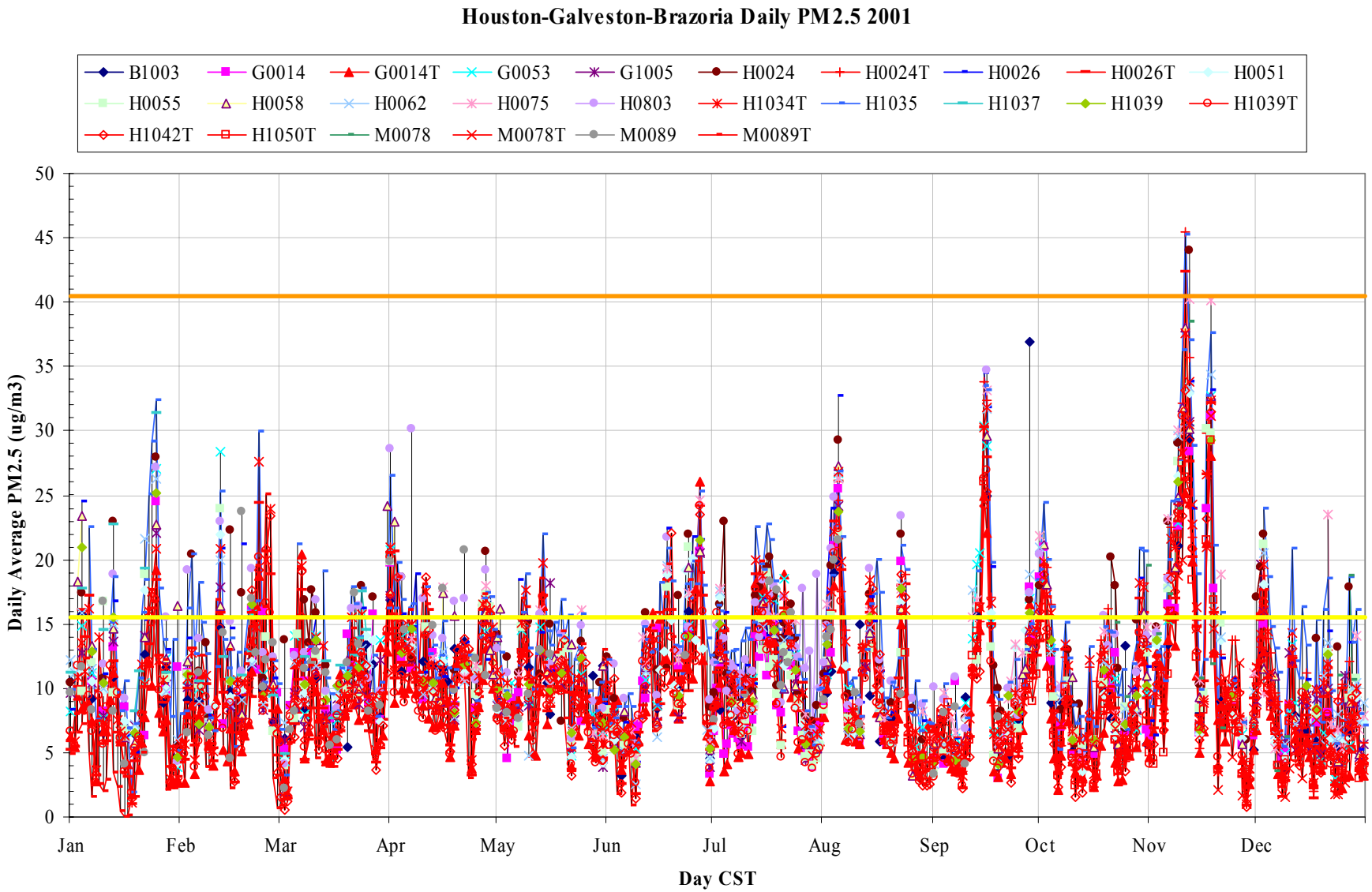
# PM2.5 Forecasting in Texas

Prepared by Bryan Lambeth
Texas Commission on Environmental Quality
February 2003

# Houston 2001 Nov 5

# Houston 2001 Nov 11

# Understanding the Problem



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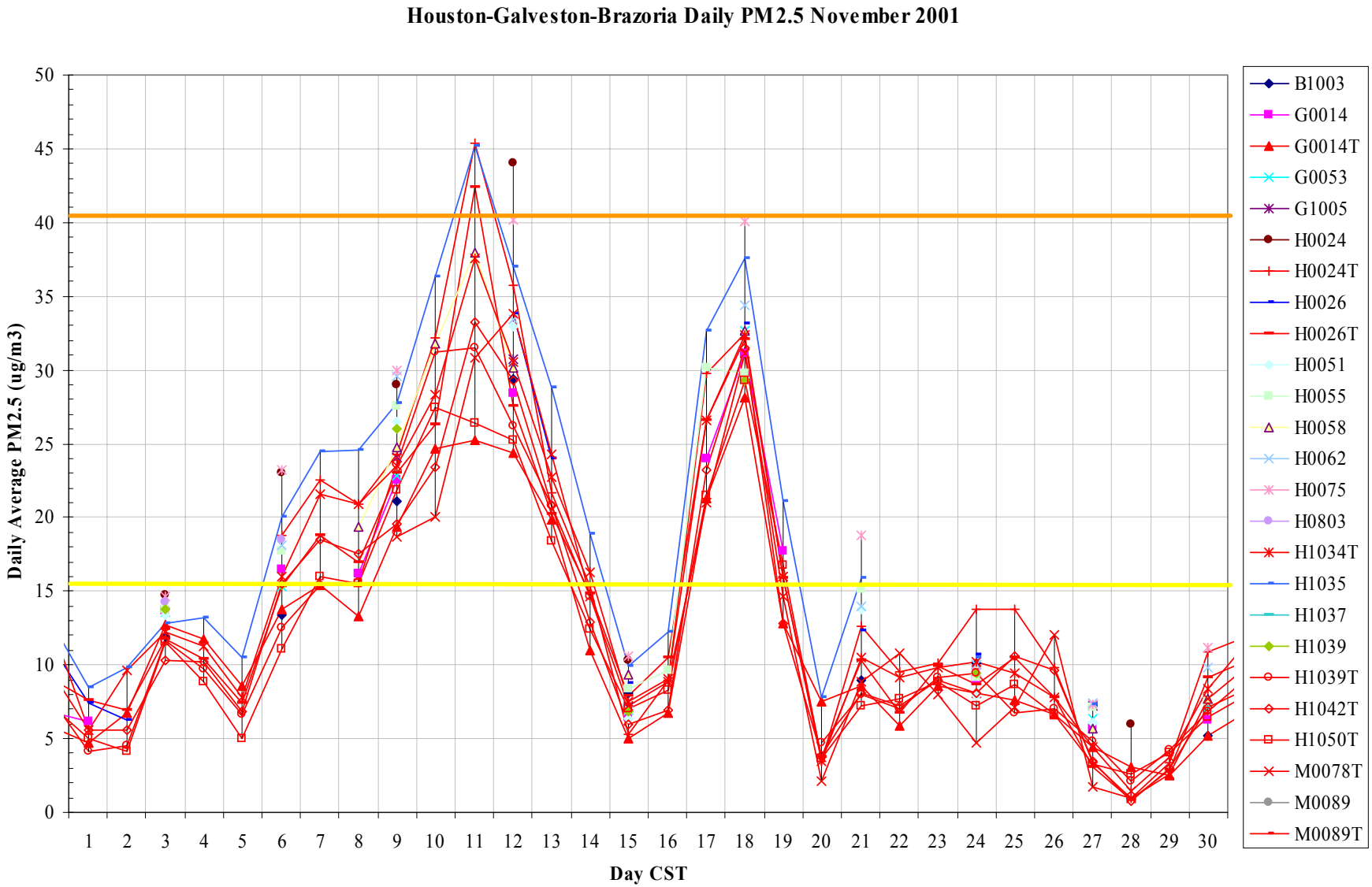

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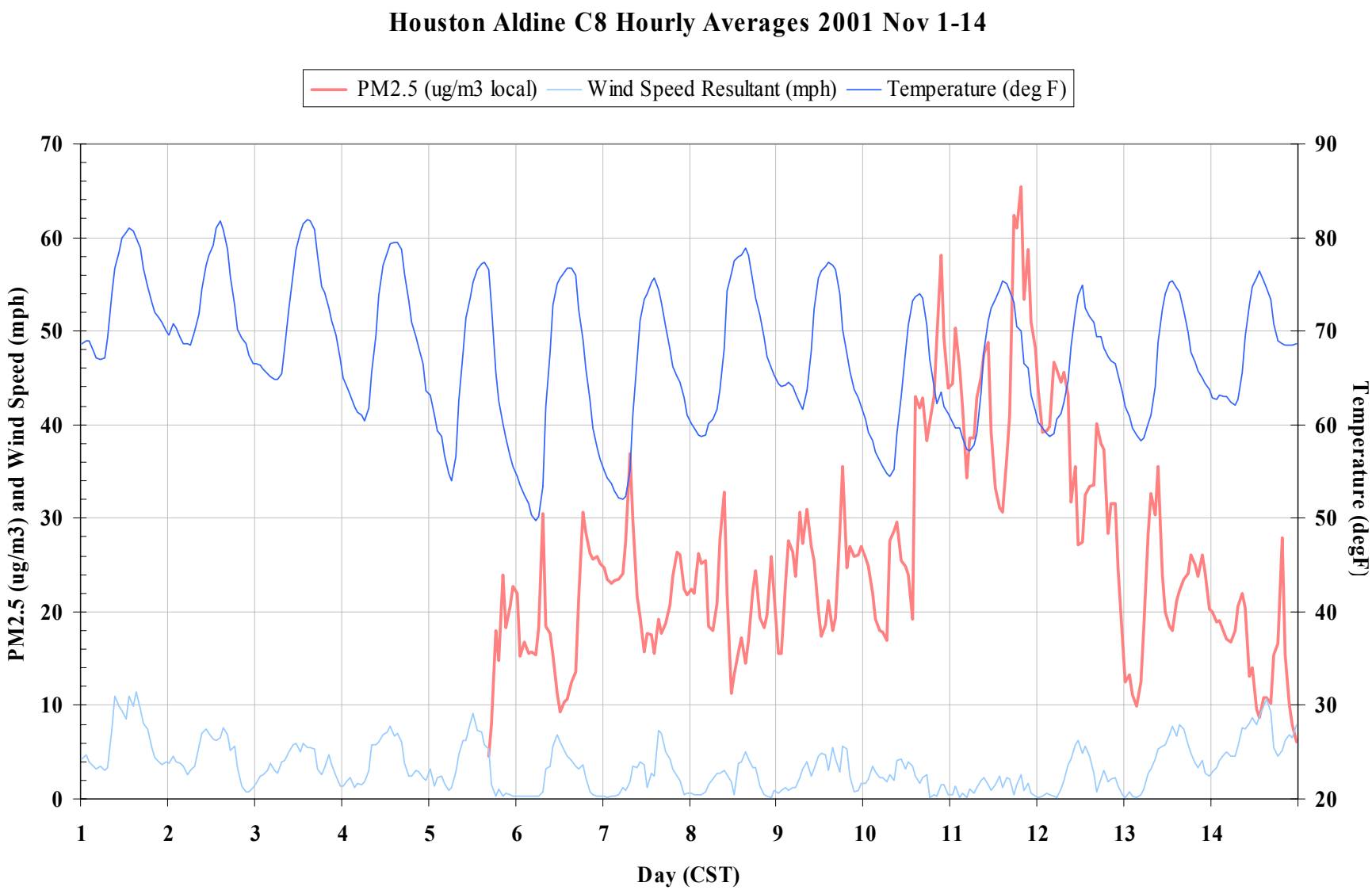

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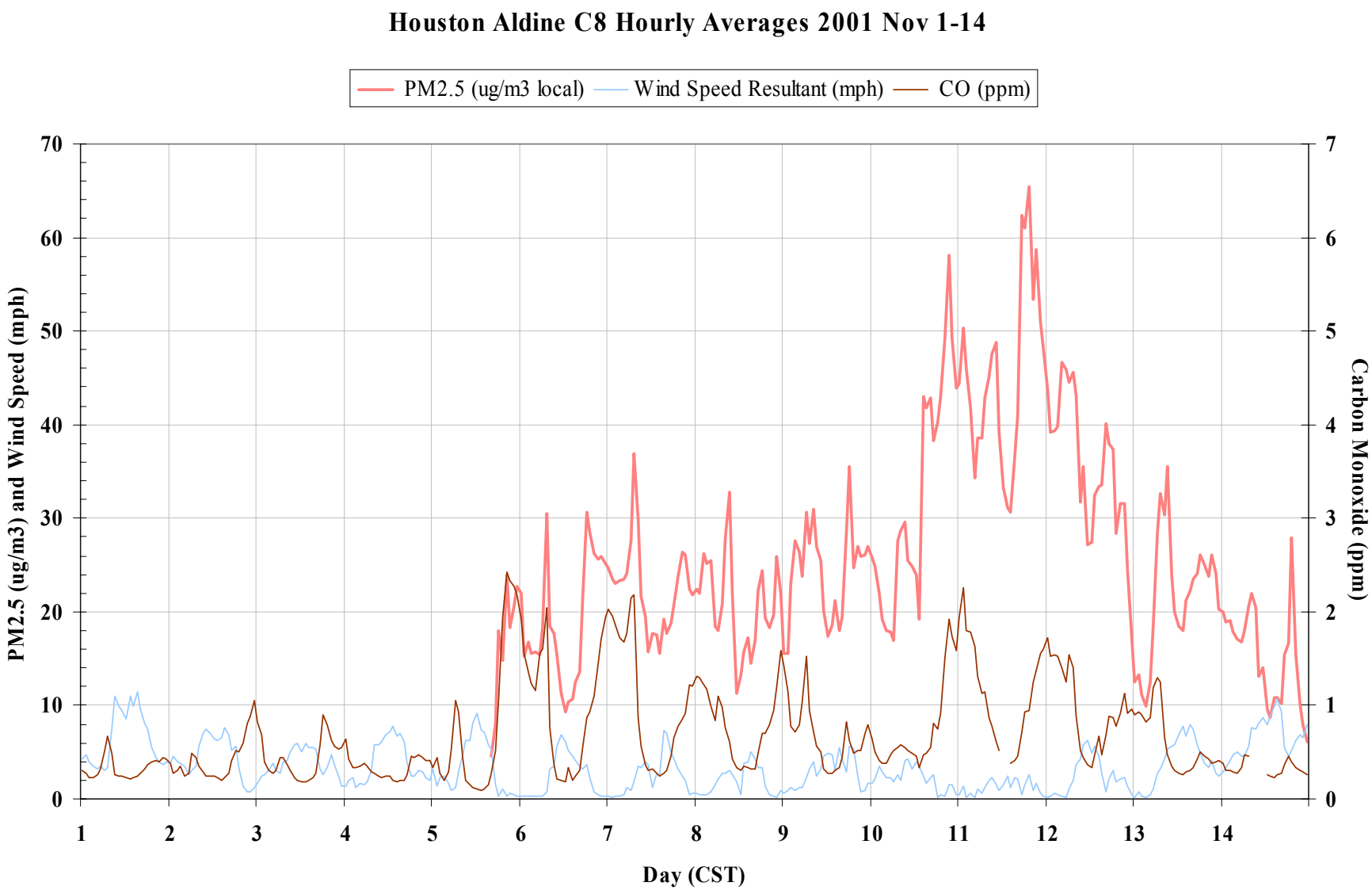

