

# The influence of meteorology and atmospheric composition on the year-to-year variability in the number of ozone exceedances in Houston

B. Lefer<sup>1</sup>, J. Flynn<sup>1</sup>, W. Vizuete<sup>2</sup>, S.-H. Chu<sup>3</sup>

<sup>1</sup> Univ. of Houston, <sup>2</sup> Univ. North Carolina – Chapel Hill, <sup>3</sup> U.S. EPA OAQPS – RTP

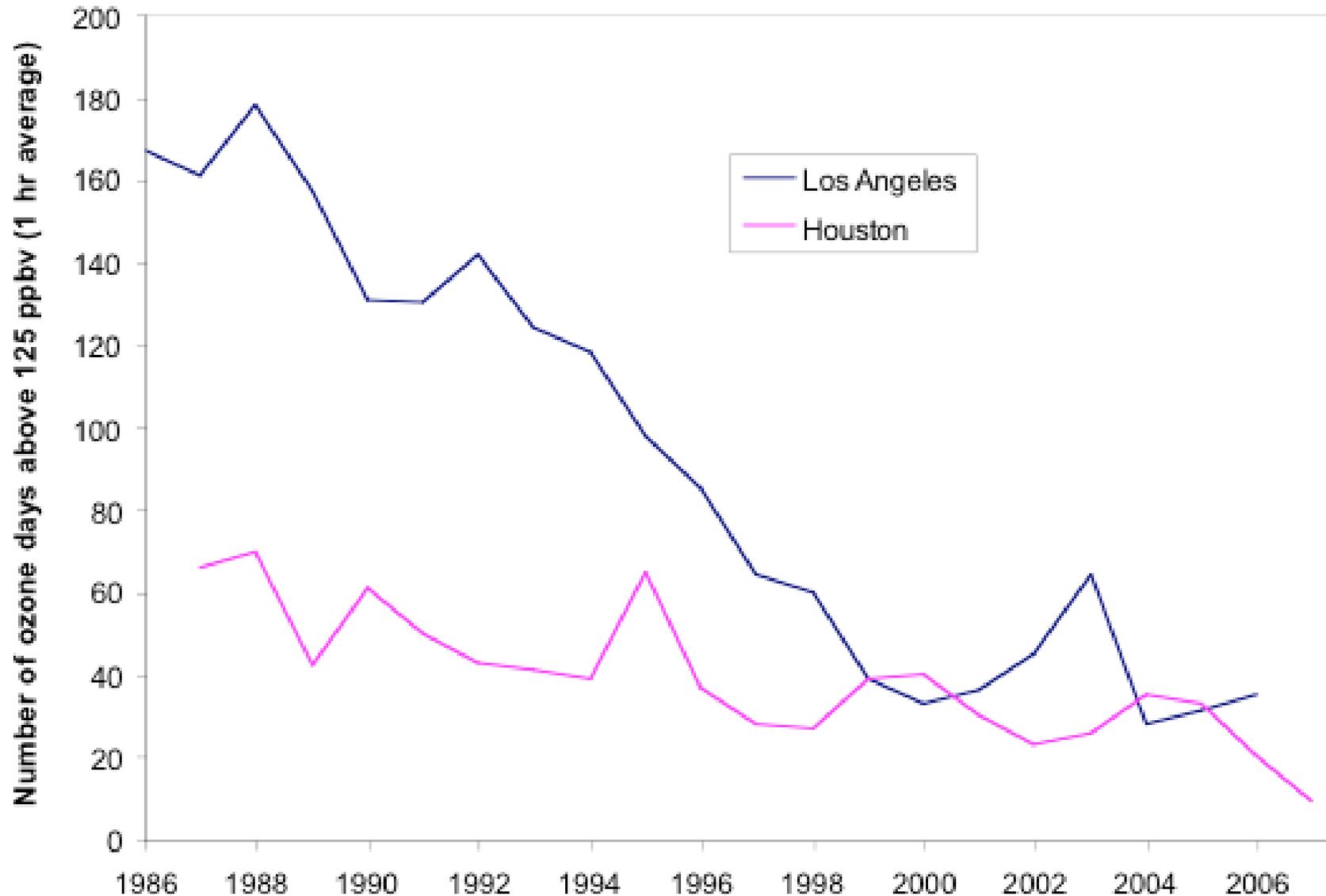


# Meteorology, Emissions, and Houston ozone exceedances

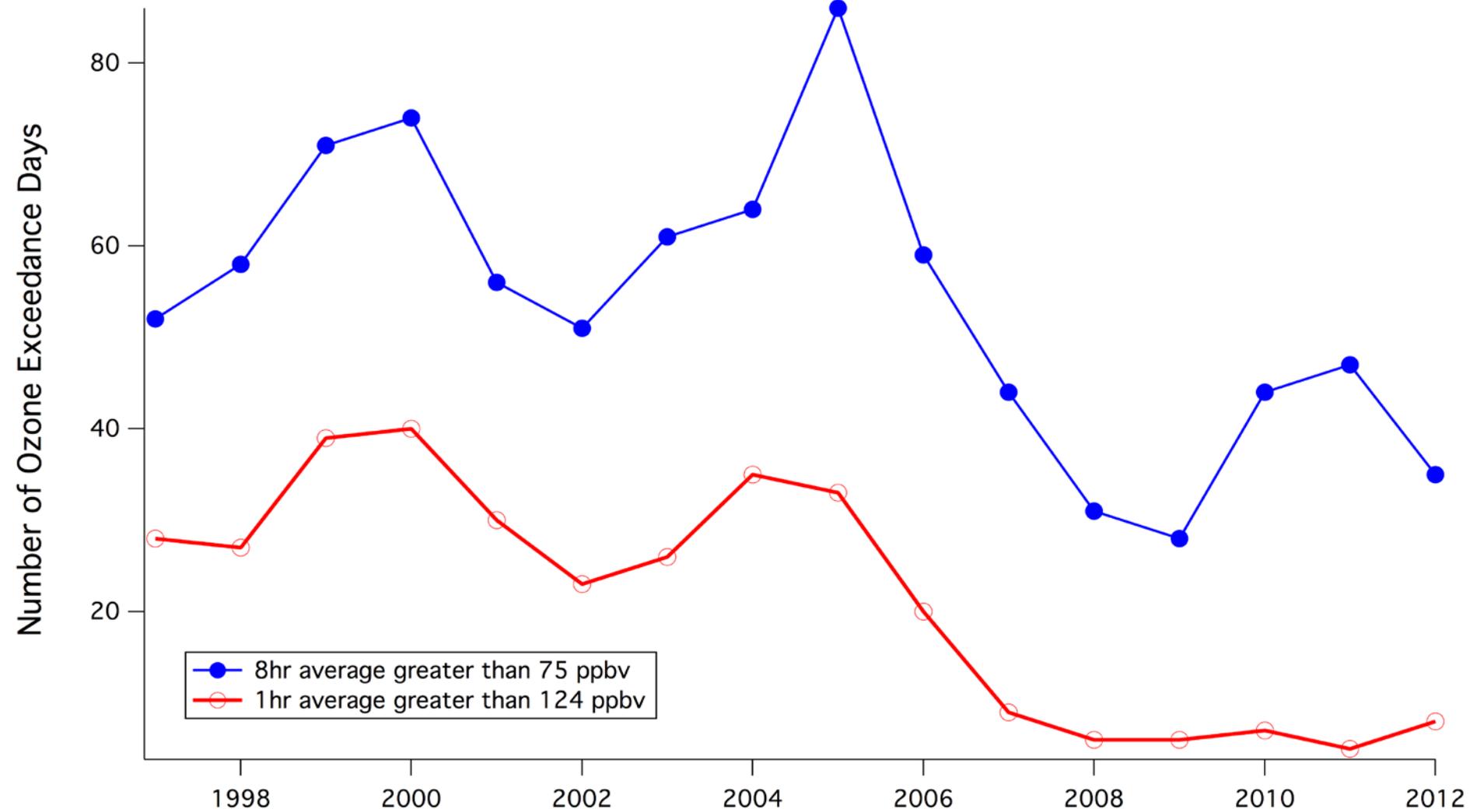
- I. Houston ozone history
- II. Houston conceptual model
- III. Trends in ambient  $\text{NO}_x$  and VOC mixing ratios
- IV. Are emissions events important?
- V. Meteorologically adjusted ozone trends



