# Daytime and nighttime atmospheric nitrogen cycling

James Flynn
University of Houston

Project Mentors: Dr. Barry Lefer
Dr. Bernhard Rappenglueck

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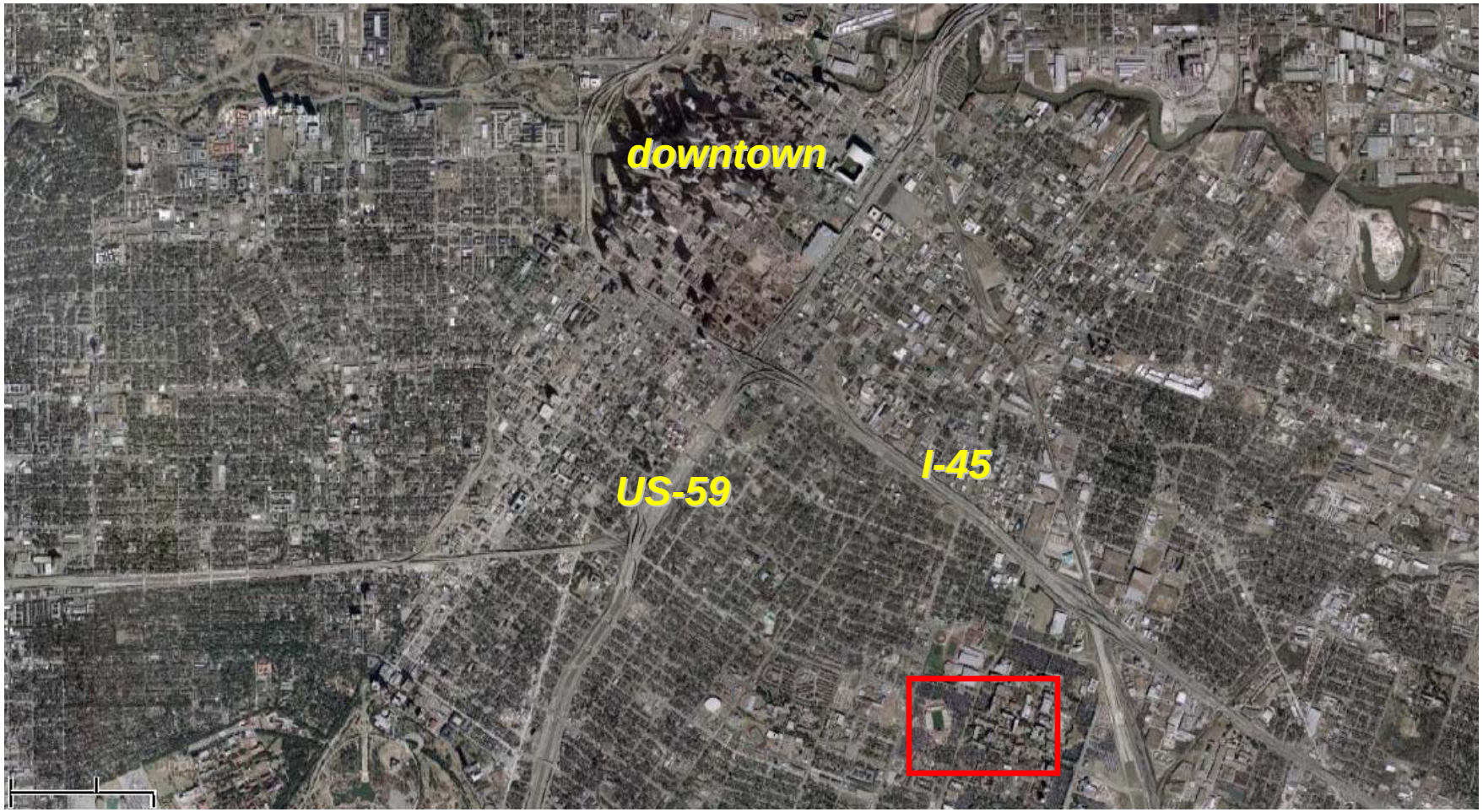
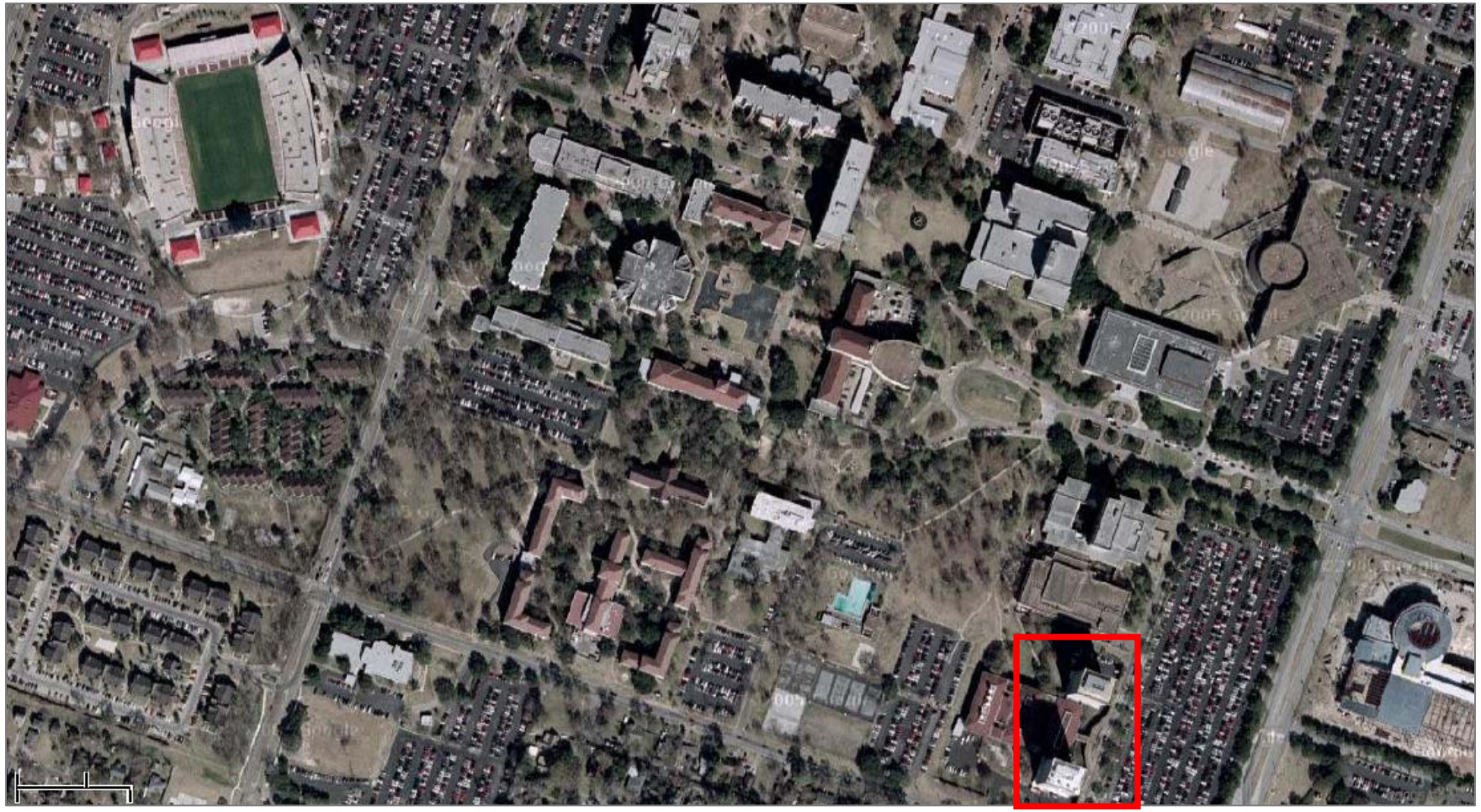
# Overhead View Downtown



