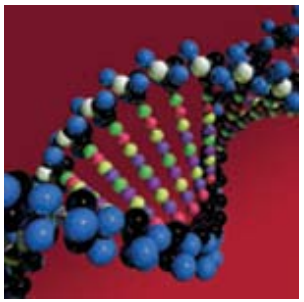
2012 Ozone Modeling Summary


Presentation to the NETAC Policy Committee

March 12, 2010

Sue Kemball-Cook and Greg Yarwood
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skemballcook@environcorp.com

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Outline of Today's Presentation

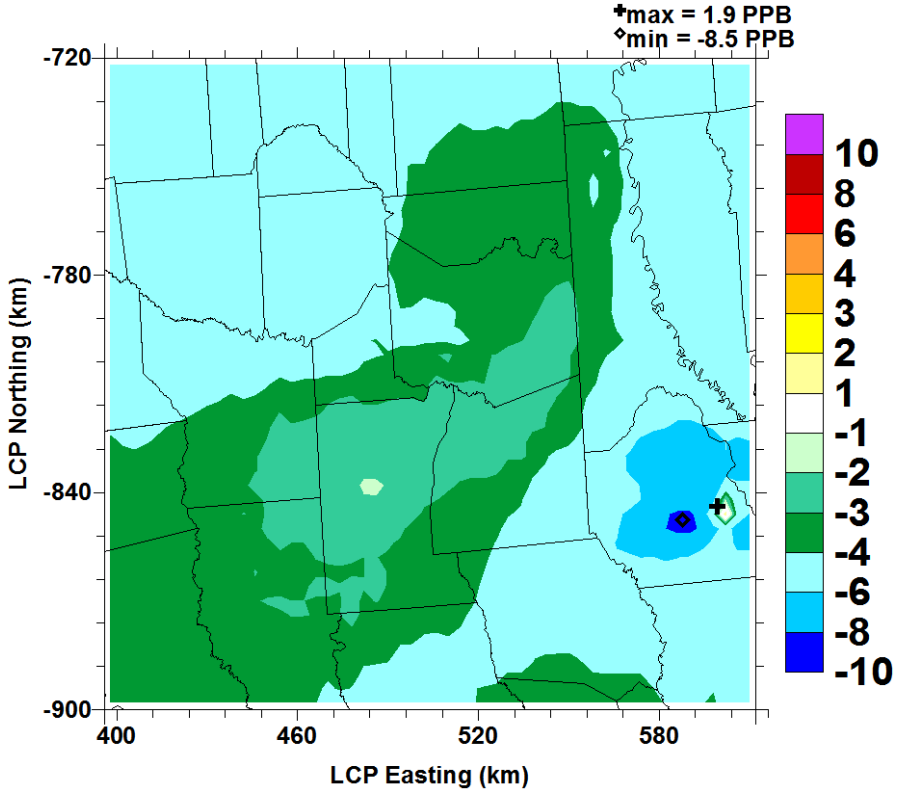
- Brief description of 2005/2012 modeling strategy
- Ozone projections for 2012
- Analysis of the relative impacts of local and distant sources of emissions on Northeast Texas ozone
- Potential Northeast Texas ozone impacts from
  - Natural gas development in the Haynesville Shale
  - East Texas Combustion Rule

NETAC Ozone Model Background

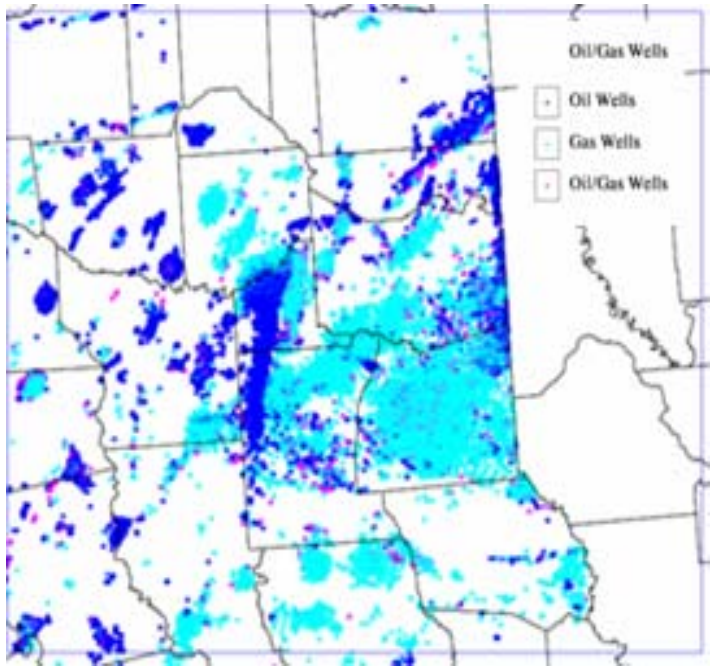
- Perform future year modeling that shows emissions reductions leading to attainment of the ozone standard
- Modeled 2005 base year, evaluated against observations of ozone and precursors
  - 2005 model performed well, and is suitable for use in SIP planning and control strategy development
- 2012 is the future year modeled with CAMx
  - 2005 meteorology and biogenic and fire emissions
  - Developed emission inventory for human activities for 2012
- How do 2005 to 2012 emission changes from human activities affect Northeast Texas ozone?

Change in 8-Hour Ozone: 2012-2005

Episode Average Difference In Daily Max 8-Hour Ozone



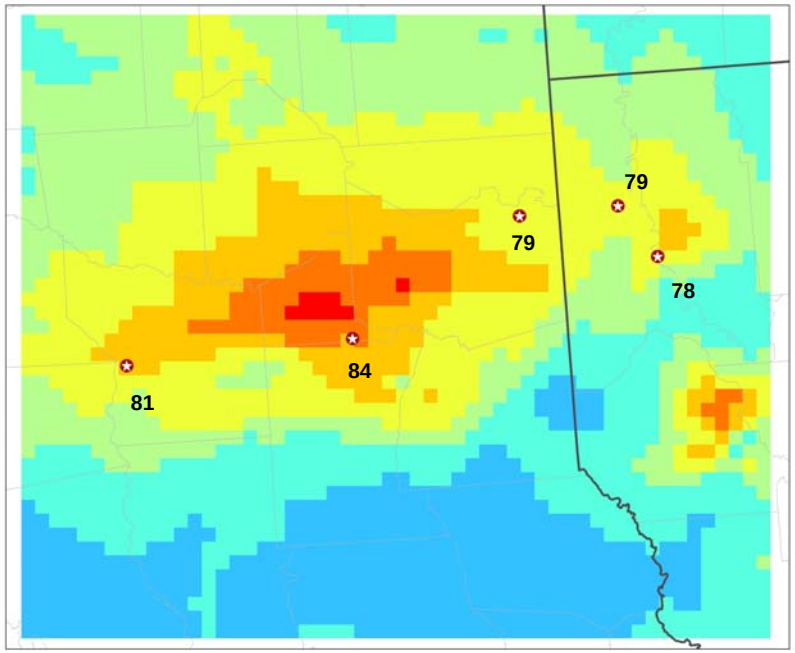
TCEQ Map of 2005 Oil And Natural Gas Wells

