Corroborative Analysis and Weight of Evidence

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Corroborative analysis

- Data analysis: ozone trends and their causes
- Modeling: insights from dynamic emission sensitivities

Predicted 2018 Design Values with control strategies (25% HECT cap cut and VMEP)

- BAYP: 86.8 ppb
- DRPK: 87.9 ppb

- EPA guidance states that weight-of-evidence demonstration is allowed when the future design value is at or below 87.9 ppb.

Chapter 5: Corroborative analysis

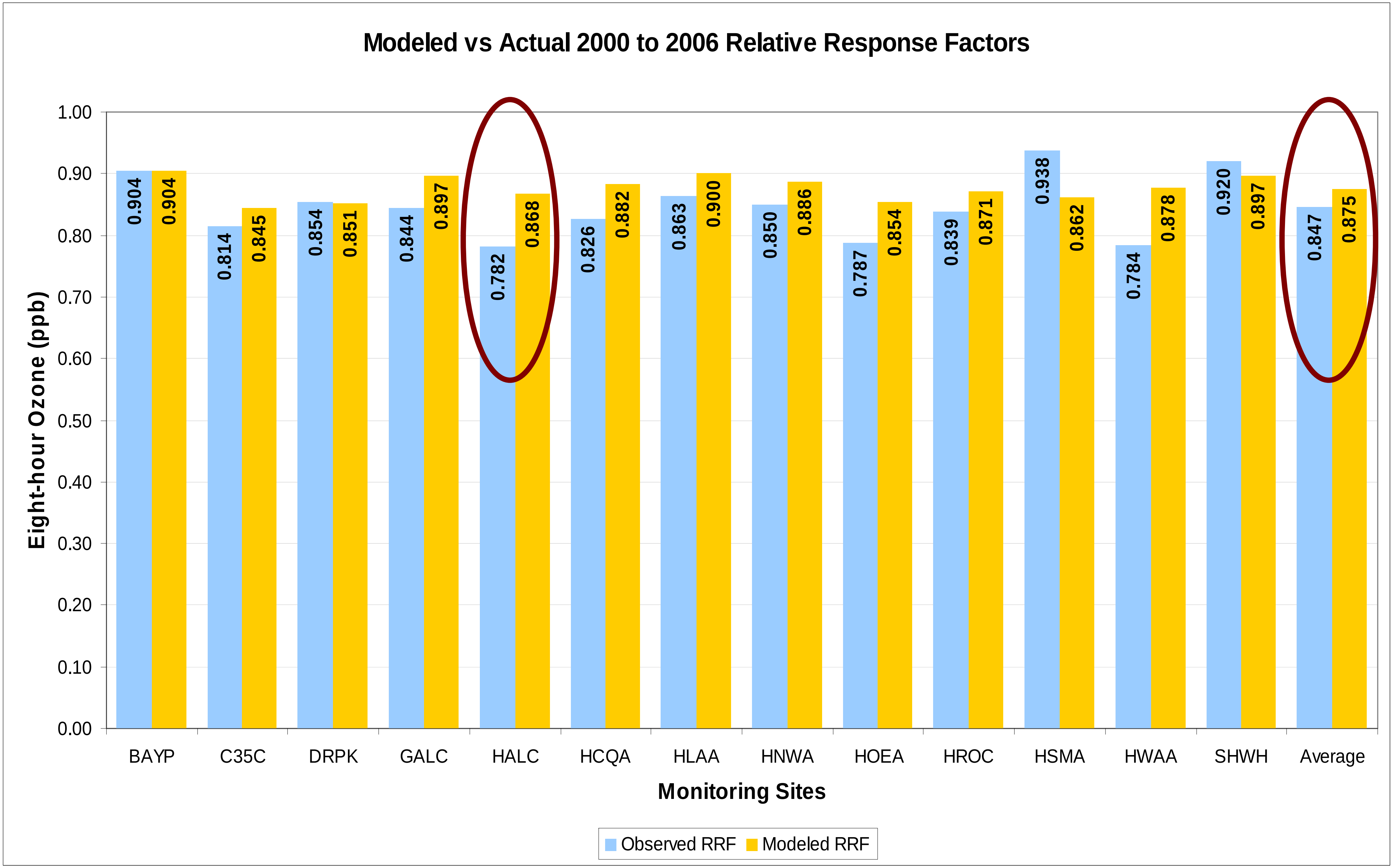
- Modeling discussion: discussion of modeling issues, summary of model performance evaluations, discussion of dynamic modeling analyses and their implications.
- Air quality trend analyses: trends in ozone and its precursors, and their causes.
- Qualitative control measures.

