Species Associations of Common Pollutants and High GWP Gases in Southern California

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Experimental Outline

GOAL:

- Measure Locally Emitted Non-CO_2 GHGs in Urban Southern California

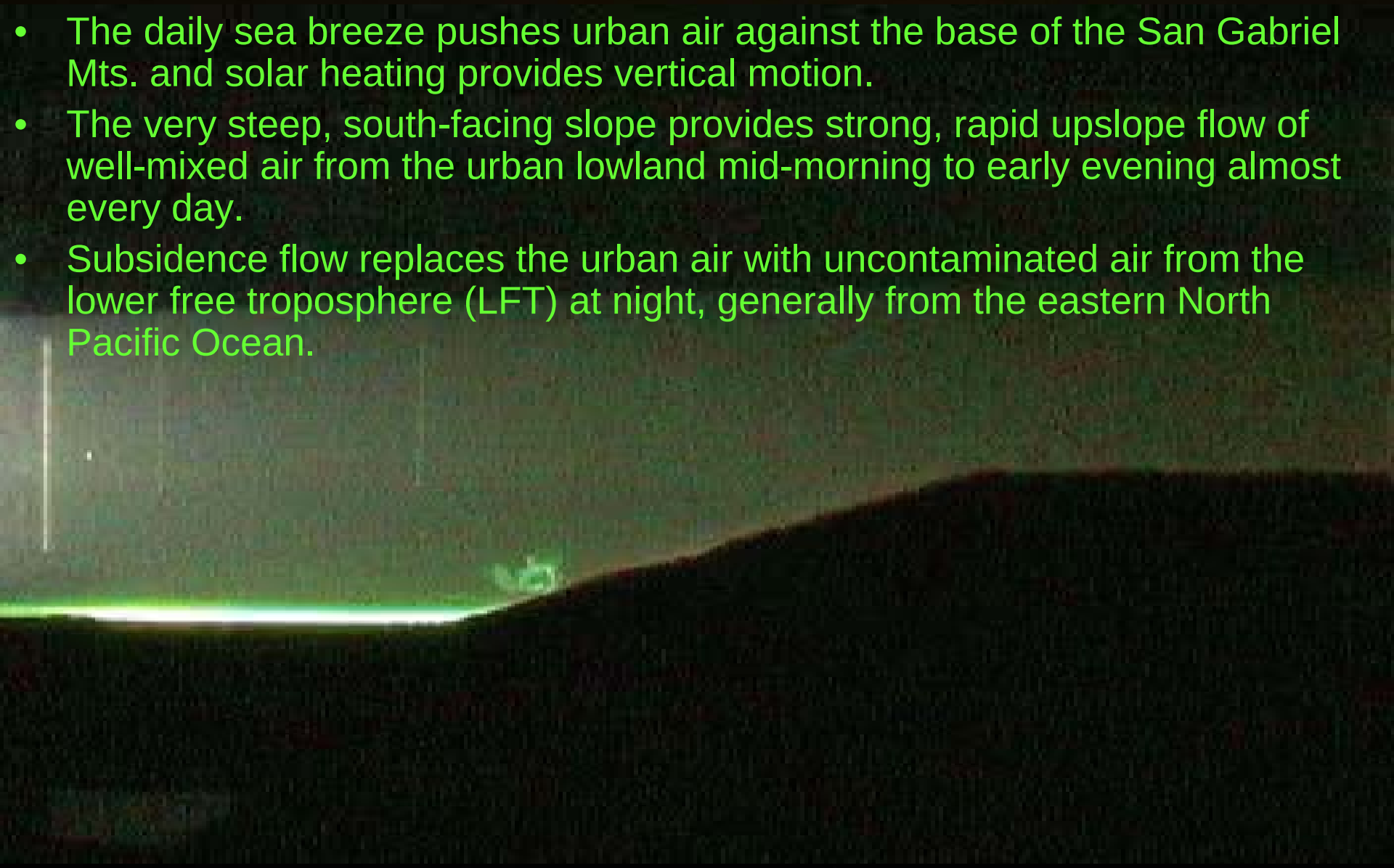
APPROACH:

- Compare “Background” vs. Urban Plume GHG and Pollutant Concentrations
- Use Known Pollutant Fluxes to Estimate GHG Fluxes

MWO is a Regional Receptor Site

How This Works - Conceptual Basis

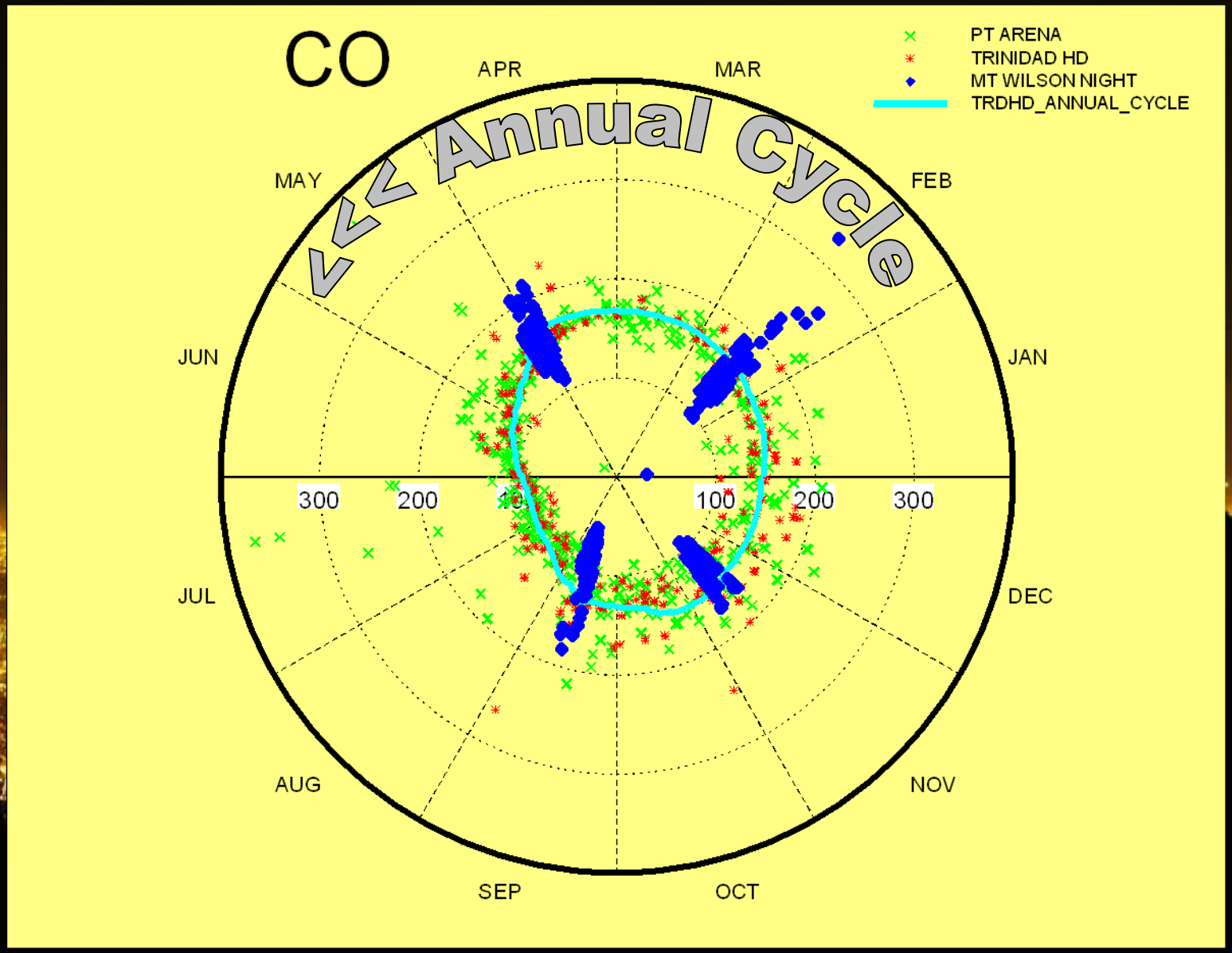
- The daily sea breeze pushes urban air against the base of the San Gabriel Mts. and solar heating provides vertical motion.
- The very steep, south-facing slope provides strong, rapid upslope flow of well-mixed air from the urban lowland mid-morning to early evening almost every day.
- Subsidence flow replaces the urban air with uncontaminated air from the lower free troposphere (LFT) at night, generally from the eastern North Pacific Ocean.