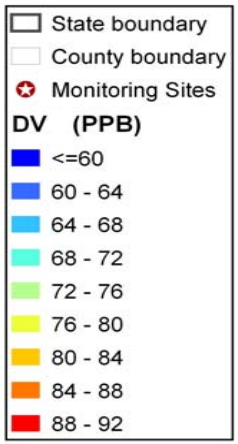


- Regional ozone reduction of 4-6 ppb in 2012
- Smaller ozone reductions in oil and gas production region
- Reduction in Dolet Hills (LA) power plant NOx emissions

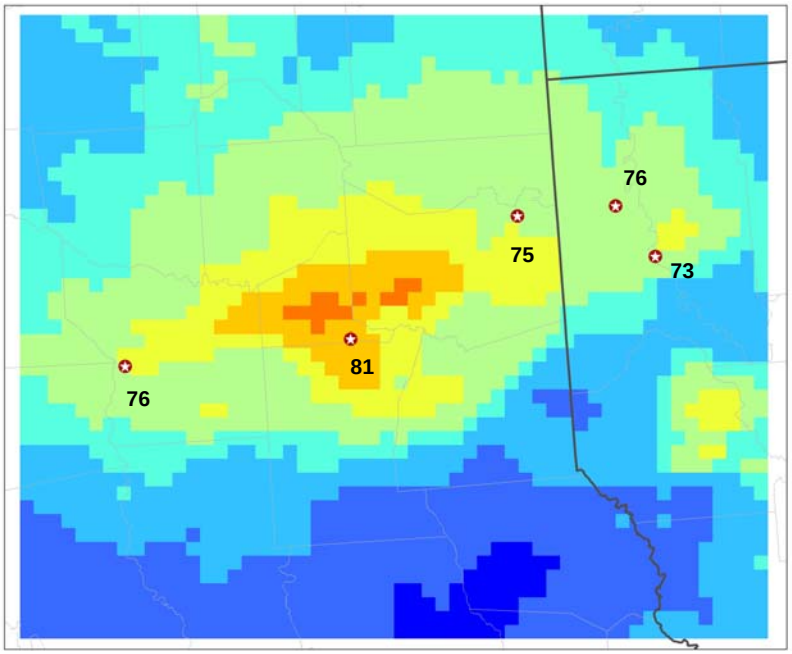
8-Hour Ozone Design Value Projections

2005 MATS Design Value



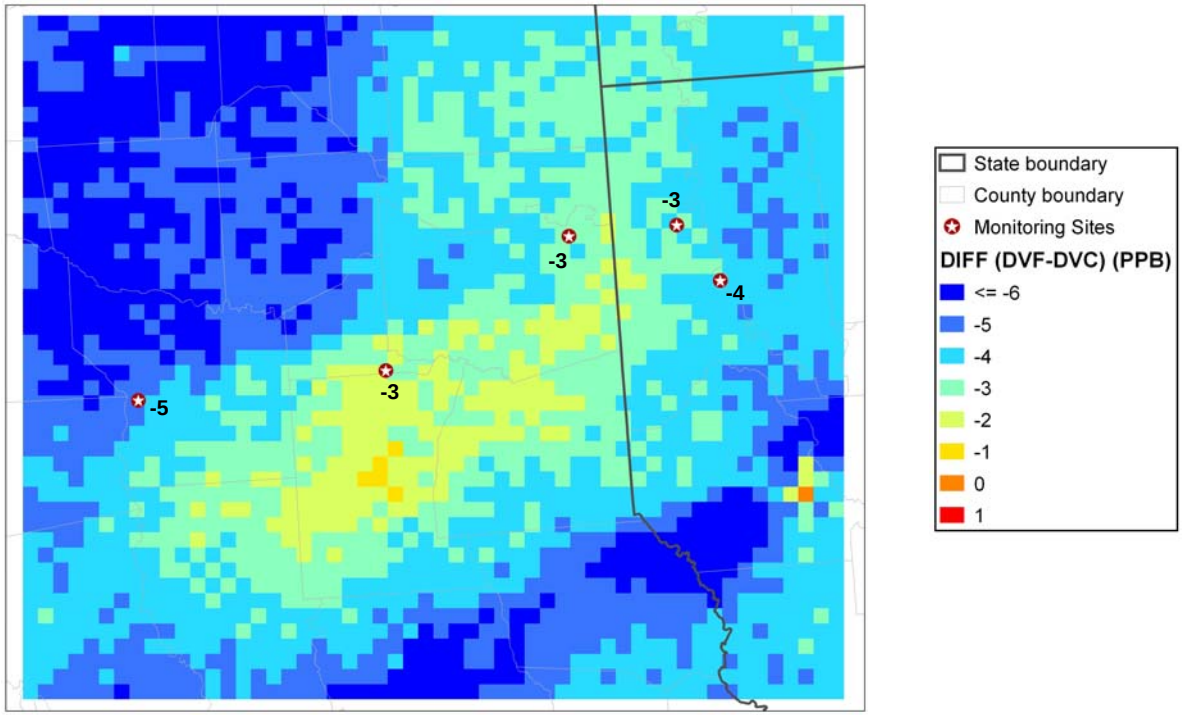


2012 MATS Design Value



- Yellow and red indicate DV > 75 ppb: violation of 2008 standard
- Regional reductions in DV going from 2005 to 2012
- 2of 3 Northeast Texas monitors exceed the 2008 ozone standard in 2012 (Longview=81 ppb, Tyler 76 ppb, and Karnack=75 ppb)

2012-2005 Design Value Difference



- Regional reduction of ~4-6 ppb in design value
- Decrease is smaller in area of intensive oil and gas development and production
- Haynesville Shale emissions are not included in this baseline 2012 run

Compare Modeled and Observed Ozone Trends in Northeast Texas

- Between 2005 and 2009, observed DV decreased for all three Northeast Texas monitors
  - Modeled DV 2005 to 2012 decrease smaller than observed 2005-2009 decrease
- After 2009, all three Northeast Texas monitors attain the 75 ppb standard
  - *Model projects non-attainment in 2012 for two of the three monitors*
- Why is this? Is this model a useful tool for control strategy development?