Retrospective dynamic analysis

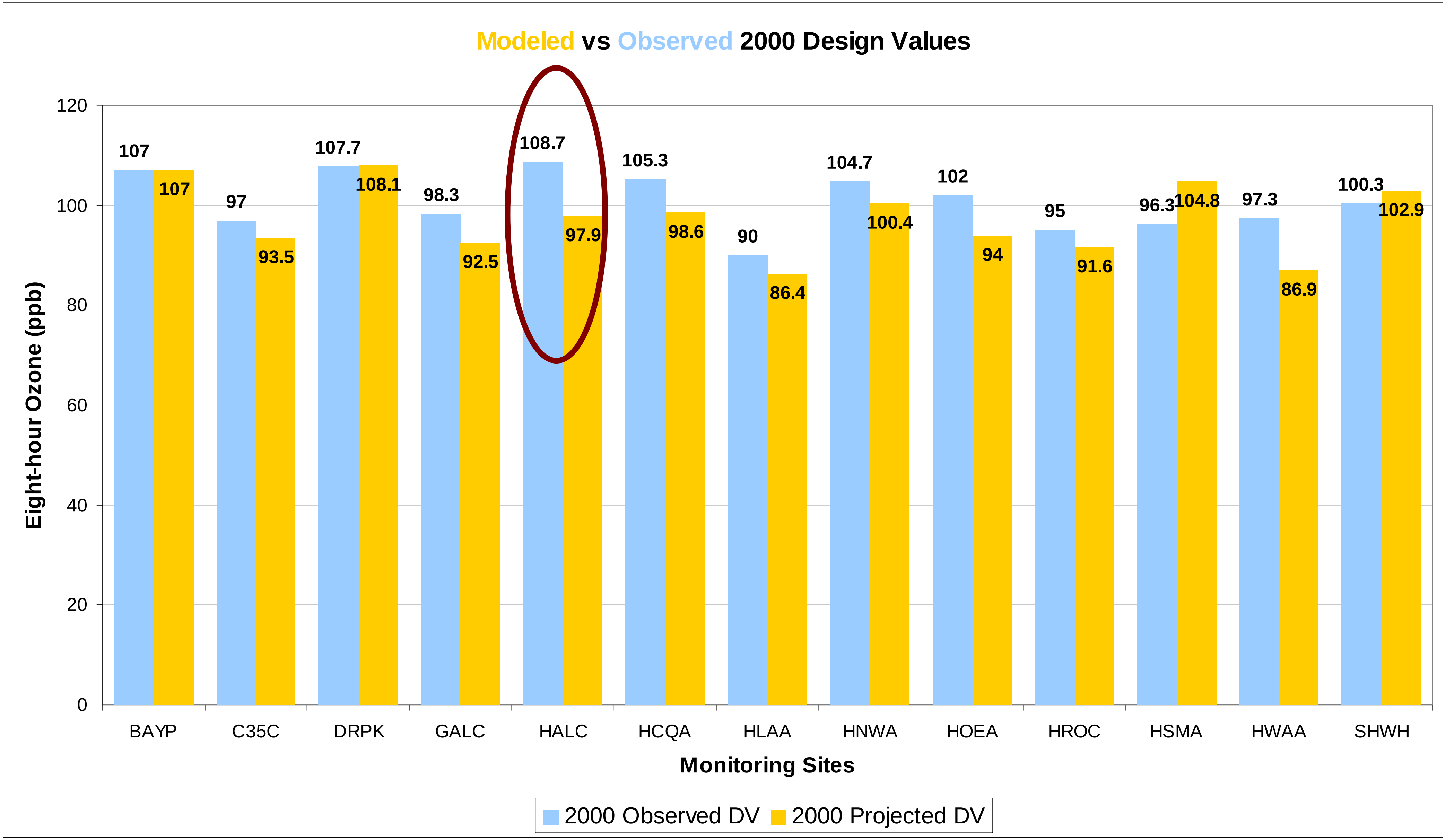
- Run CAMx for 2006 emissions and 2000 emissions; quantify how the model responds to the emissions change by calculating a relative response factor.
- Examine ozone monitoring data for the same period; quantify how the real world responded to the emission changes between 2000 and 2006 by calculating a relative response factor.
- Compare the two, to see if the model responds like the real world.

Retrospective dynamic analysis

- Calculate the modeled design value and the observed design value, using the corresponding relative response factors.
- Compare the two, to see how well the model “predicts” the 2000 DV.



HALC (Aldine) had the highest DV in 2000, and the model underestimates its response to emission changes, as it does the overall average.