Reuten, C., D. G. Steyn, and S. E. Allen (2007), Water tank studies of atmospheric boundary layer structure and air pollution transport in upslope flow systems, *J. Geophys. Res.*, 112, D11114, doi:10.1029/2006JD008045.

How This Works – Upslope Flow Delivers Urban Air

How This Works – Verification of Night Background



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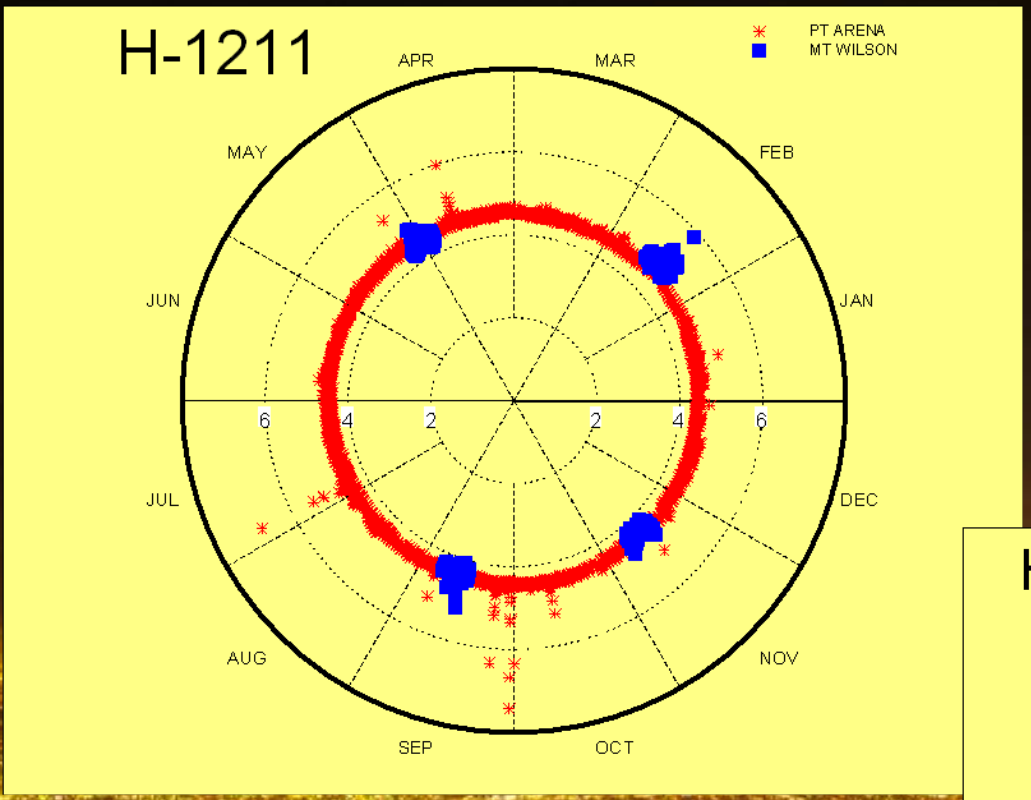
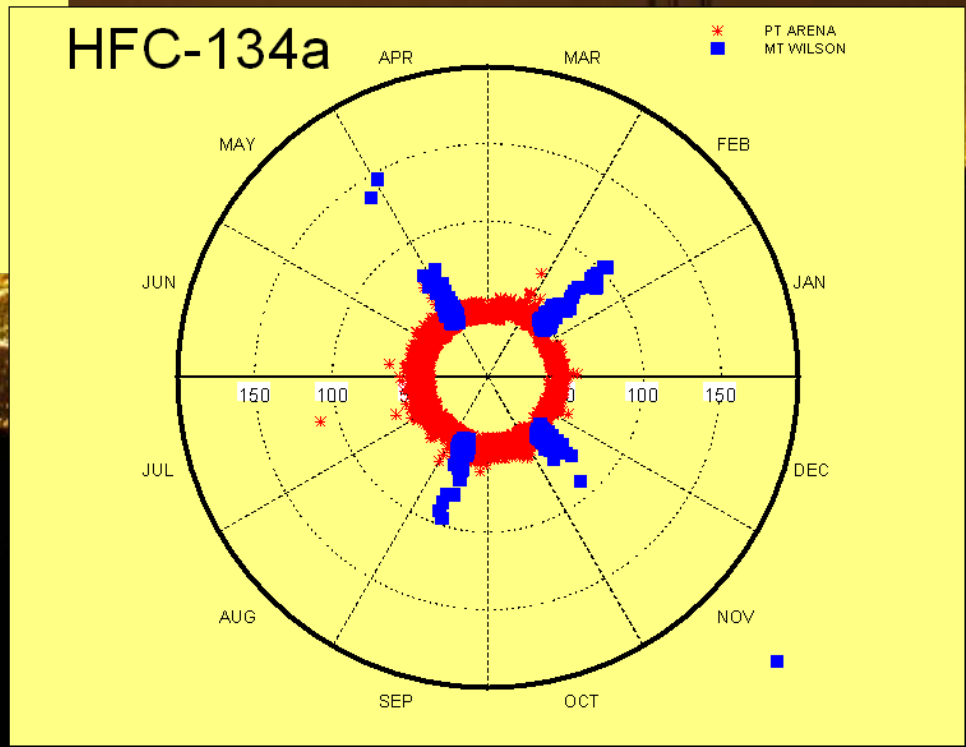
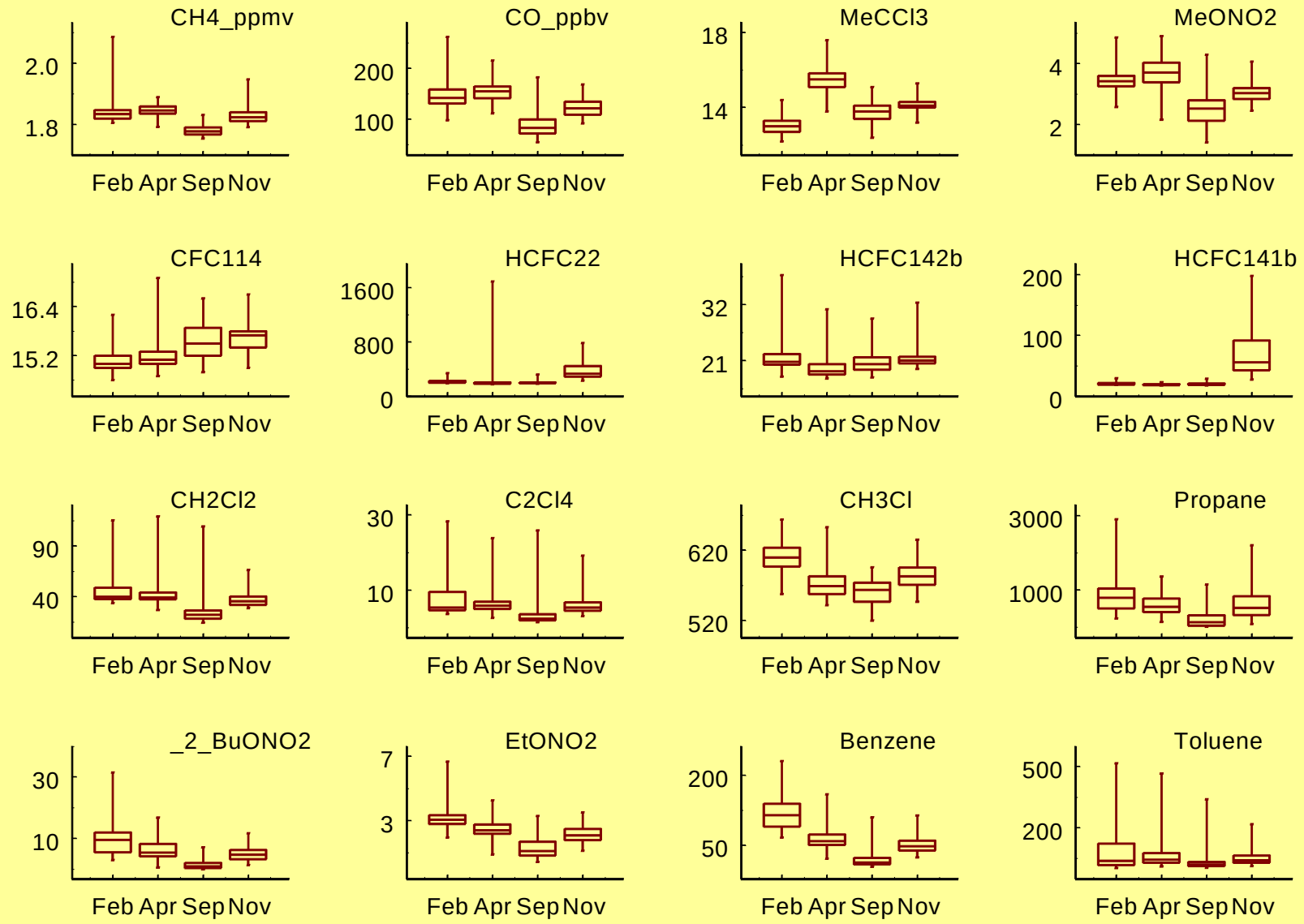