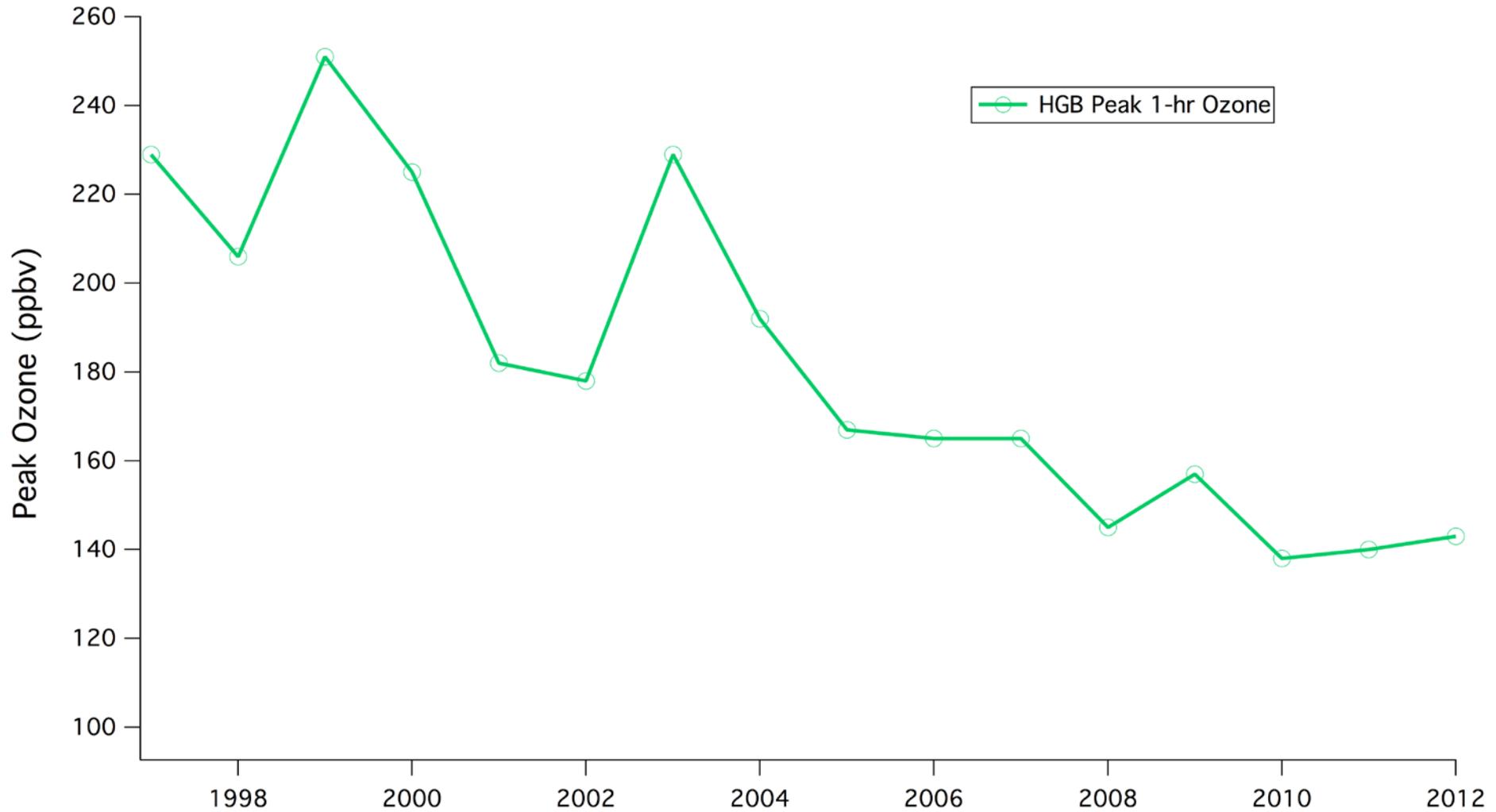
# 1-hr Ozone Exceedances (Houston & LA)