Projected DVs calculated as 1/RRF. If model did not respond enough to emission changes, Observed DV > Projected DV. At most sites, model didn't respond enough (3.6 to 10.8 ppb under-response). At three sites, model over-responded (0.4 to 8.5 ppb).

Retrospective findings: Caveats

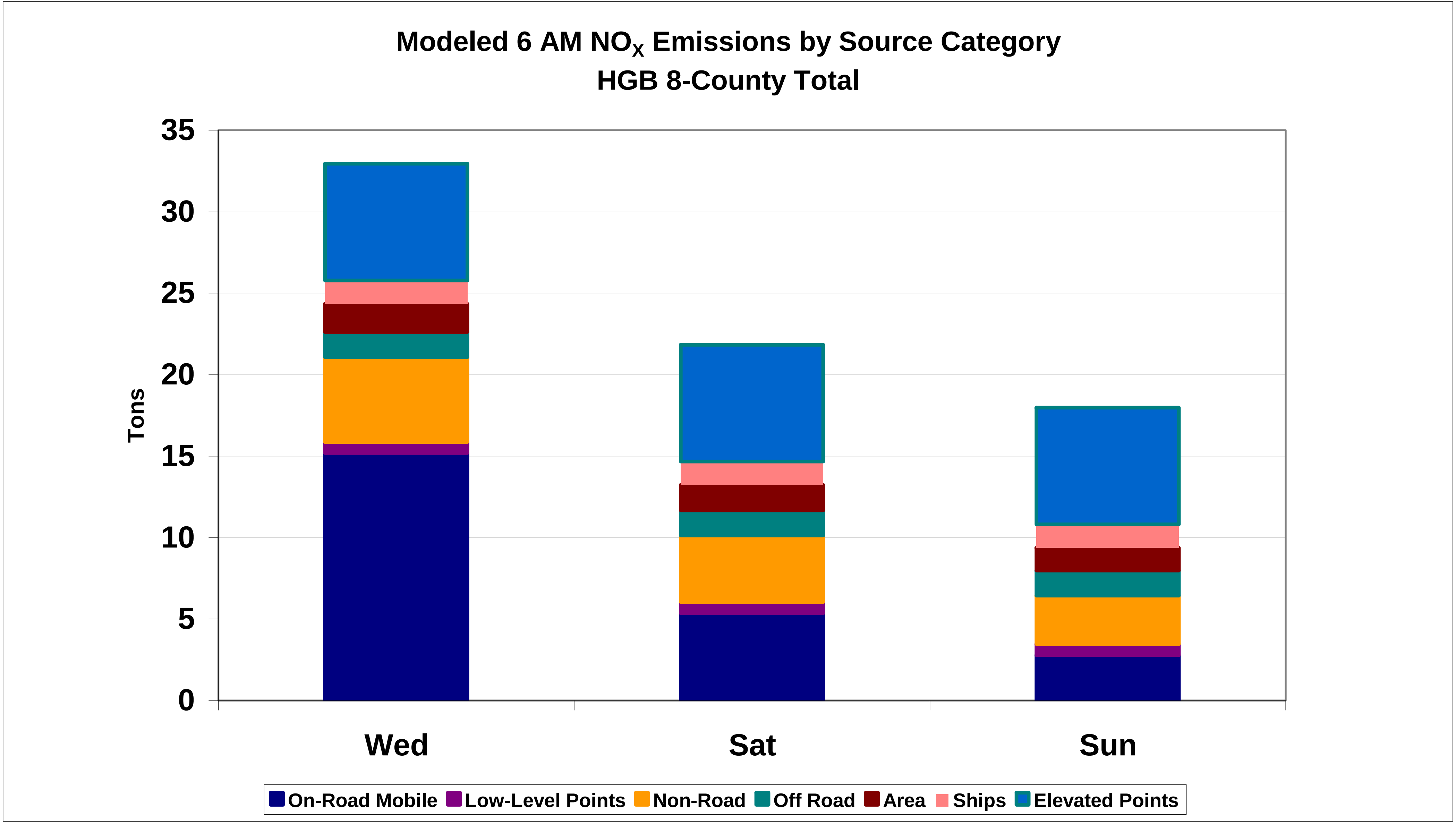
- Emission change between 2000 and 2006 is an estimate—actual change isn't precisely known.
- Retrospective emission scenario uses simulated meteorology from 2005-2006; observations are based on real world weather in 2000, which was different.