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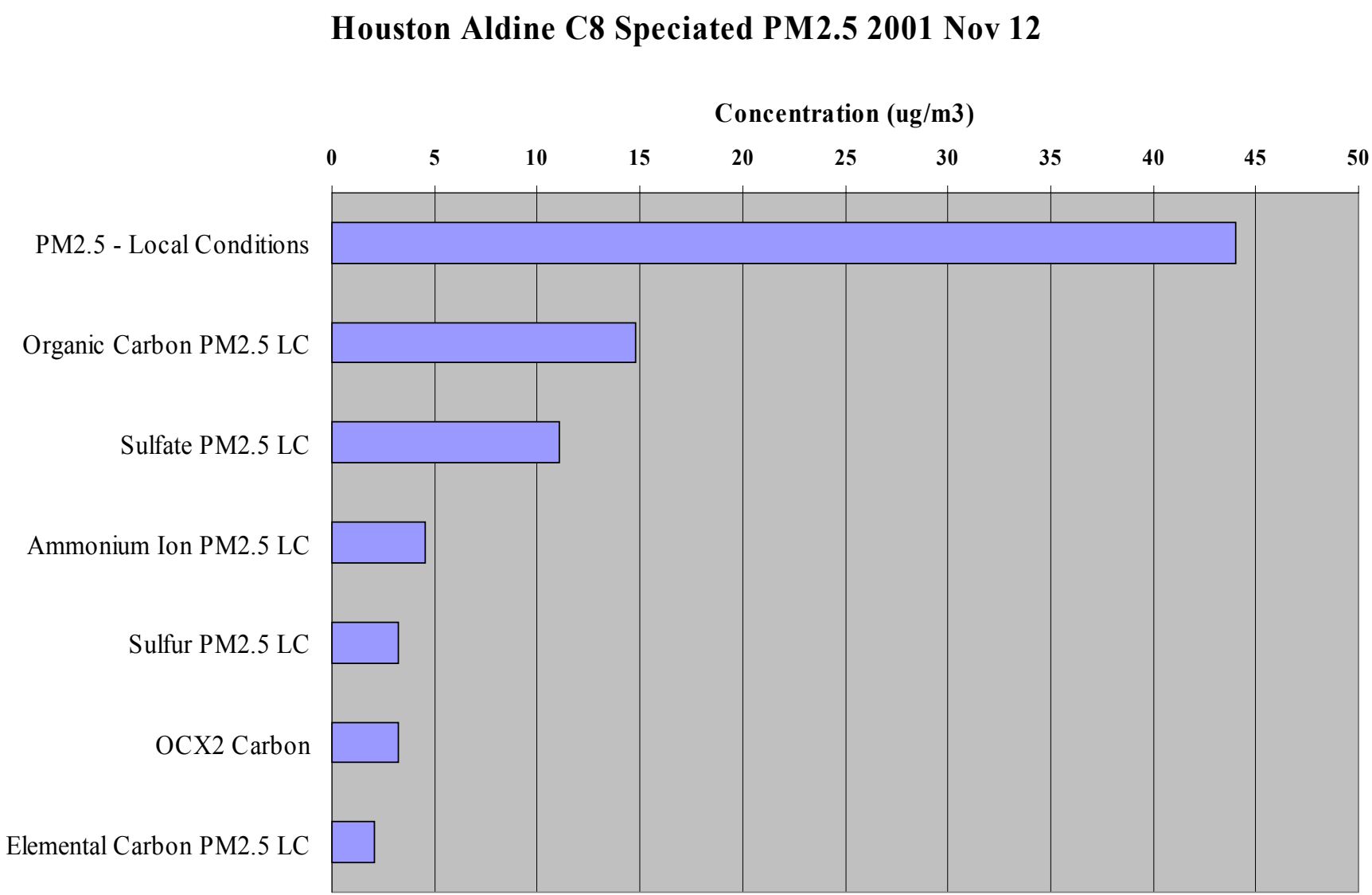

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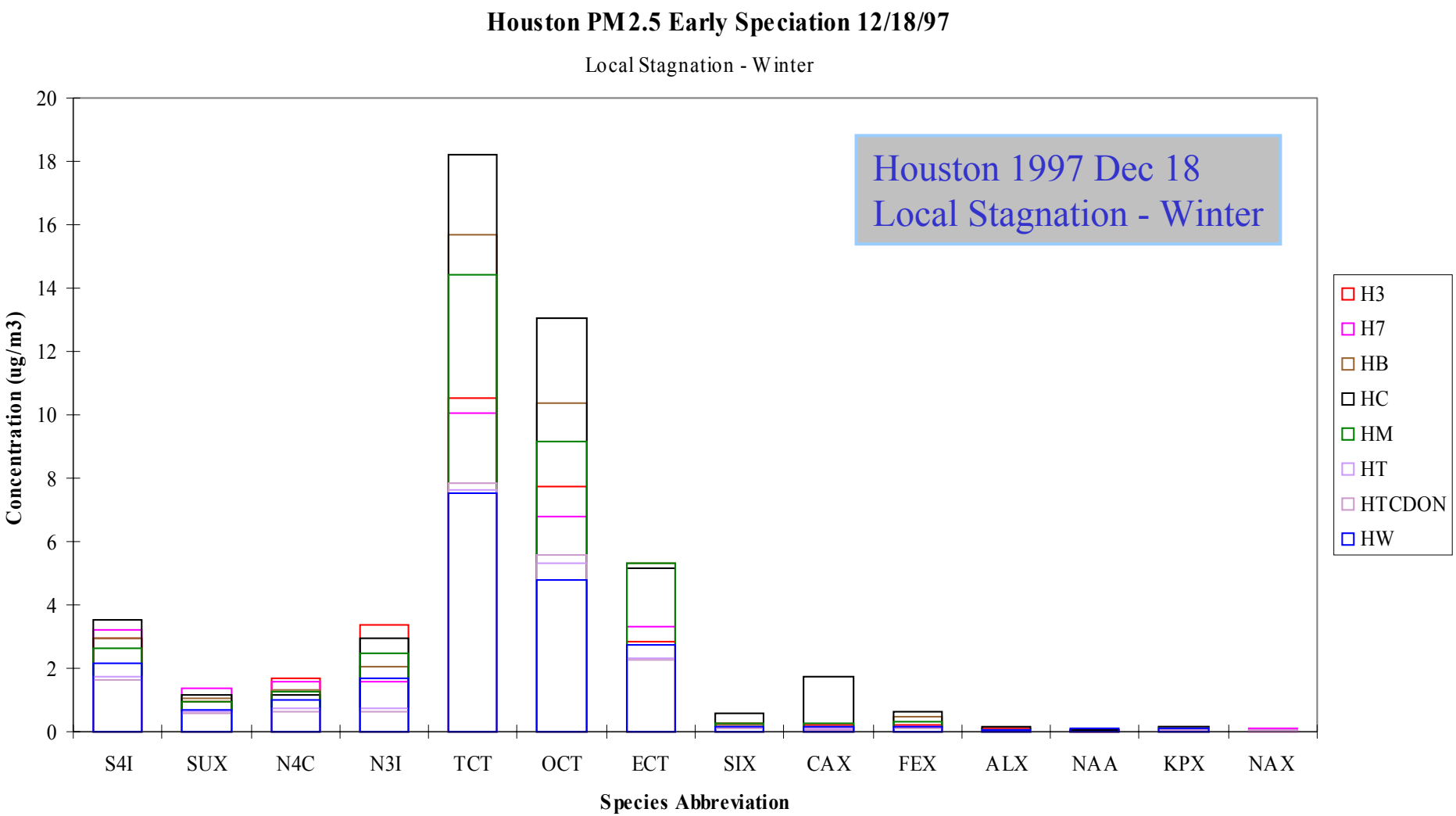

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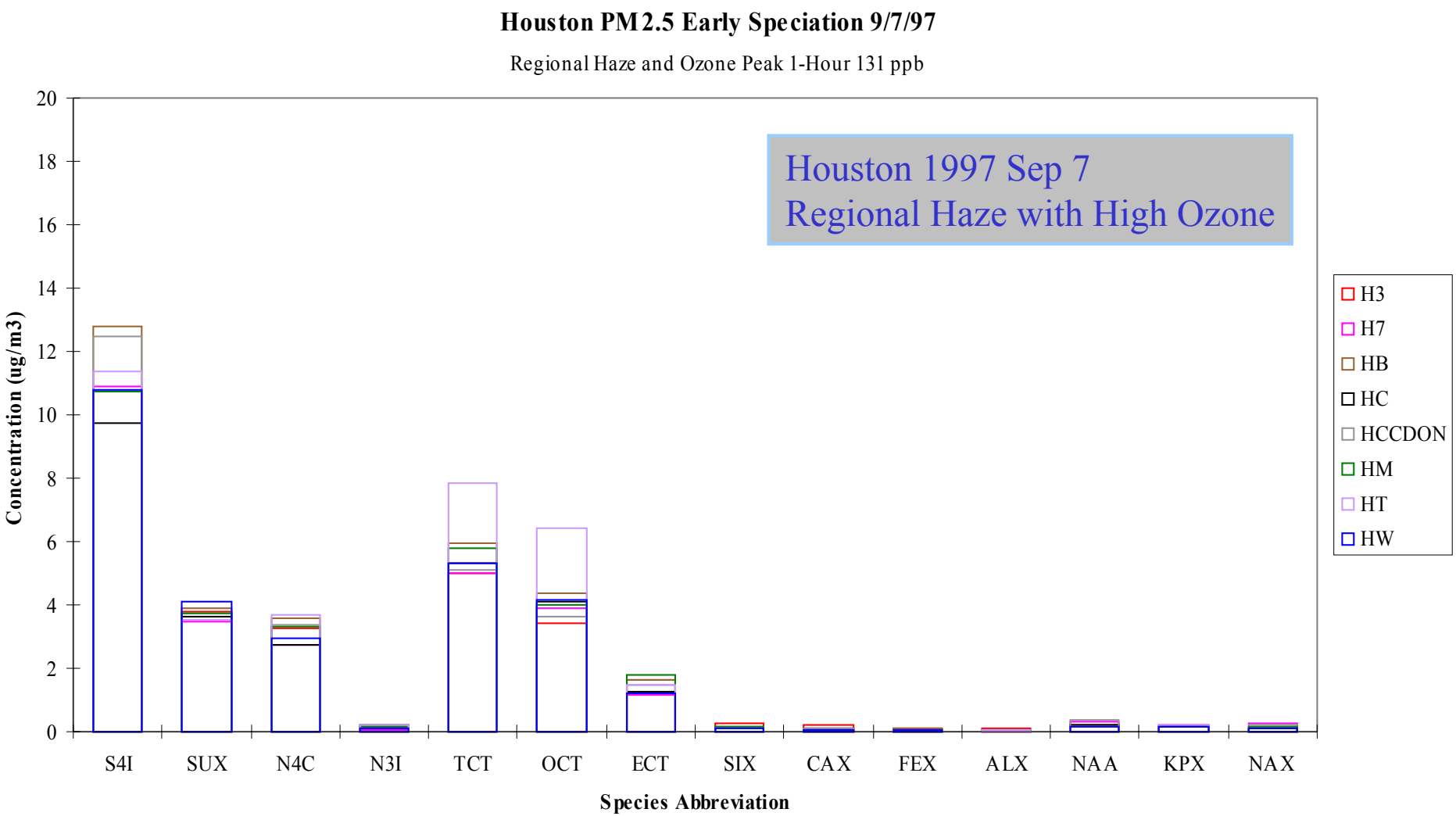

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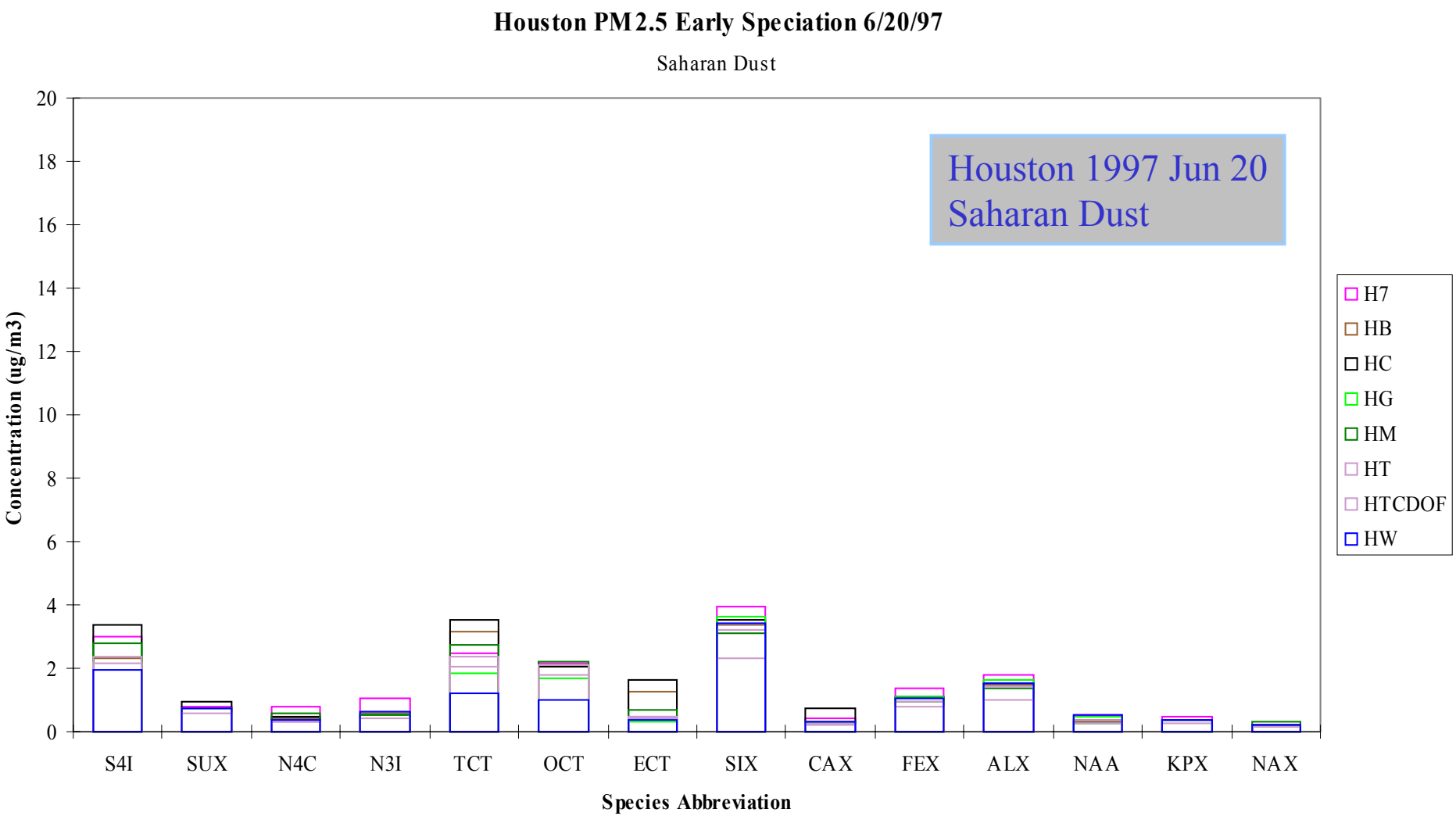


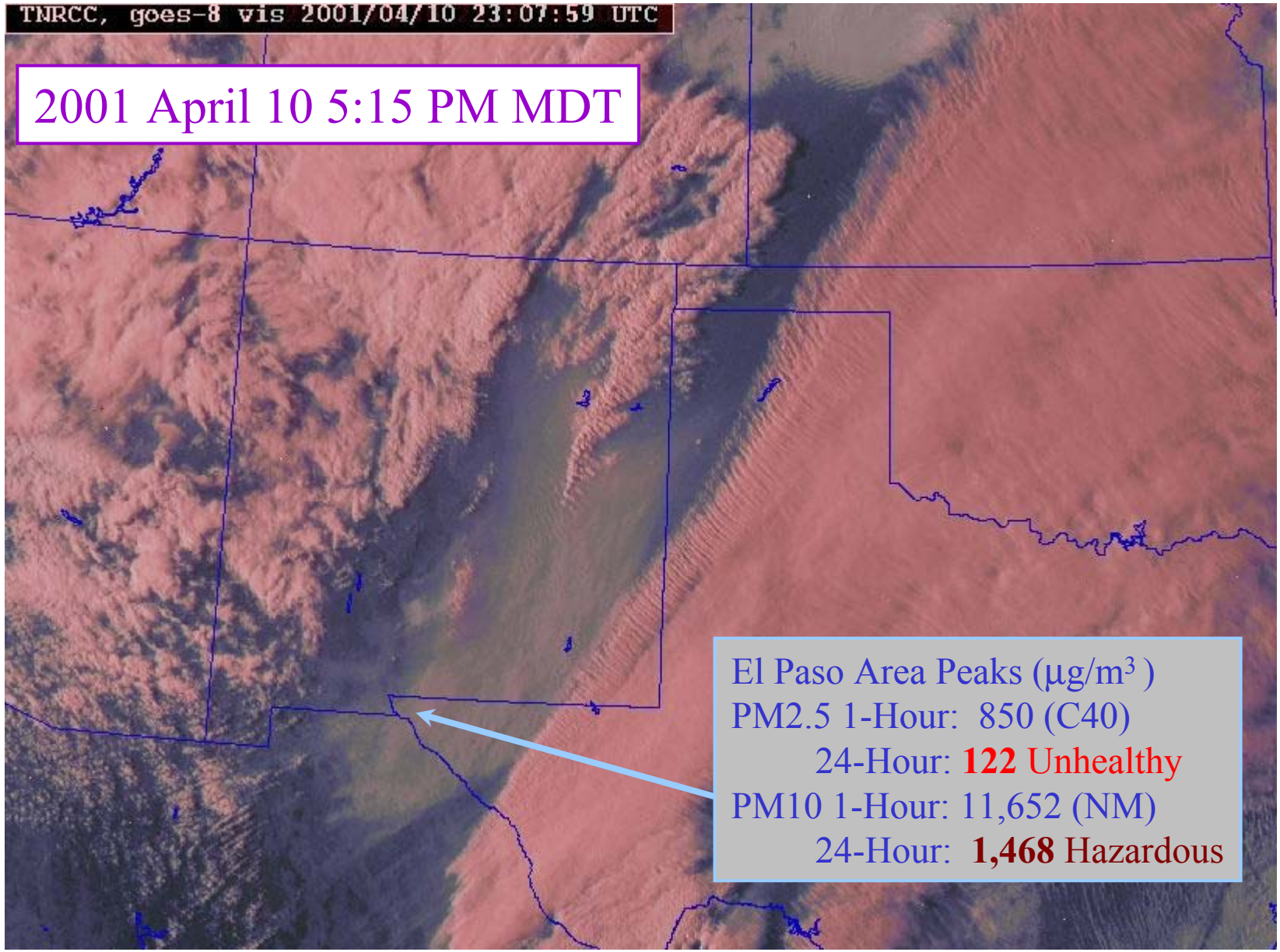
# Types of High PM2.5 Events

- Regional dust storm (includes Saharan dust)
- Regional smoke (controlled and wild fires)
- Regional haze (stagnation – transport)
- Local stagnation (greatest local source impact)
- Local smoke (small fires near site)
- Local dust (dry weather – construction)