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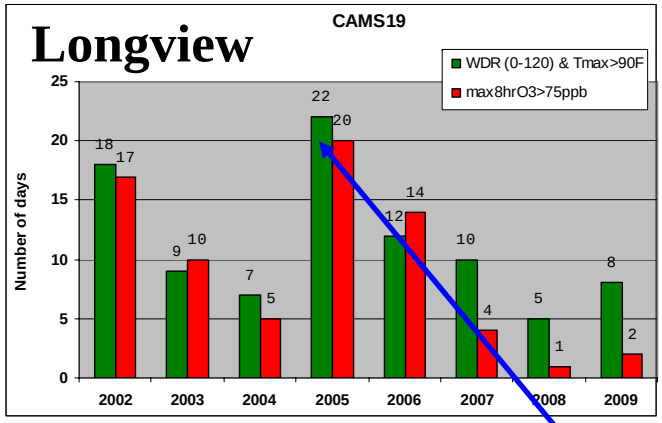
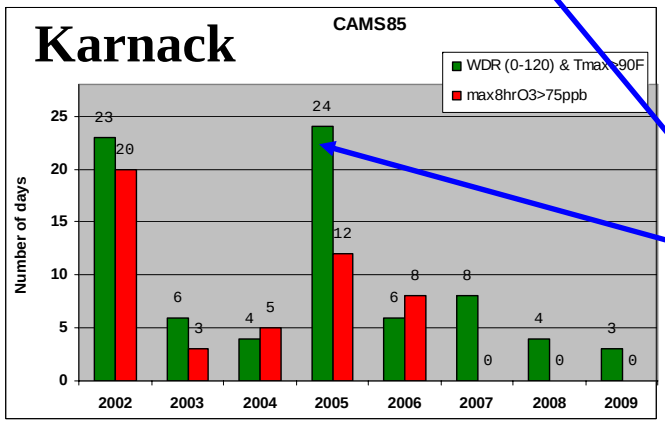
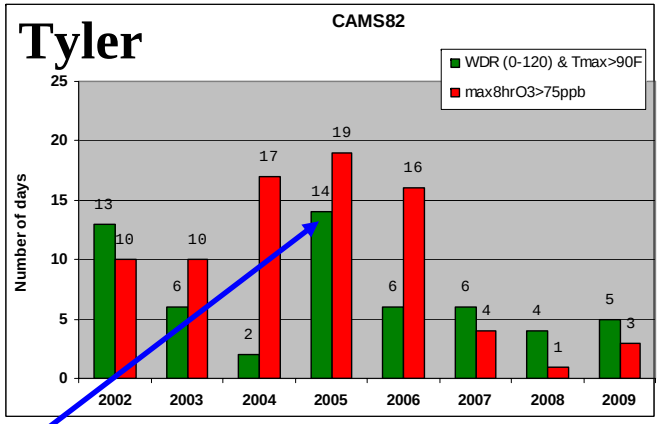
Potential Factors

- 2012 inventory does not account for the effects of the recent economic slowdown
  - Area sources are the only category with increasing NOx emissions from 2005 to 2012
    - Area source oil and gas emissions in 5-county area extrapolated from 2005-2008 TRRC data, so do not include effects of slowdown in 2009, but also do not include Haynesville Shale emissions
- 2005 was an unusually severe year in terms of weather conditions
  - 2006-2009 years had fewer days when weather was conducive to high ozone in Northeast Texas

Weather and Ozone: 2005-2009





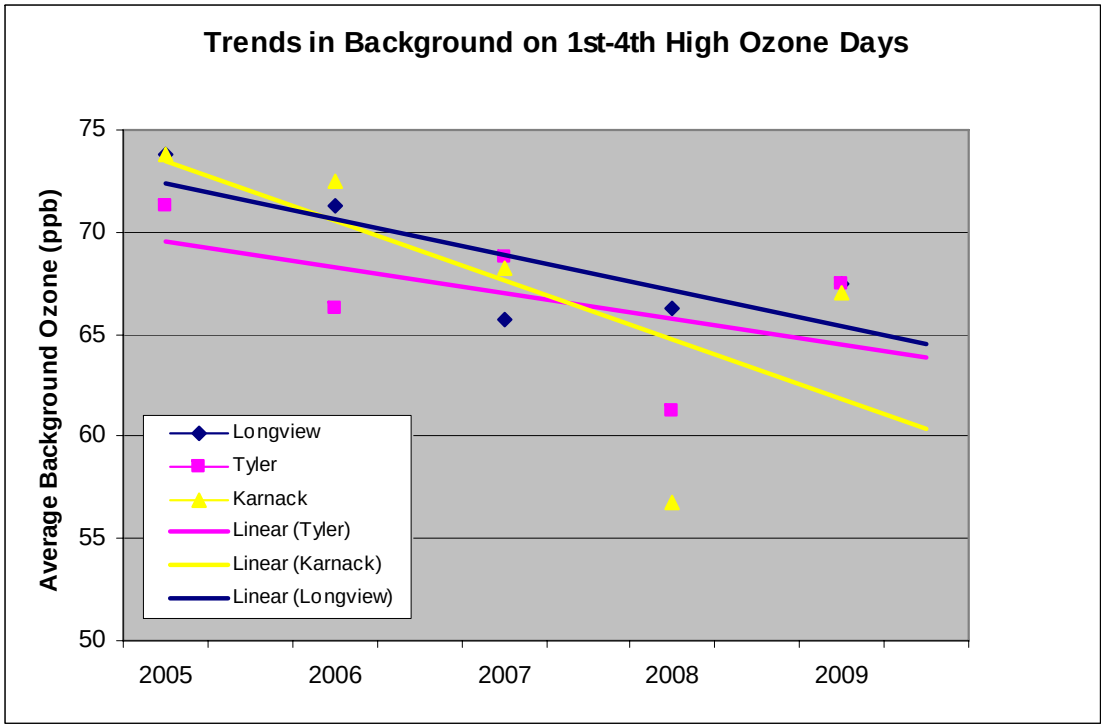


2005 had more days with weather favorable to ozone formation than any year during 2006-2009

Green Bars: # days with weather conditions favorable for ozone Formation

Red Bars: # of high ozone days

Trends in Diagnosed Background Ozone



- Average the peak background ozone on the four highest ozone days each year, look at trend from 2005-2009
- Background ozone declining, ~4-7 ppb decrease from 2005-2009
  - Consistent with modeling results