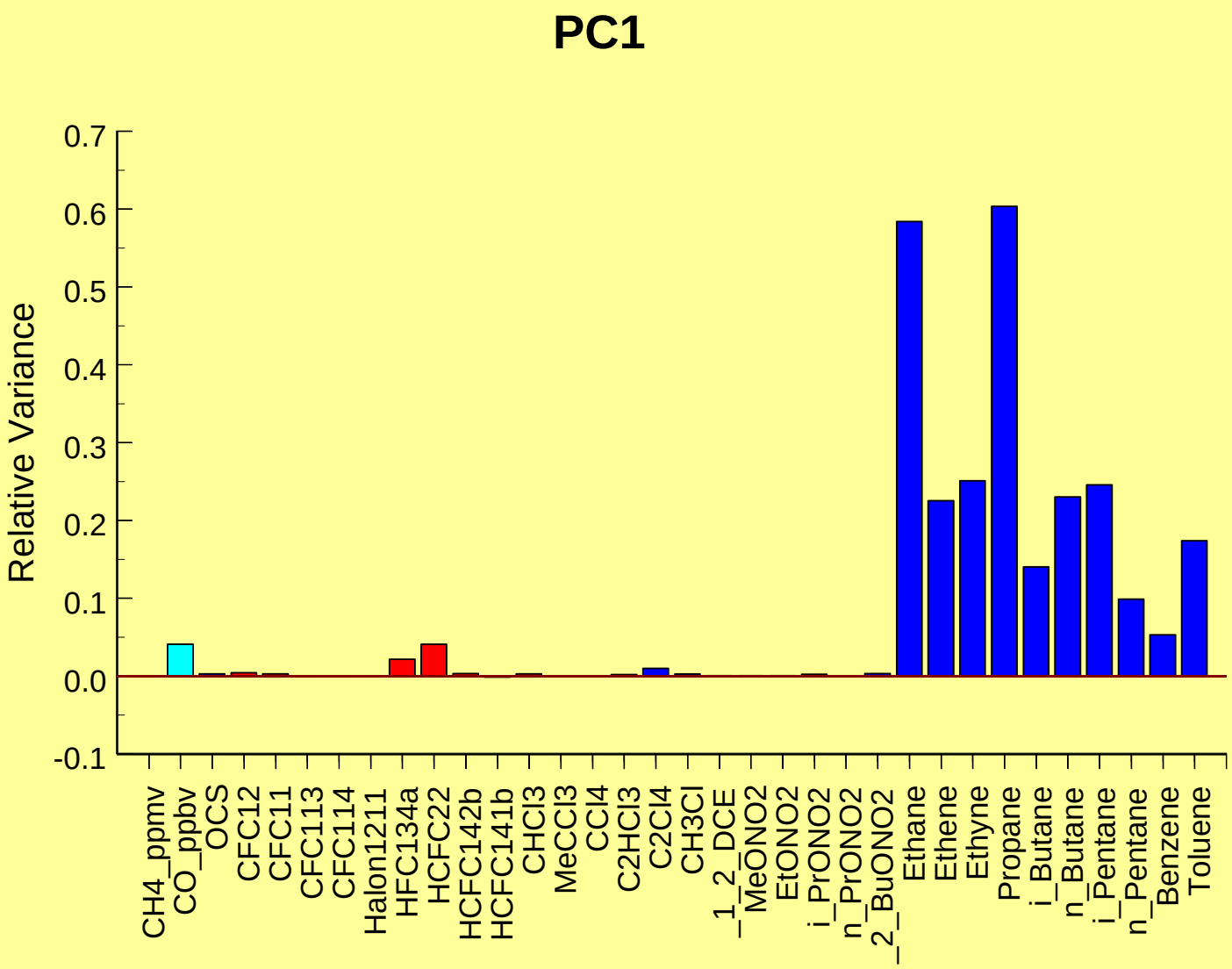


Compositional Patterns - Background

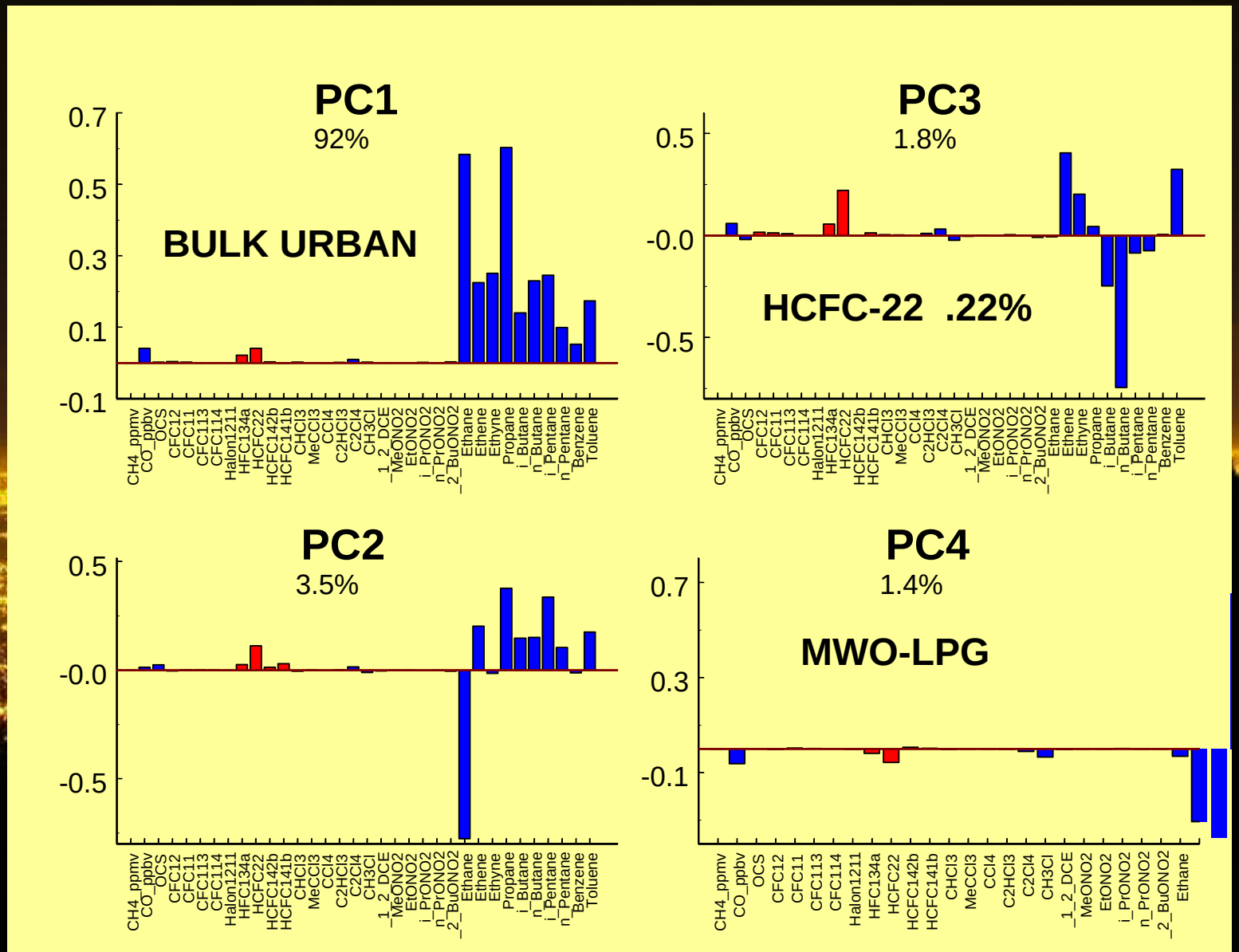


Compositional Patterns – Urban Plume

PCA – Shows how species vary together

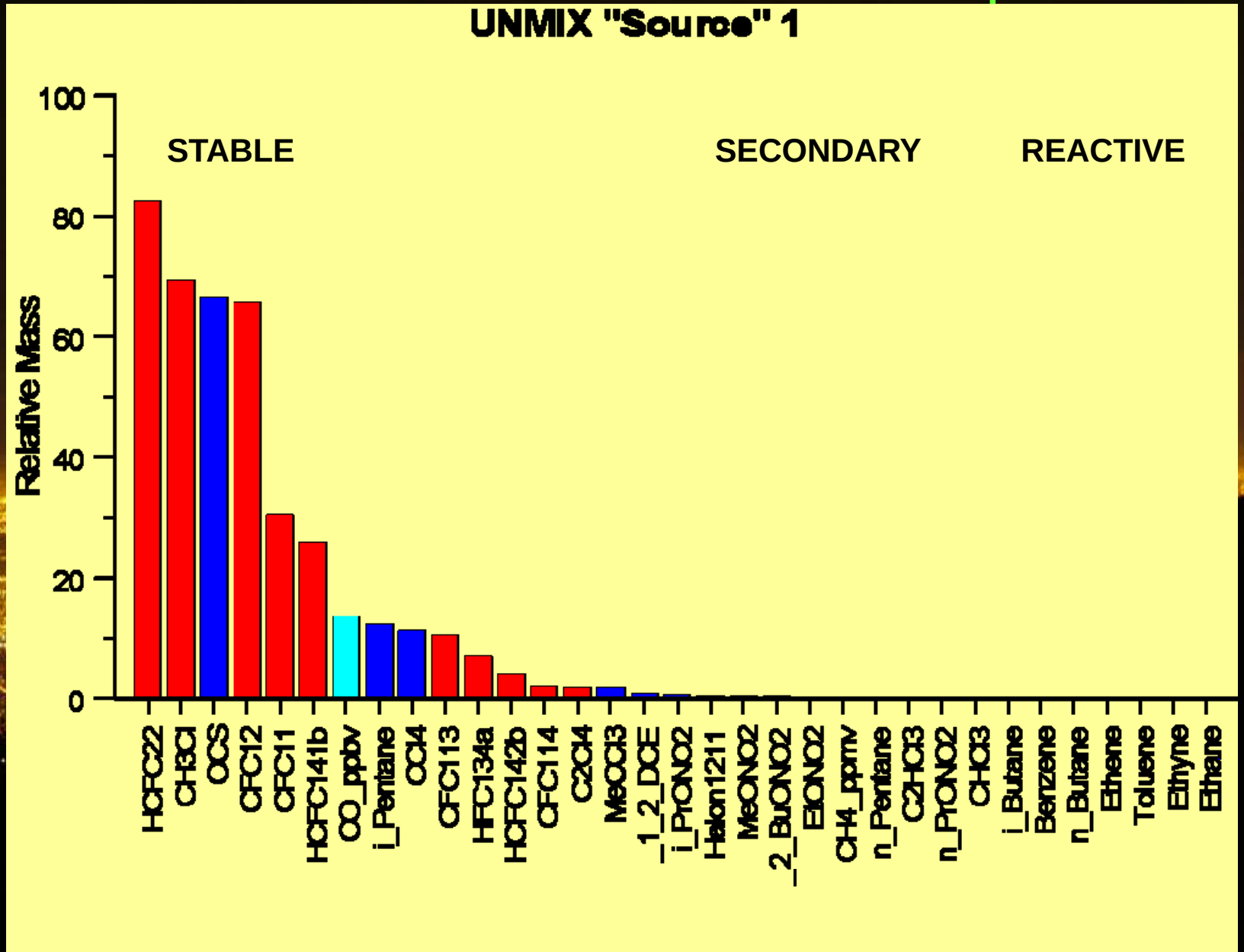