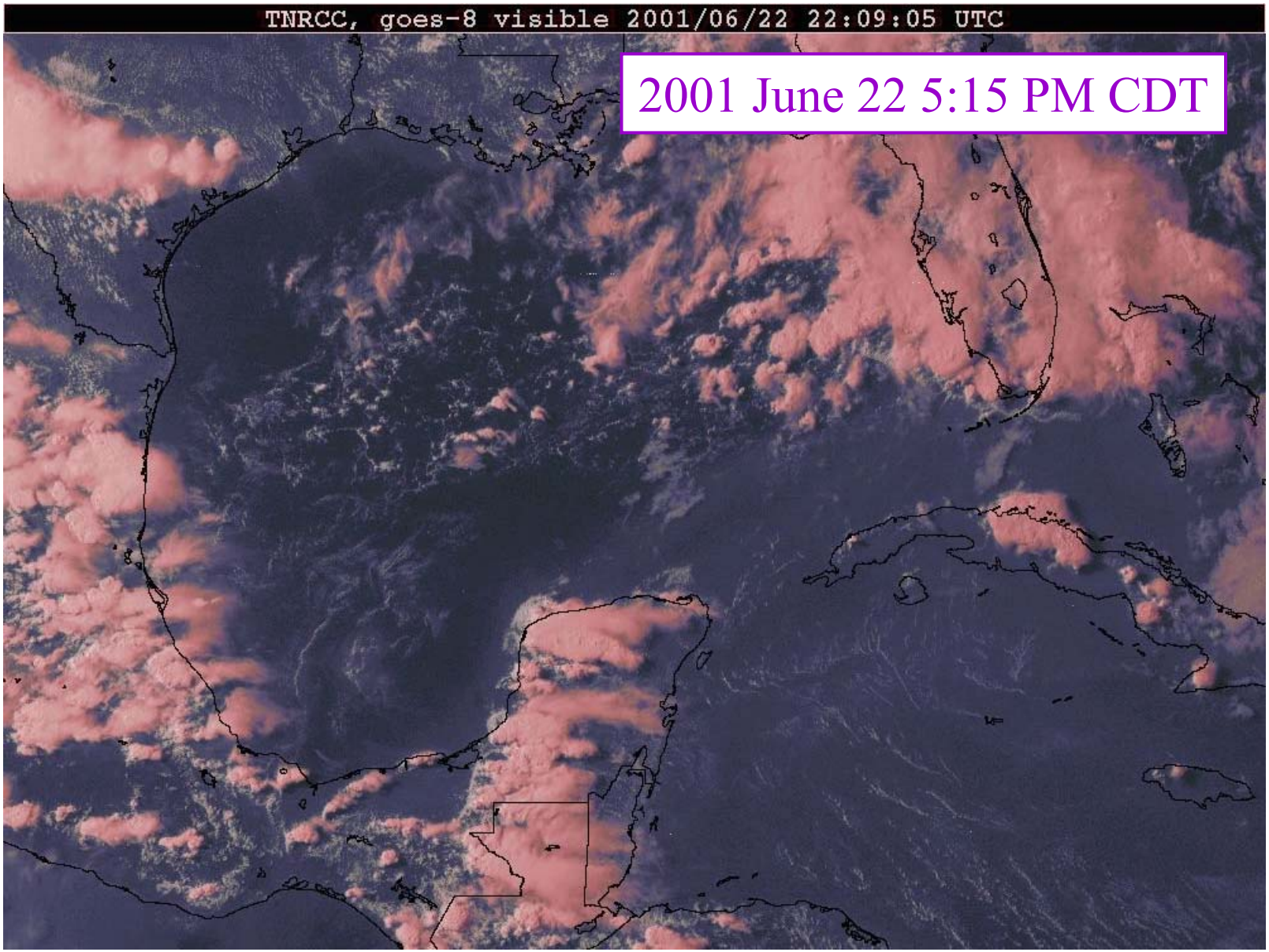
# Components of Forecast

- Regional background level
  - proximity to regional source areas
  - transport and dispersion
  - satellite imagery, visibility, and PM data
- Local contribution
  - proximity and intensity of local sources
  - wind speed and atmospheric stability
  - temperature and humidity
  - emissions inventory

# Regional Dust Storm



# Regional Dust – Long Range Transport



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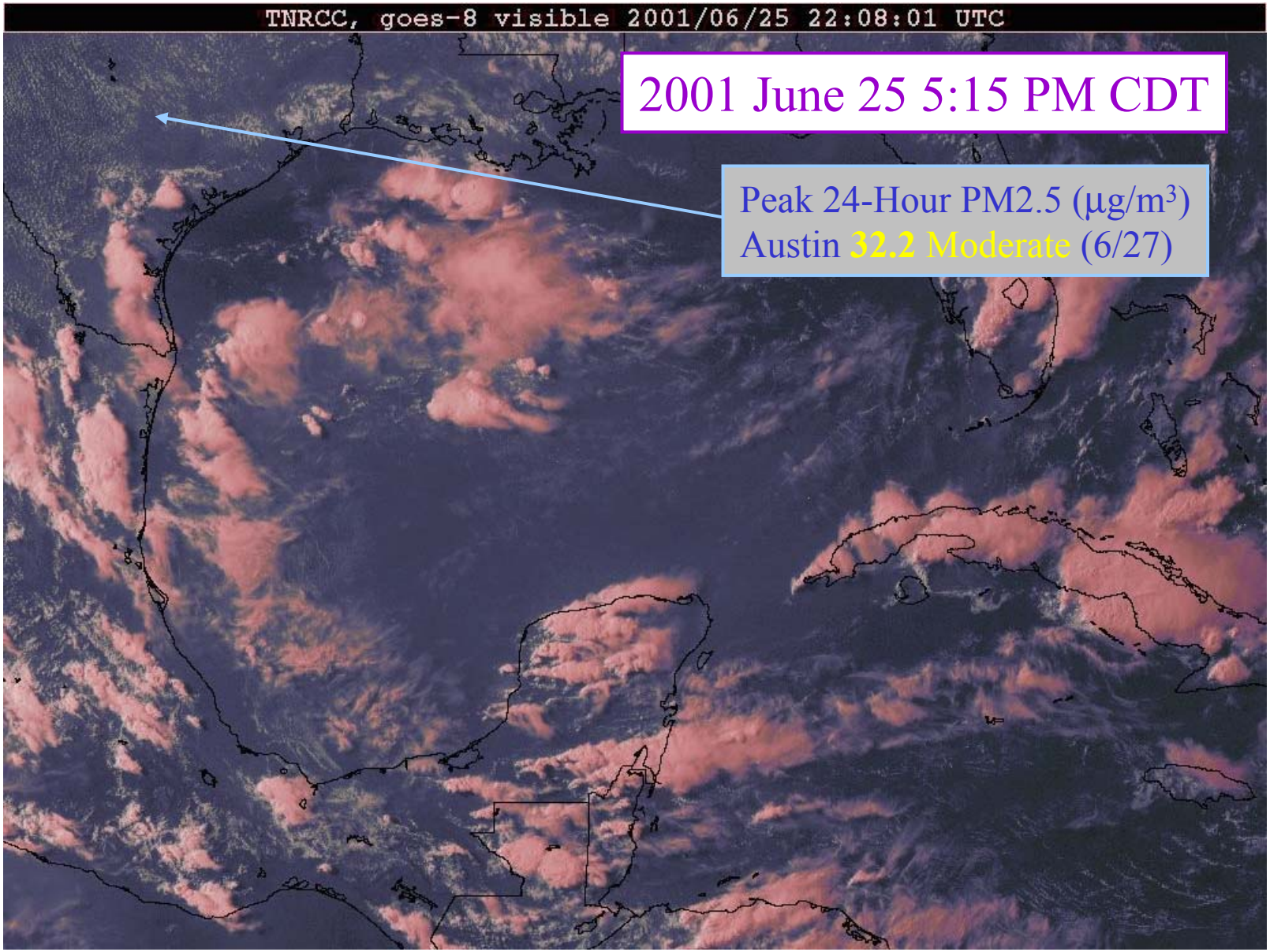
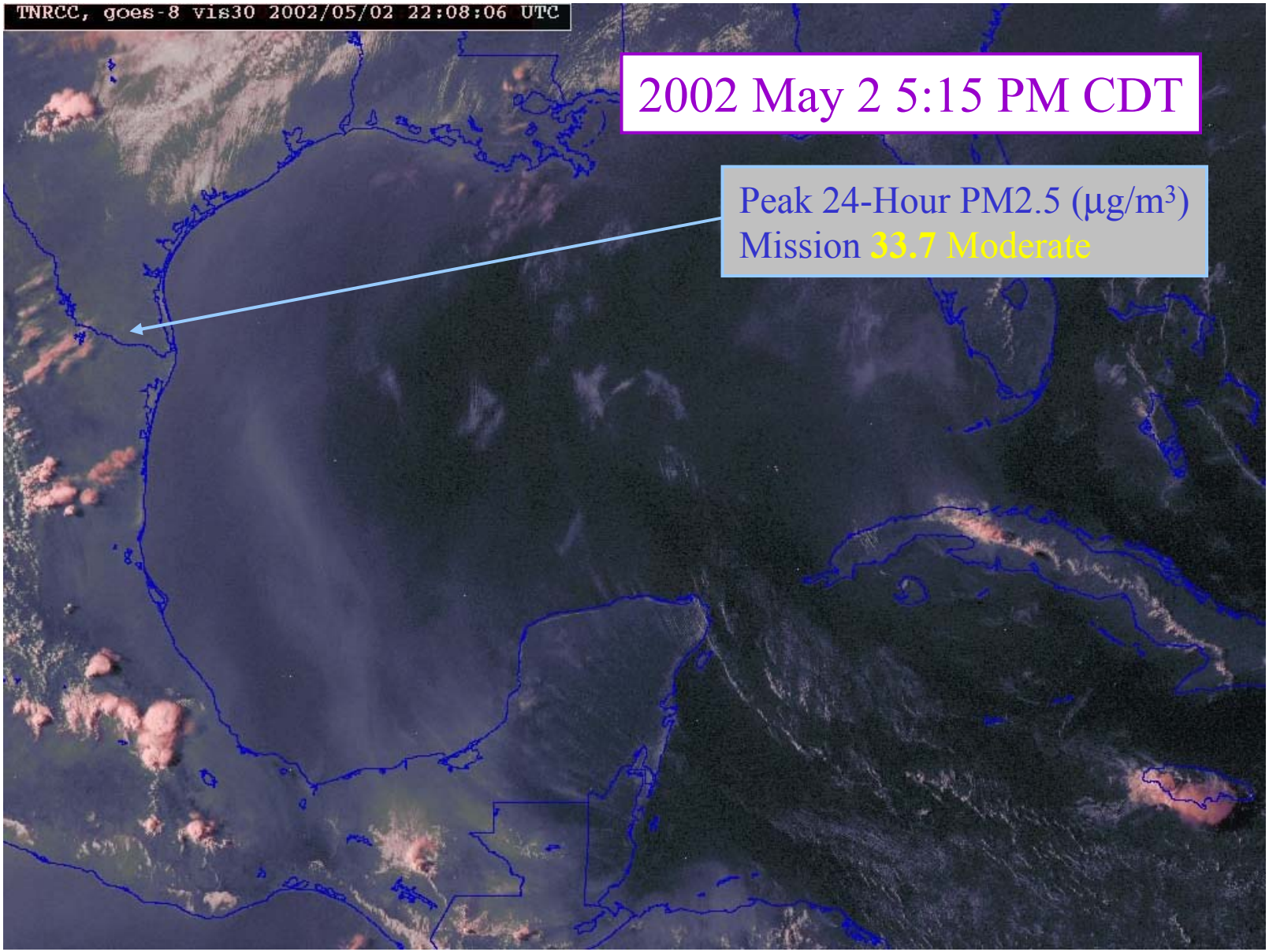