2012 Ozone Projections: Summary

- Model predicts nonattainment of 75 ppb standard for Longview and Tyler in 2012; Karnack attains the standard
  - 2005 had unfavorable meteorological conditions which have not repeated during 2006-2009 period, but could recur
- Modeled decrease in background ozone is consistent with observed trends
- Local NOx emissions decrease overall from 2005-2012, but area source emissions increase, lessening effects of regional ozone reductions within 5-County area
  - Results emphasize importance of oil and gas sources to regional air quality
- Model results are reasonable given trends in observed ozone and emissions and can be used to assess effects of emissions growth as well as control strategies

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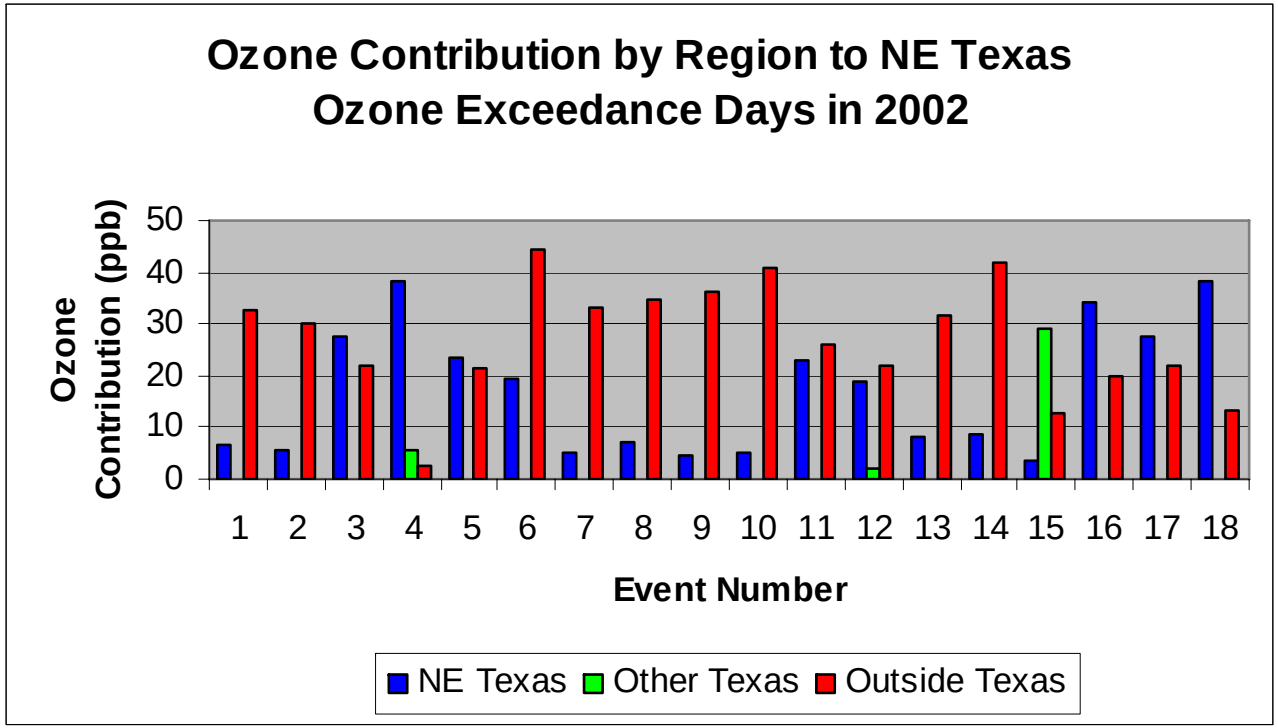
Ozone Transport: Background

- NETAC analyses (e.g. aircraft flights, modeling) have shown that the area can be brought to the brink of an exceedance of the 75 ppb standard through transport alone
  - Revised lower standard will enhance importance of transported background ozone
  - How helpful are local control strategies in achieving attainment of the ozone standard?
- Assess role of transport of ozone and precursors from regions outside of Northeast Texas on high ozone days
- Compare previous NETAC 2002 model results with new 2005/2012 model results

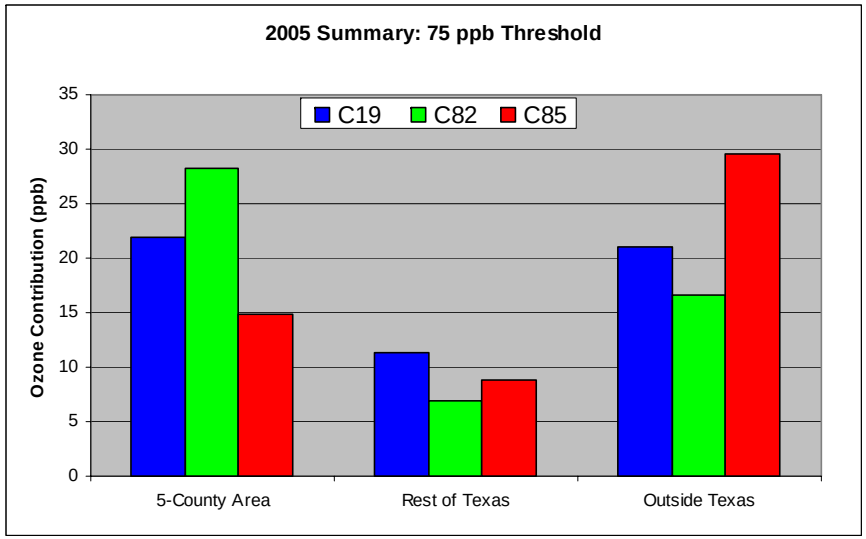
Previous 2002 Ozone Transport Analysis



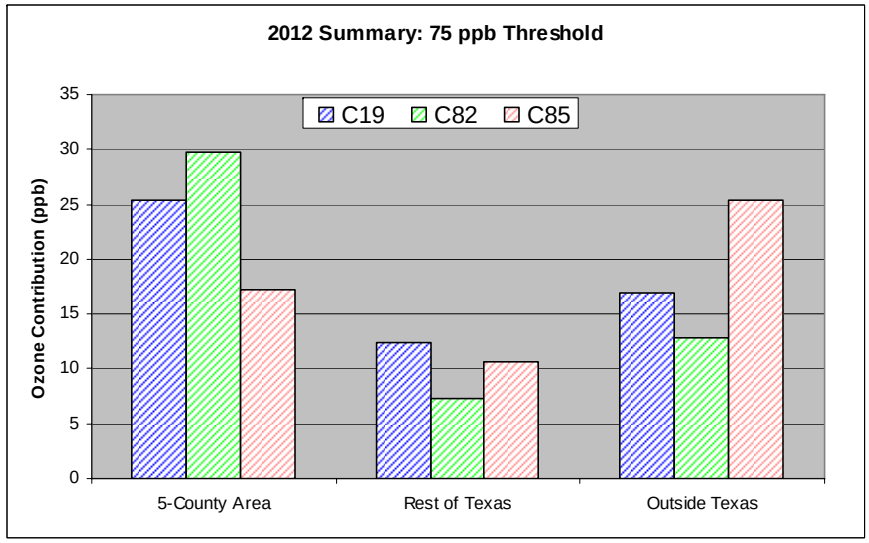
- NETAC May-September 2002 Seasonal Model, 36/12 km grid
- In 11 of 18 events, sources outside TX contributed more to high NE TX ozone than local sources
  - Both local sources and transport are important
  - Transport usually from outside Texas