Retrospective findings

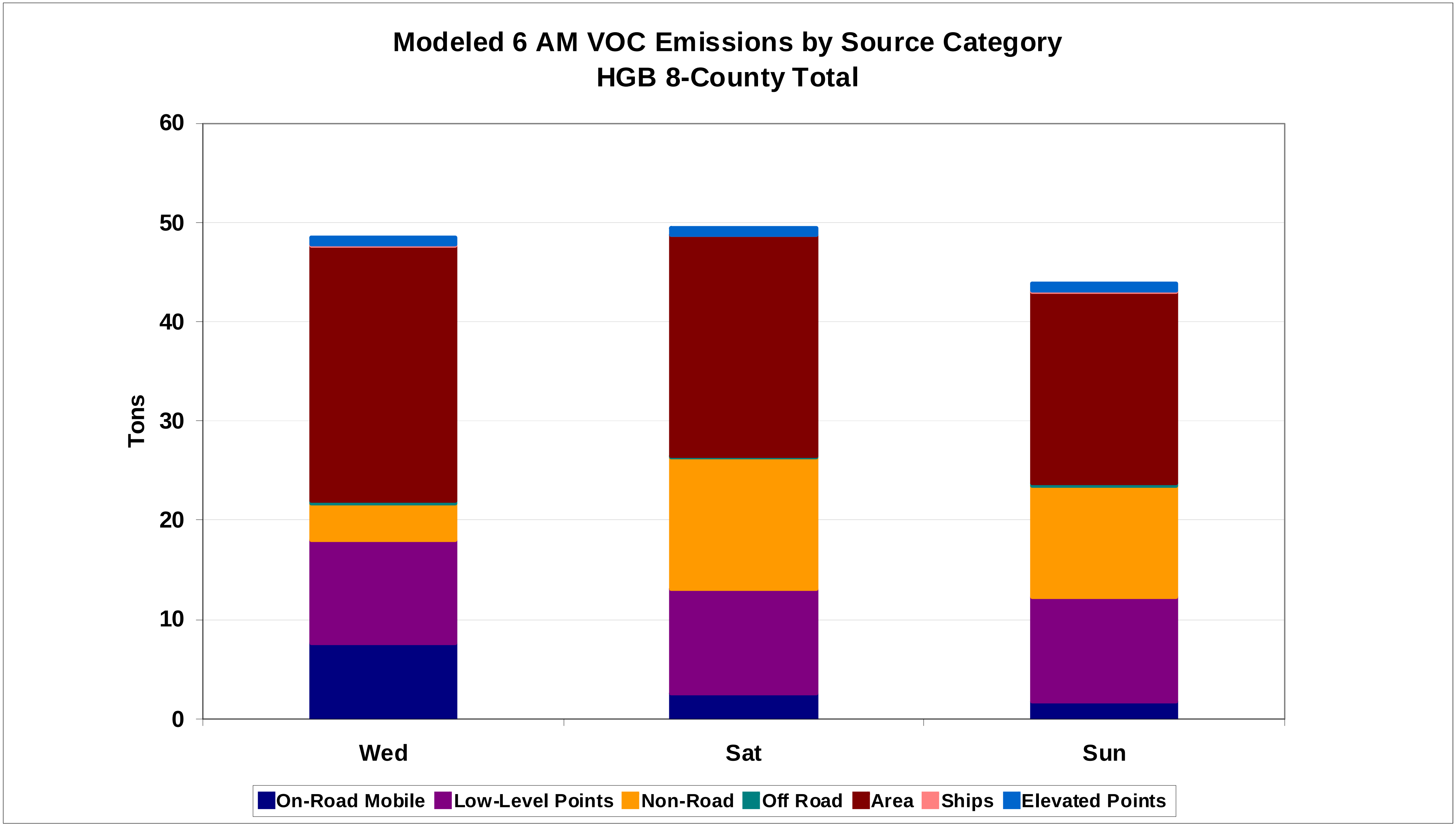
- In general, model responds *less* than the real world to the emission change that occurred between 2000 and 2006.
- This finding suggests that the modeled ozone response to the proposed emission changes between 2006 and 2018 may be less than the actual observed ozone changes.
- In other words, the real world is likely to respond more strongly to emission reductions than the model has responded.

Weekend effect dynamic analysis

- Run CAMx for all episode days with Wednesday emissions; run it again with Sunday emissions.
- Calculate the difference for each day between the Wednesday run and the Sunday run, to see the effect of reduced mobile source NOx emissions during the weekend.
- Compare to the actual differences between Sunday and Wednesday ozone observed in Houston, to see if the model responds to NOx emission reductions in the same way as the real world.