# Regional Smoke



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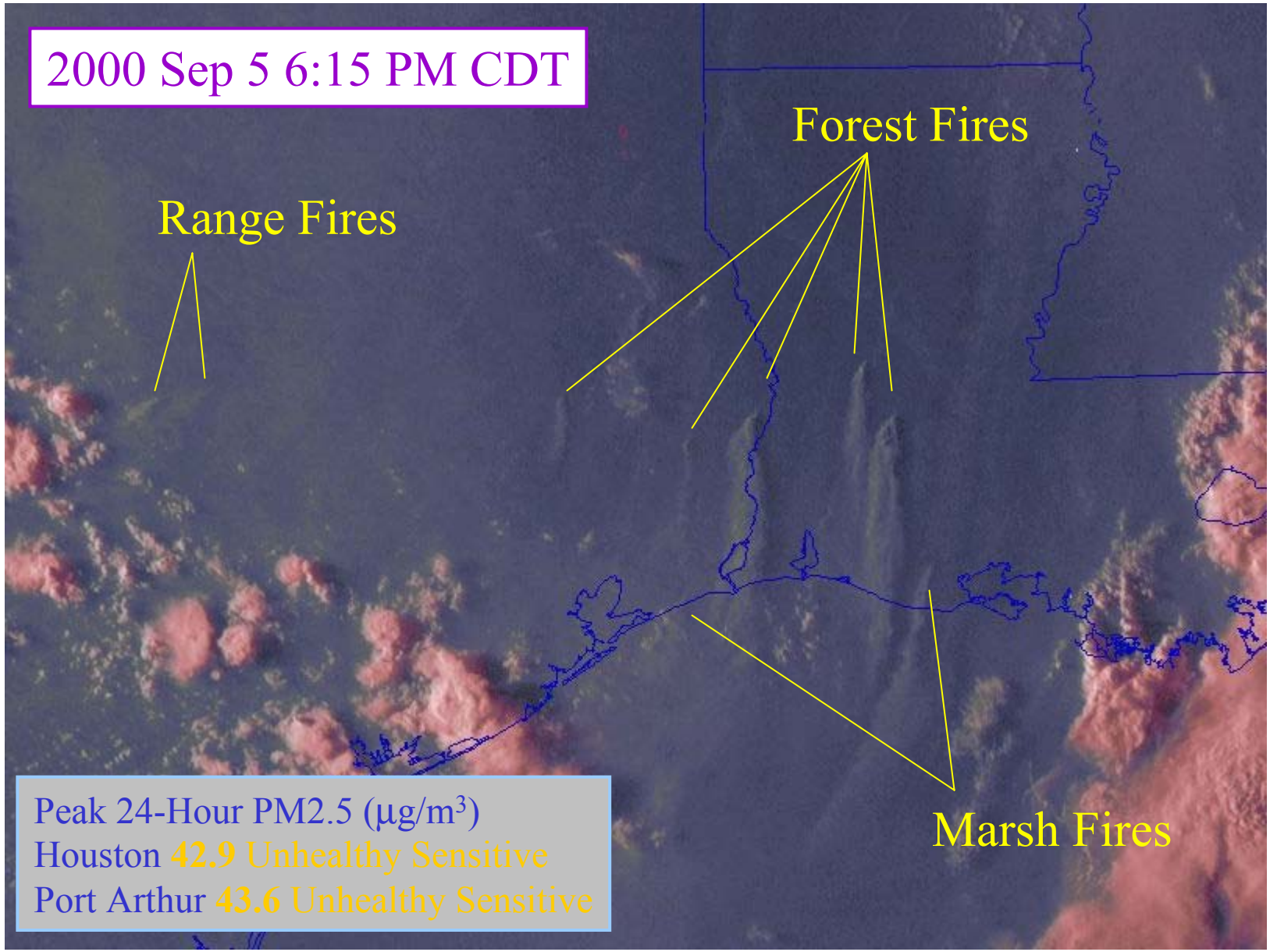
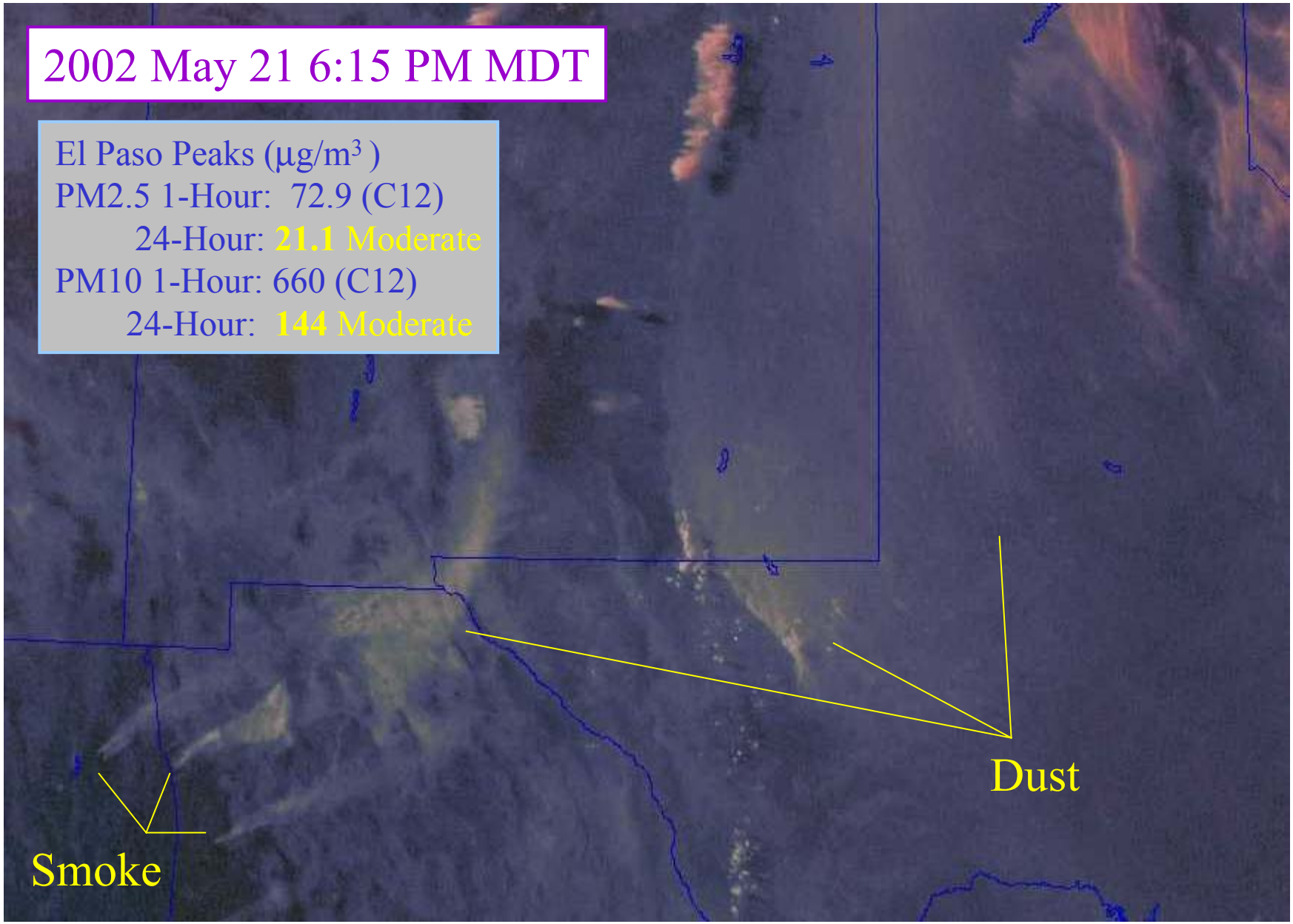
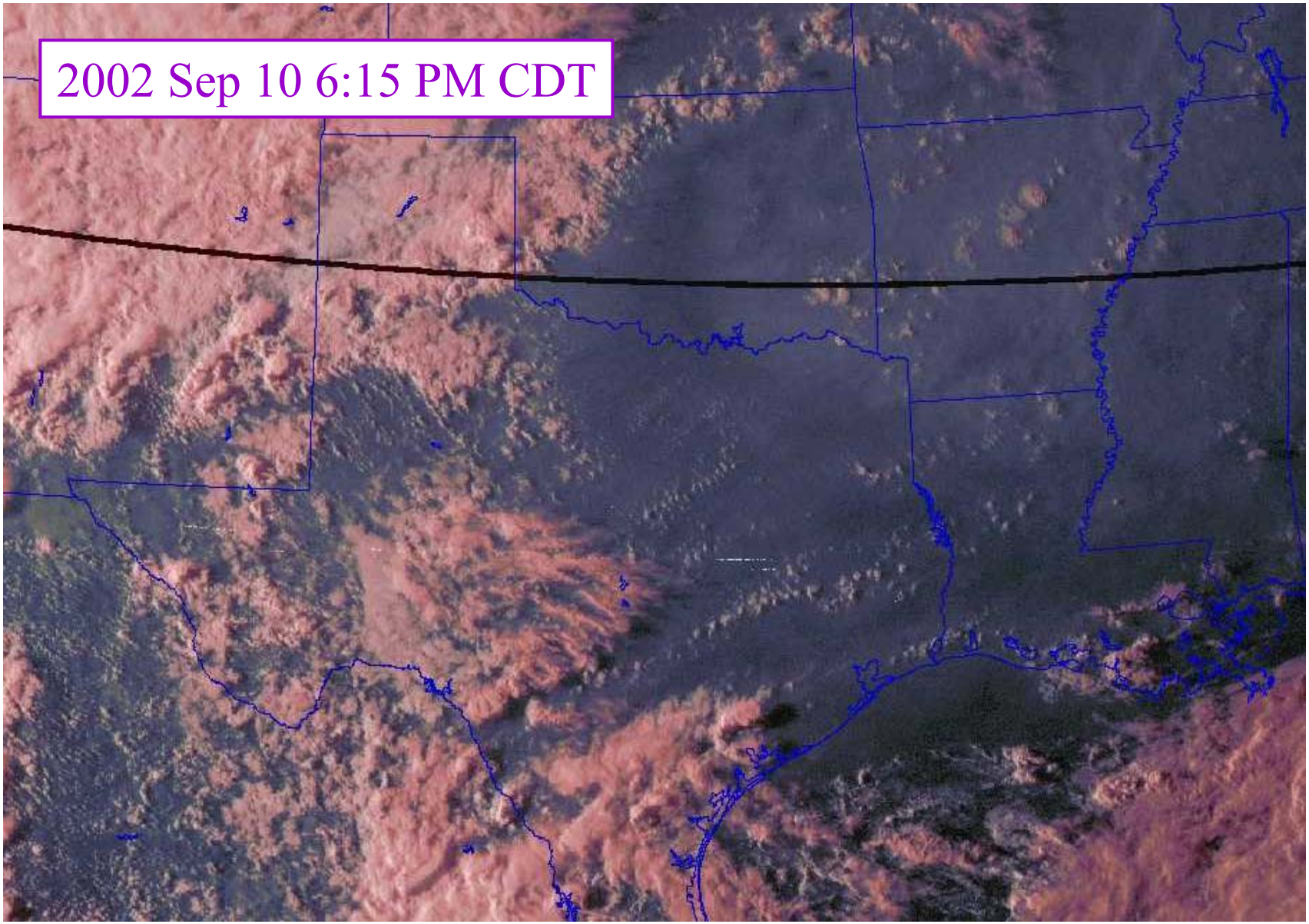


# Regional Smoke and Dust



# Regional Haze



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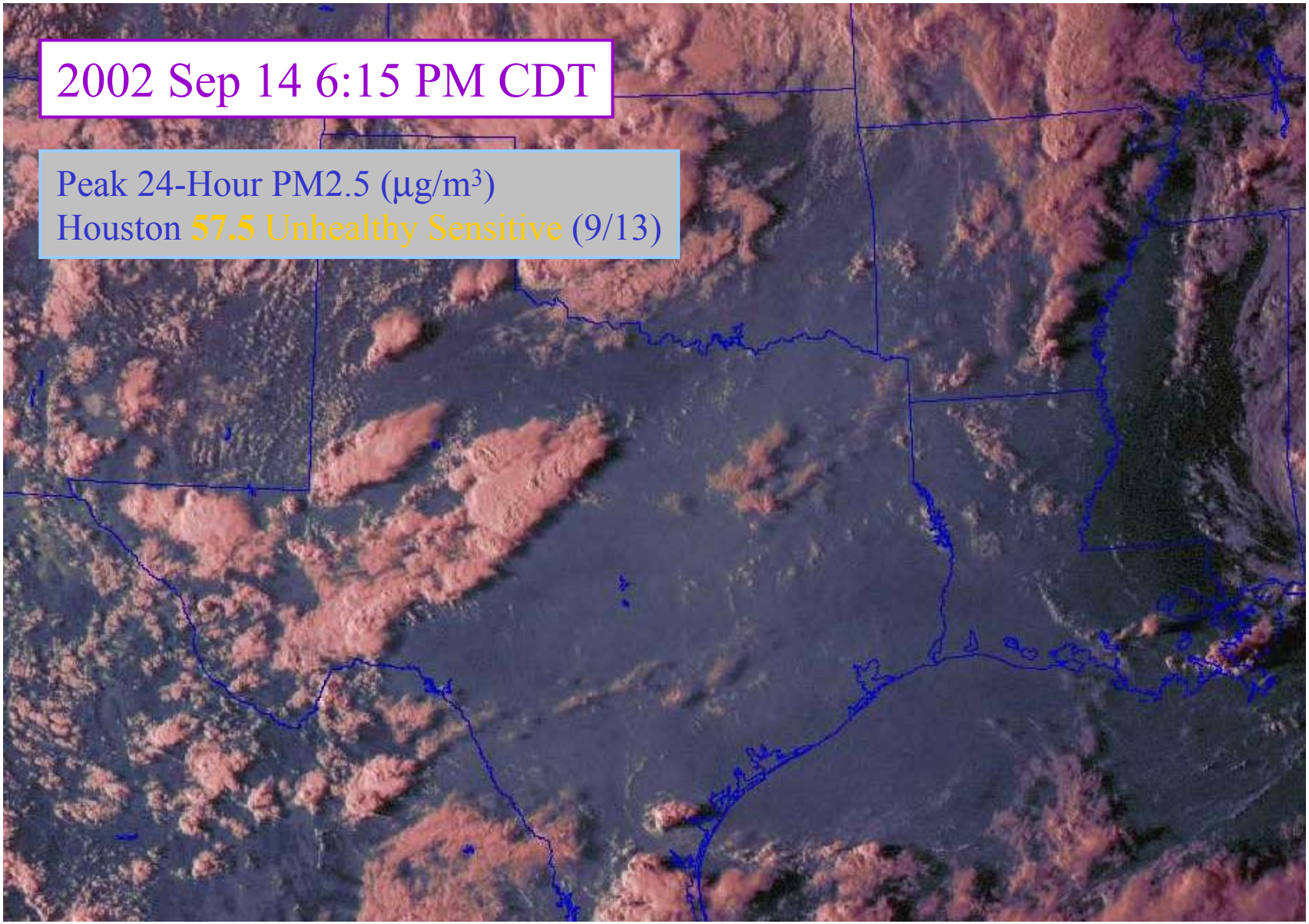

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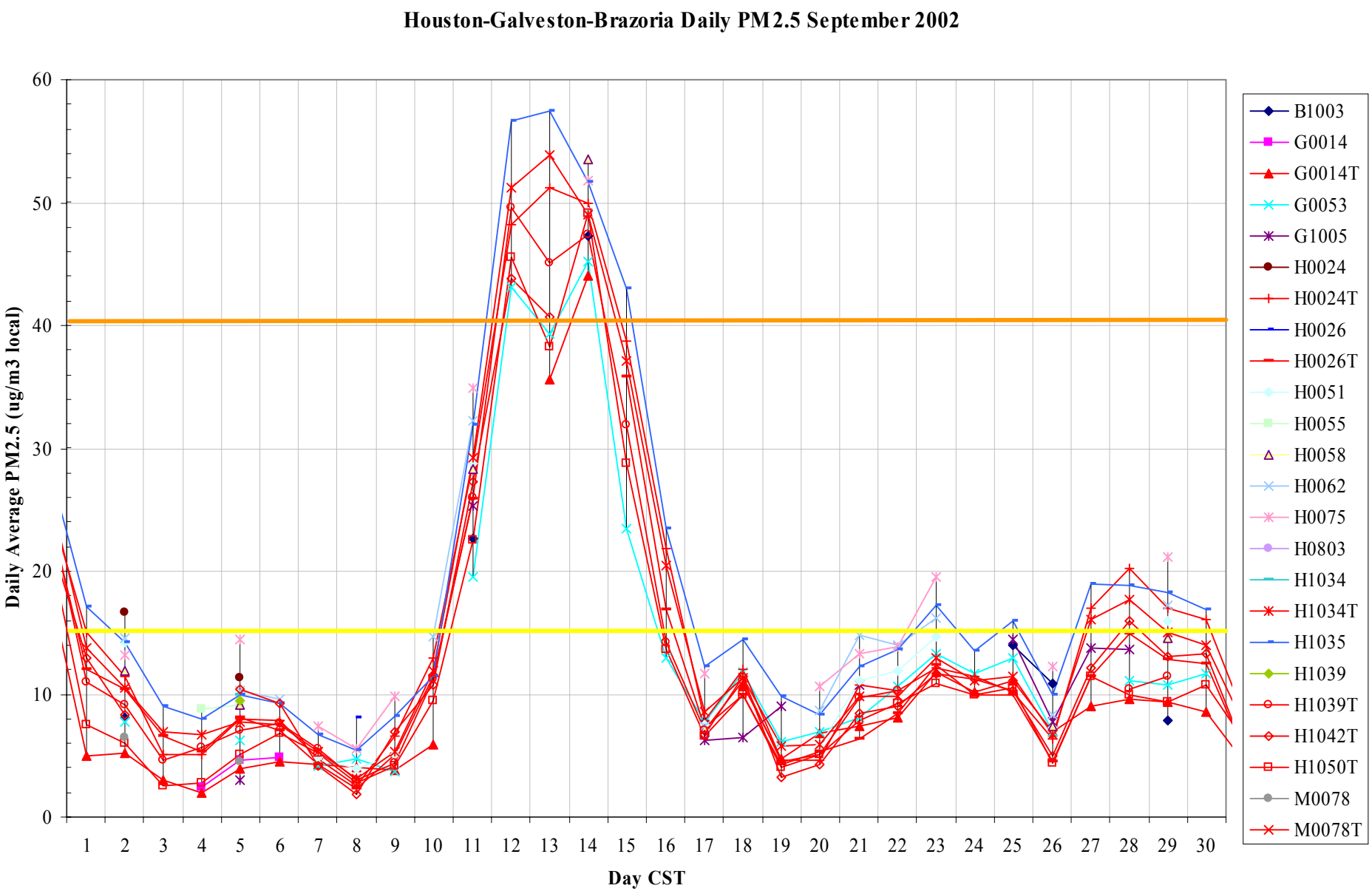