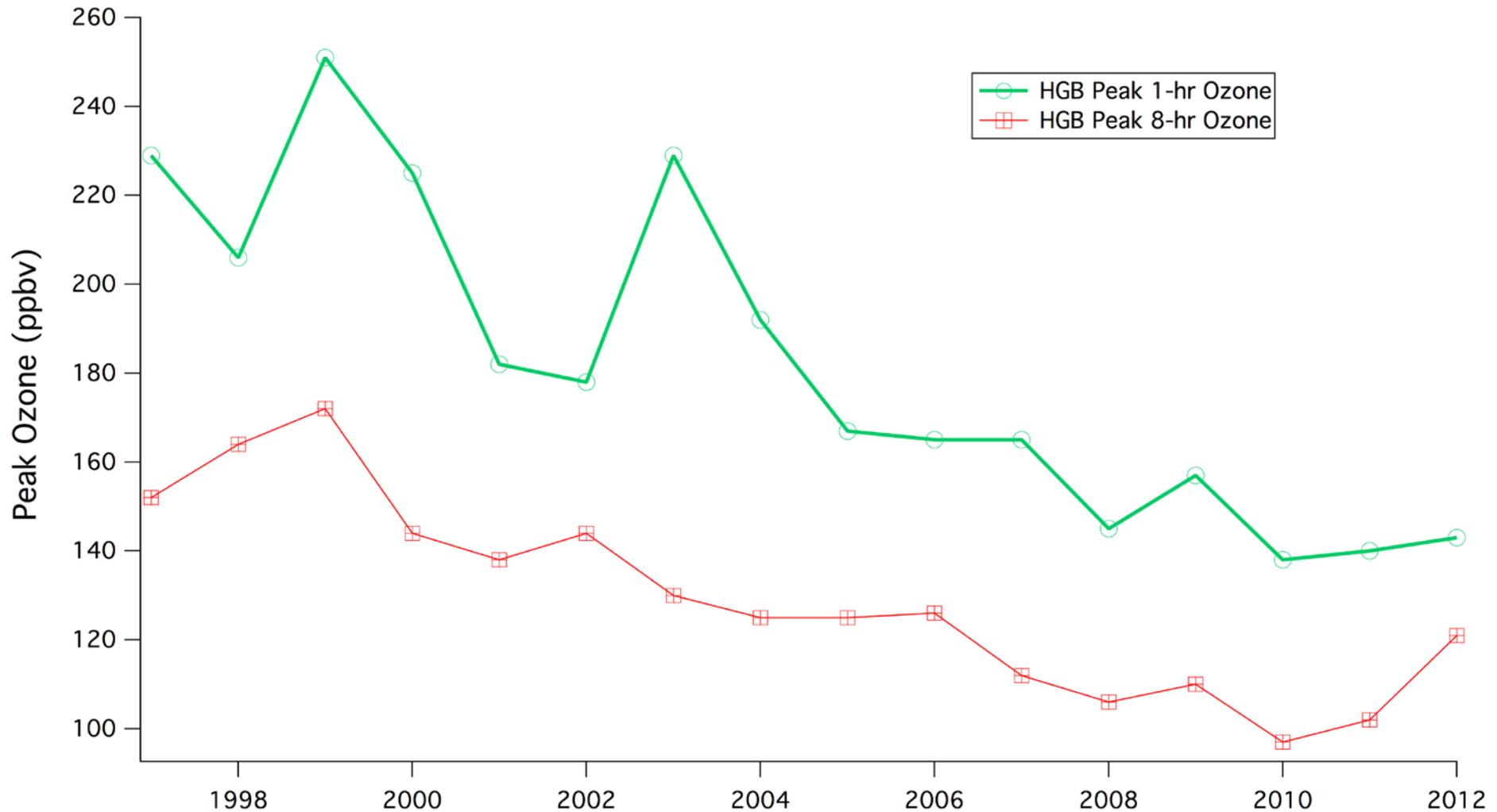
# Recent Houston Ozone Trend



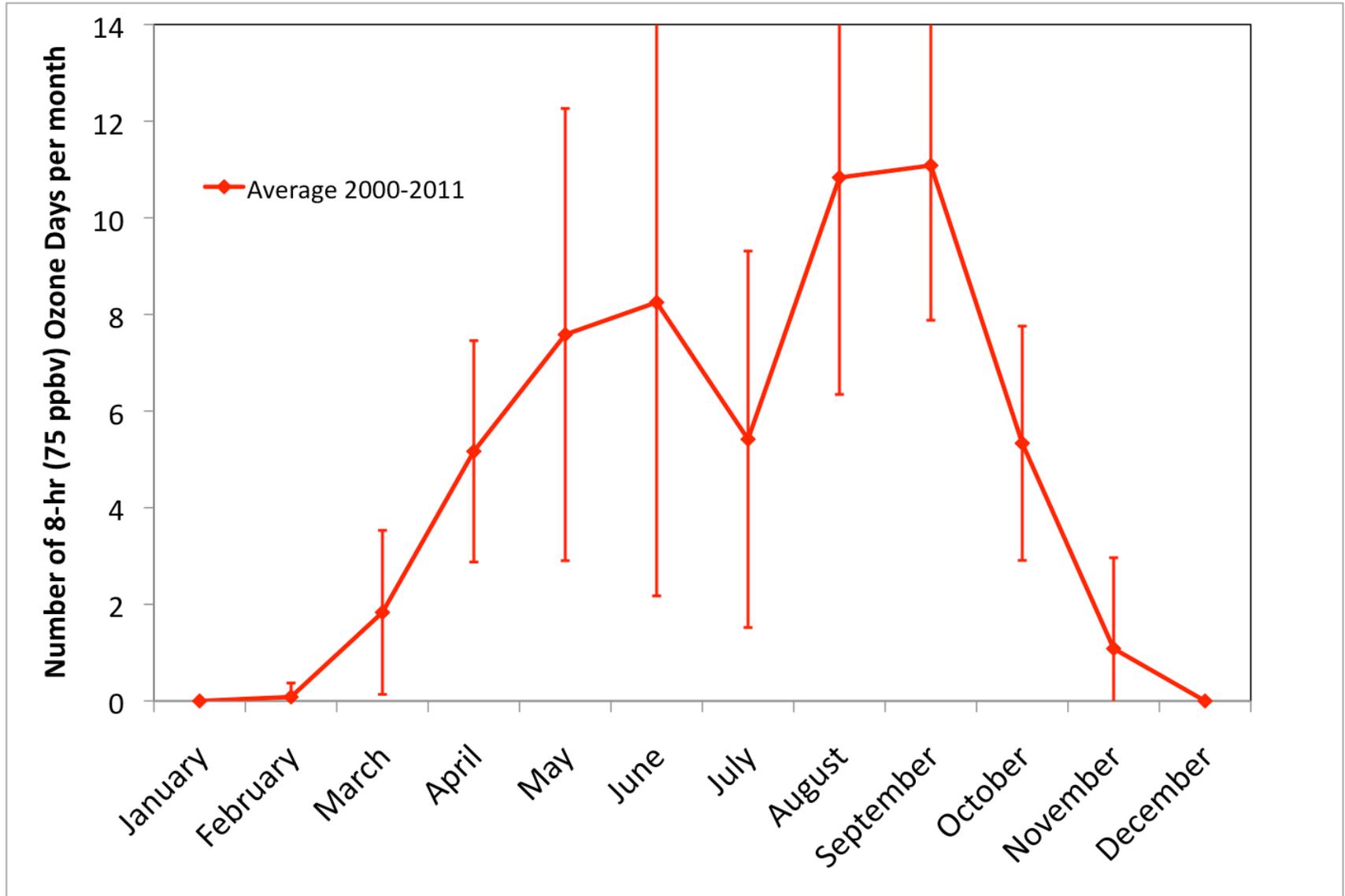
# Trend in Peak 1-hr Ozone



# Trend in Peak 1-hr and 8-hr Ozone

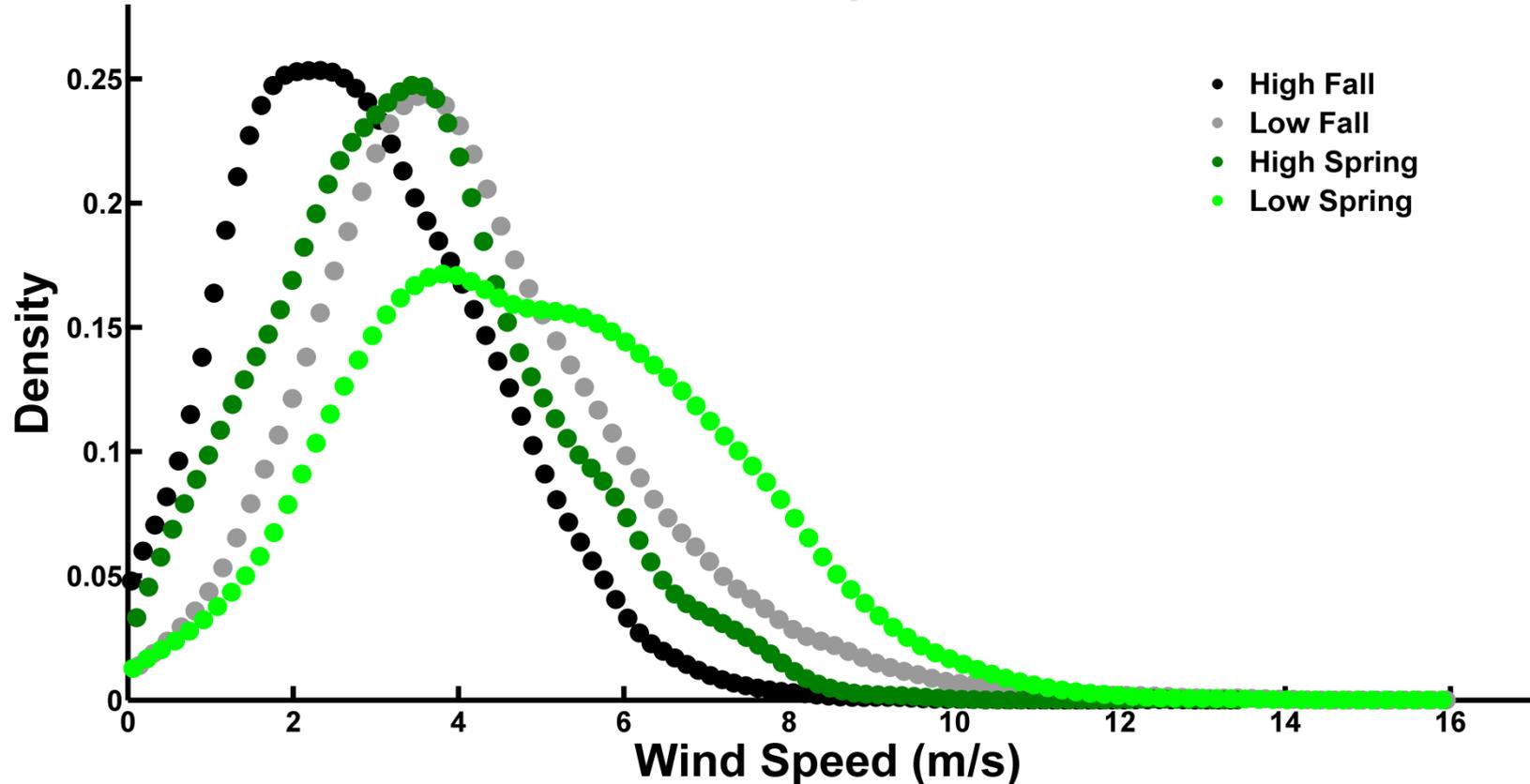


