

# Using Aircraft Data to Improve East Texas Regional Modeling

Presentation to the TERC  
Science Advisory Committee

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# Outline

- Extensive database of regional flights by Baylor Aircraft in 2005/2006
  - Described by Martin Buhr
- Opportunity to evaluate and improve regional modeling
  - Example for Dolet Hills power plant on September 8, 2005
  - Other data: ozone aloft at tall TV tower in Moody, Tx
- Project suggestion: Evaluate regional CAMx modeling using 2005 and/or 2006 aircraft data
  - Develop modeling improvements for future application
  - Links to 3 other project suggestions

# 2006 Baylor Aircraft Flights

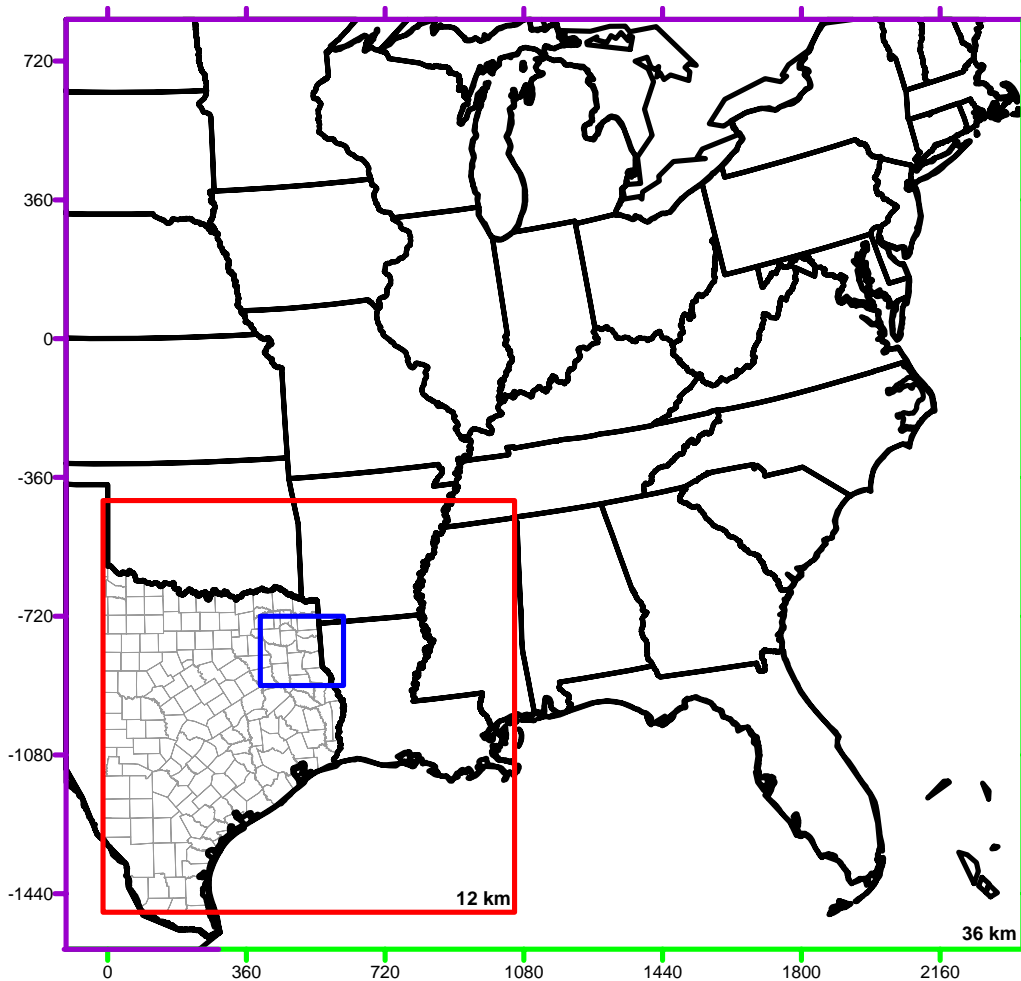
- Multiple campaigns over 2006 season
  - HARC: Houston SOF and Moody Tower
  - NE Texas: Cross-border transport and point sources
  - CAPCOG: Austin area point sources and transport
  - Waco: Waco area point sources and transport
- Need 2006 seasonal meteorology with data assimilation to model 2006 flights => John Nielsen- Gammon

# 2005 Flights in NE Texas

Flight	Date	Border	Point Sources					Urban Areas			Fire
			Eastman Huntsman	Martin Lake	Pirkey	Dolet Hills	Paper Mill	Tyler	Long view	Shreve port	
1	8/24		•	•							•
2	8/26		•		•						
3	9/1	<b>Rain</b>									
4	9/2	•	•	•	•	?	?	•	•	•	•
5	9/4	•	•	•	•	?	?	•	•	•	
6	9/5	•	•	•	•	?	?	•	•	•	
7	9/8	•				•	?				
8	9/9		•								

