionicon PTR-MS)



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# DISCOVER-AQ





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# Battleship Texas





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# Texas City Dike







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# Tomball City Park

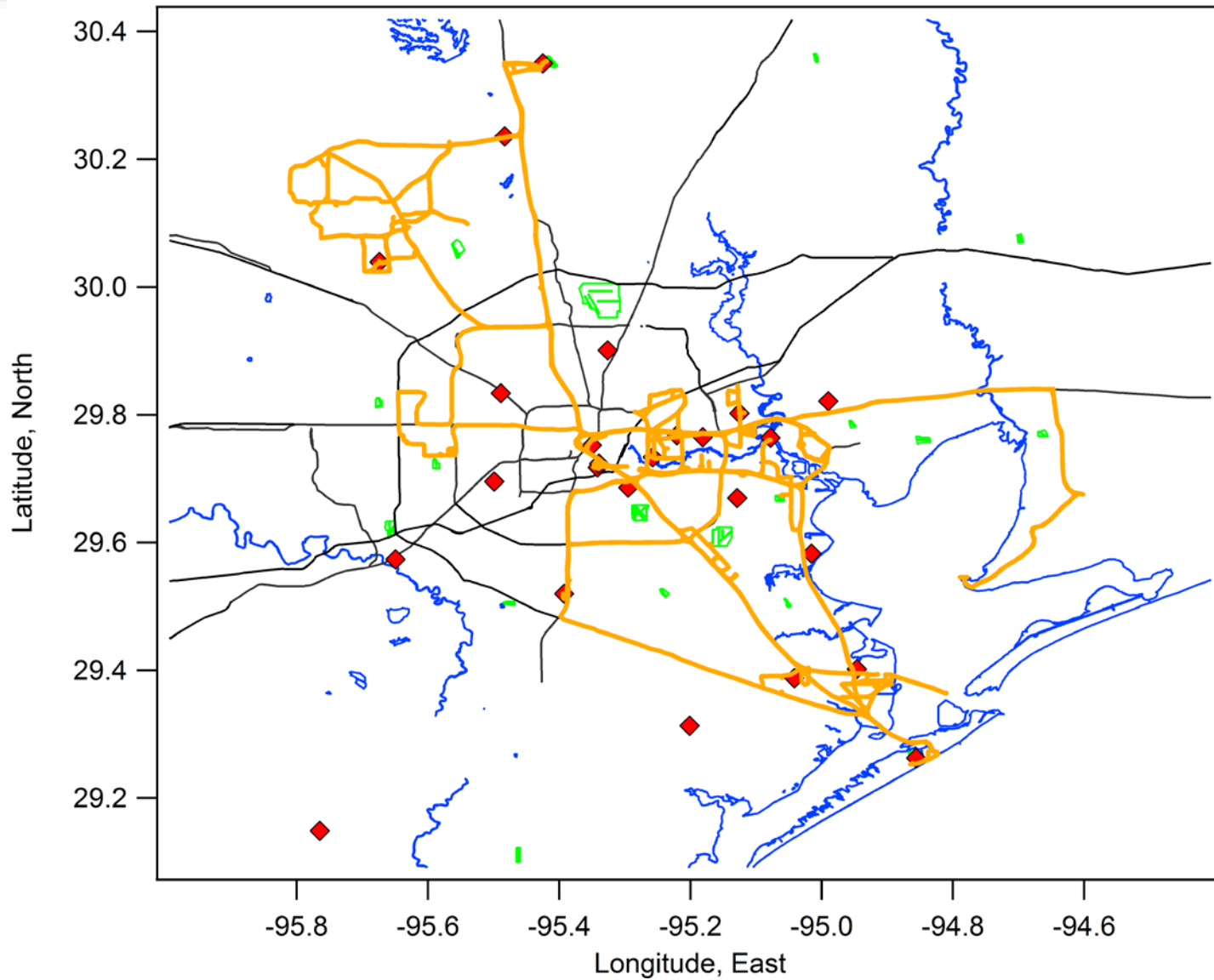




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# DISCOVER-AQ

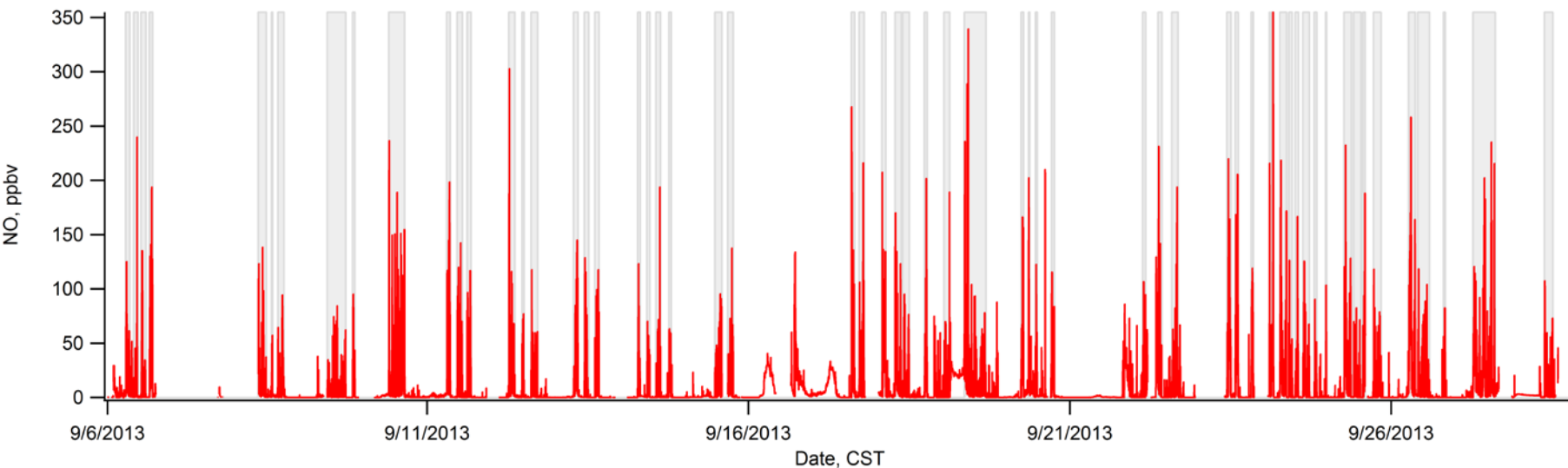
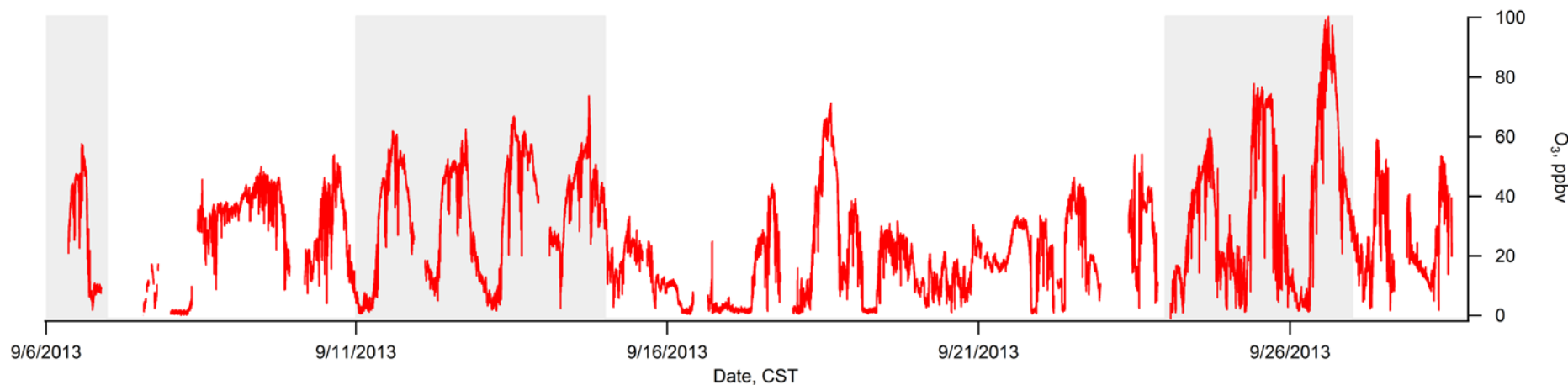