Contributions to Ozone at Monitors When Ozone>75 ppb

2005



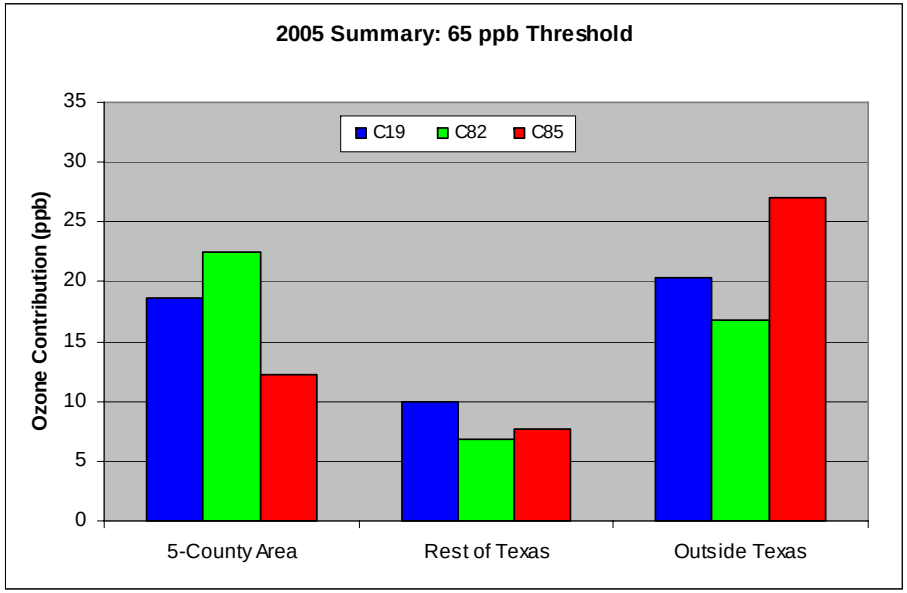
2012



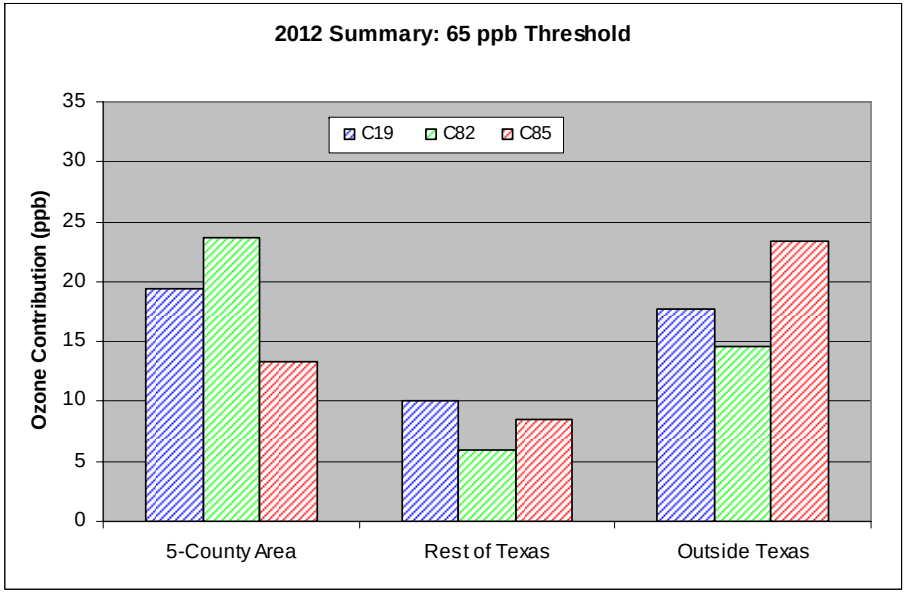
- Local sources and transport both make significant contributions
- Contribution of transport from outside Texas decreases at all three monitors going from 2005 to 2012
- Local contributions increase from 2005 to 2012 at all three monitors

Contributions to Ozone at Monitors When Ozone>65 ppb

2005



2012



- Transport from outside Texas decreases going from 2005 to 2012, but decrease is smaller with lower threshold
- Little change in transport from within Texas-less change than for 75 ppb threshold
- Local source contributions show small increases at all three monitors
  - Increases smaller than with 75 ppb threshold

Summary of Ozone Transport

- Transported background from outside Texas decreases going from 2005 to 2012 on high ozone days and across entire episode
- On average, local contribution increased slightly going from 2005 to 2012
- 2005/2012 results consistent with 2002: both transport and local sources are important
  - Local controls can be effective, but regional strategies also required

Ozone Impacts from Haynesville Shale Development

- Evaluate the effect of the Haynesville Shale emissions on ozone levels in Northeast Texas
  - Developed emissions estimates for future Haynesville Shale, low, medium and high development scenarios
  - Used 2012 ozone model to quantify potential near-term ozone impacts of development of the Haynesville Shale
  - Emission inventory projects increases in emissions through end of inventory period in 2020