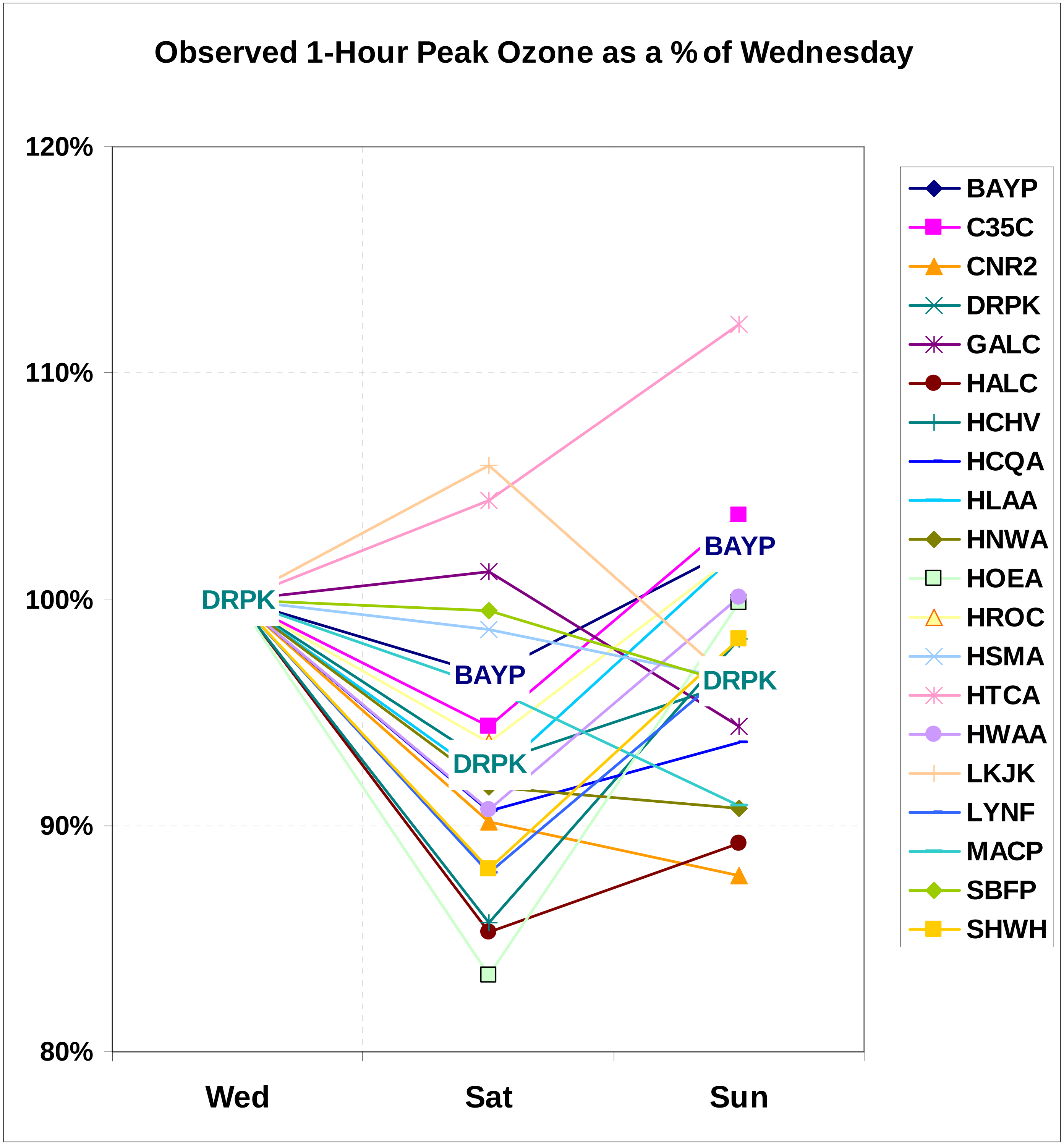


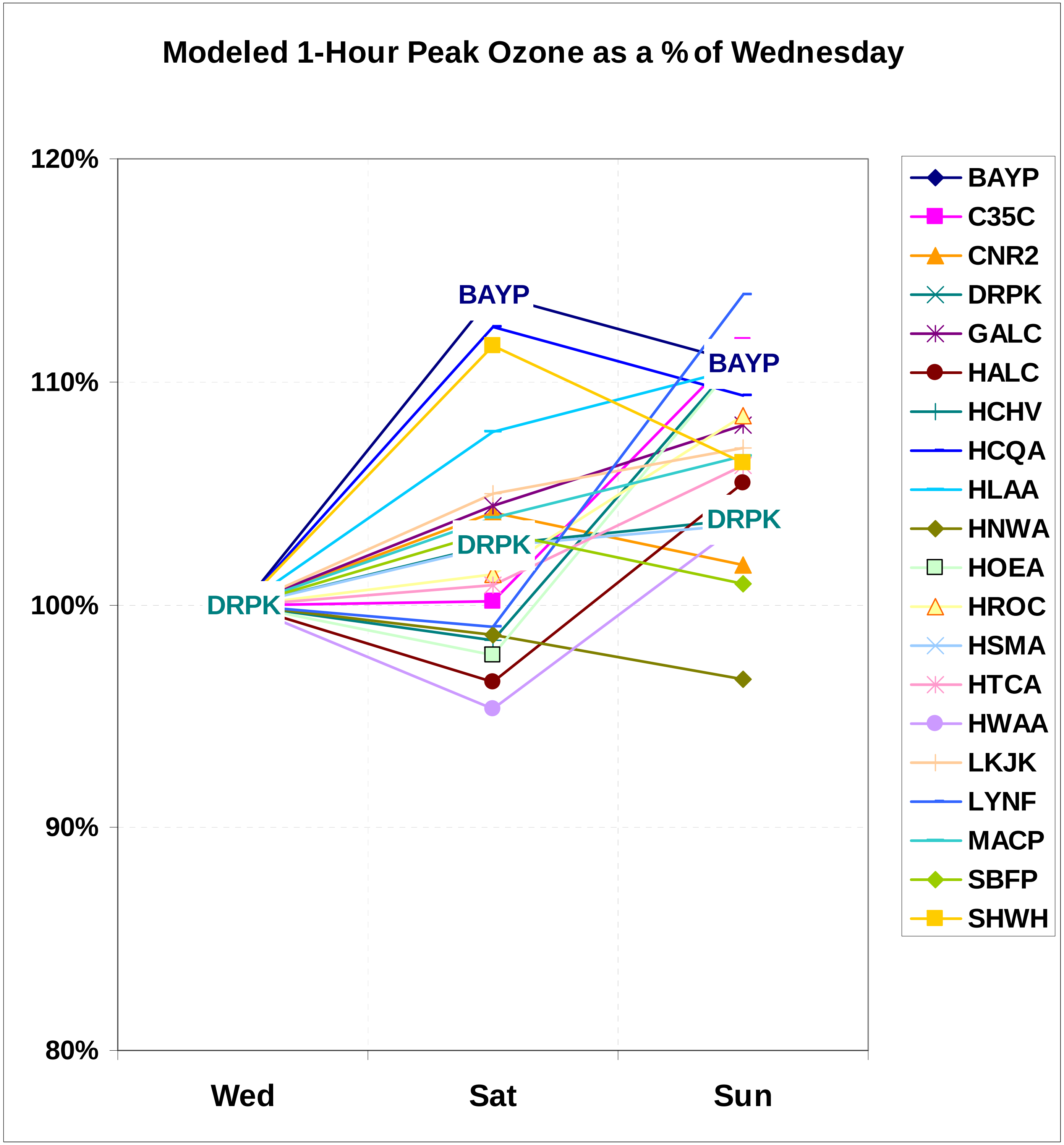
Modeled 6 AM NO_X Emissions by Source Category
HGB 8-County Total
35
30
25
20
15
10
5
0
Tons
Wed
Sat
Sun
On-Road Mobile
Low-Level Points
Non-Road
Off Road
Area
Ships
Elevated Points



VOC emissions barely change on the weekends, whereas NOx emissions change considerably.

What is the effect of the weekend change in (mobile) NOx emissions on Houston’s ozone?


Observed 1-Hour Peak Ozone as a % of Wednesday
120%
110%
100%
90%
80%
Wed
Sat
Sun
DRPK
BAYP
DRPK
BAYP
DRPK
BAYP
C35C
CNR2
DRPK
GALC
HALC
HCHV
HCQA
HLAA
HNWA
HOEA
HROC
HSMA
HTCA
HWAA
LKJK
LYNF
MACP
SBFP
SHWH