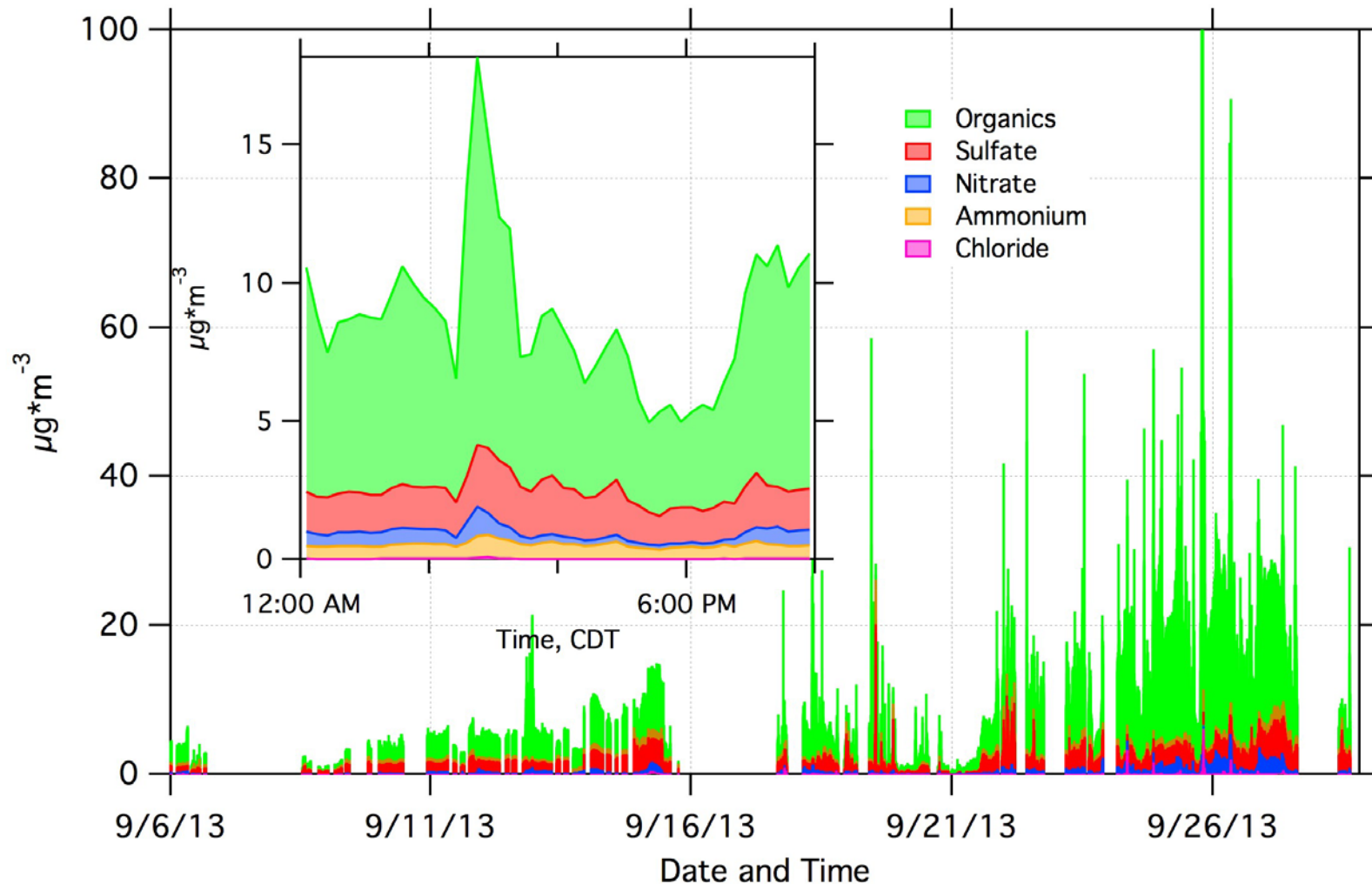
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# Trace Gas Data



Elevated O<sub>3</sub> at the end of the campaign. Excluding Calibrations and Maintenance Periods: 455 hrs of data (120 hrs (26%) on-