# Seasonal 8-hr Ozone HGB (75 ppbv)

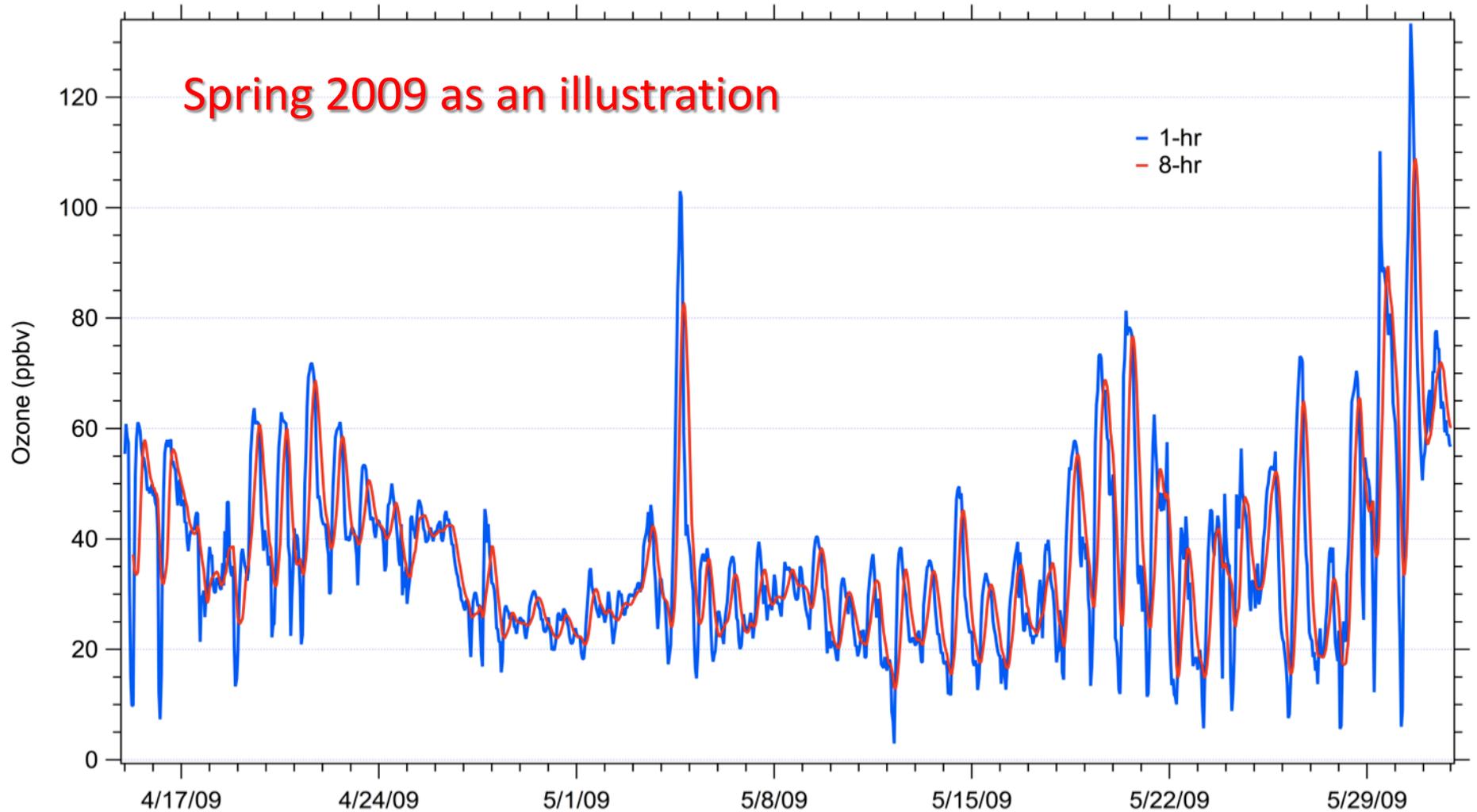


# Houston Conceptual Ozone Model

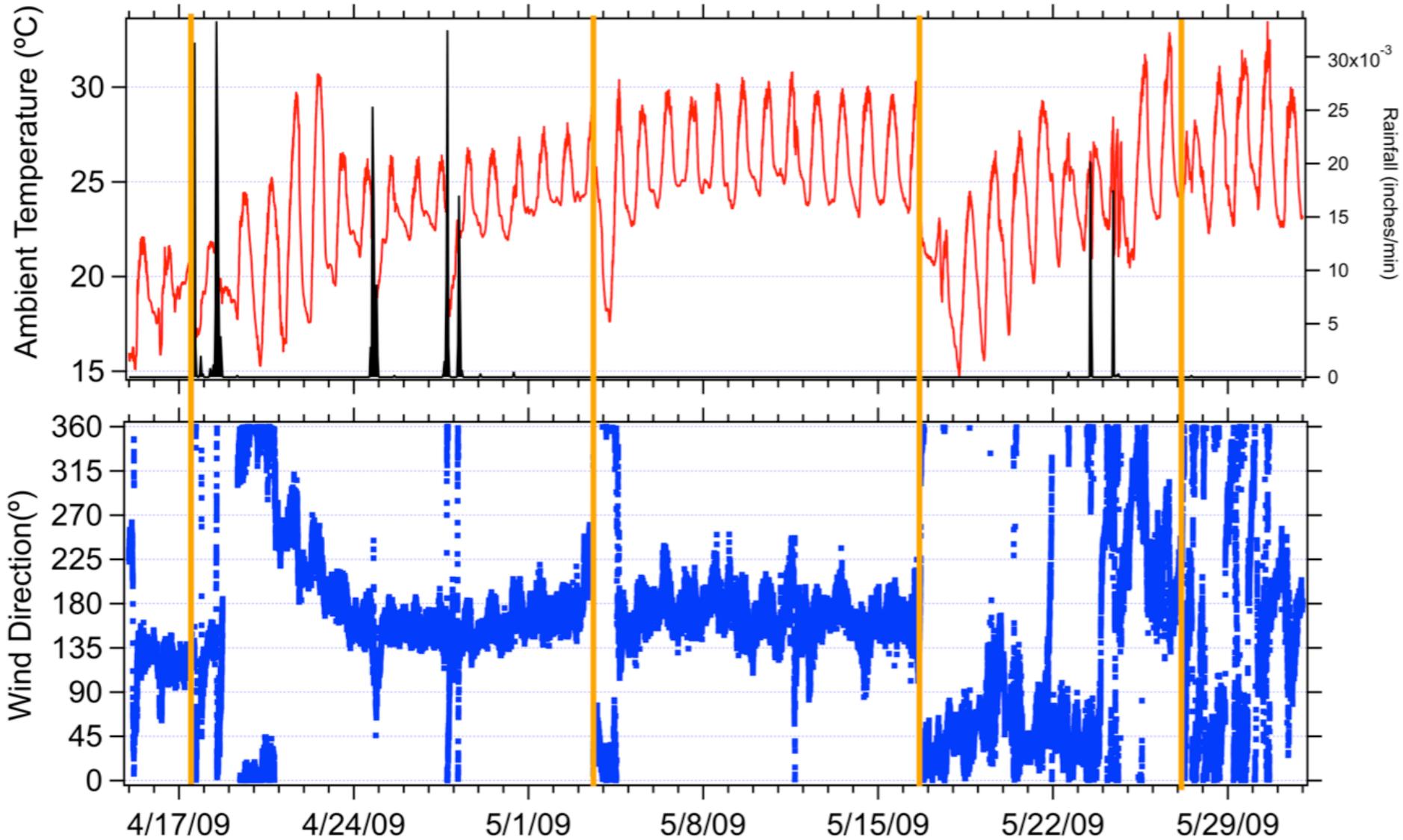
## Ozone and wind speed



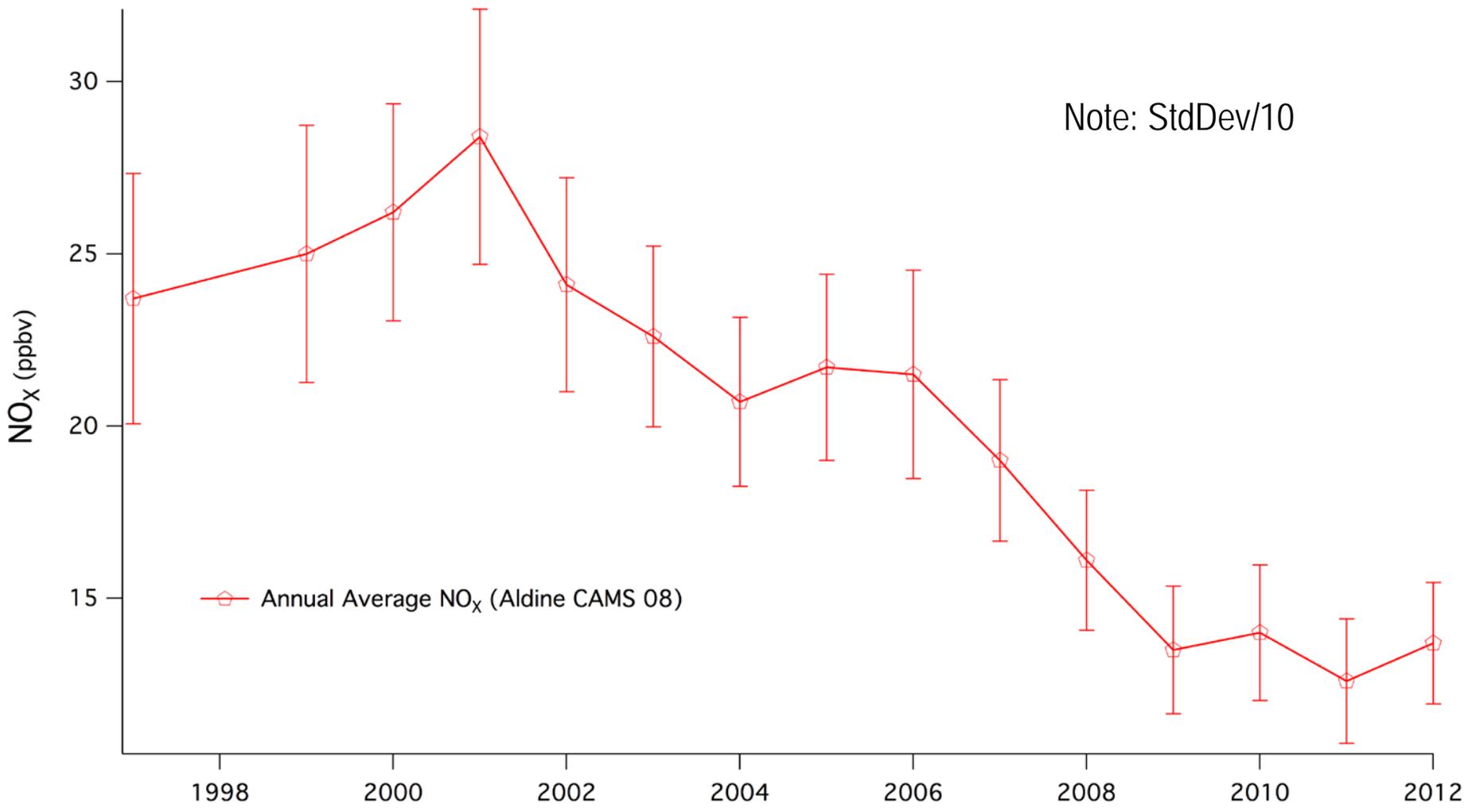