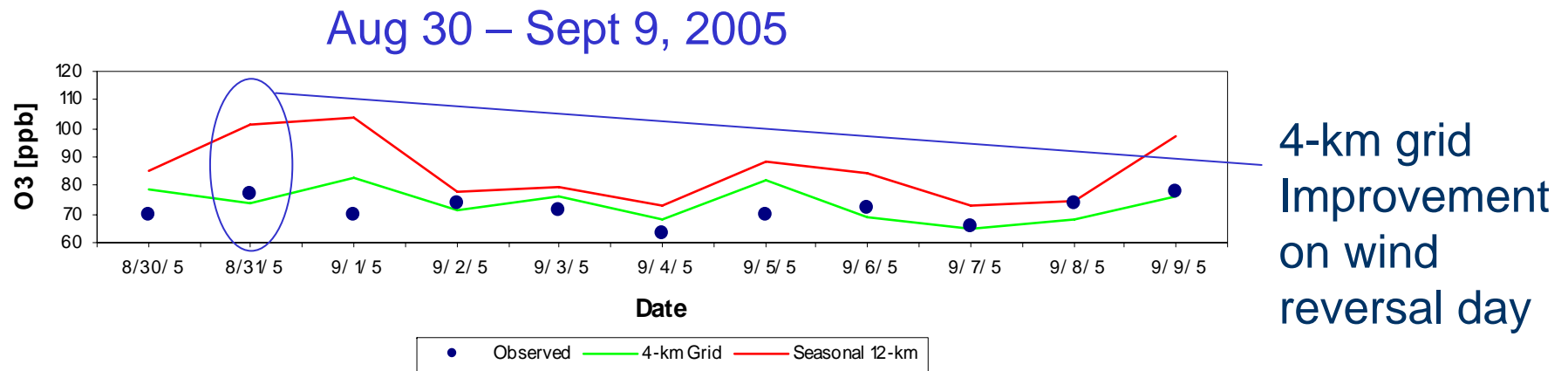
- Most days had high regional background
- Flights combine border transport, point sources, urban plumes and wildfire plumes

# Modeling Available for 2005



- MM5 by Texas A&M for May-September, 2005 for TERC
- ENVIRON seasonal CAMx modeling for TERC
- Model improved by NE Texas
  - Hourly point source inventory
  - 4 km grid over NE Texas point sources

# 8-hr Ozone at Longview



- 4-km grid improved performance at monitor close to point sources
- Hourly CEM NOx emissions data improved model performance
- TCEQ 2005 emissions should be included