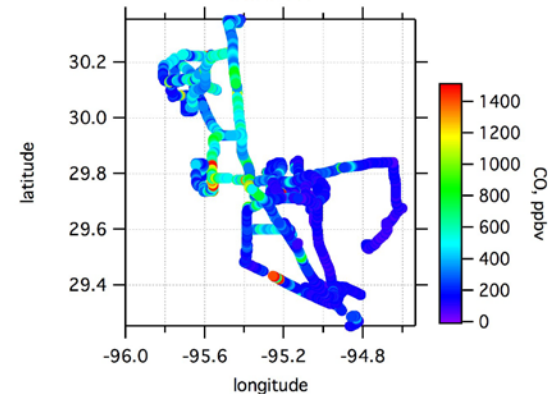
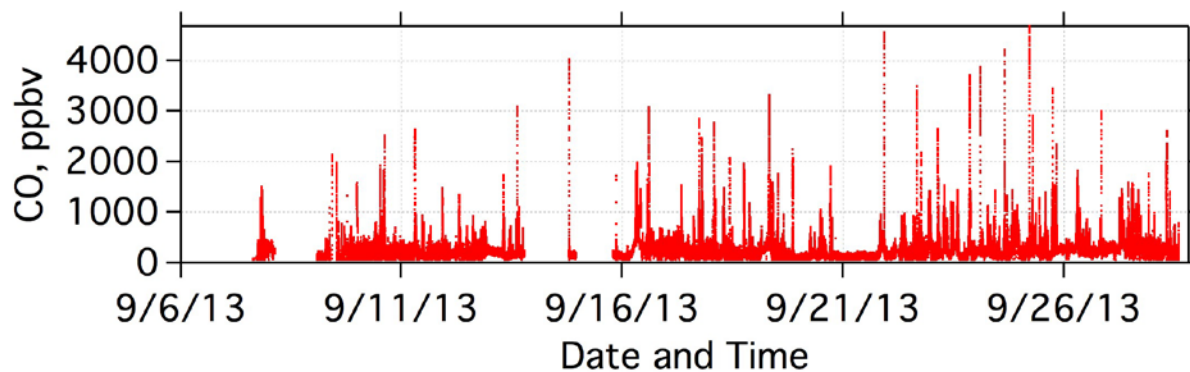
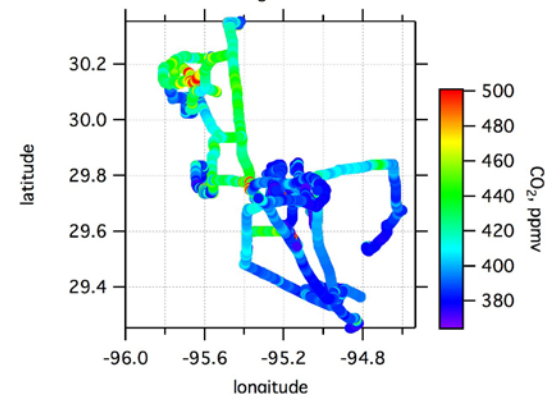
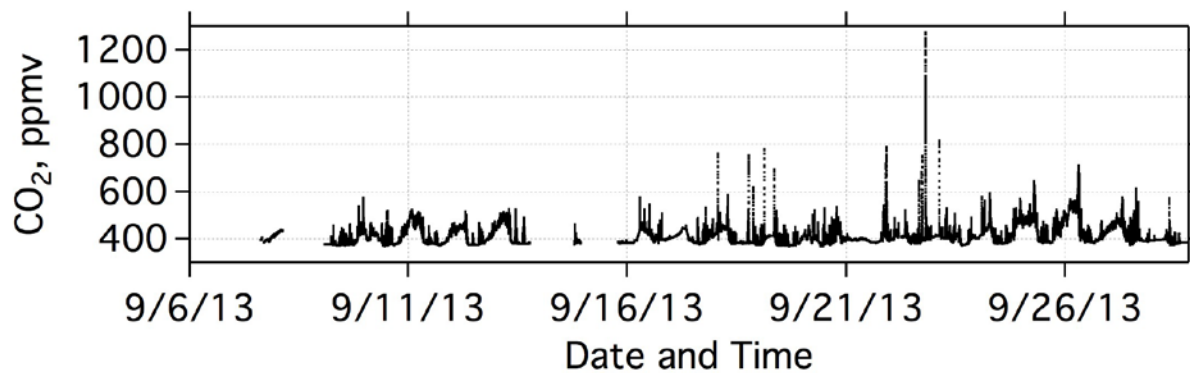
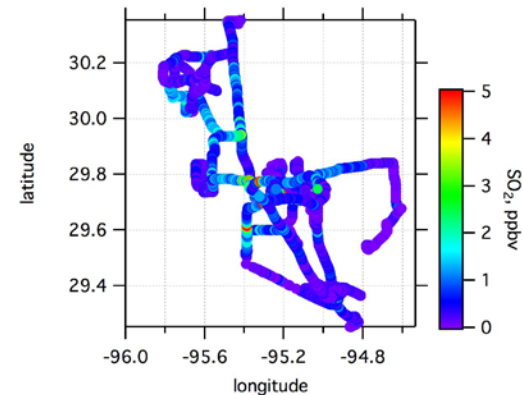
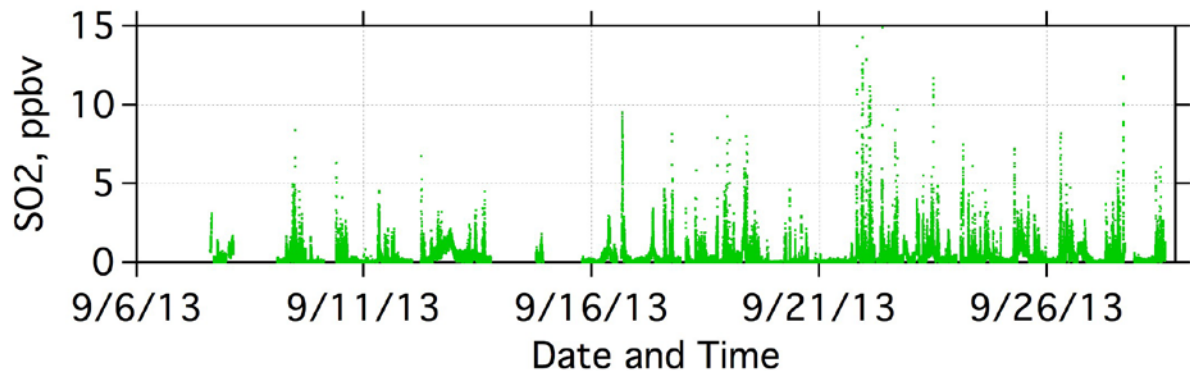
Elevated PM and  $\text{O}_3$  at the end of the campaign.  
PM highest at night! Un-neutralized sulfate!



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# SO<sub>2</sub>, CO, CO<sub>2</sub>