# Houston Conceptual Ozone Model



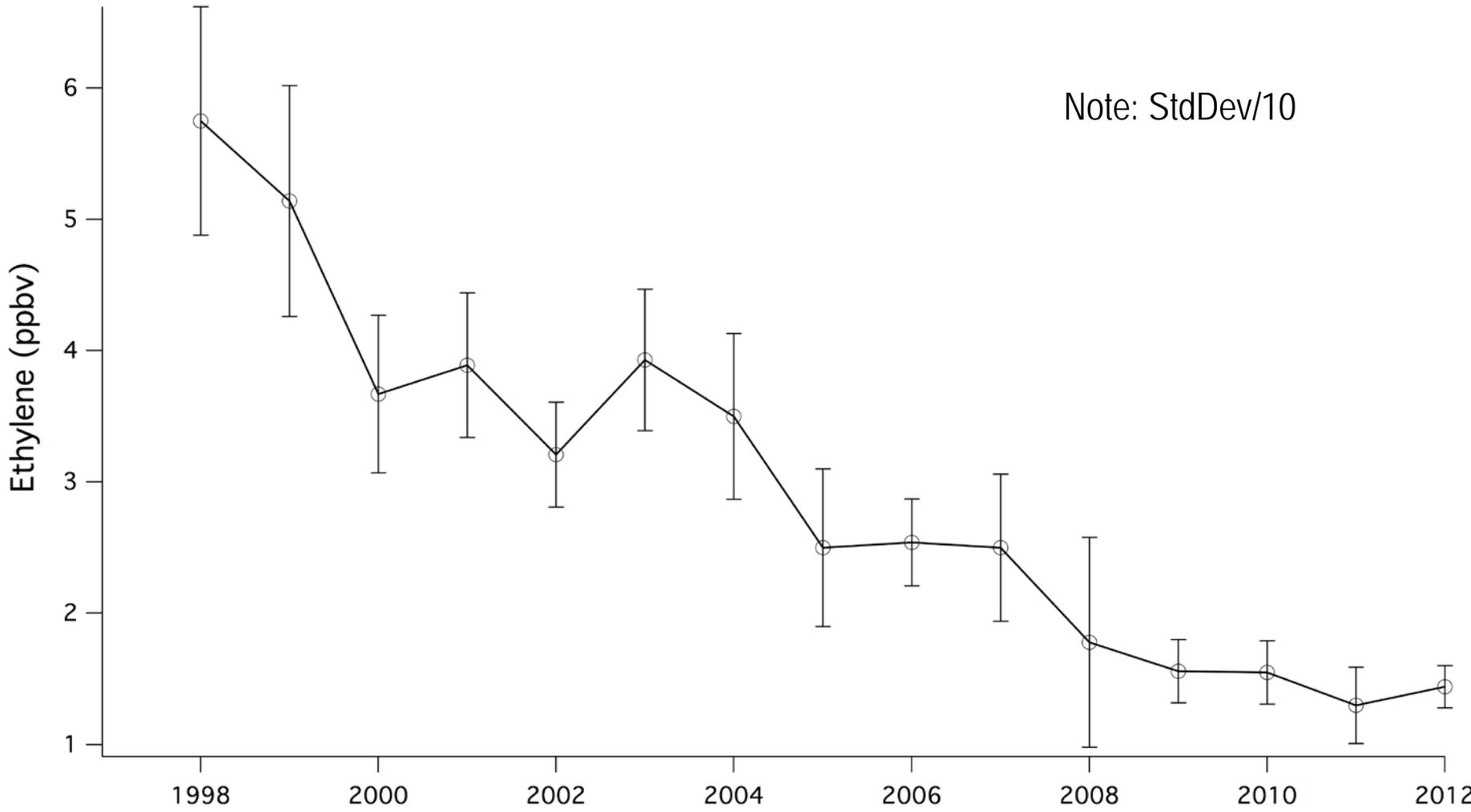
# Post-Frontal conditions important



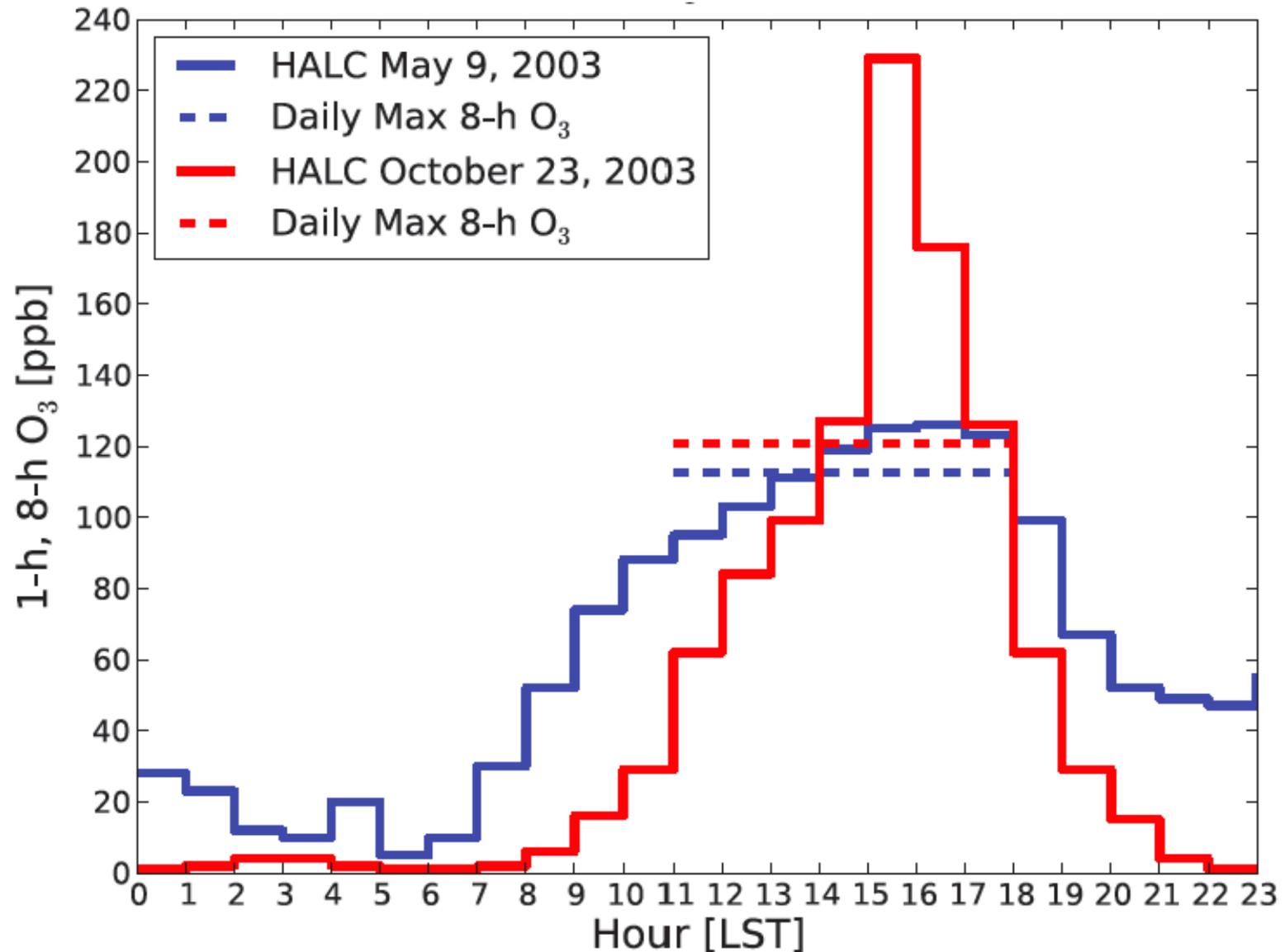
# Annual Average 1-hr NO<sub>x</sub> – Aldine