# *Overhead View UH Campus*



# UH North Moody Tower

- **18 story tall building (200 ft tall)**
- **30 ft Met Tower**
- **representative site with no direct surface emission impacts**

Balcony space on the 18th floor of the North Moody Tower prior to site enhancements

# Moody Tower Site Enhancements

Left: 6m walk-up tower and met tower with two trailers in the background

Right: Third trailer housing DOAS and LIDAR

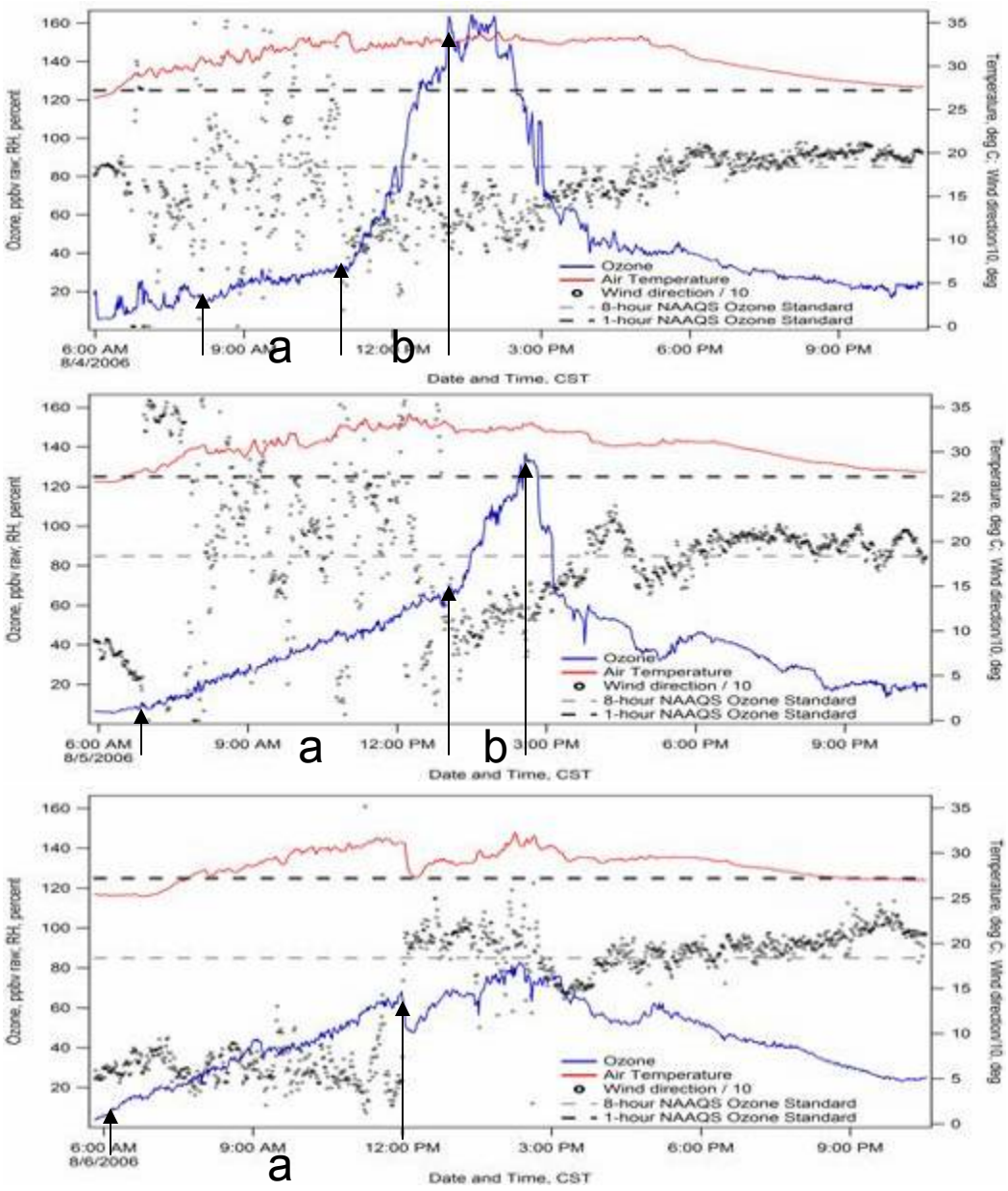
Left: Permanent radiation platform with Brewer and Cimel sun photometers as well as shadowband and UVB radiometers

Right: Walk-up platform on roof of trailer

# Basic Ozone ($O_3$) Chemistry

- When NO and $NO_2$ are present in sunlight, ozone formation occurs as the result of the following reactions
  - $NO_2 + h\nu \rightarrow NO + O$
  - $O + O_2 + M \rightarrow O_3 + M$
- Once formed, $O_3$ reacts with NO to regenerate the $NO_2$
  - $O_3 + NO \rightarrow NO_2 + O_2$
- Net Ozone production not possible unless a peroxy radical is present to react with NO to regenerate the $NO_2$
  - $RO_2 + NO \rightarrow NO_2 + RO$
    (where R can be: H, $CH_3$, $C_2H_5$, etc.)