# Dolet Hills EGU, September 8, 2005

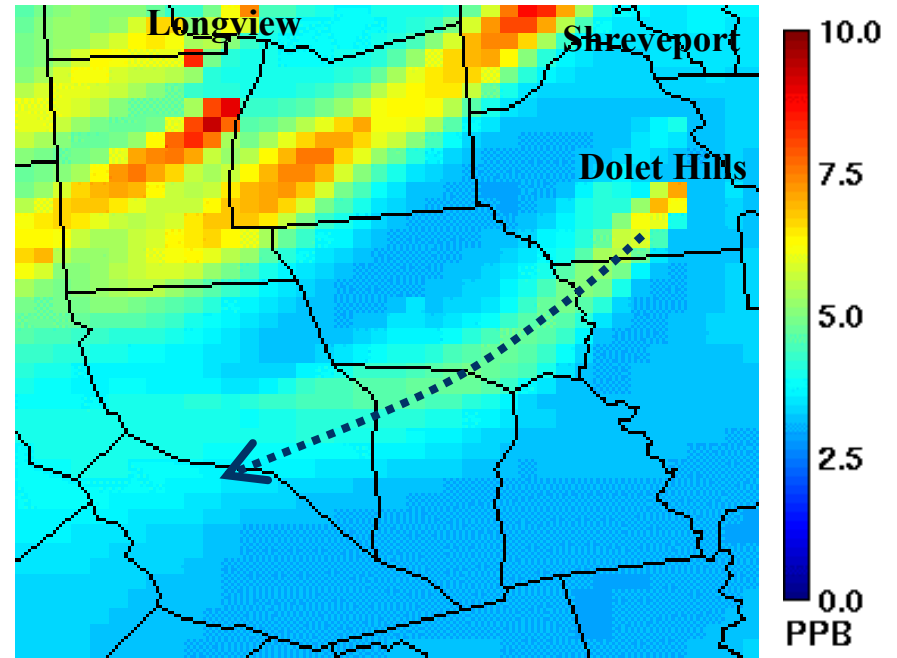
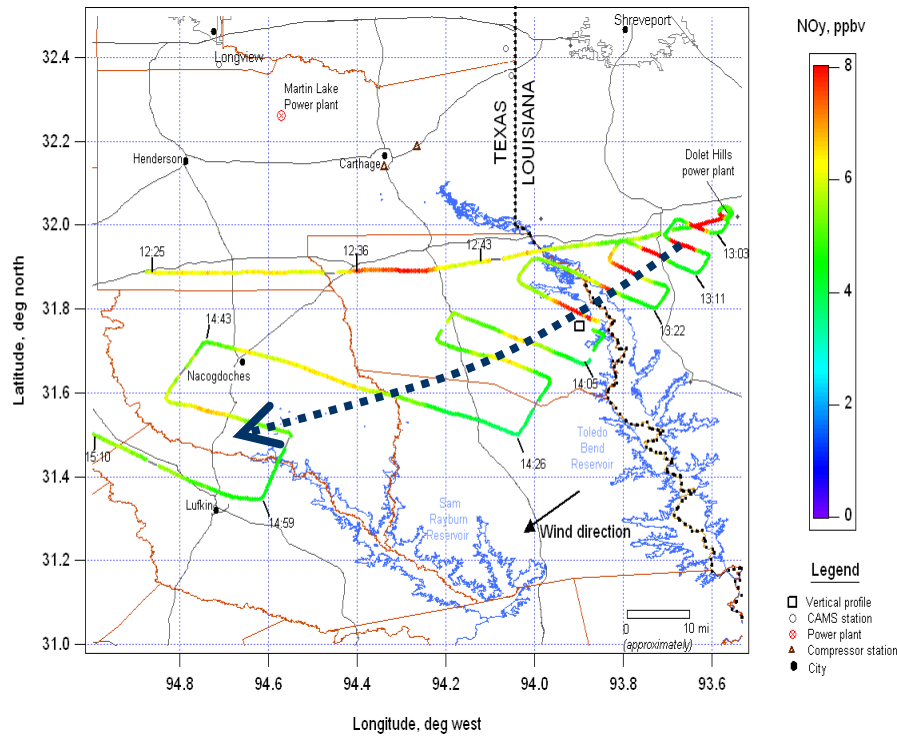


- Single, 650 MW, lignite fired EGU near Mansfield in Desoto Parish, LA
- Isolated source location and northeasterly wind direction kept the Dolet Hills plume separated from other major sources
- Good case study for CAMx EGU plume simulation