# Annual Average 1-hr Ethylene – Clinton Dr.

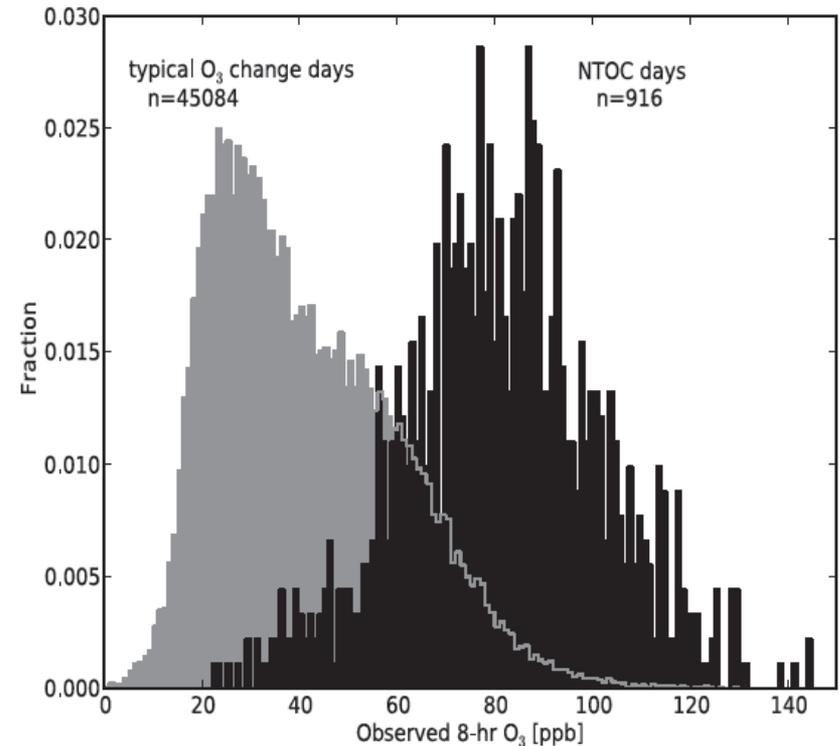
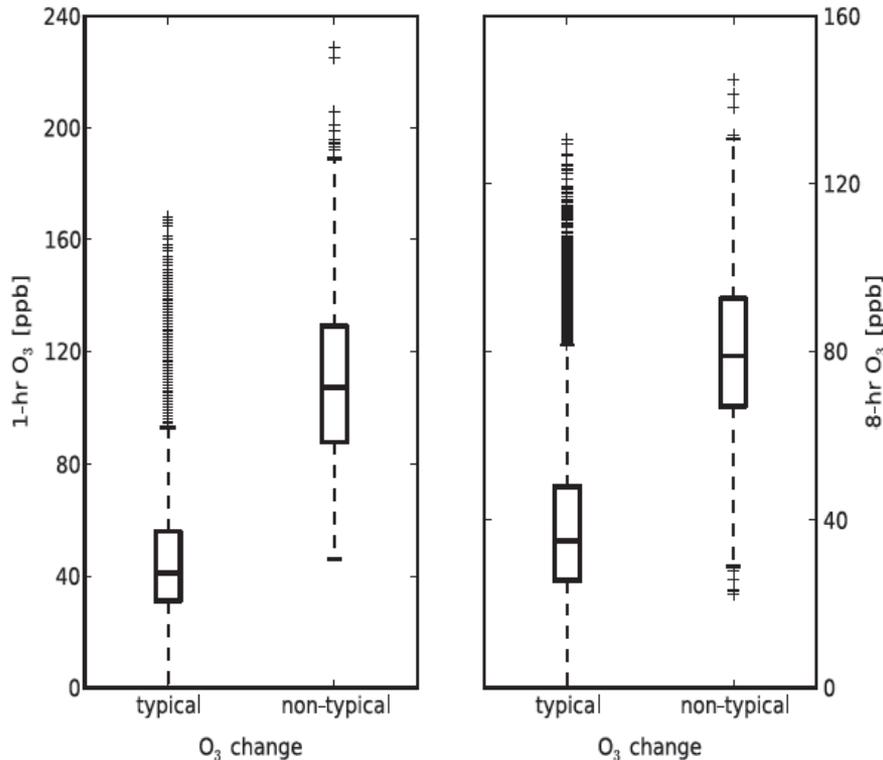