# Influence of meteorology on ozone formation




Ozone peaked just after 1:30 CST at approximately 165 ppbv

a: ~6 ppbv/hr increase

b: ~35 ppbv/hr increase

Ozone peaked just after 2:30 CST at approximately 135 ppbv

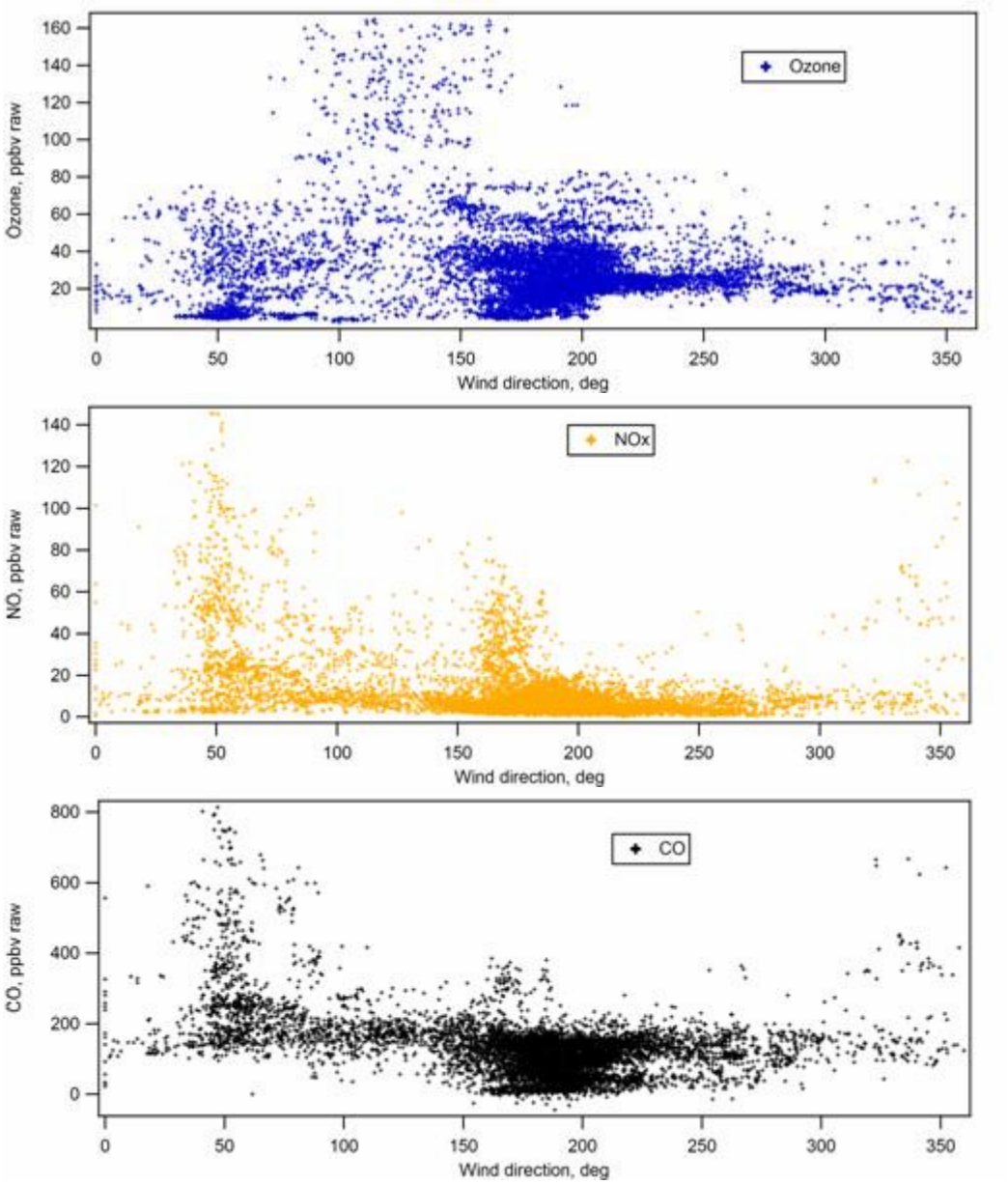
a: ~9 ppbv/hr increase

b: ~48 ppbv/hr increase

Ozone began to increase at similar rates in the morning until a thunderstorm passed over the Moody Tower site just after noon CST and disrupted ozone production