Ozone Impacts from Haynesville Shale Development

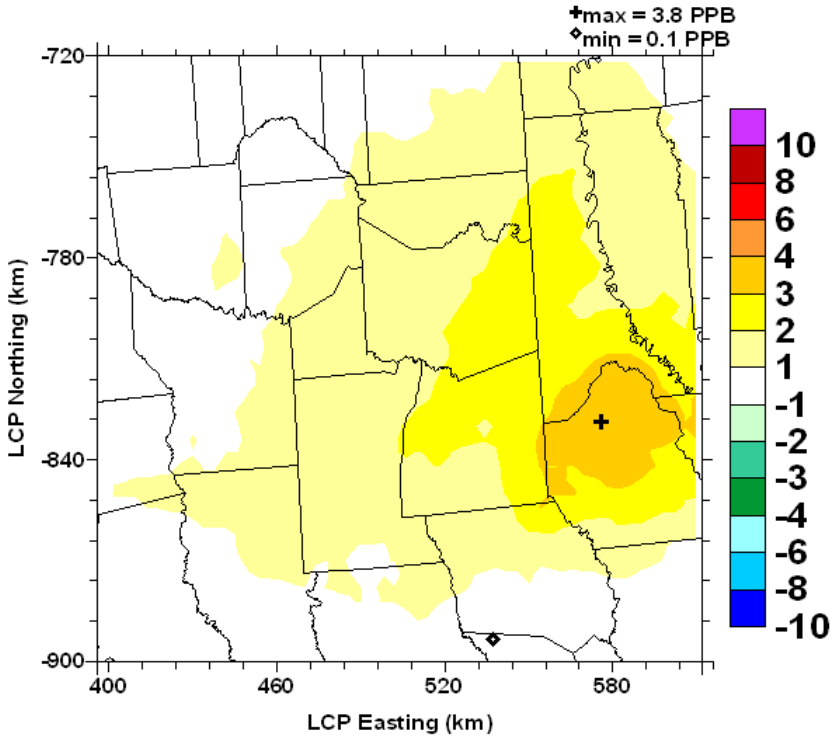
Forecast
NOx Emissions (Tons/Day)

Scenario	2012	2020
Low	61	64
Medium	82	127
High	140	267

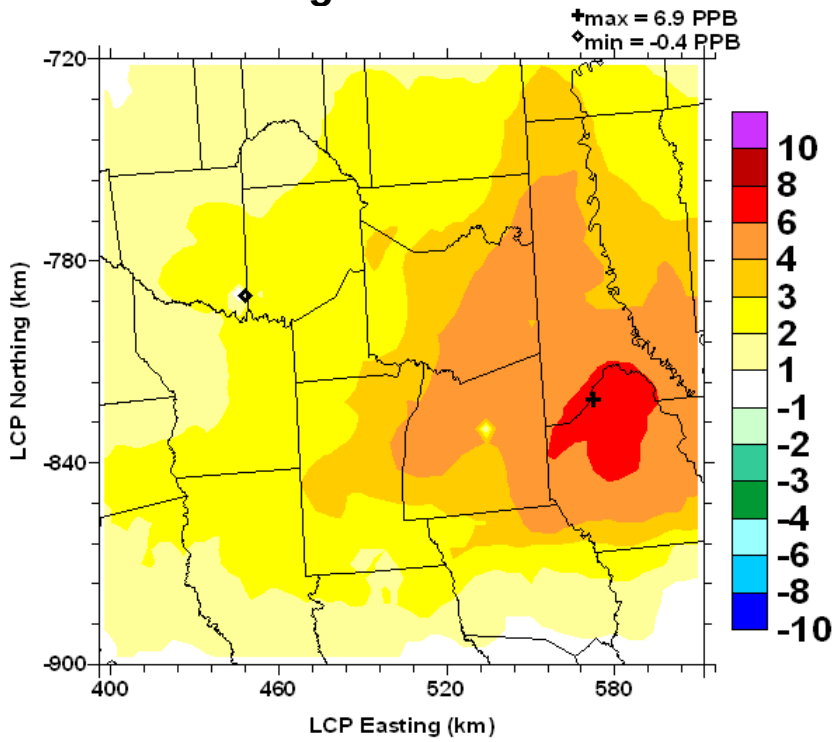
- Show results from low and high scenarios; ozone impacts from medium scenario fell between those of the low and high cases
- Emissions projections are highly uncertain, so treat as a sensitivity test

Episode Average Difference in Daily Max 8-Hour Ozone: Haynesville-Baseline, 4 km Grid