# Two types of Houston ozone events



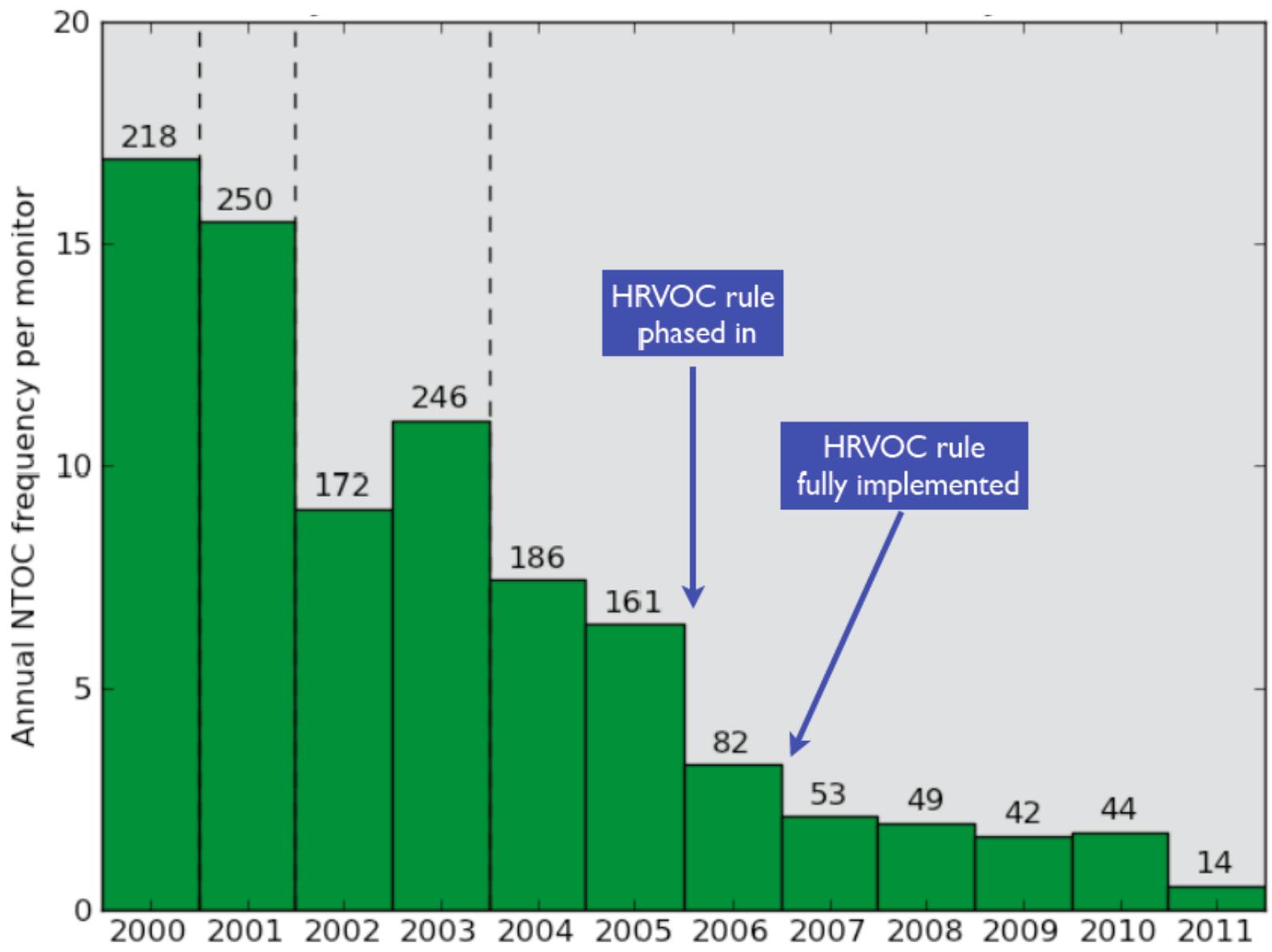
# Two types of Houston ozone events

Observations, May-Oct 2000-2009



•60% of NTOC days exceed NAAQS compared to just 1% of typical days

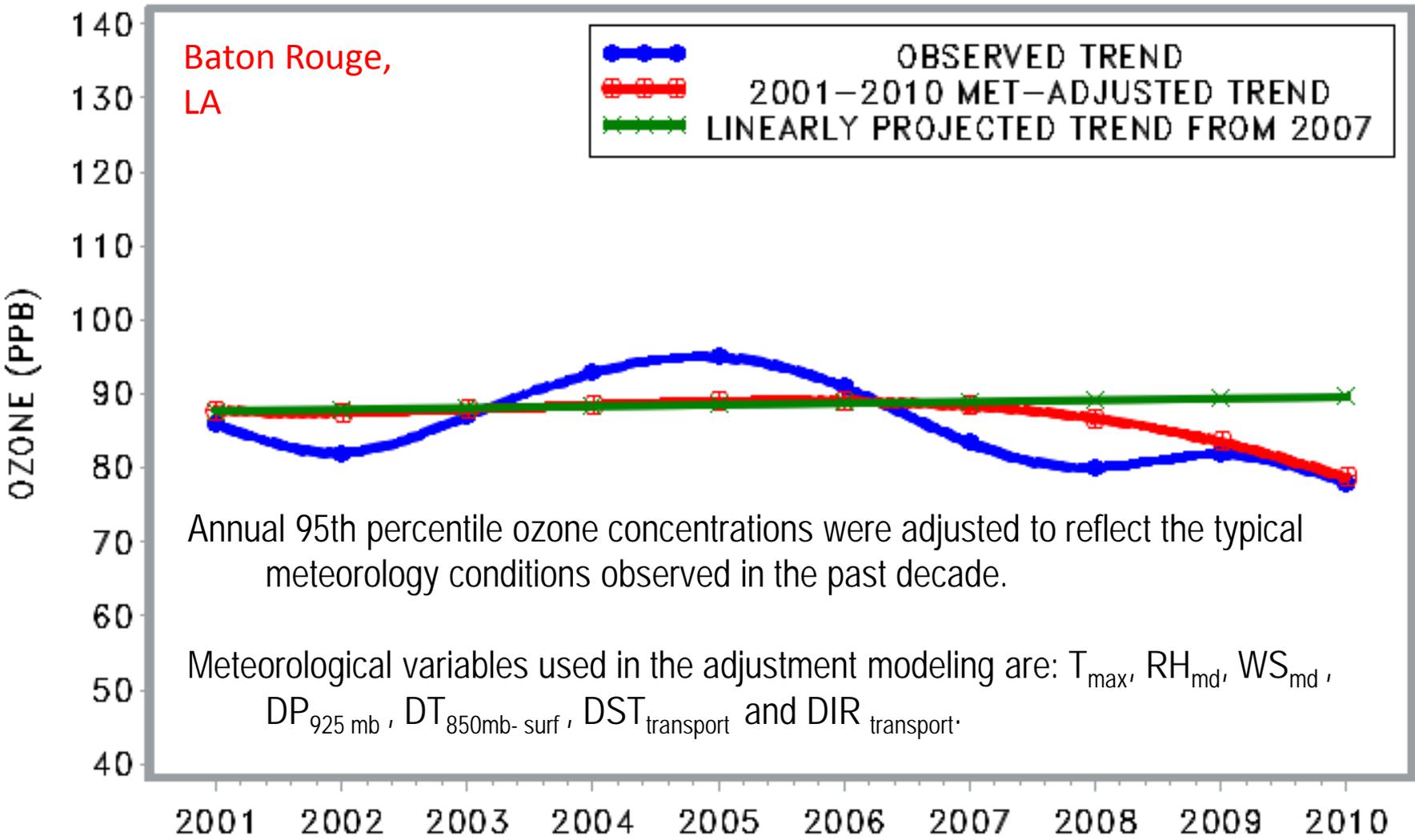
# NTOC events becoming less common



IV. Are emission events important?

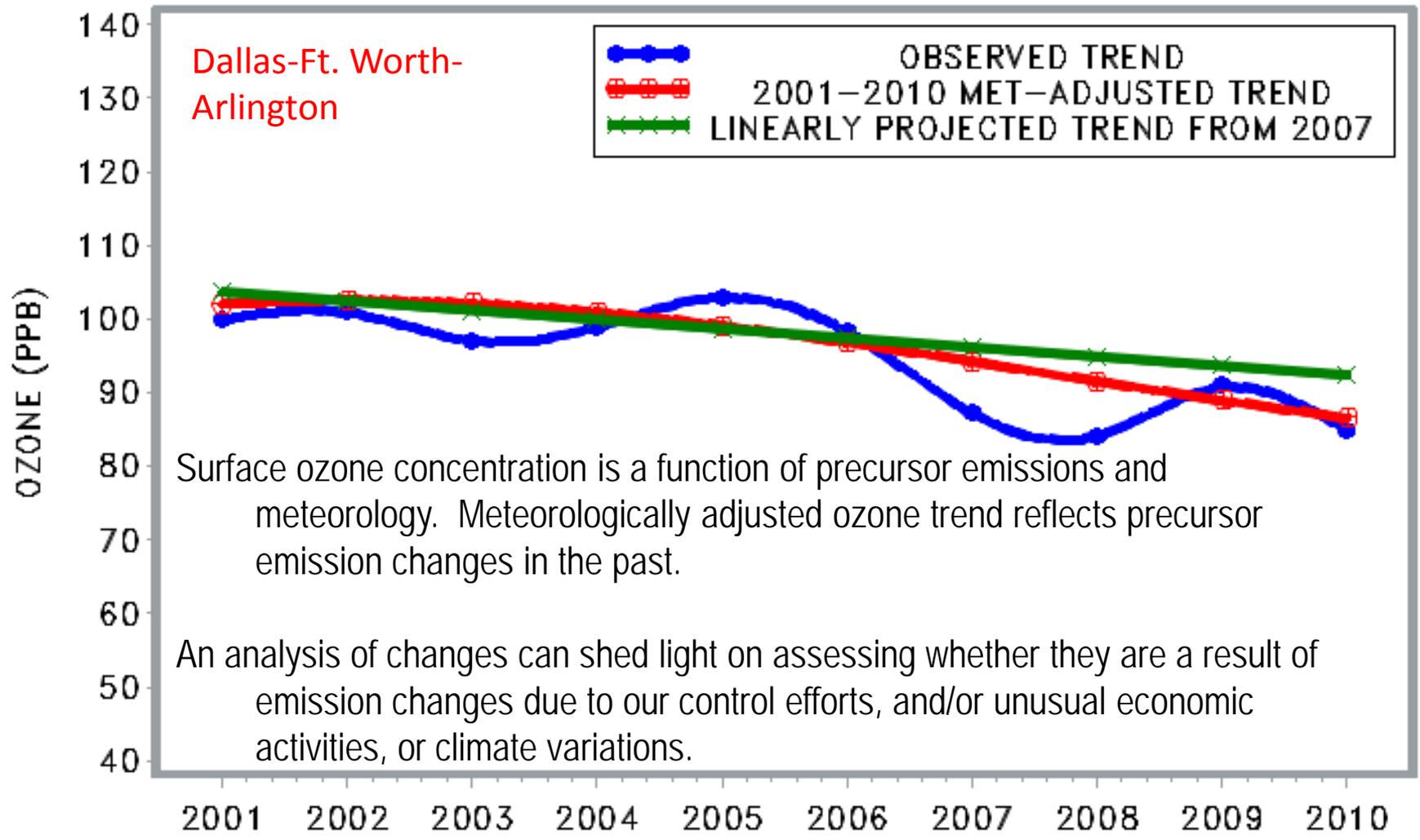
Figure Source: W. Vizuete (UNC)