# Dolet Hills NO<sub>y</sub> Comparison

## Aircraft

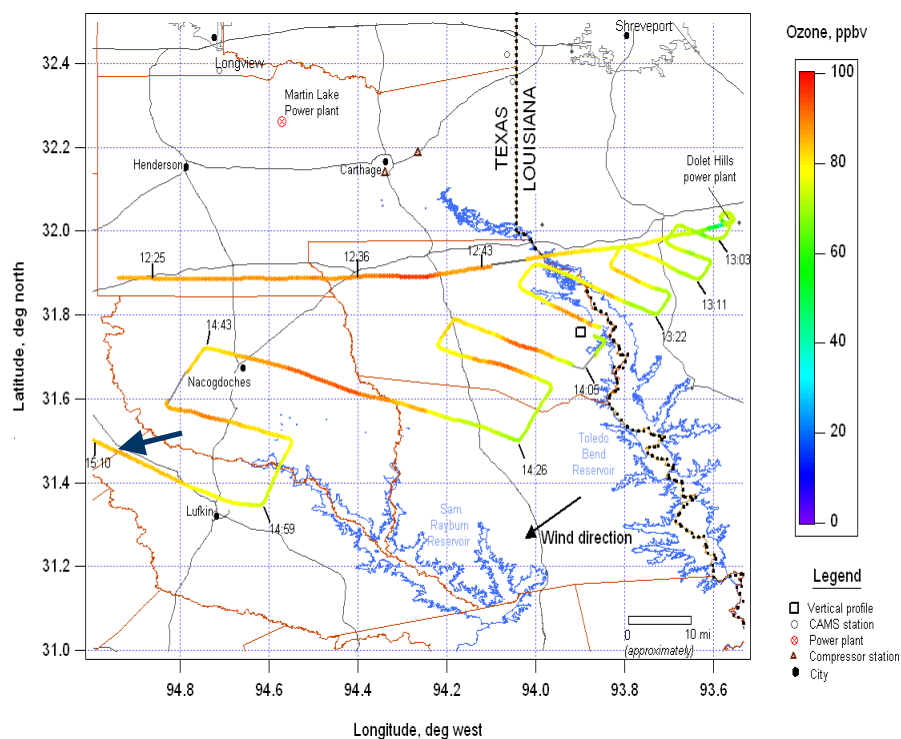
## CAMx



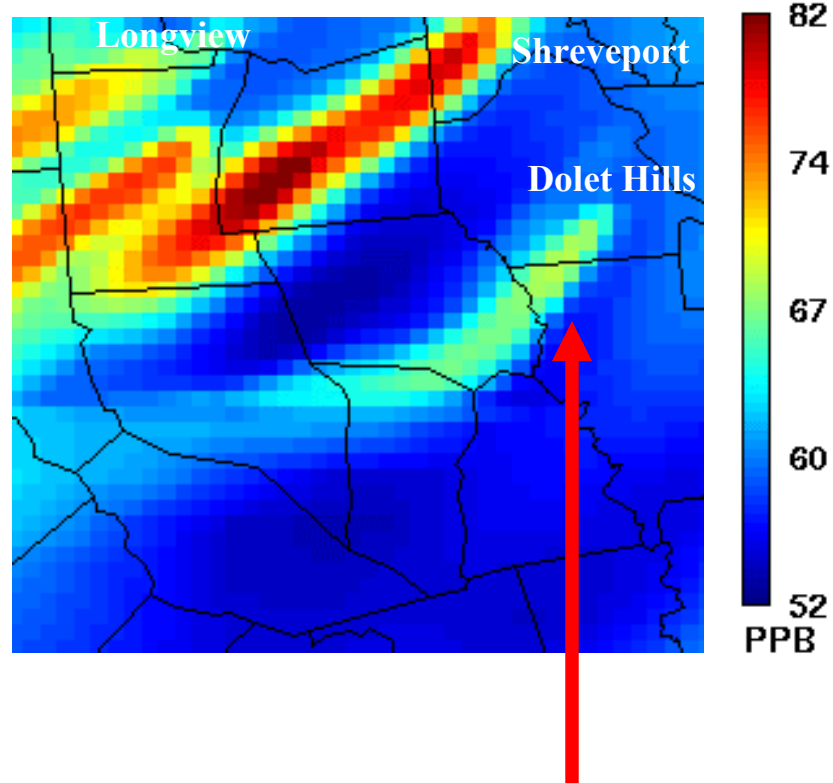
- Model captures plume curvature, small southerly bias
- Model NO<sub>y</sub> plume has max near source, as observed

# Dolet Hills Ozone Comparison

## Aircraft



## CAMx



Ozone forms sooner in model than observed

# Baylor Aircraft Ozone/NO<sub>y</sub> Comparison

	Ozone		NO <sub>y</sub>	
	Background	Plume Enhancement	Background	Plume Enhancement
<b>Aircraft</b>	70	10-15	4-5	2-3
<b>CAMx</b>	54-58	10-15	4-7	3-4

- Plume impact:
  - Model reproduces daytime NO<sub>y</sub> and ozone plume enhancements
- Background:
  - NO<sub>y</sub> well-simulated
  - Ozone underestimated
  - Possible influence of nocturnal NO<sub>y</sub> processing? => Dave Allen

# Ozone Aloft at Moody in Central Texas



- KWTW TV tower
- Sampling aloft
  - 30 m
  - 122 m
  - 457 m
- Multi-pollutant
  - Ozone, CO, CO<sub>2</sub>
  - CO/CO<sub>2</sub> ratio indicates source impacts
- Continuous, multi-year record
  - 2003 onward by NOAA ESRL Carbon Group
- Complementary to Baylor Aircraft

# Project Suggestion

- Evaluate regional CAMx modeling with 2005 and/or 2006 data
  - Develop modeling improvements for widespread application
- Links to other project suggestions
  - Need for 2006 seasonal meteorology to utilize 2006 aircraft data (=>John Nielsen-Gammon)
  - Nocturnal NOx processing (=>David Allen)
  - Provide data to support UAH plume modeling (=>Noor Gillani)

# Project Suggestion

- Evaluate regional CAMx modeling using 2005 and/or 2006 aircraft data
- Objectives
  - Evaluate daytime plume dispersion, chemistry and downwind transport
  - Evaluate nighttime NO<sub>x</sub> processing and next day ozone formation
  - Improve models

# Project Suggestion

- Evaluate regional CAMx modeling using 2005 and/or 2006 aircraft data
- Approach
  - Develop existing 2005 model and/or develop 2006 model
    - Incorporate TCEQ 2005 emissions inventory just being released
  - Aircraft tracking of daytime plumes
  - Aircraft intercepts of nocturnal plumes in early morning
  - Aircraft and TV tower regional background
  - Evaluate and improve modeling methodology
    - Plume in grid
    - Grid resolution
    - Plume chemistry (heterogeneous, early plume gas-phase)