Low Scenario



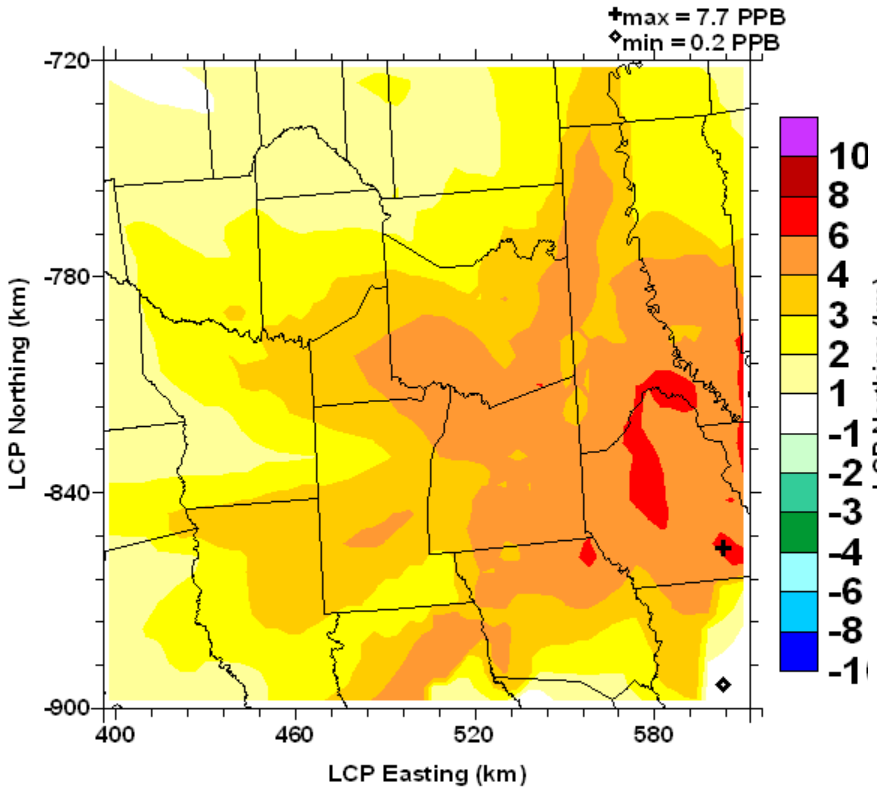
High Scenario



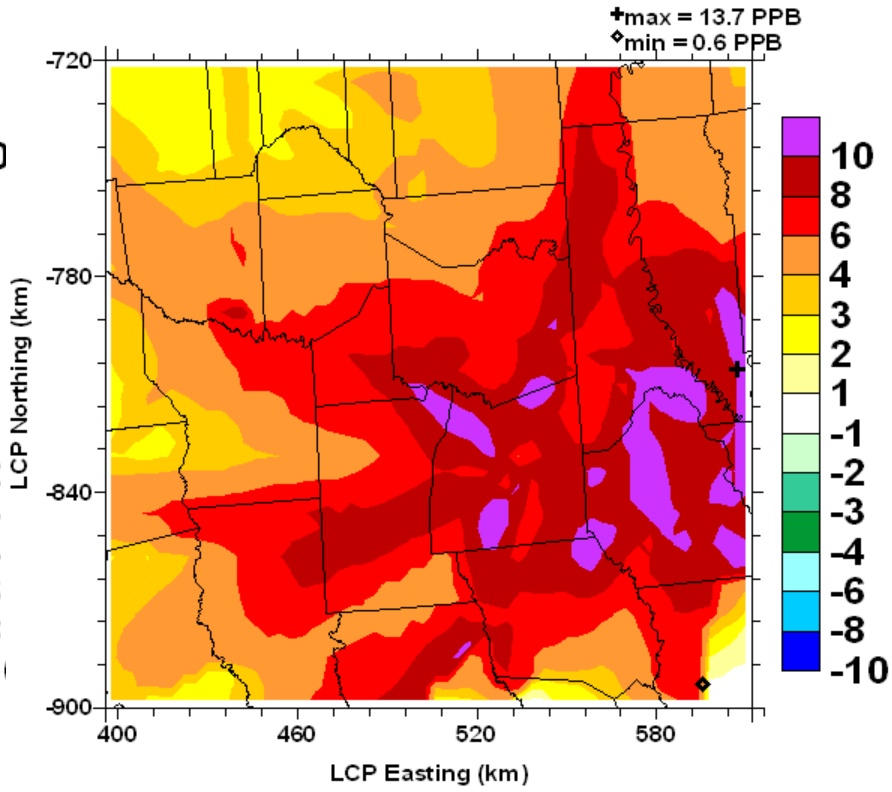
- Average 8-hour ozone impacts in Northeast Texas range from 0-6 ppb
- Largest impacts occur in Louisiana

Episode Maximum Difference in Daily Max 8-Hour Ozone: Haynesville-2012 Baseline, 4 km Grid

Low



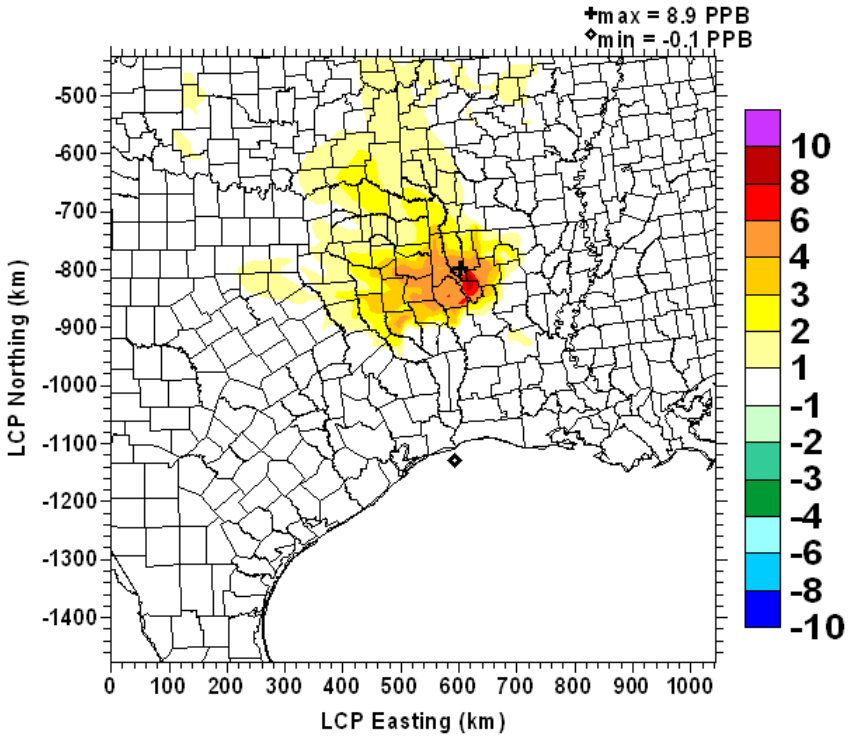
High



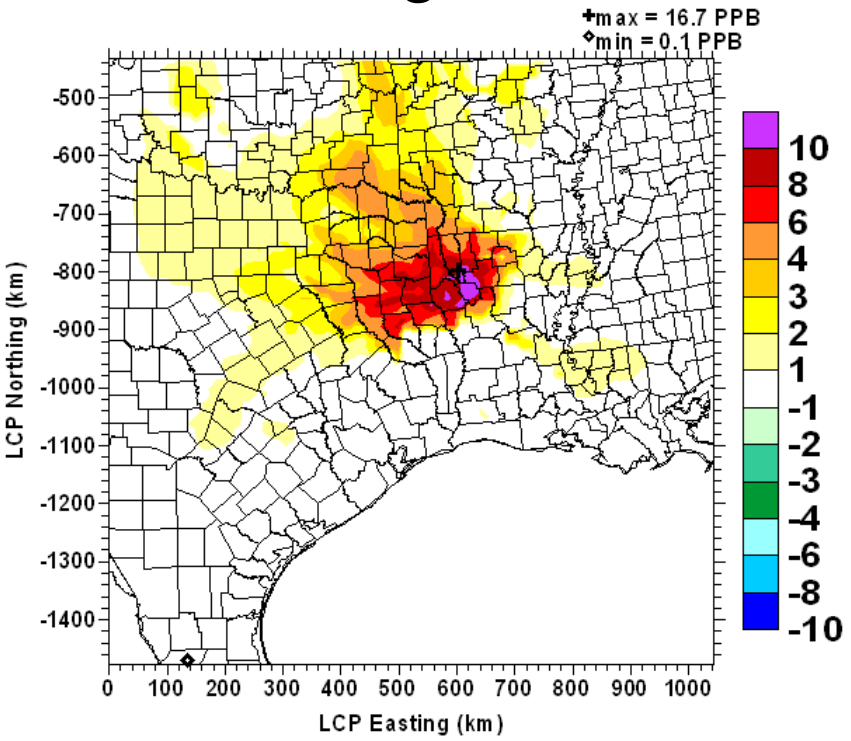
- Maximum 8-hour impacts > 10 ppb within Northeast Texas in high development scenario
- Peak Northeast Texas impacts in low scenario 6-8 ppb

Episode Maximum Difference in Daily Max 8-Hour Ozone: Haynesville-2012 Baseline, 12 km Grid

Low



High



- Maximum impacts extend well outside Northeast Texas in both low and high scenarios