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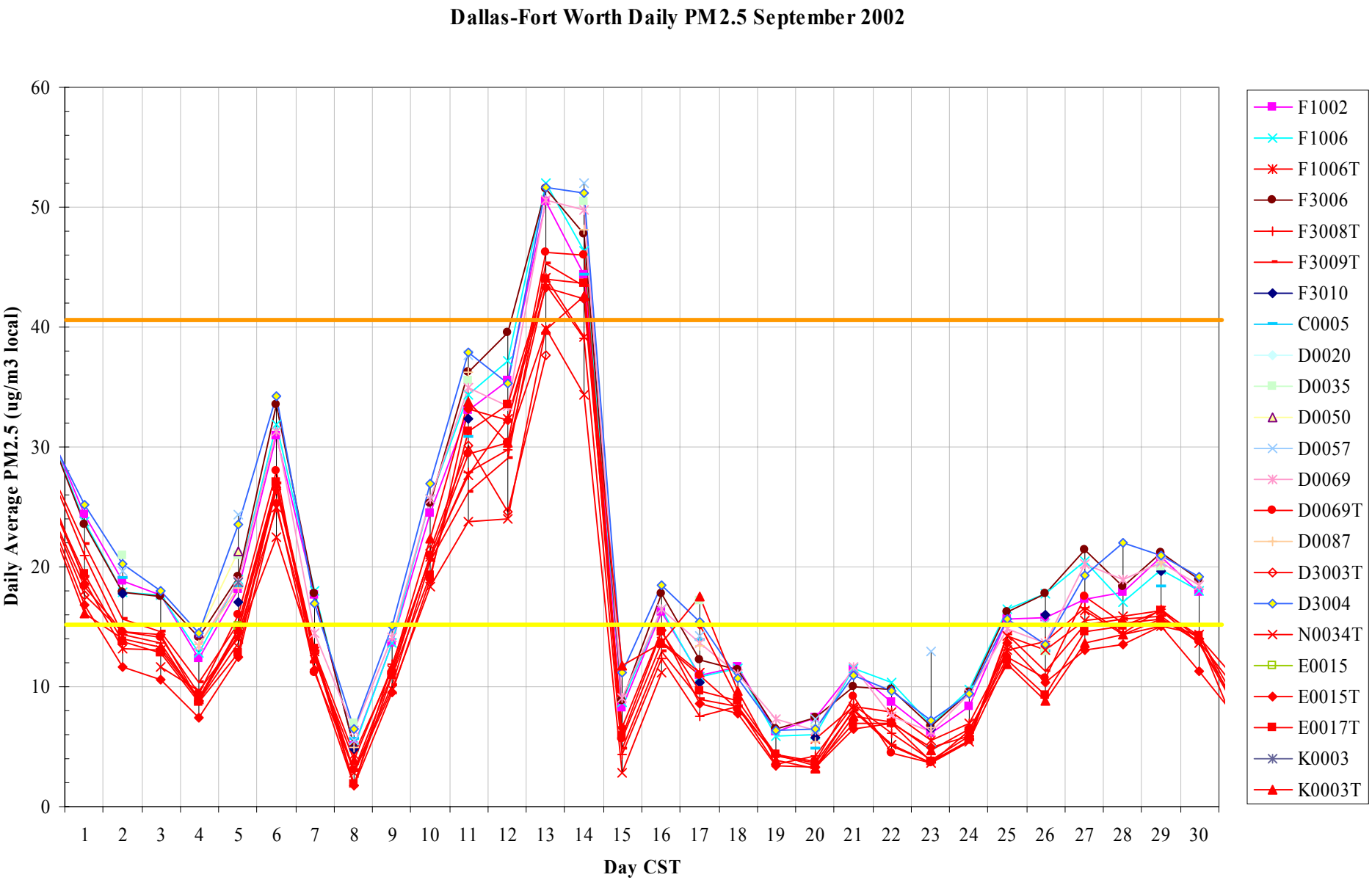

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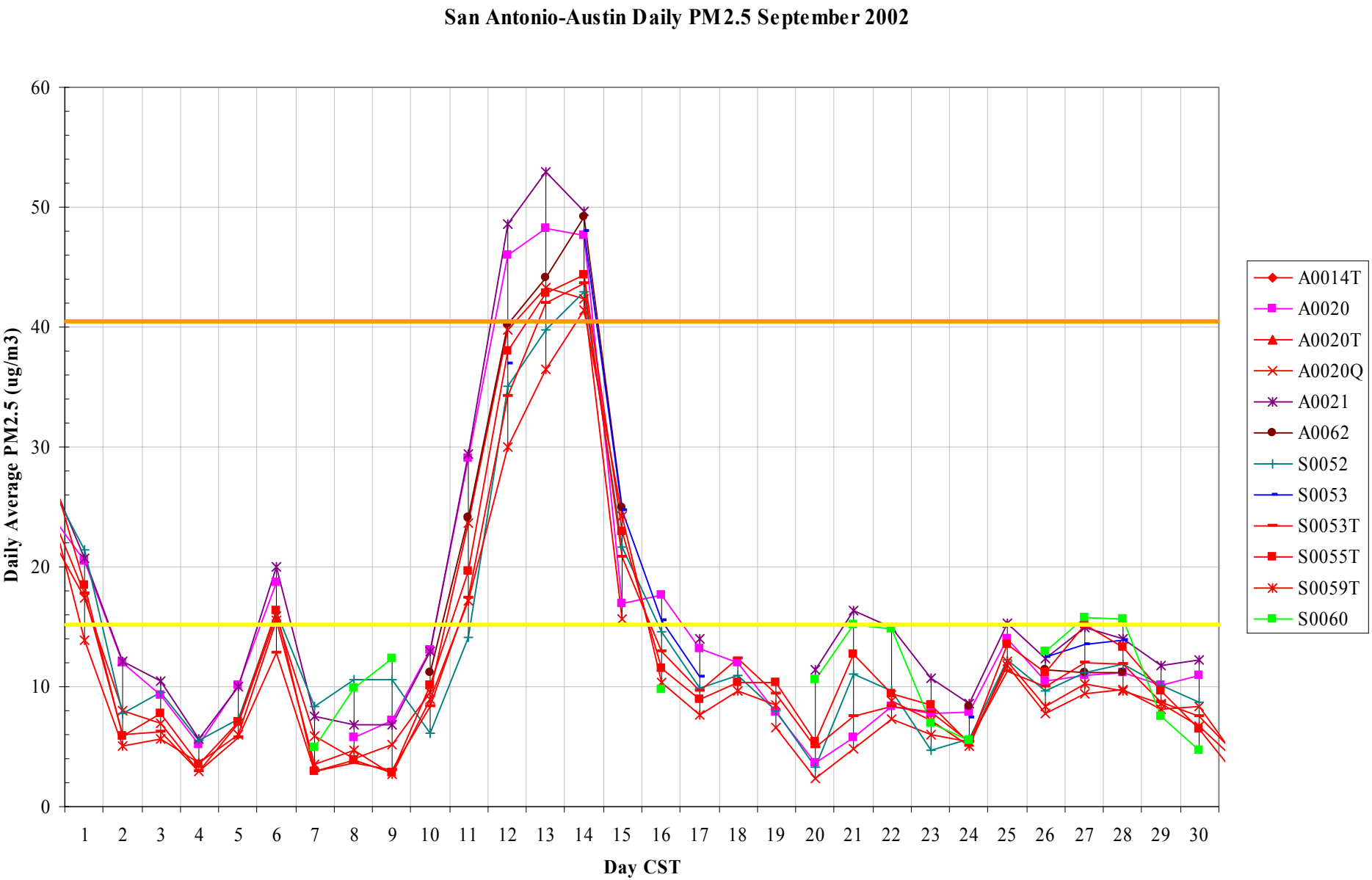
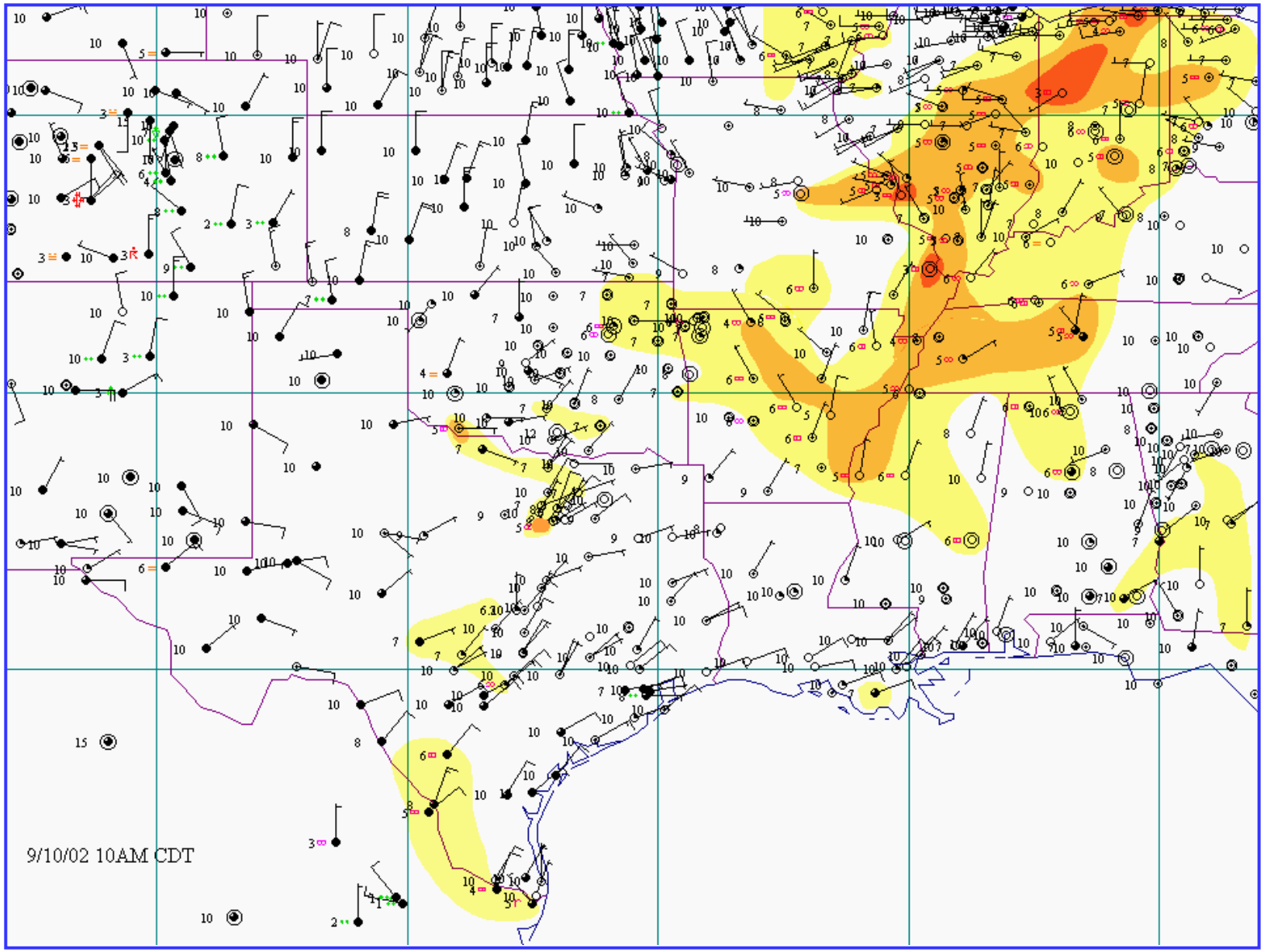
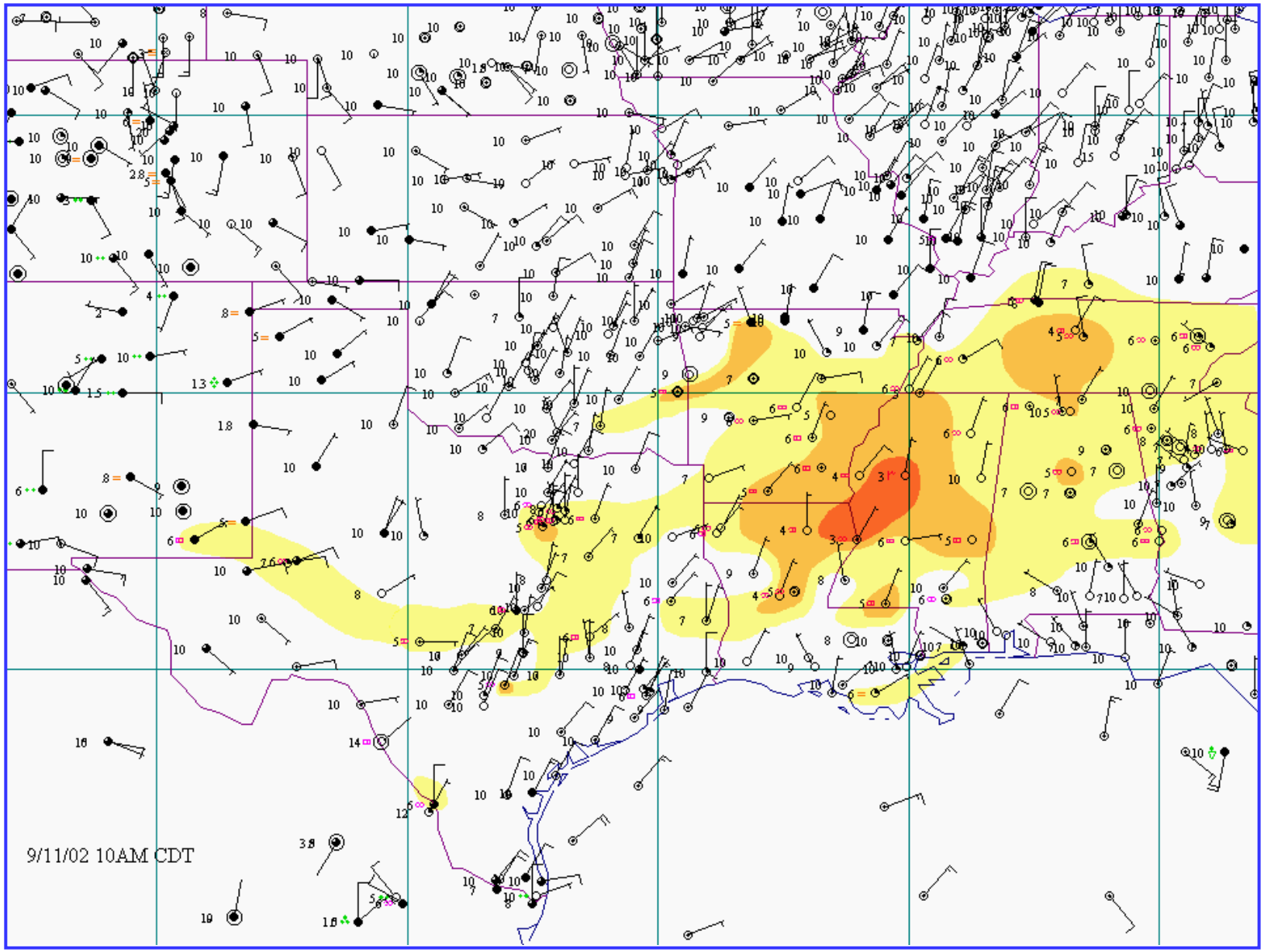