a: ~10 ppbv/hr increase

# Concentration vs. Wind Direction




Peak ozone concentrations occurred under east through southeast wind conditions

Concentrations above 135 ppbv occurred on 8/04/06

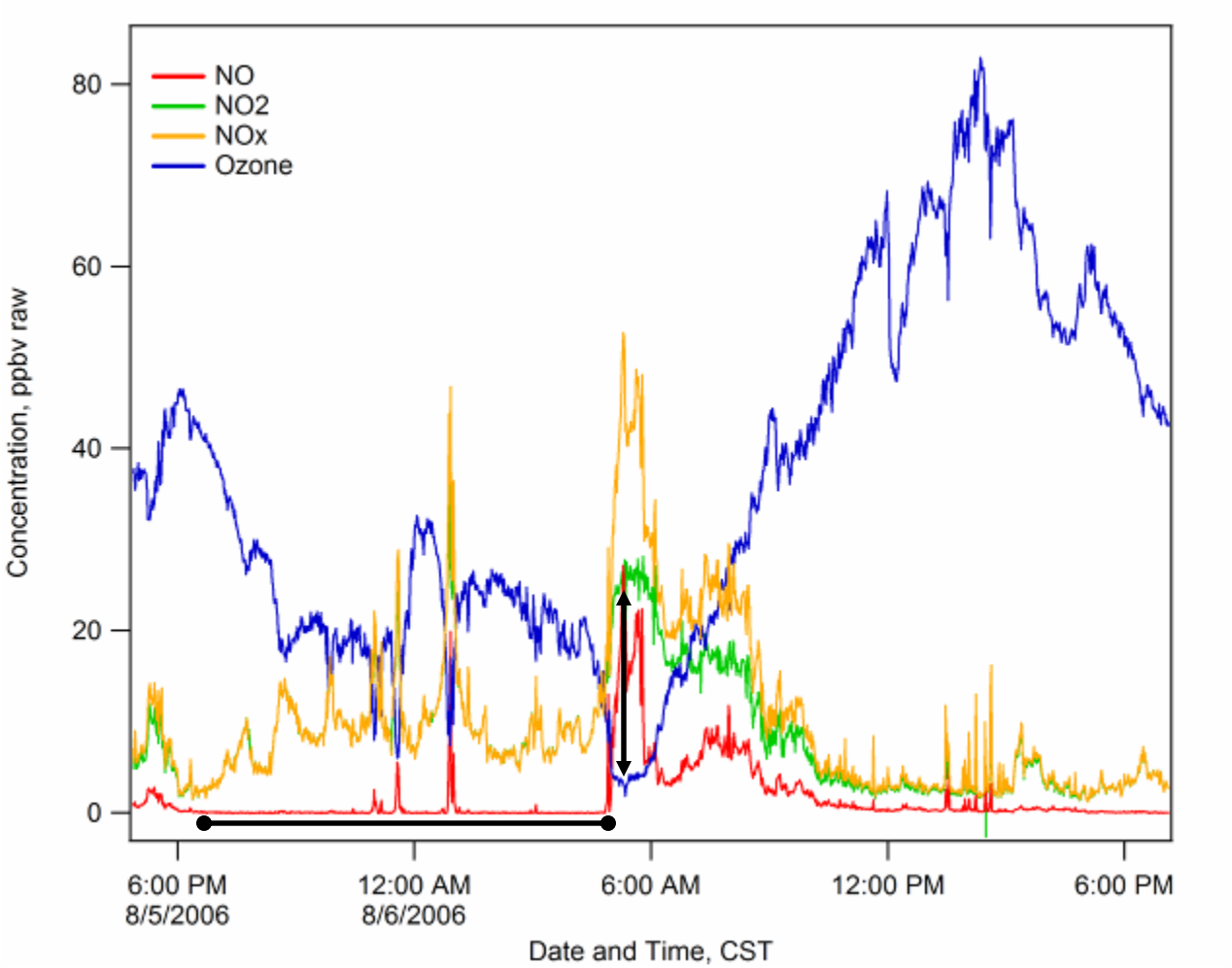
Elevated NOx concentrations are most common under northeast and southeast conditions

Elevated CO* occurs under the same wind conditions as the elevated NOx, suggesting the emissions are from the same source

*without baseline corrections

*Note: Wind direction is off by as much as 20°*

# Diurnal Nitrogen cycling




From approximately 6:00 pm through 5:00 am CST ambient ozone titrated NO

Note that in the plume between 5:00-6:00 am, NO was titrated to $NO_2$ by ozone; The Δ ozone is approximately equal to the Δ $NO_2$

As the sun rises $NO_2$ is photolyzed and begins to produce ozone

This cycle repeats itself on a daily basis, although with varying magnitudes

# Acknowledgements

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