Compositional Patterns – Urban Plume

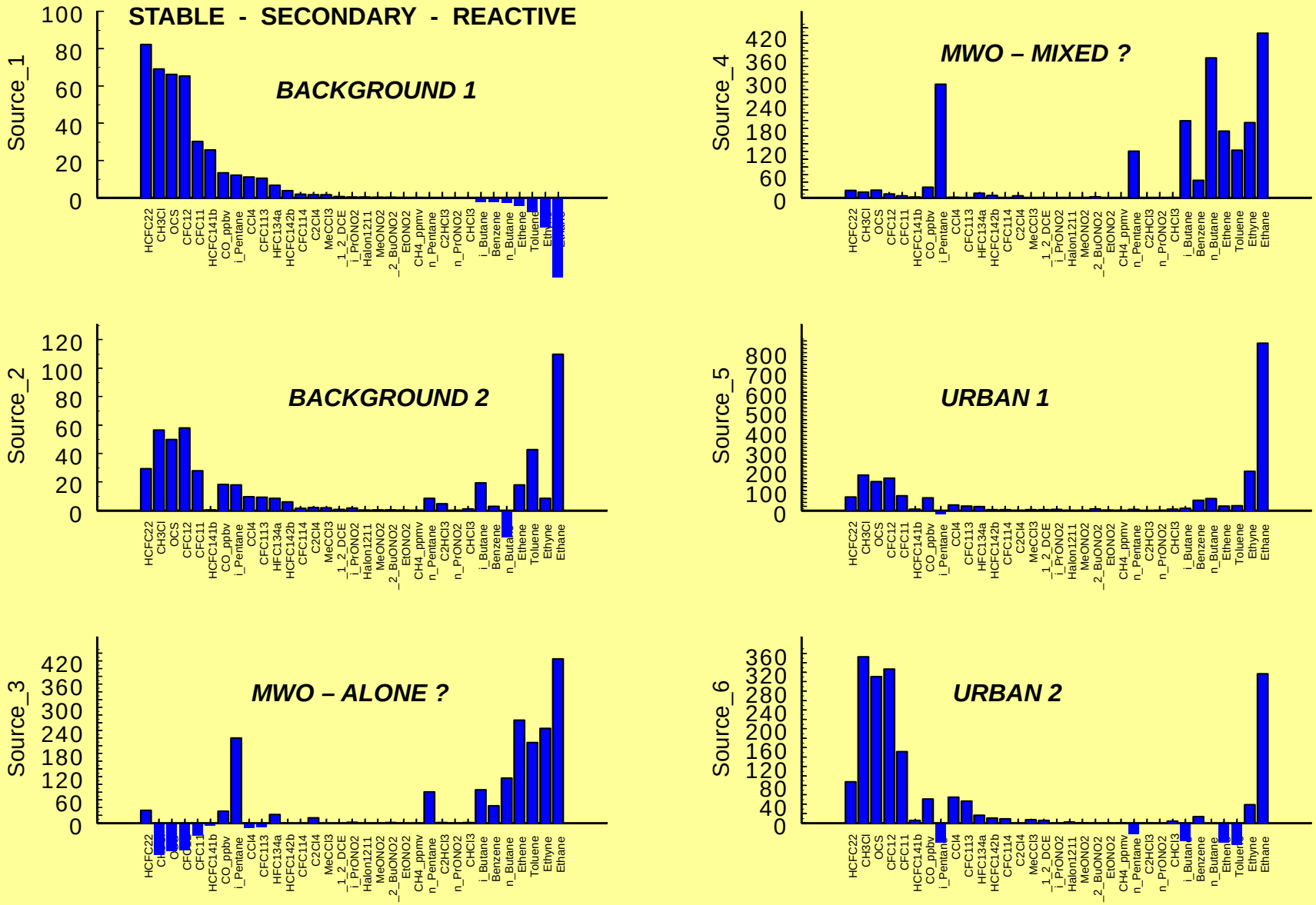


Compositional Patterns – Urban Plume

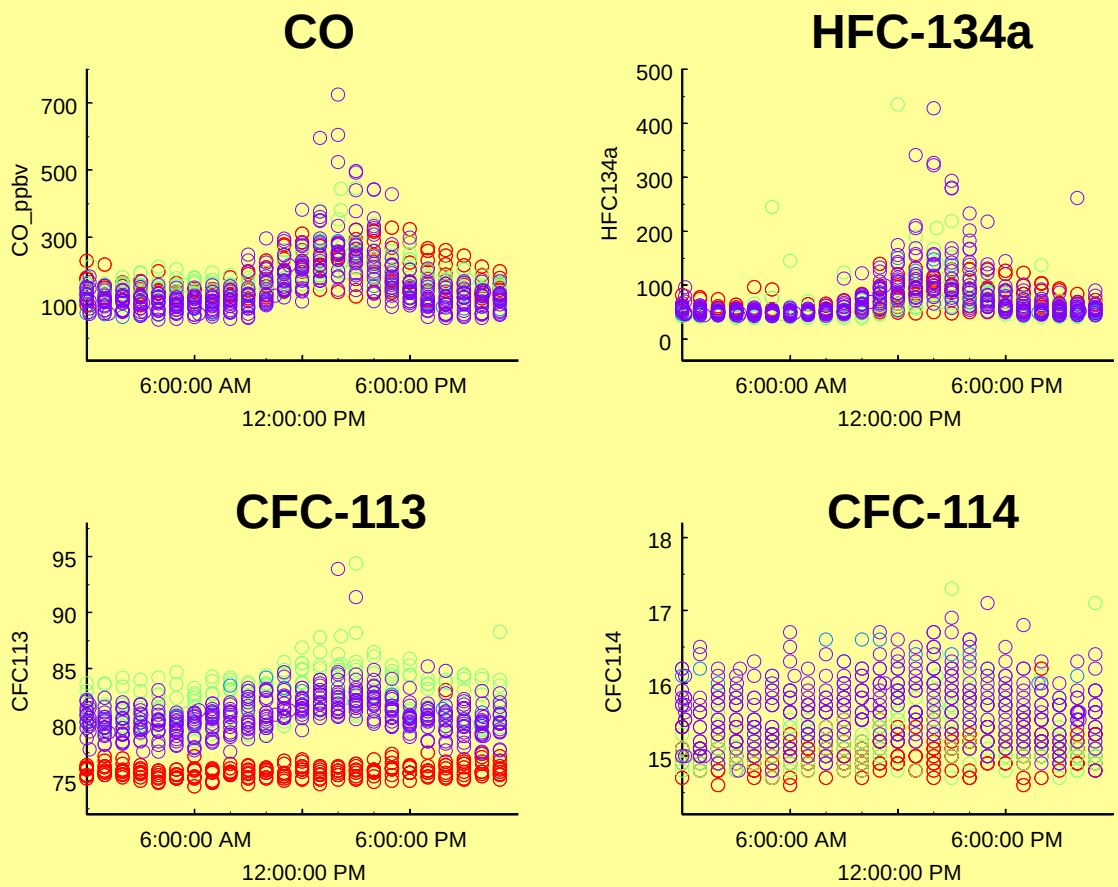
UNMIX – Estimates “Source” Compositions



Compositional Patterns - PMF