Haynesville Shale Summary

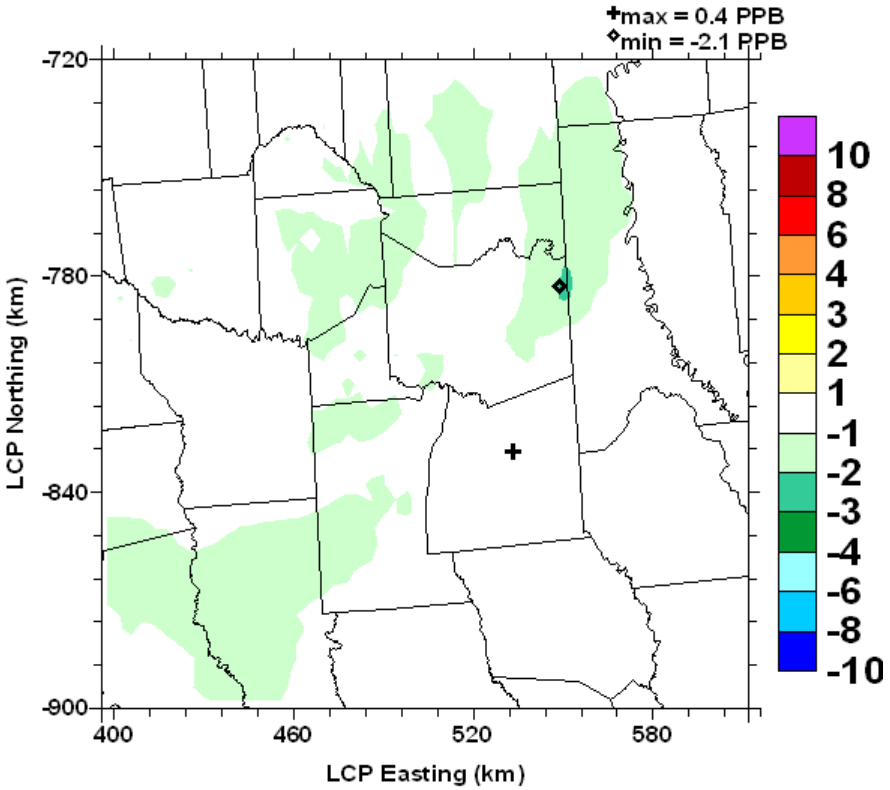
- Haynesville Shale development is an area of concern for future air quality in Northeast Texas
- Emissions scenarios here assumed minimal well site compression-this may cause NOx emissions to be underestimated
- Additional study is required and would benefit from more data regarding well site compression, well decline curves, etc.
  - Input from energy companies would be very useful in constraining the emissions projections

East Texas Combustion Rule Test

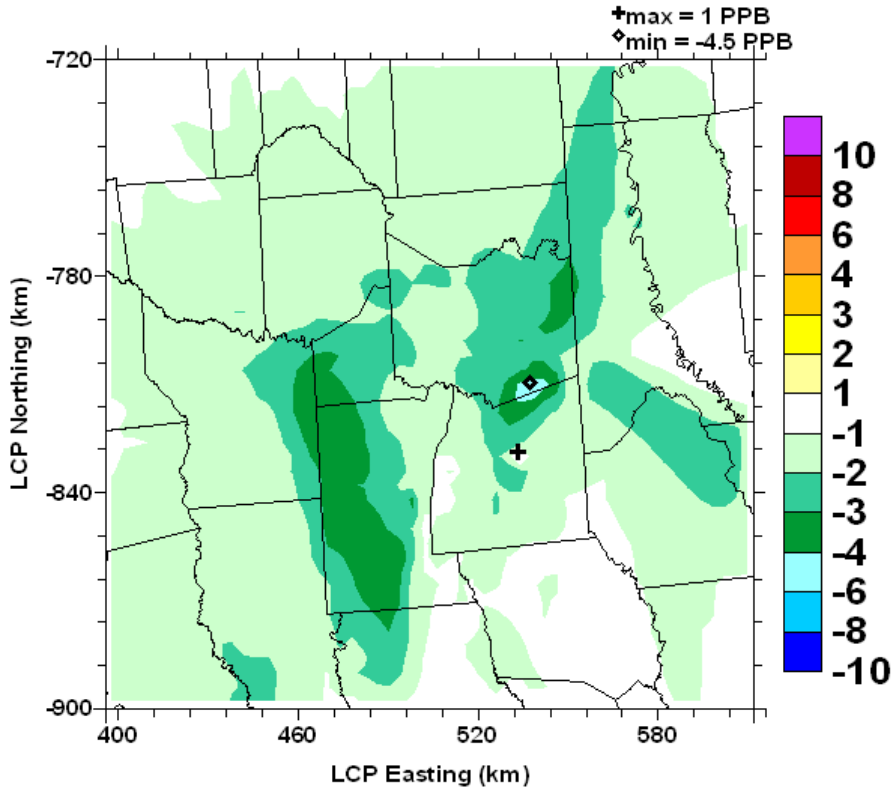
- In June 2007, the TCEQ adopted an East Texas Combustion Rule as part of the Dallas-Fort Worth 8-Hour Ozone SIP Revision
  - The Rule applies to rich-burn engines with horsepower greater than 240 hp
  - The rule applies in 33 East Texas Counties; compliance deadline is March 1, 2010
- NOx emissions reduction of ~17 tons/day in the 5-County area in 2012
- What are the effects of the ETxCR on 8-hour daily max ozone in 2012?

Ozone Impacts of the East Texas Combustion Rule

Episode Average Difference In Daily Max 8-Hour Ozone



Episode Maximum Difference In Daily Max 8-Hour Ozone



- In 2012, ETxCR results in reductions in daily max ozone averaged over episode that reach 1-2 ppb
- Maximum reduction from East Texas Combustion Rule over episode is ~5 ppb

Summary of 2012 Modeling (1)

- Model predicts nonattainment of 75 ppb standard for Longview and Tyler in 2012, attainment for Karnack
  - 2005 had unfavorable meteorological conditions which have not repeated during 2006-2009 period, but could recur
- Both local sources and transport are important in high ozone days in Northeast Texas
  - Requires a combination of local and regional controls
- On average, model predicts increase in local source contributions over entire episode
  - Area source NOx emissions (mostly O&G) increase going from 2005 to 2012
  - Uncertainty in oil and gas inventory projections due to effects of economic slowdown and Haynesville Shale development

Summary of 2012 Modeling (2)

- Development in Haynesville Shale may have significant effects on air quality in Northeast Texas
  - Updating Haynesville Shale emission inventory should be a priority
- East Texas Combustion Rule provides ozone benefits to Northeast Texas
  - Track compliance for future inventory and modeling efforts

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End