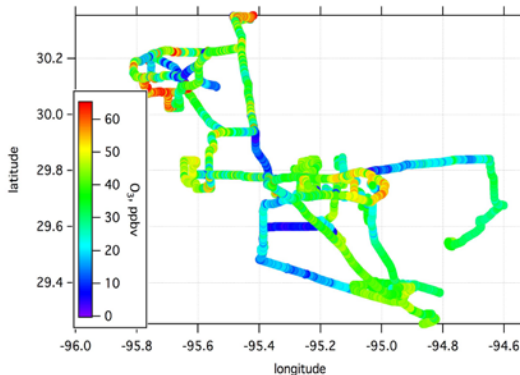
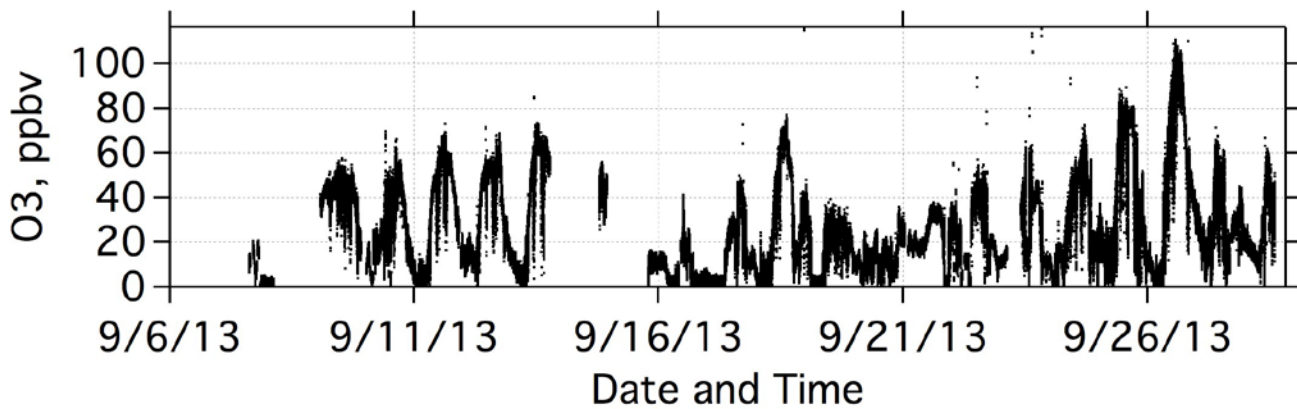
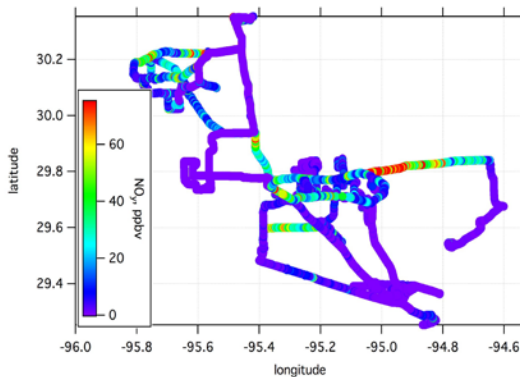
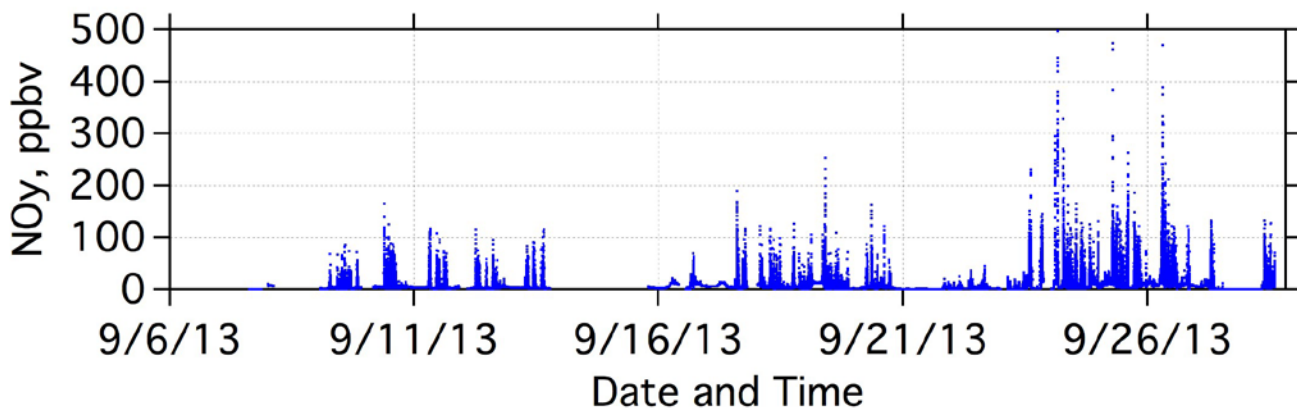




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# NO<sub>y</sub> and O<sub>3</sub>