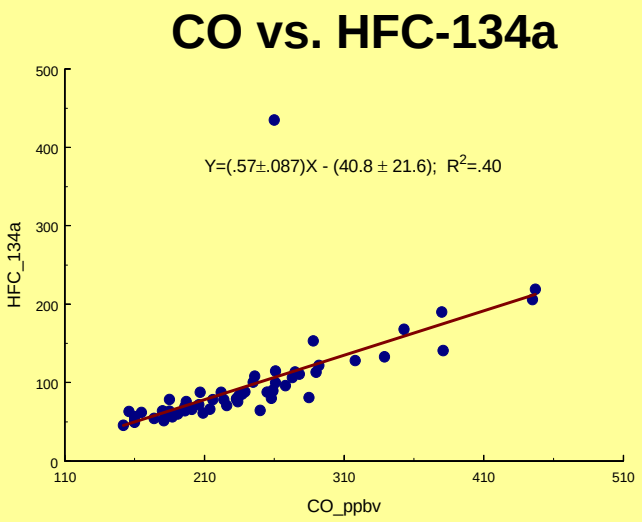


Extracting Emissions Estimates

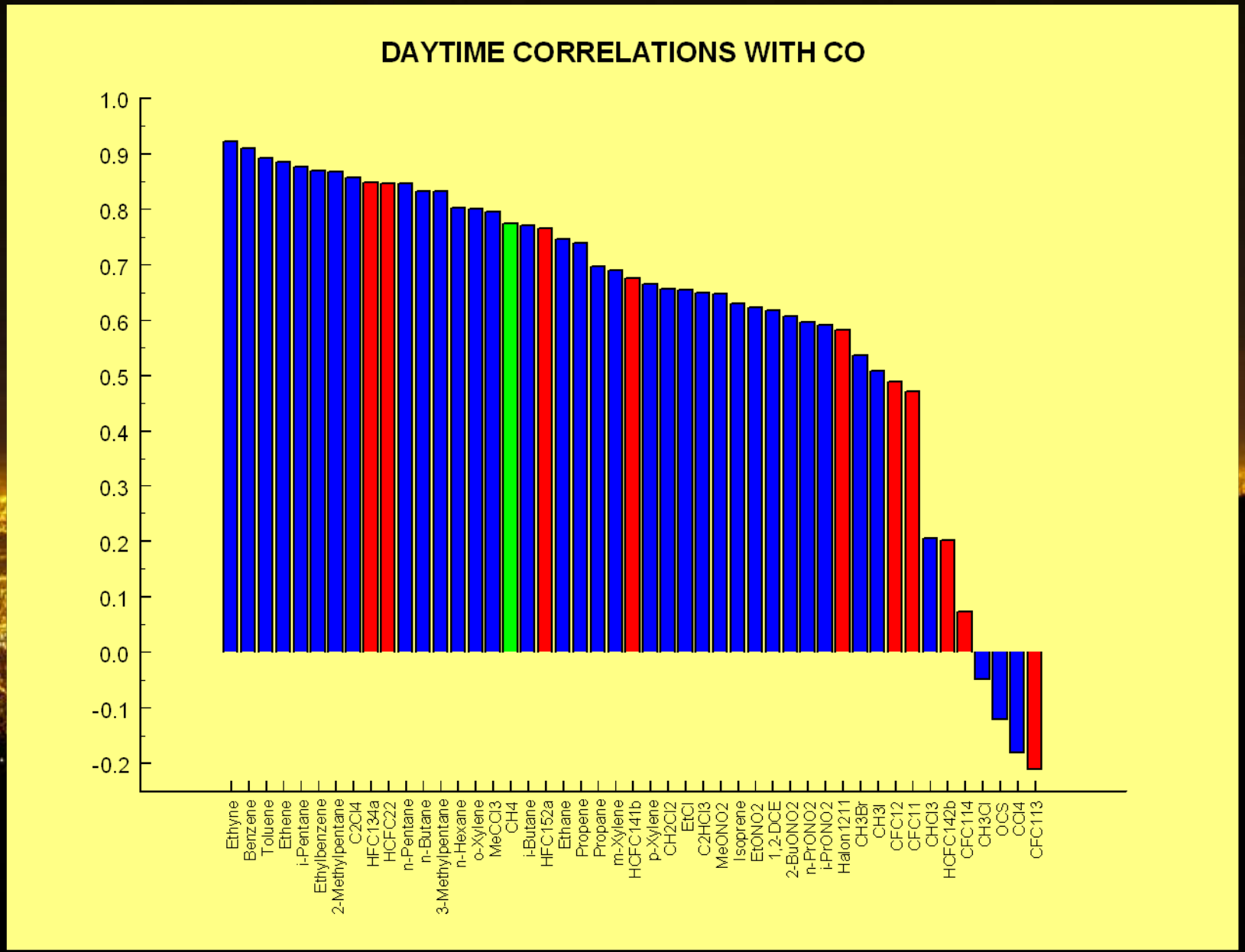


Diurnal Cycles

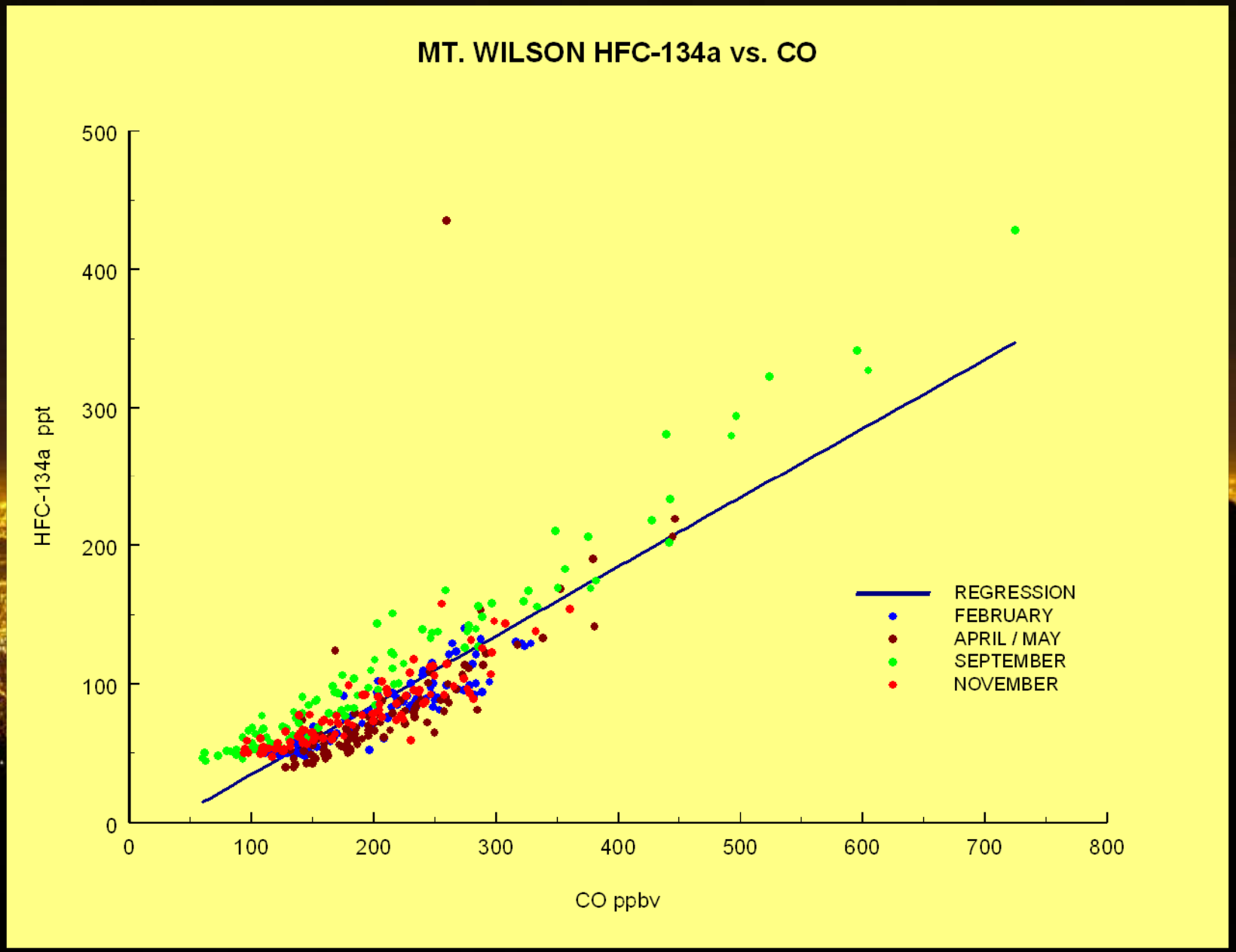
Pollutant – GHG Regressions



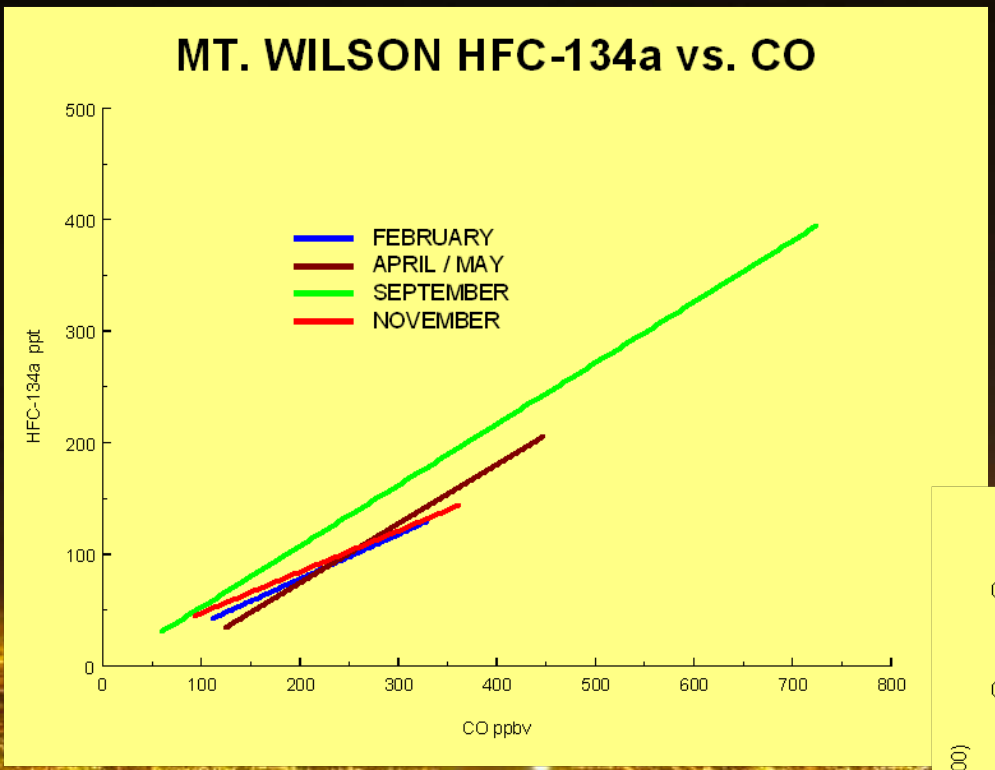