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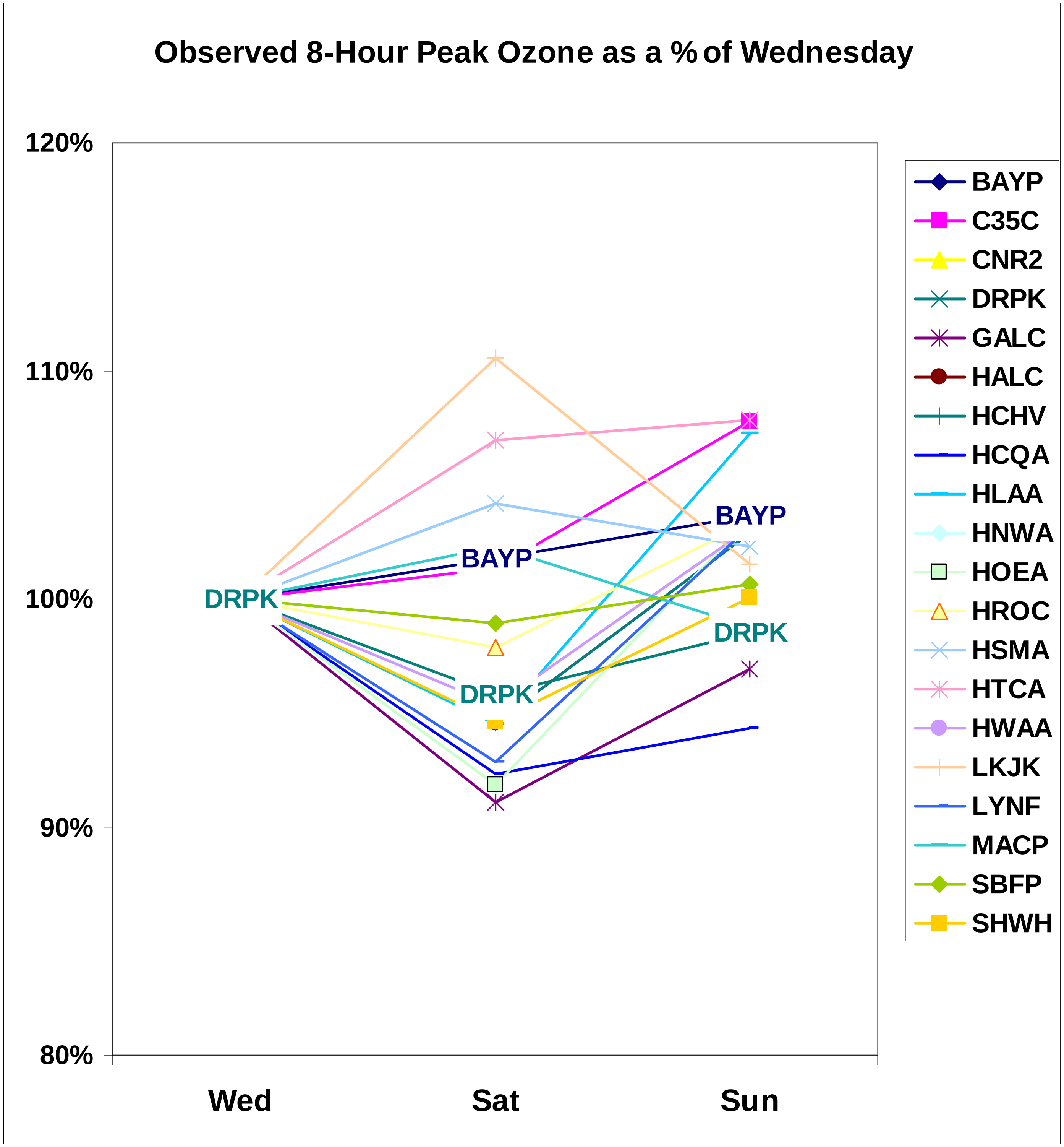
Observed 8-Hour Peak Ozone as a % of Wednesday
120%
110%
100%
90%
80%
Wed
Sat
Sun
DRPK
BAYP
DRPK
BAYP
DRPK
BAYP
C35C
CNR2
DRPK
GALC
HALC
HCHV
HCQA
HLAA
HNWA
HOEA
HROC
HSMA
HTCA
HWAA
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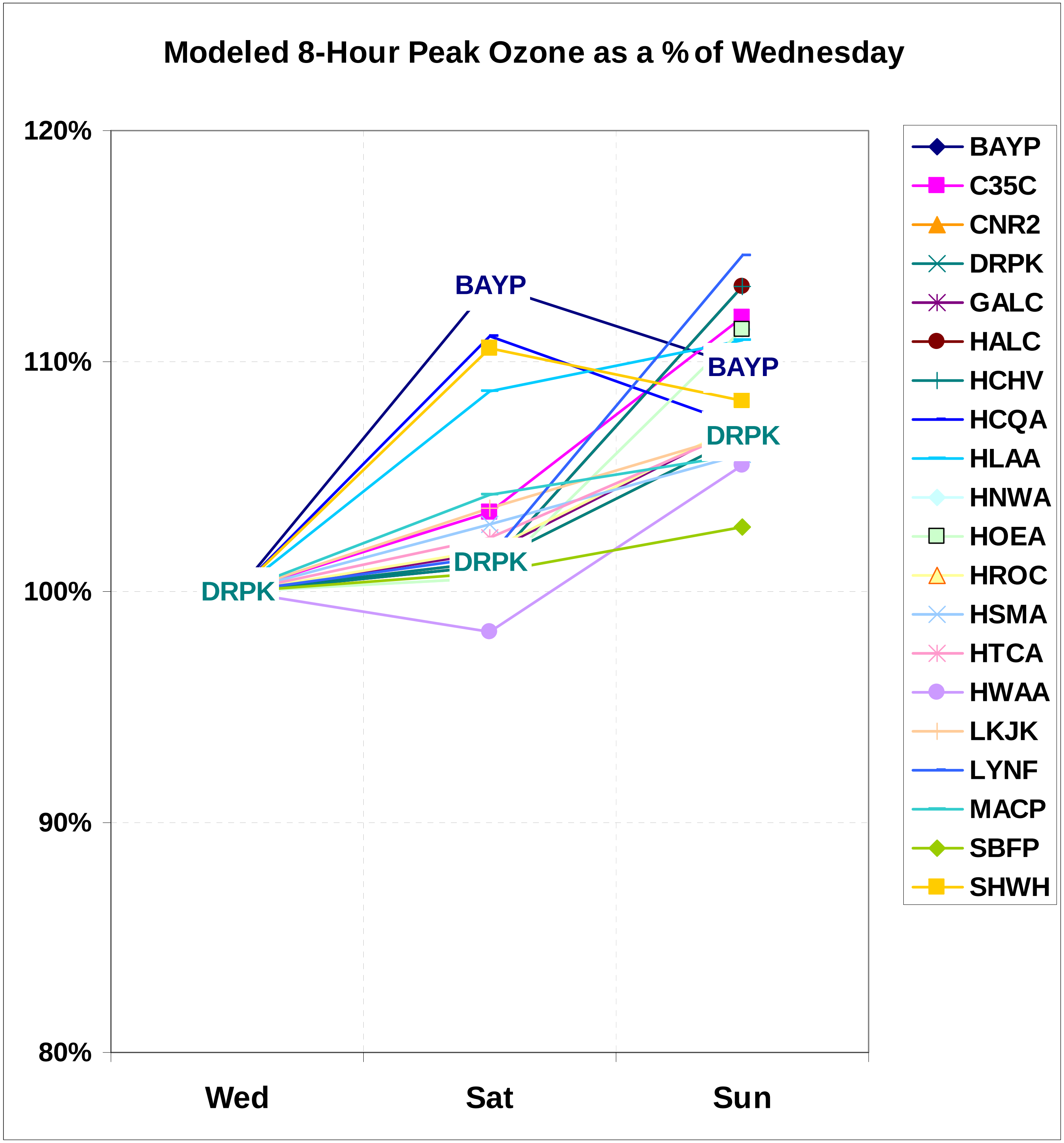