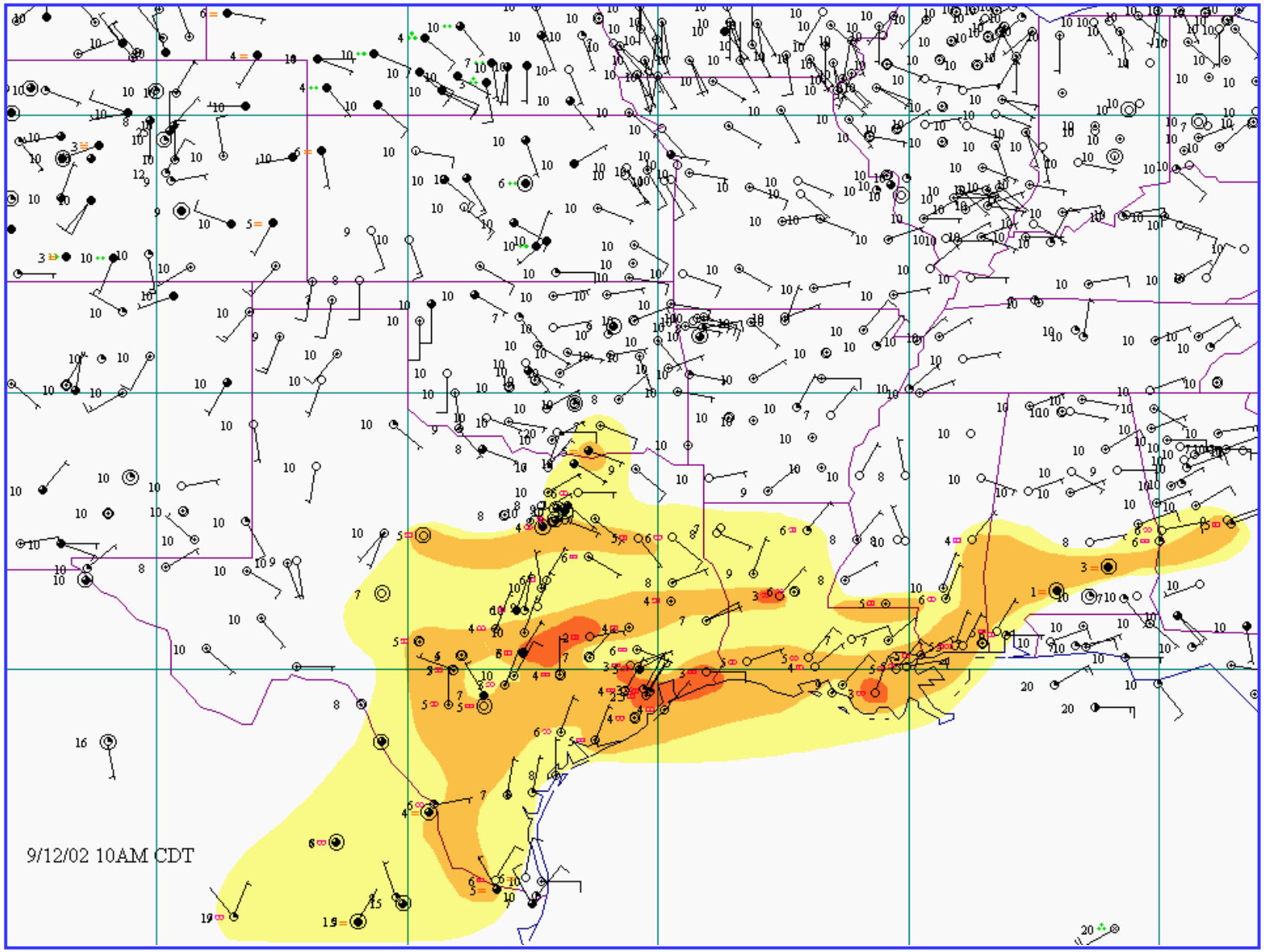
# Regional Haze - 2002 Sep 10



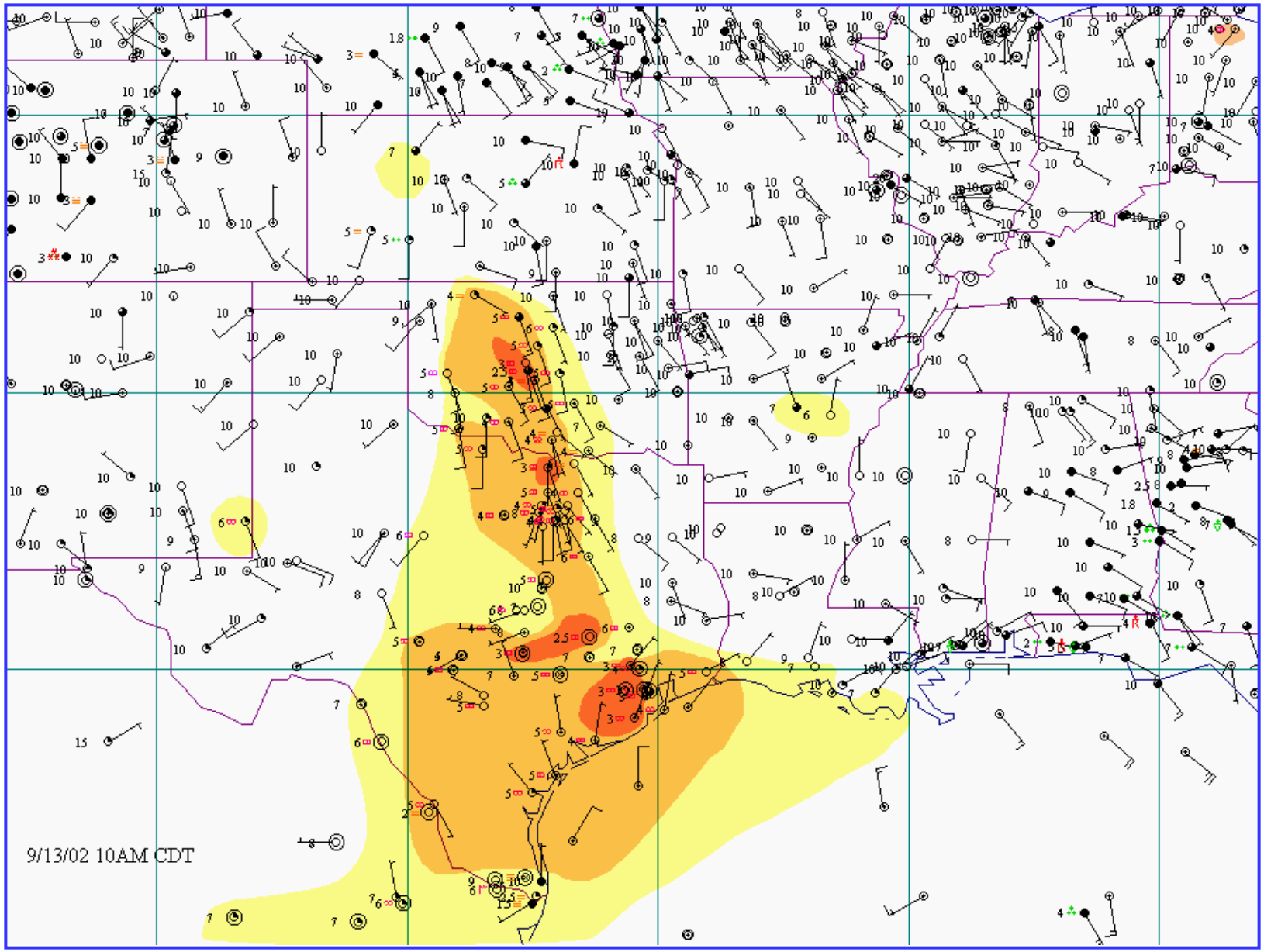
# Regional Haze - 2002 Sep 11



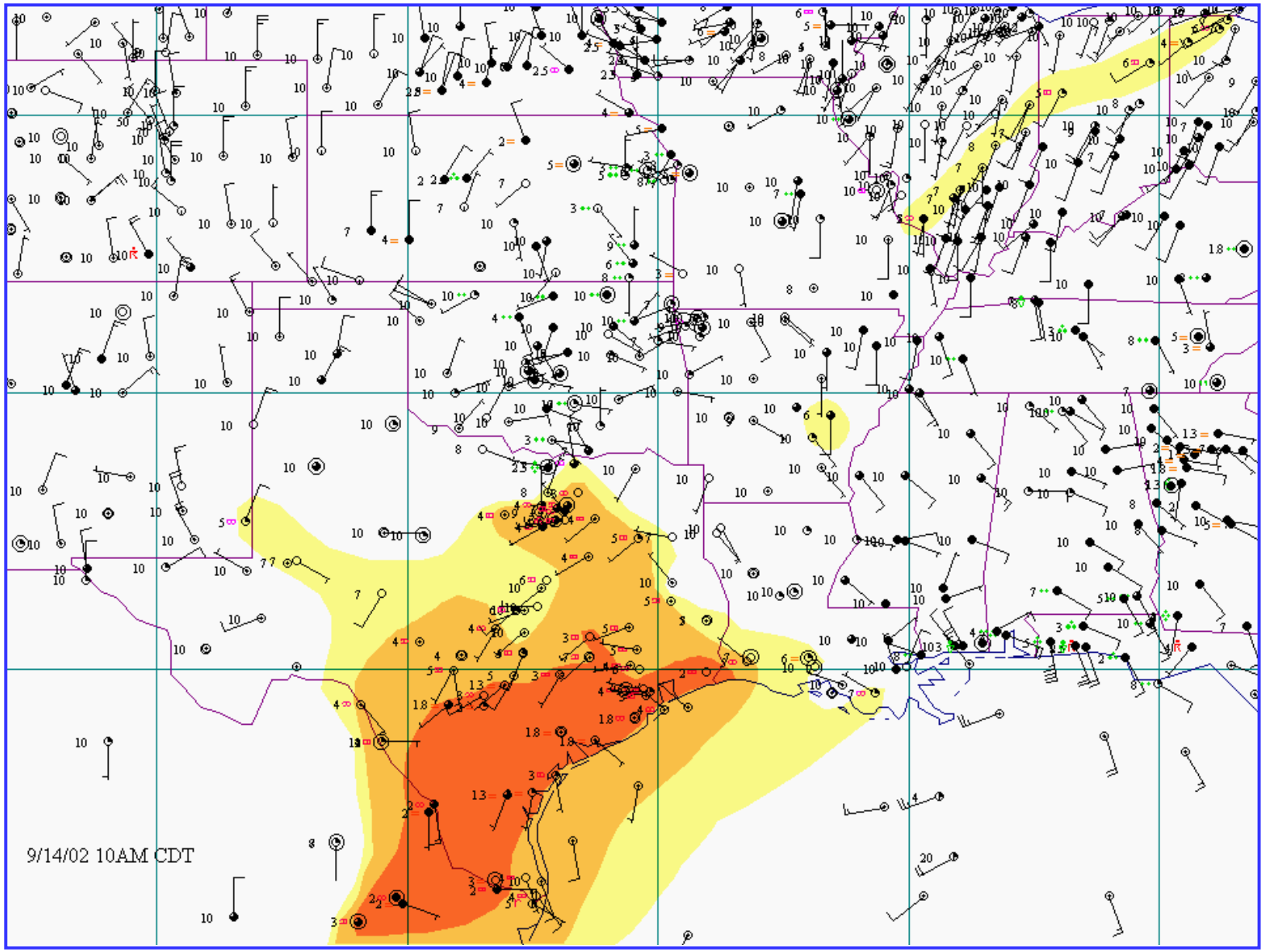
# Regional Haze - 2002 Sep 12



# Regional Haze - 2002 Sep 13

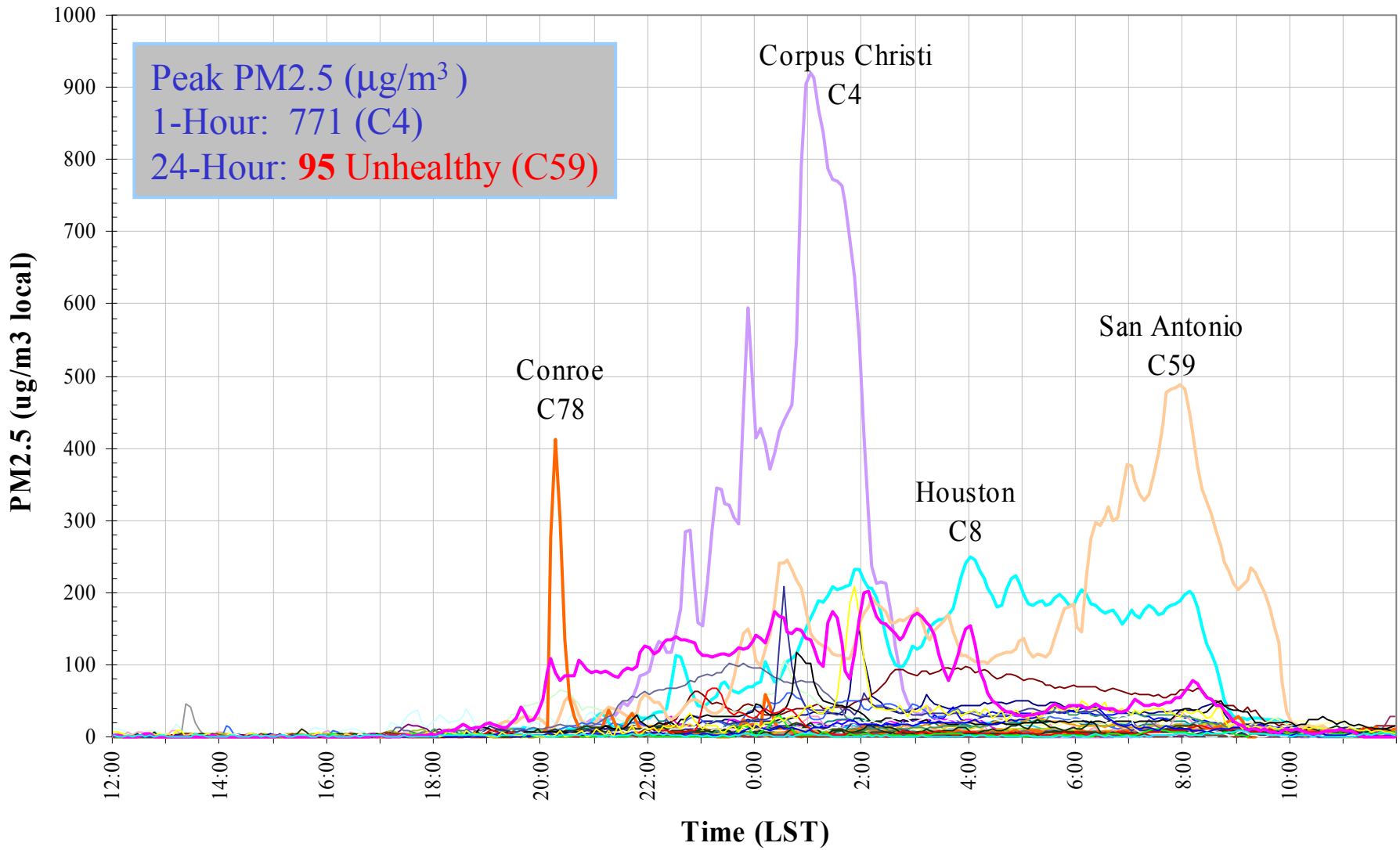


# Regional Haze - 2002 Sep 14

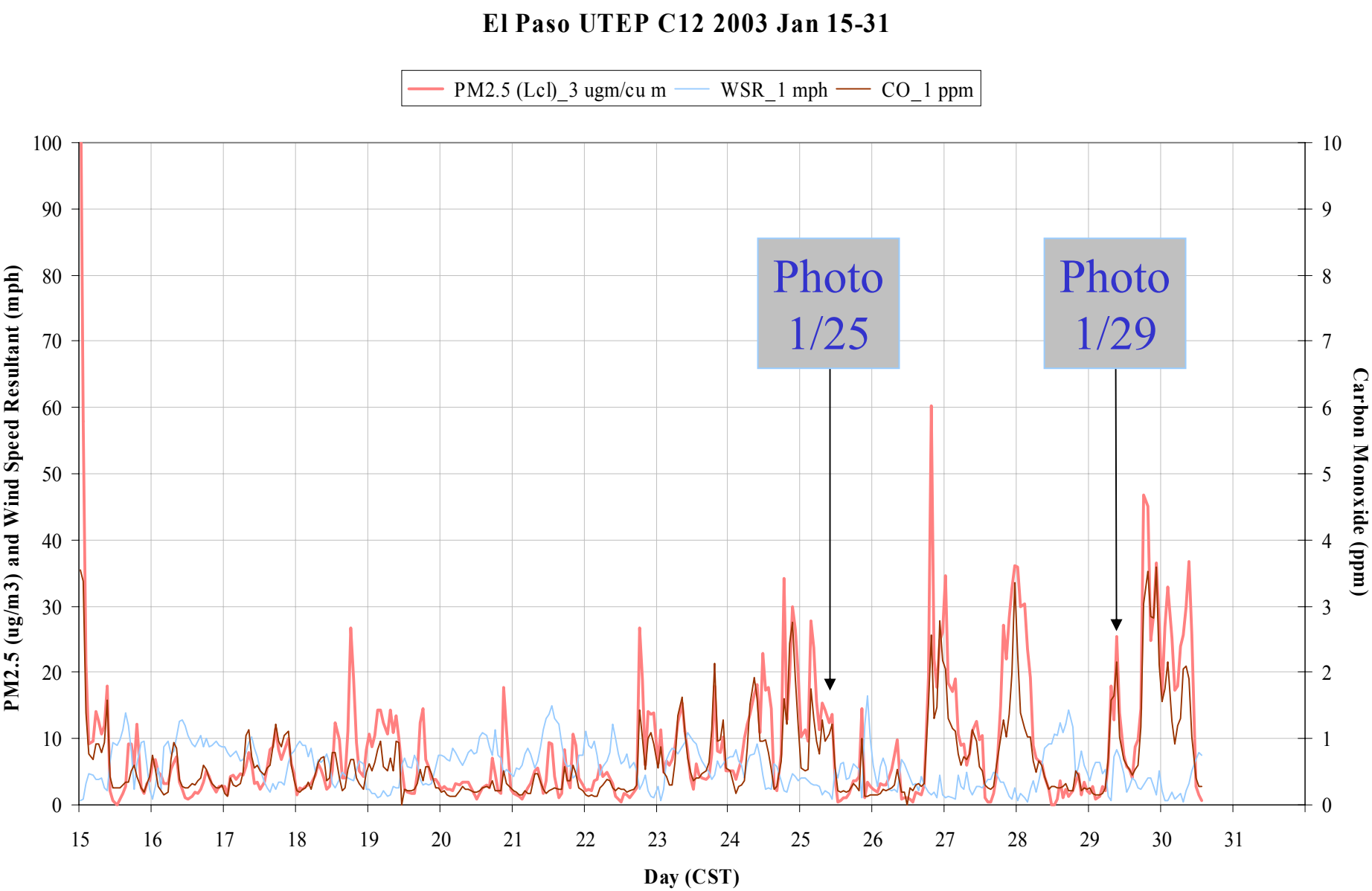


# Local Smoke – Fireworks

**Texas PM2.5 Five-Minute Averages Dec 31 2002 - Jan 1 2003**



# Local Stagnation



# Local