CO Relationships

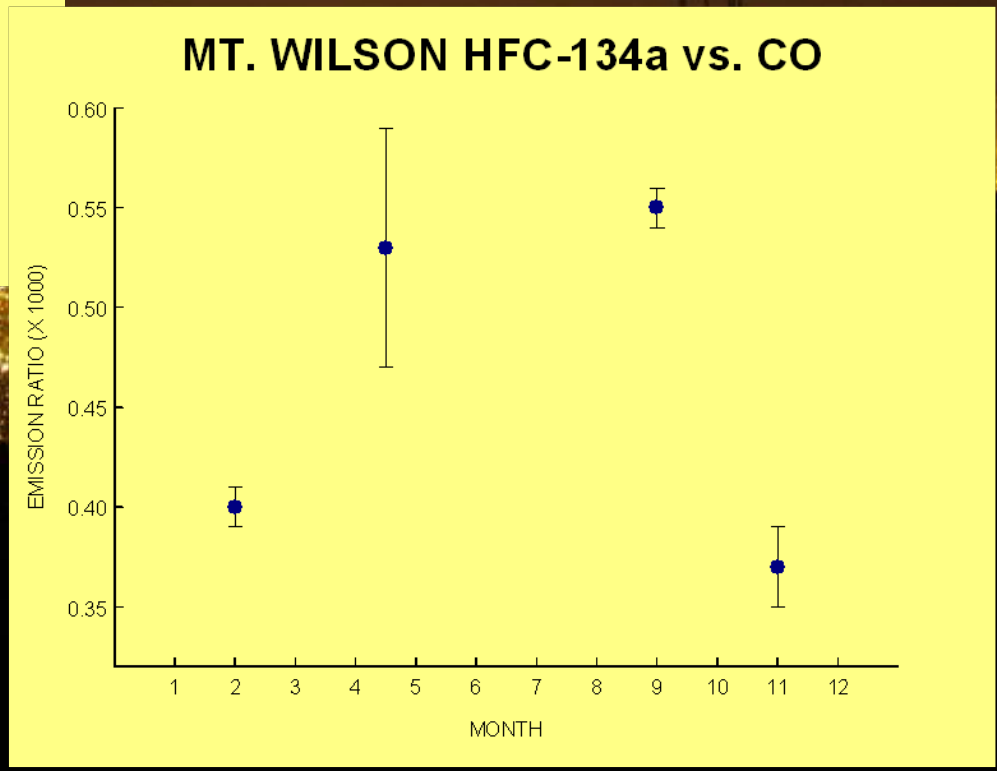


CO Regressions

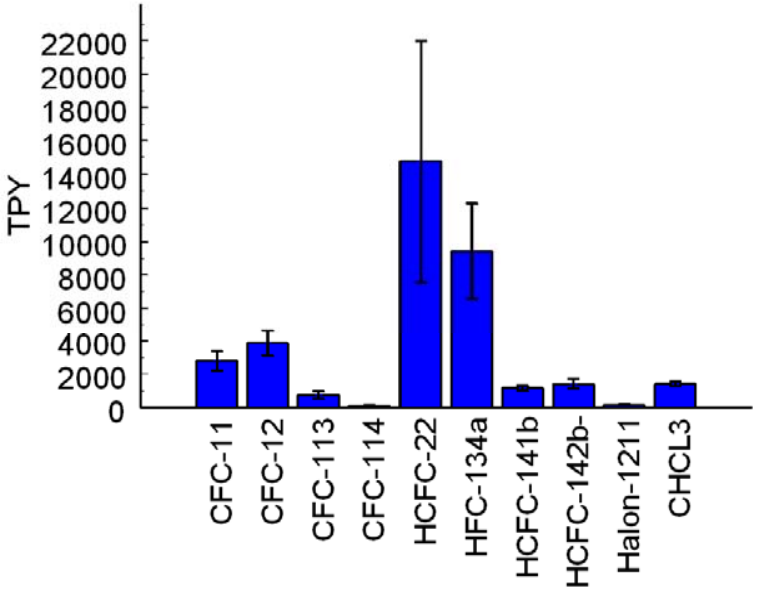


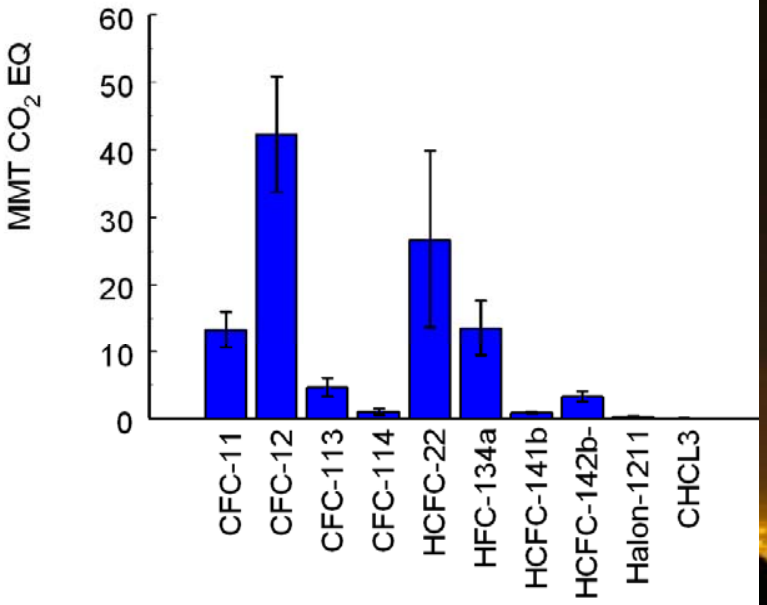
Regression Seasonality

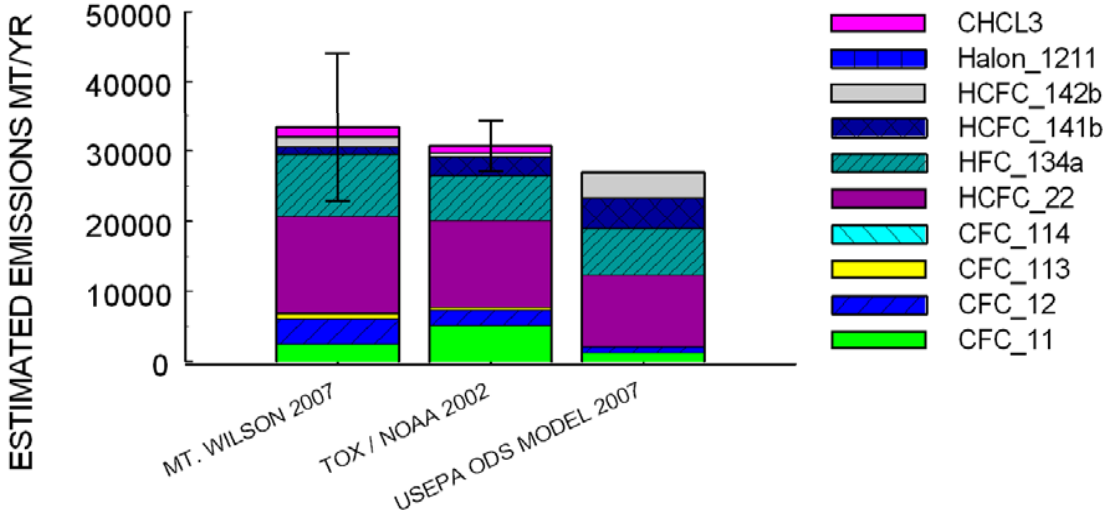




Preliminary High-GWP Emission Estimate







General Findings

- The MWO Site Appears Capable of Detecting and Tracking Emission Trends of GHGs
- “Background” and Urban Composition Show Diverse Seasonal Patterns that Vary Across VOC Species
- Multiple High-GWP Gases Correlate Well with Urban CO, Allowing Emission Estimates
- Emission Estimates Based on CO Regressions Generally Agree with Estimates Based on National Data (USEPA Model), with Discrepancies for a Few Species
- Much More to be Done…