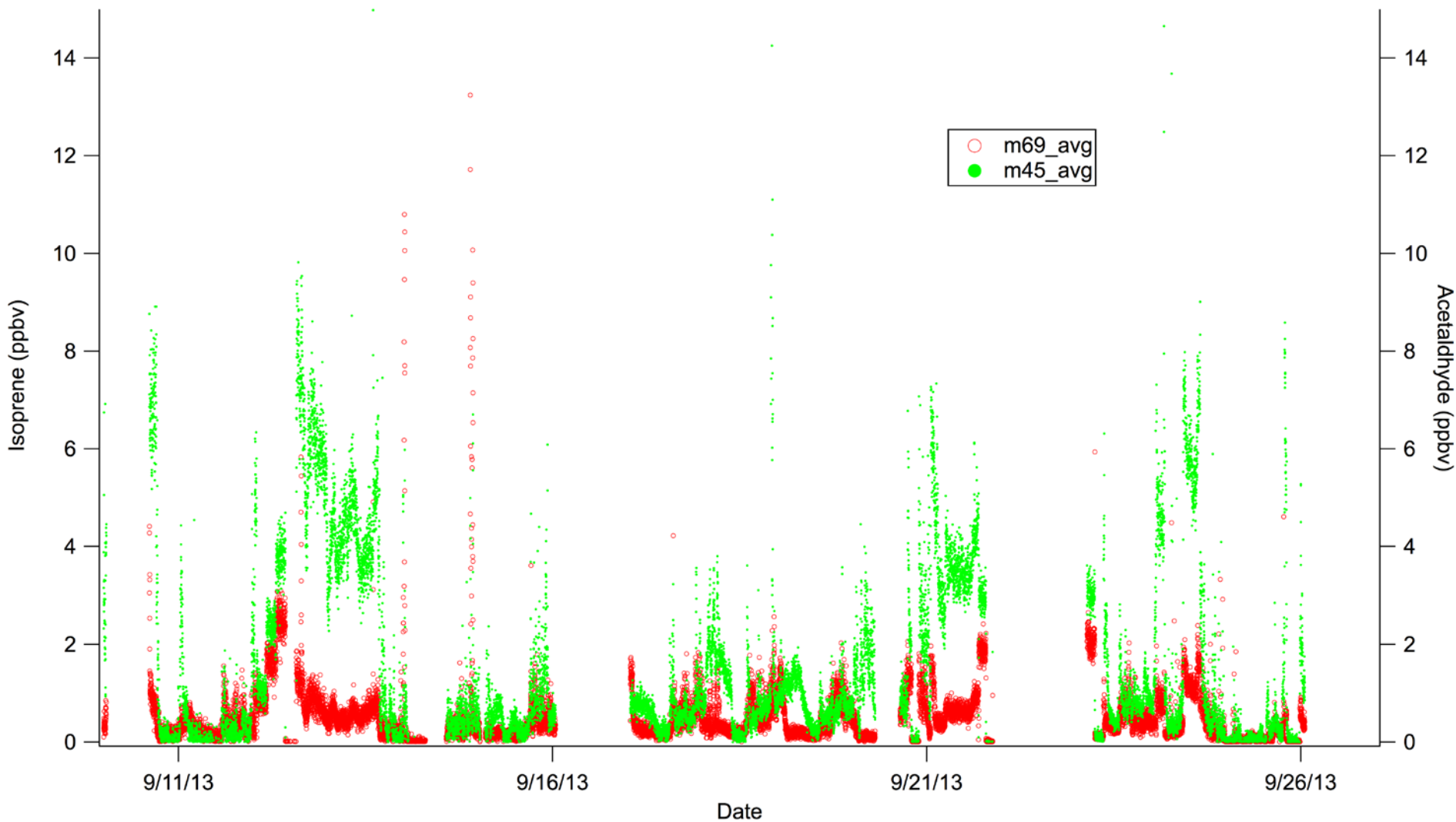




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# PTr-MS

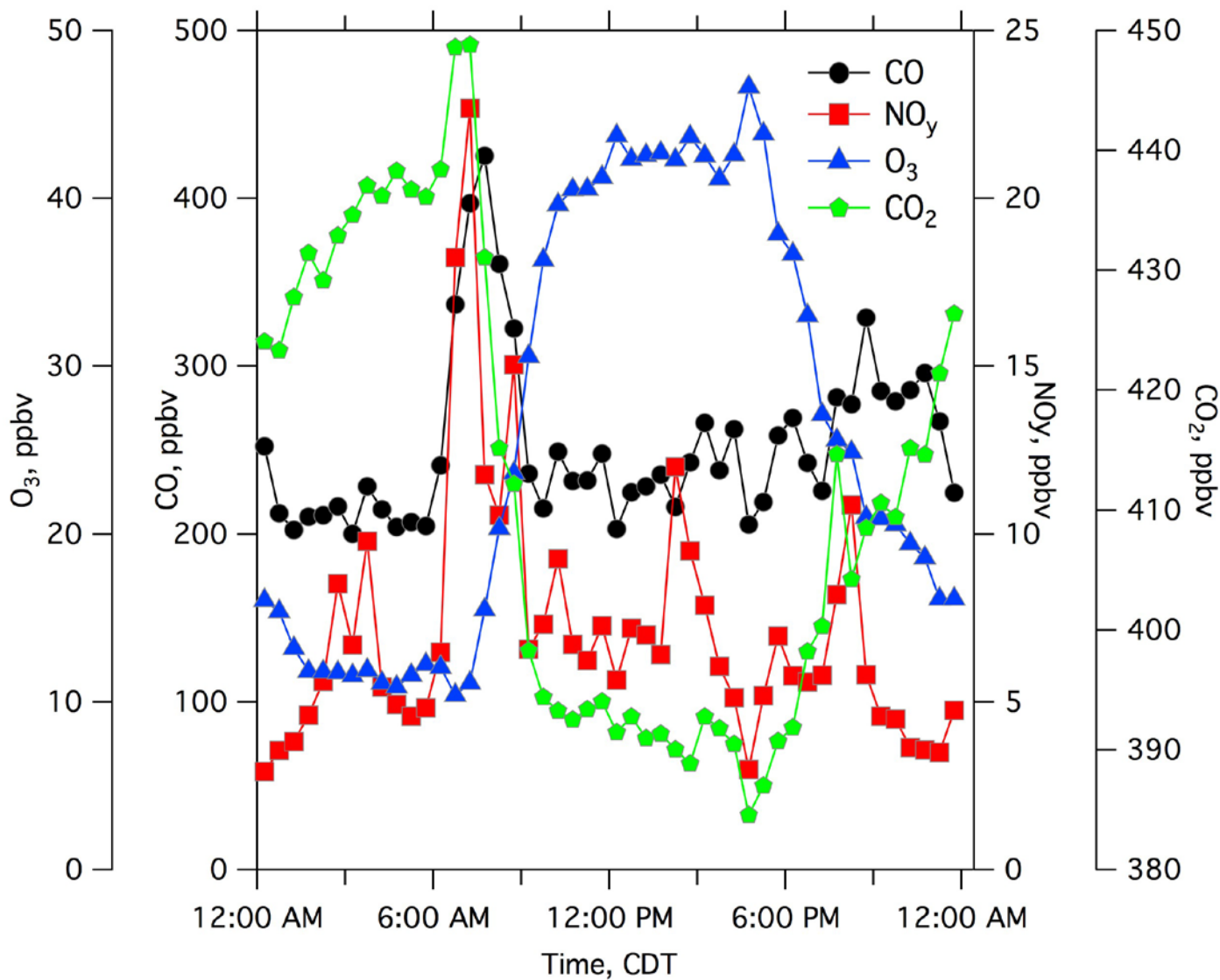




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# Gas Phase Diel



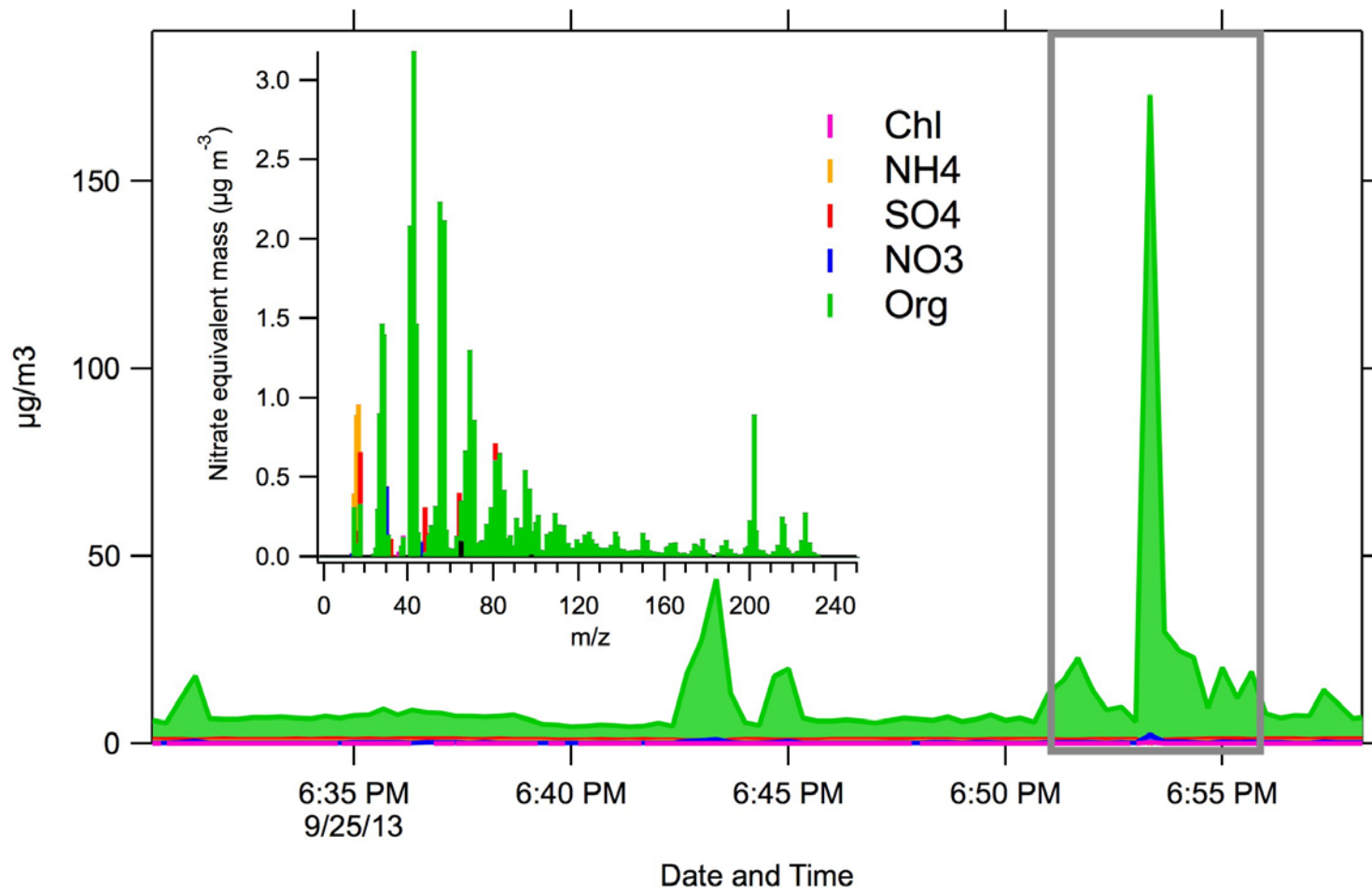




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# Modified Diesel

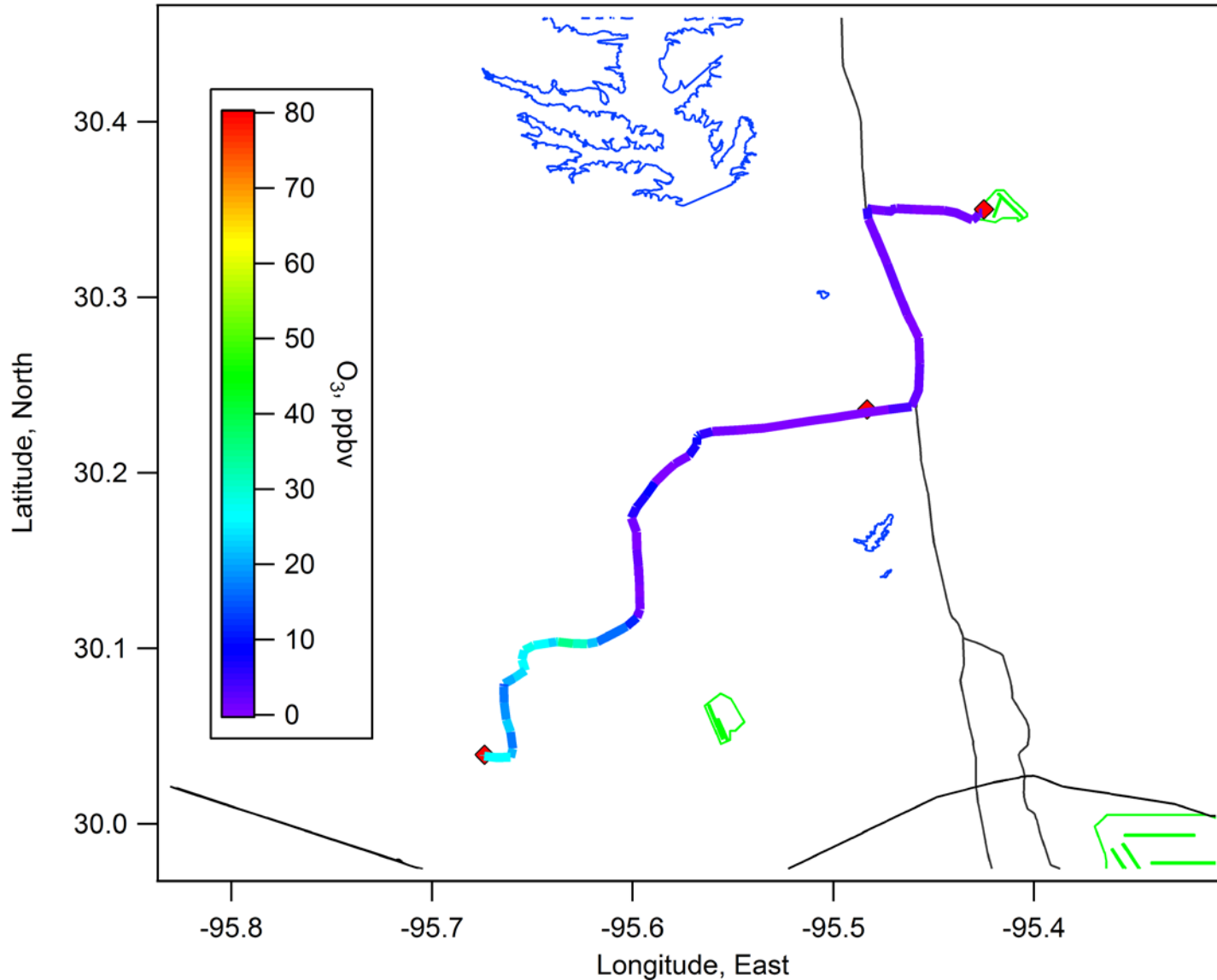




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# Ozone 26 Sept T1

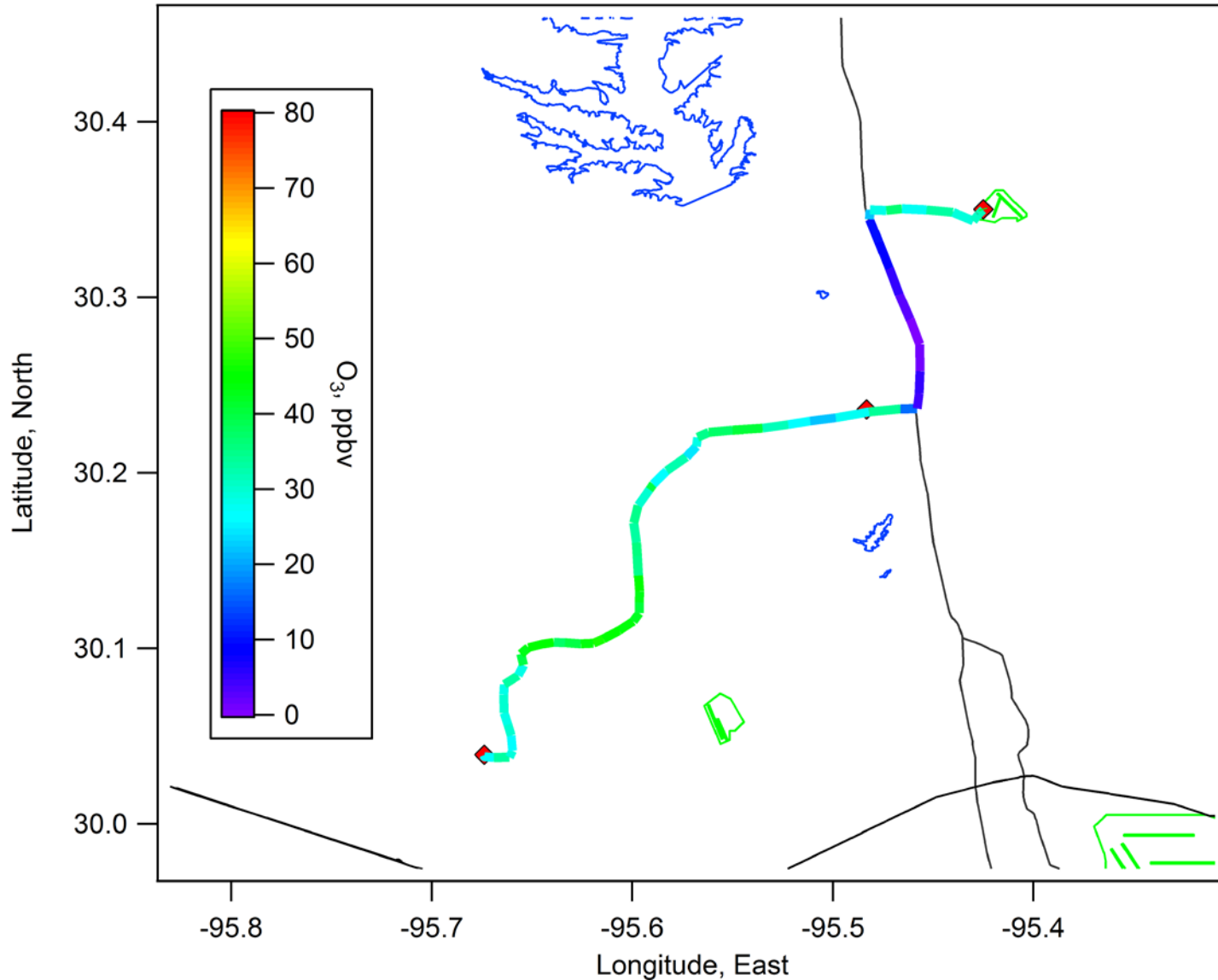




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# Ozone 26 Sept T2