Stagnation – El Paso

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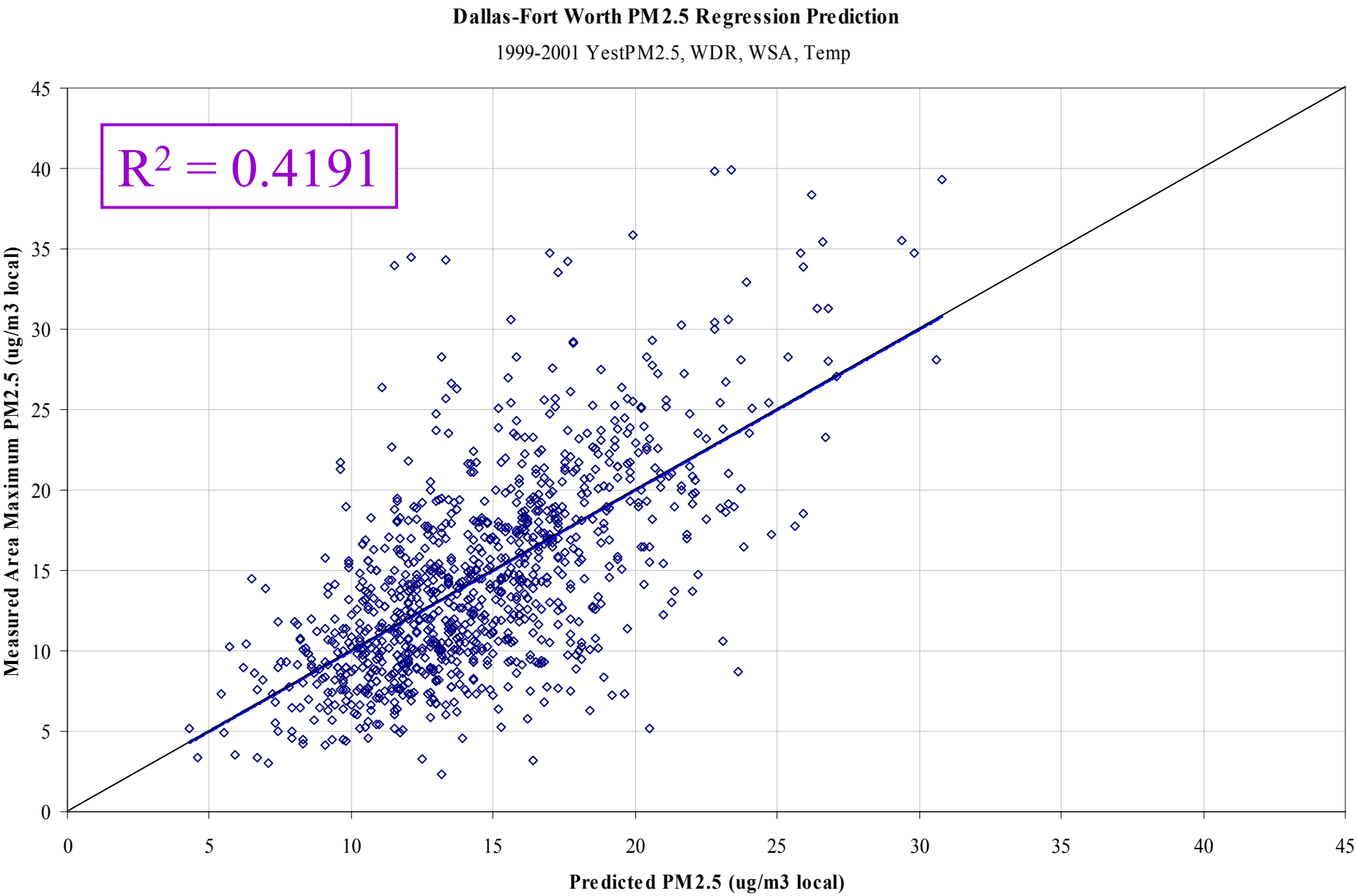
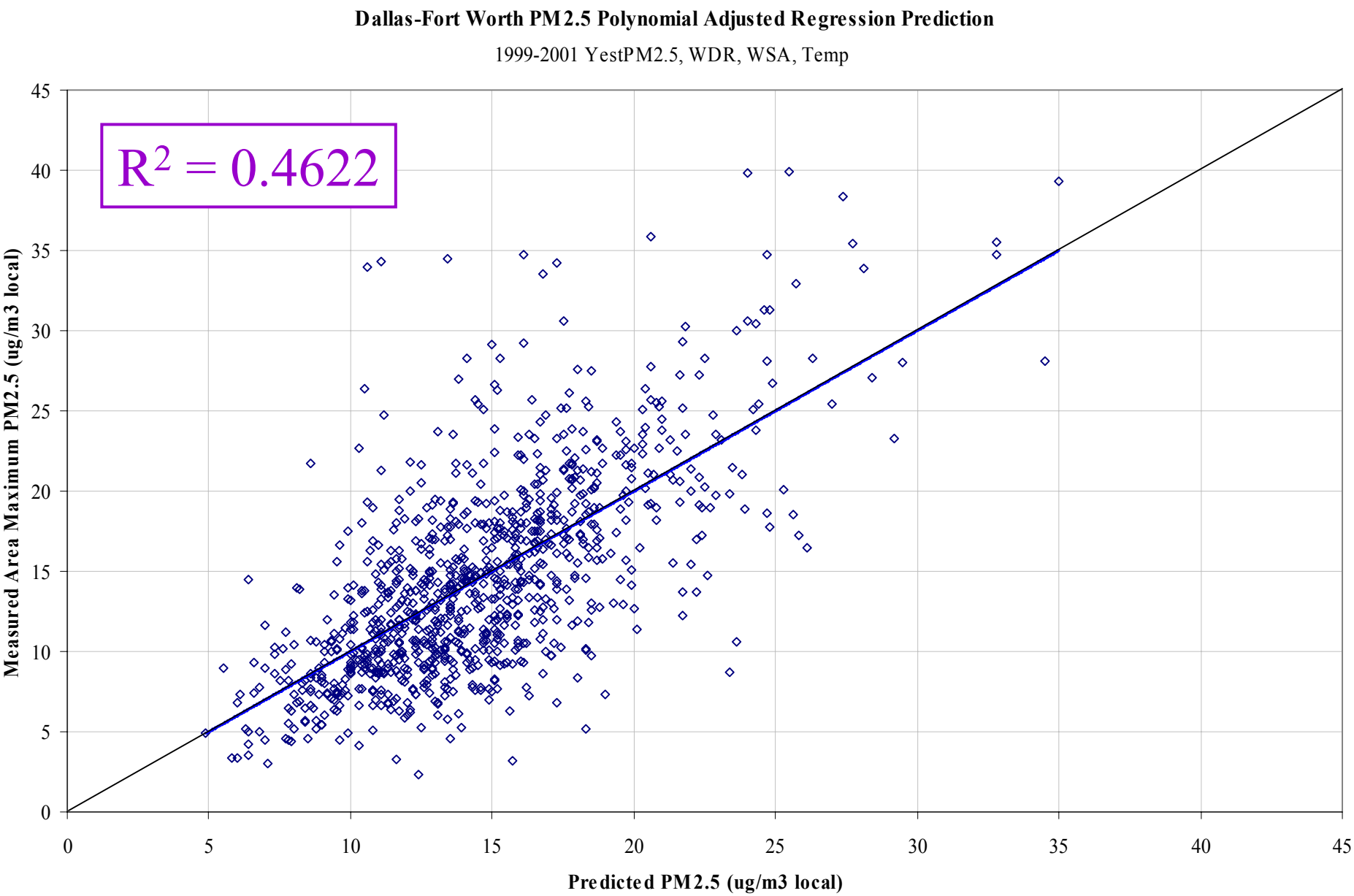
# Regression Studies

- Multiple Linear Regression of $PM_{2.5}$ versus
  - Yesterday $PM_{2.5}$
  - Wind Direction Resultant (WDR)
  - Wind Speed Average (WSA)
  - Average Temperature (Temp)
- Slightly better results obtained by substituting Polynomial Regression results for each parameter into Multiple Linear Regression Model