# Observed vs met-adjusted 95<sup>th</sup> pCTL ozone

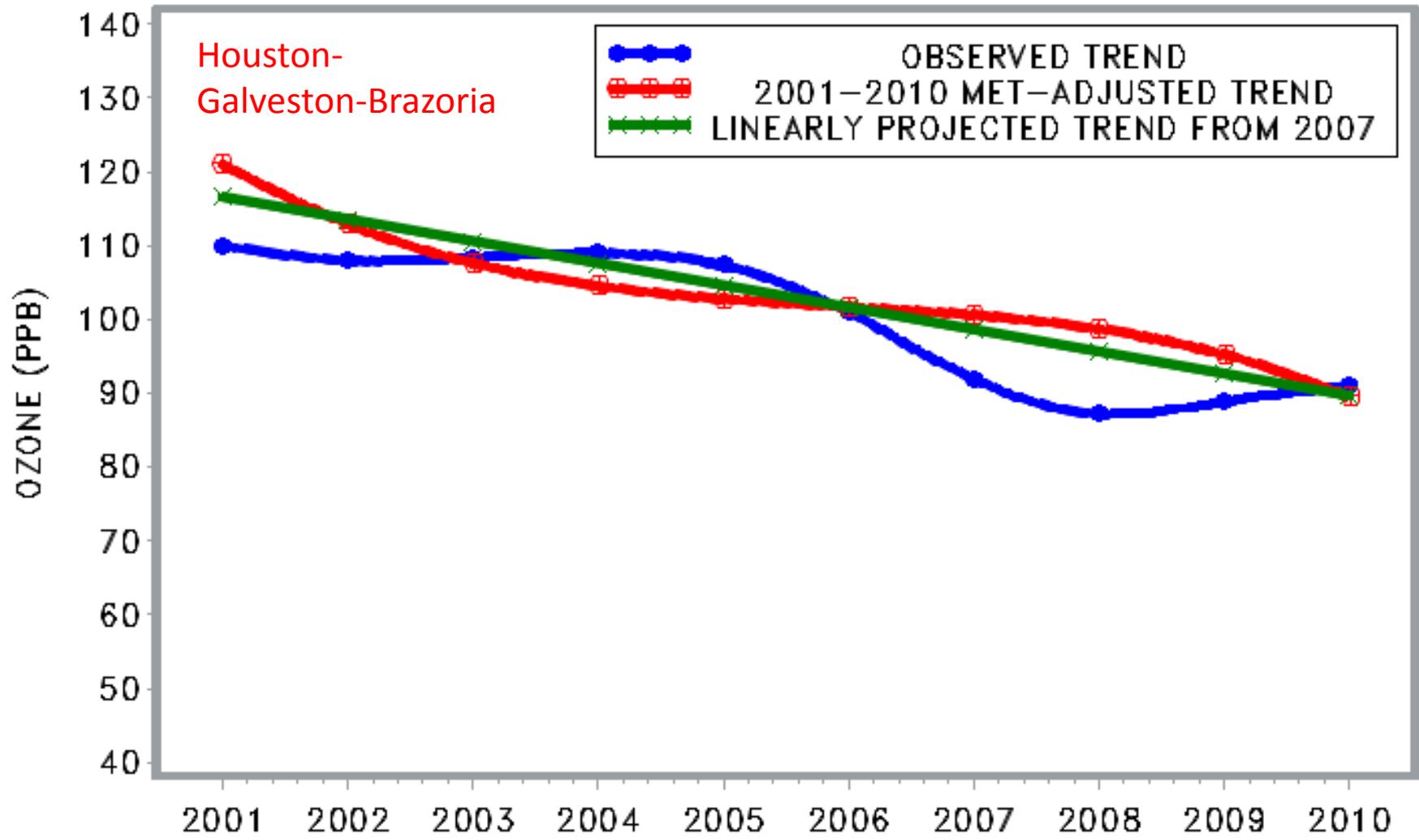


Adapted from: Camalier et al. / Atmospheric Environment 41 (2007) 7127–7137.

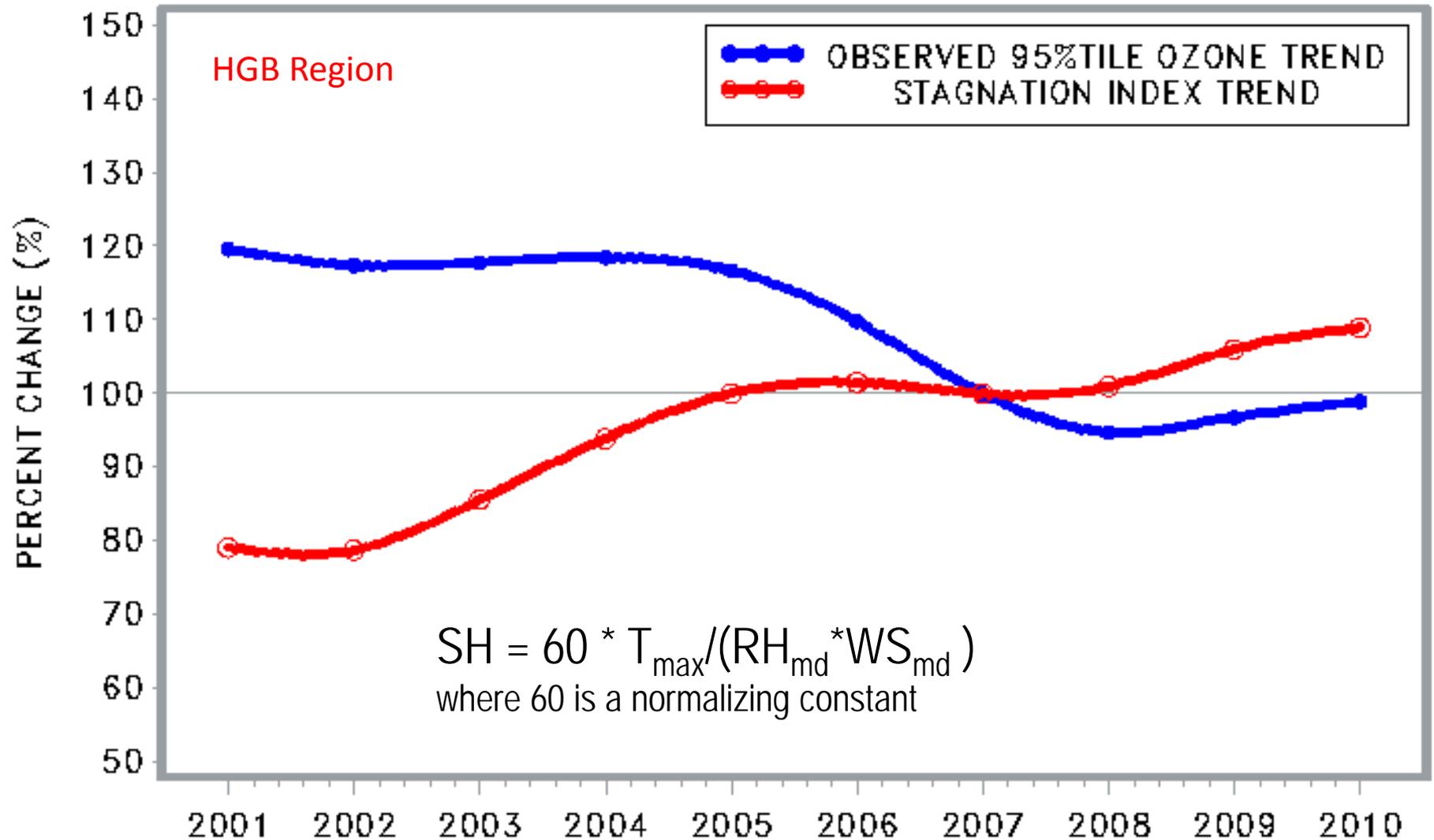
# Observed vs met-adjusted 95<sup>th</sup> pCTL ozone



# Observed vs met-adjusted 95<sup>th</sup> pCTL ozone



# 95<sup>th</sup> pCTL ozone and Stagnation Index (SH)



# Conclusions

Year to year changes in number of ozone exceedances the result of meteorological variability.

Long-term reductions in peak ozone and number of ozone events most likely the result of emissions reductions.

Reductions in number of HRVOC emission events on “favorable” ozone days also beneficial (as shown by fewer NTOCs).

Houston does not show large decrease in ozone resulting from recent economic recession.

Decrease in number of ozone events persists despite increase in stagnation index (SH).

## Acknowledgments:

TCEQ and EPA for financial support.

## Disclaimer:

These results have not been subject to the US EPA's or TCEQ scientific and policy review and therefore do not necessarily reflect the views of these Agencies and no official endorsement should be inferred.