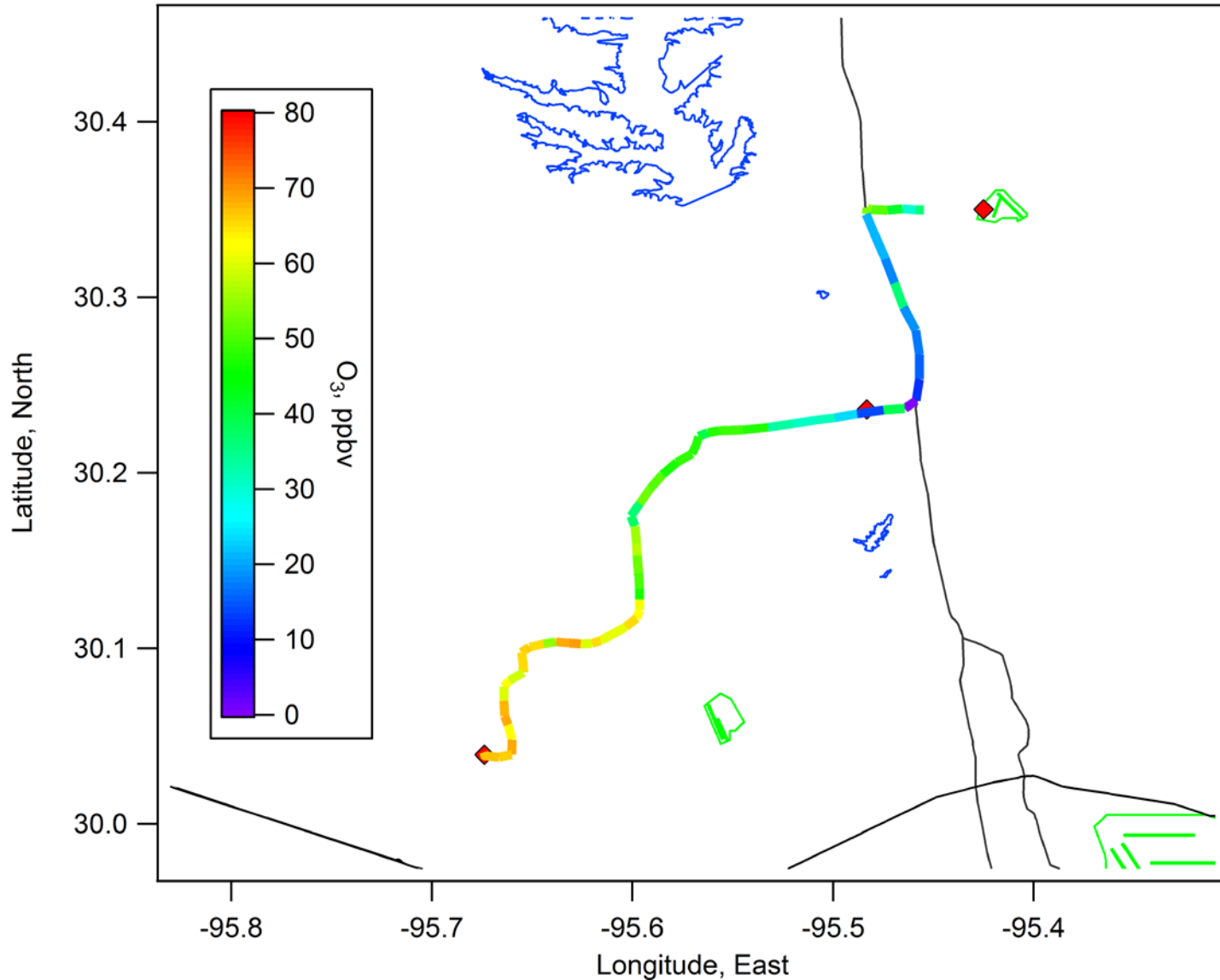




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# Ozone 26 Sept T3

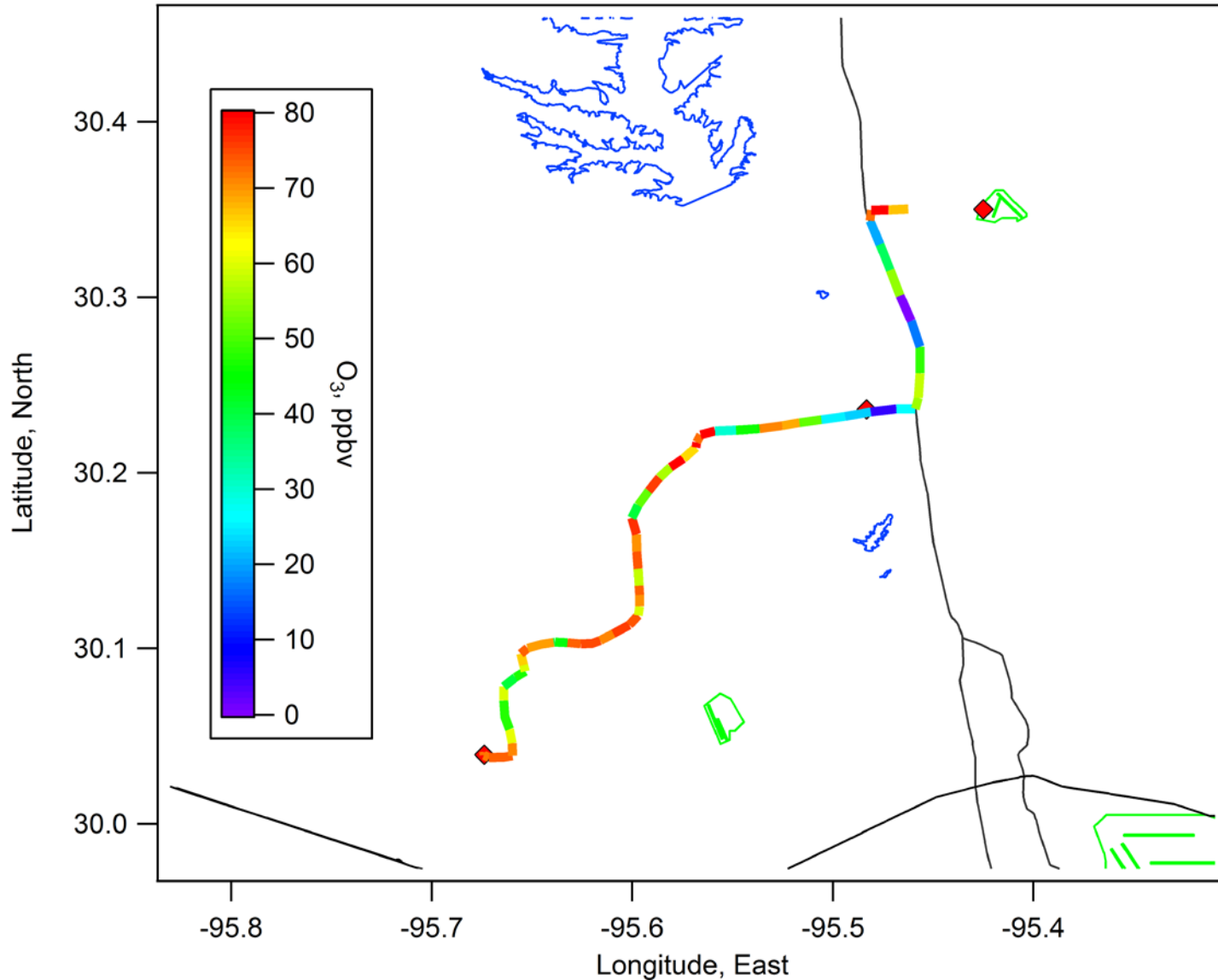




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# Ozone 26 Sept T4

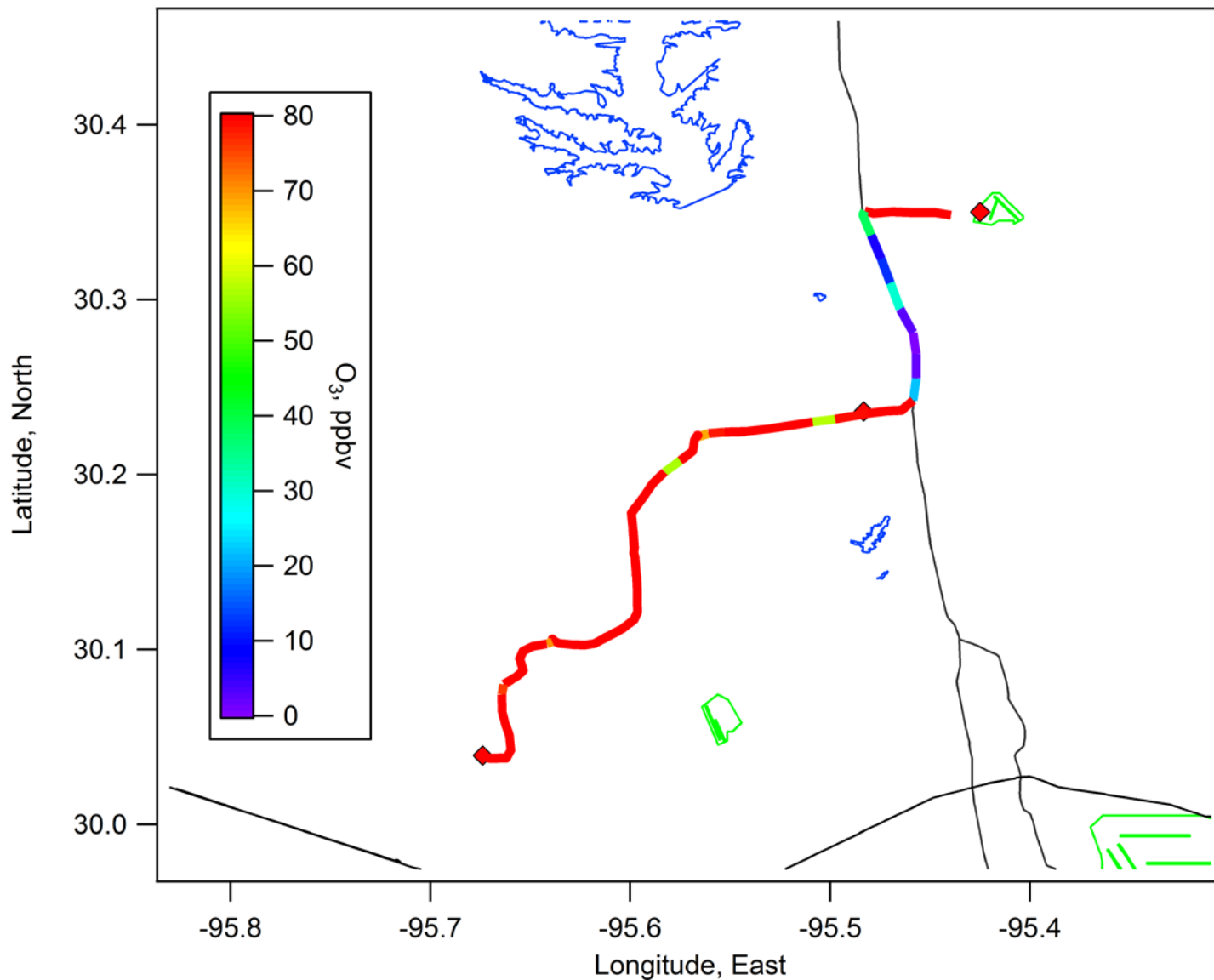




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# Ozone 26 Sept T5





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# Future Work

- Calculate ozone production rates for DAQ (Photochemical box modeling).
- OH and peroxy-radical sources and sinks (upwind vs downwind transects).
- Examine PM formation (relationship between oxygenated VOCs and PM)
- PM chemical speciation to investigate potential sources
- Relative Importance of Biogenic emissions on ozone and PM formation
- Generate emission factors for chemically resolved PM (g PM type/ L fuel) for diesel and gasoline vehicles.



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# Future Work

- Use emissions ratios of speciated PM-to NO<sub>x</sub>, and PM CO along with emission factors from literature to estimate chemically resolved, size dependent aerosol emission factors.
- Identify individual vehicle plumes in the data. Sort into speed, age, engine type bins.
- Calculate PM-to-NO<sub>x</sub> and PM-to-CO ratios using linear regressions.
- Use calculated ratio and literature emission factors to estimate PM emissions factors.
- Use PTRMs data and PM data with emissions maps and plume modeling to derive particulate emissions inventories for the refineries?





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# Acknowledgements

- AQRP
- TCEQ
- DISCOVER-AQ
- Aerodyne