# Dallas Linear Regression Model

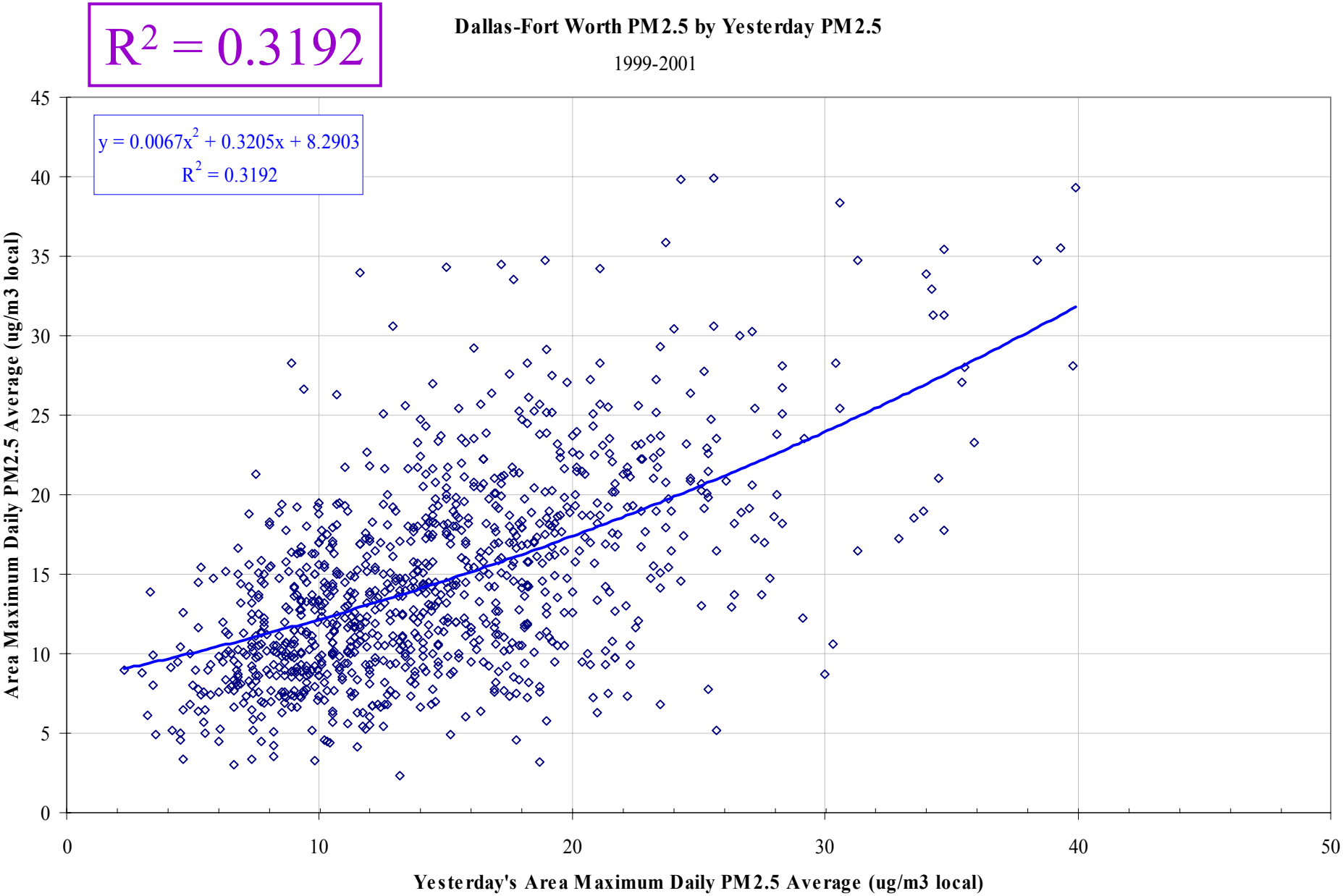


# Dallas Polynomial Regression Model

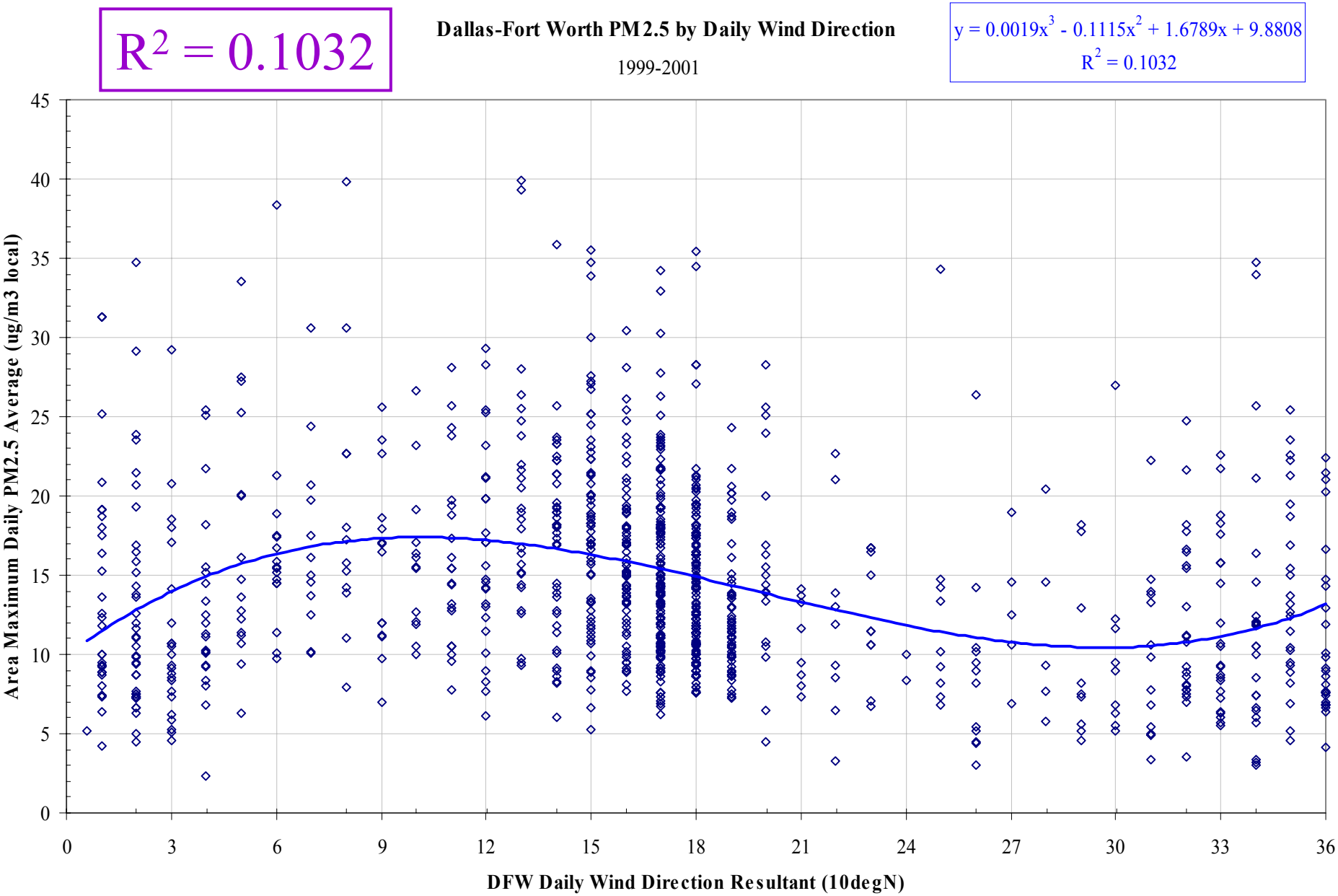


# PM2.5 - Yesterday PM2.5

$R^2 = 0.3192$

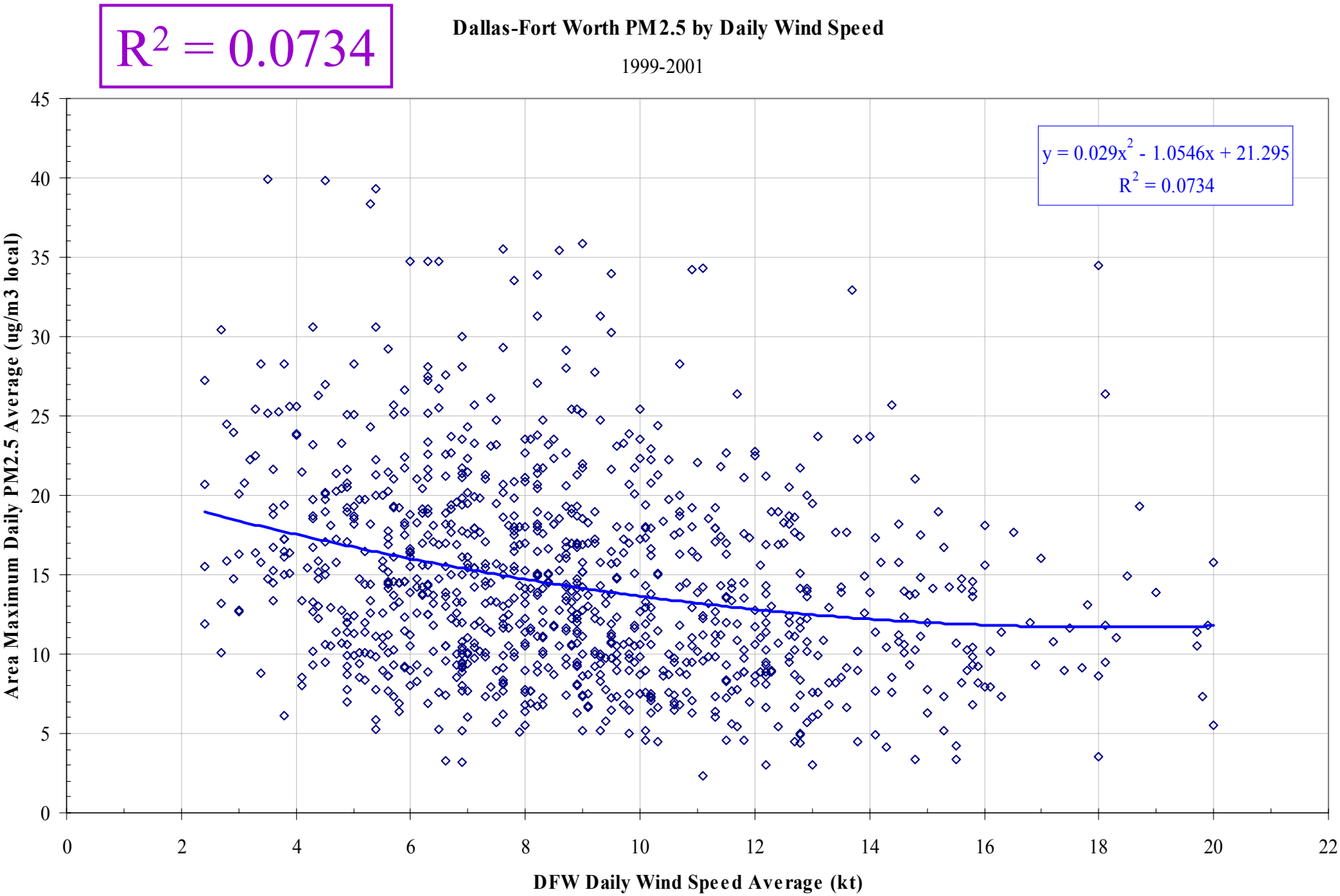


# PM2.5 - Wind Direction



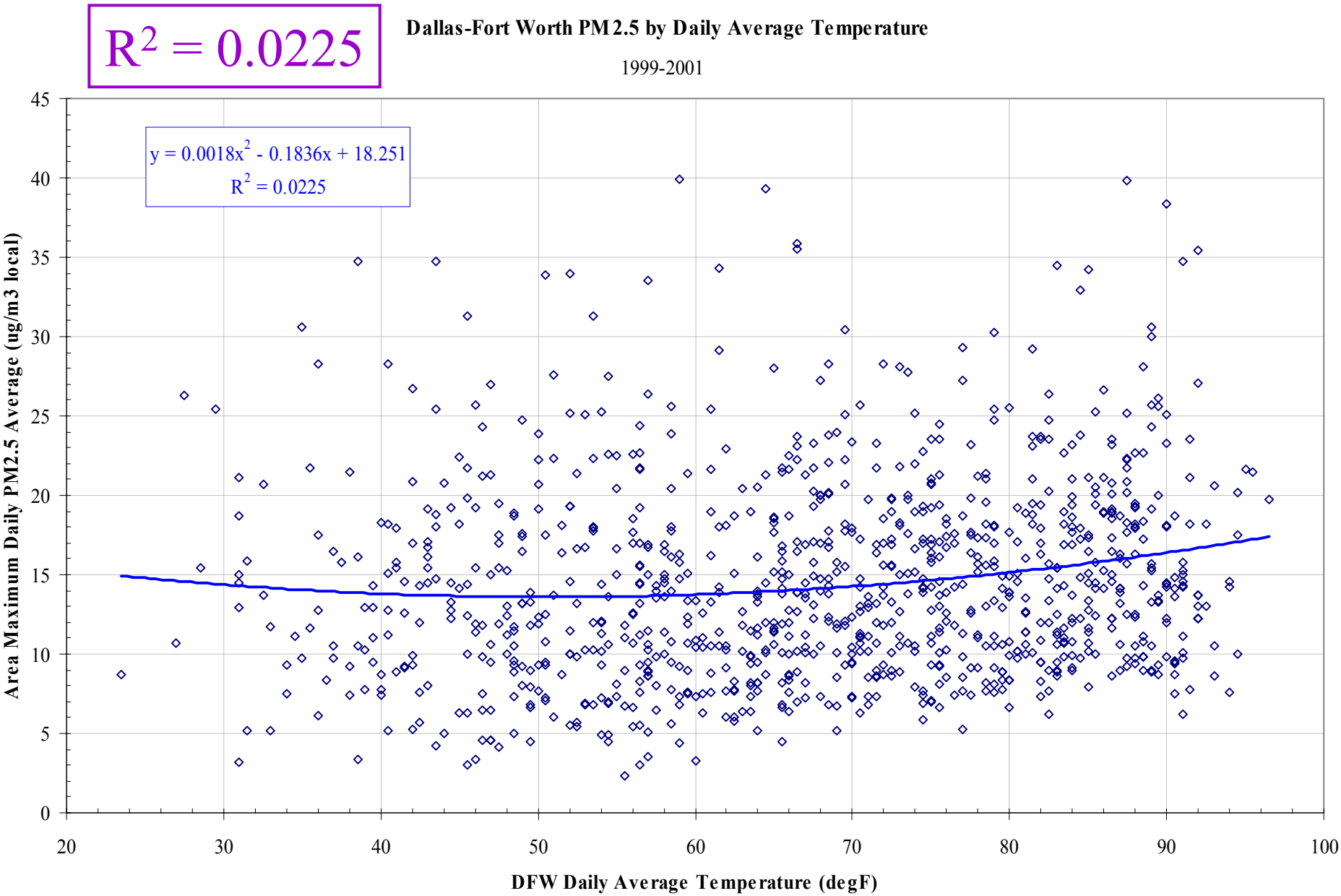
# PM2.5 - Wind Speed

$R^2 = 0.0734$

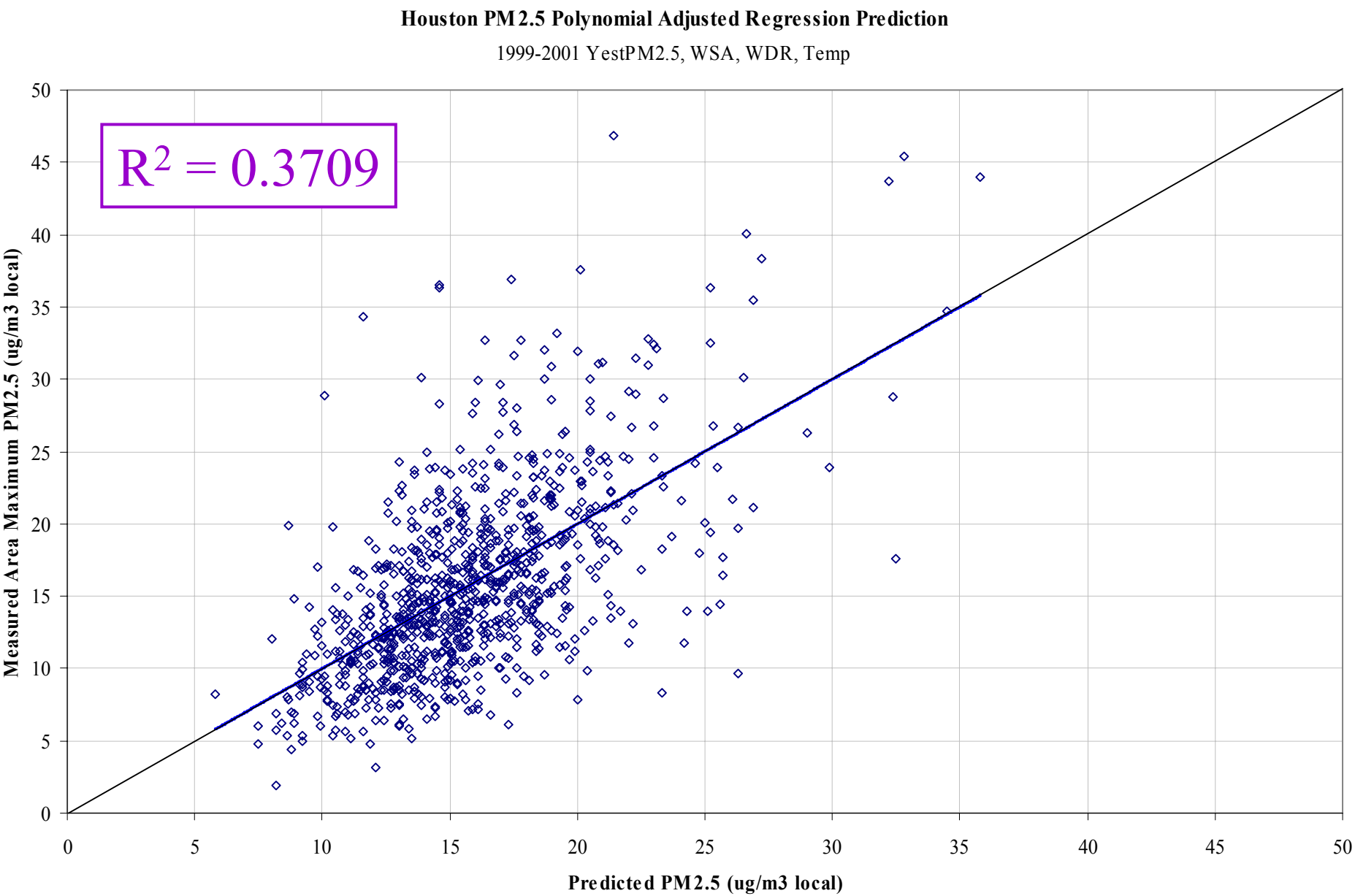


# PM2.5 - Average Temperature

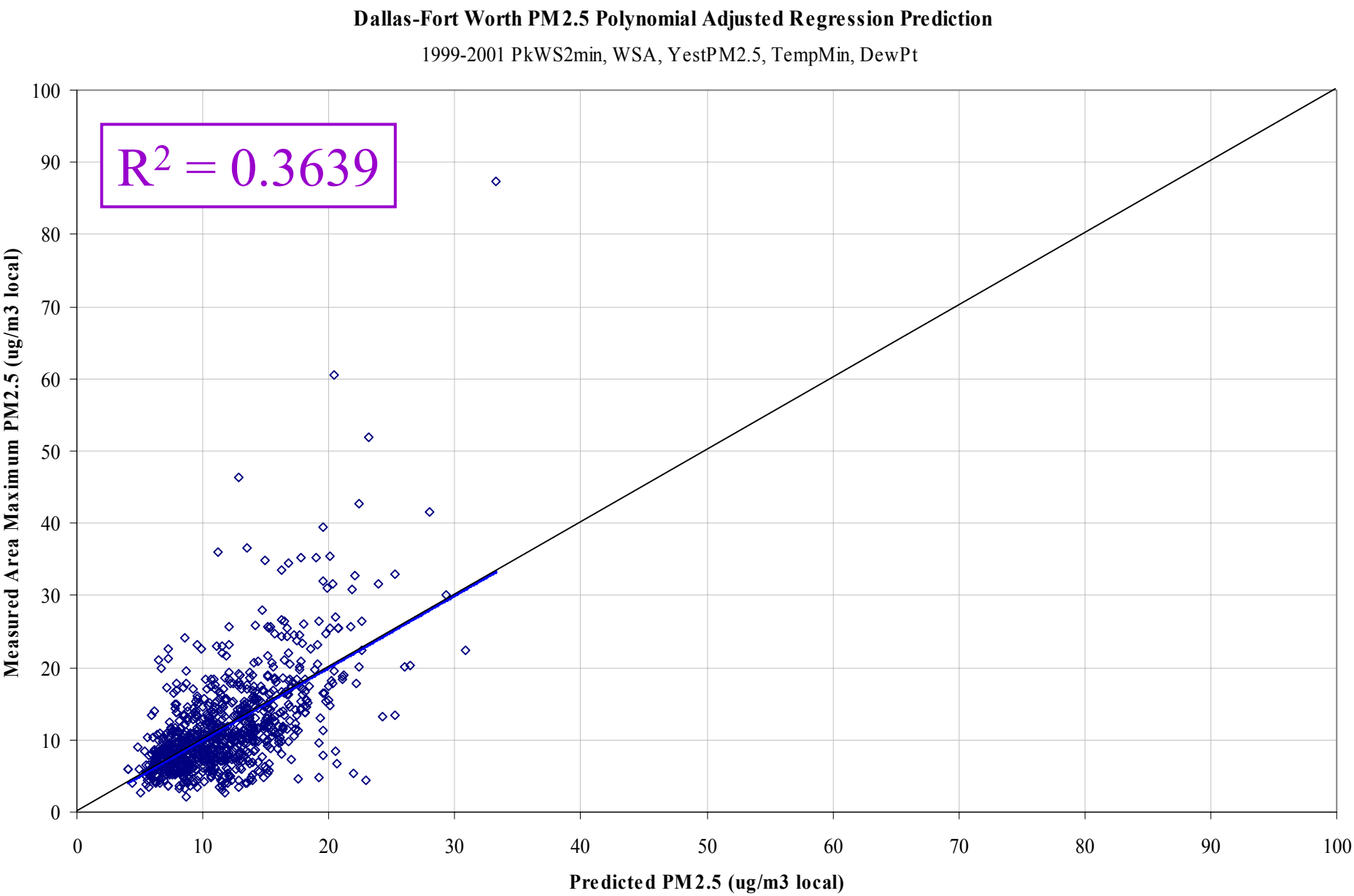
$R^2 = 0.0225$



# Houston Polynomial Regression Model



# El Paso Polynomial Regression Model



# TCEQ Web Pages

- Air Monitoring:
  http://www.tnrcc.state.tx.us/air/monops
- Air Pollution Events:
  www.tnrcc.state.tx.us/updated/air/monops/airpollevents/2003/sigevents_2003.html
  (analyses and descriptions of major air pollution events including high PM2.5 episodes)
- Current PM2.5 Levels:
  www.tnrcc.state.tx.us/cgi-bin/monops/texas_pm25
  (map of Texas showing highest PM2.5 1-hour averages by metro area for last hour)