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Weekend effect sensitivity

- Modeled ozone *increases* slightly with decreasing mobile NOx.
- Observed ozone *decreases* slightly with decreasing mobile NOx.
- Therefore, observed ozone is apparently more sensitive to mobile NOx reductions than the modeling.

Modeling Corroborative Analysis Conclusions

- “The photochemical grid model performed by the TCEQ for this SIP revision has been rigorously evaluated against observational data. While there are a number of shortcomings that this modeling has in common with other modeling exercises in the HGB area, *modeling for many of the simulated ozone days appears to behave in a manner consistent with most of the atmospheric phenomena of interest*. Evaluation of the modeling response to emission changes appears to show that the *modeled ozone is slightly less responsive to emission changes than the observed ozone*. Thus, modeling of 2018 emissions with the proposed control package in place may overpredict the future ozone concentrations.”

Corroborative analysis conclusions

- Ozone trend analyses show that ozone has decreased significantly since the late 1990s. Meteorological variations alone cannot explain the significant downward trend. Decreases in background ozone cannot explain the downward trend either. Significant decreases in ozone precursors, however, coincide with the decreases in ozone, indicating that the ozone decreases observed in the HGB area are due to local emission controls.
- Additional air quality improvement measures are being adopted in the HGB area that cannot be included in the photochemical modeling analysis because they cannot be accurately quantified. These additional measures can provide additional assurance that the HGB area is on the path toward attainment.
- *Based upon the photochemical grid modeling results and these corroborative analyses, the weight of evidence indicates that the HGB area will attain the 1997 eight-hour ozone standard in a timely manner.*

For further reading…

- Chapter 5 summarizes the Corroborative Analysis and Weight of Evidence.
- TCEQ Conceptual Model discusses the air quality trends and flow regimes (Attachment to Chapter 3 of the proposed HGB Attainment SIP).
- TCEQ model performance evaluations can be found in Chapter 3, Appendix C, and Appendix I.