

Baylor 2006 Aircraft-Based Air Quality Measurements



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Aztec specifications and operational parameters

Piper Aztec N6607Y

Sampling Speed.....	90 – 160 knots (46 – 82 m/sec) 120 knots (63 m/sec) typical
Endurance at 120 knots.....	~7 hours with 30 minute reserve
Instrument package max weight.....	~640 lbs
Electrical Power.....	Two 1000 watt sine wave static inverters
Seating Capacity.....	2 (one pilot & one scientist)

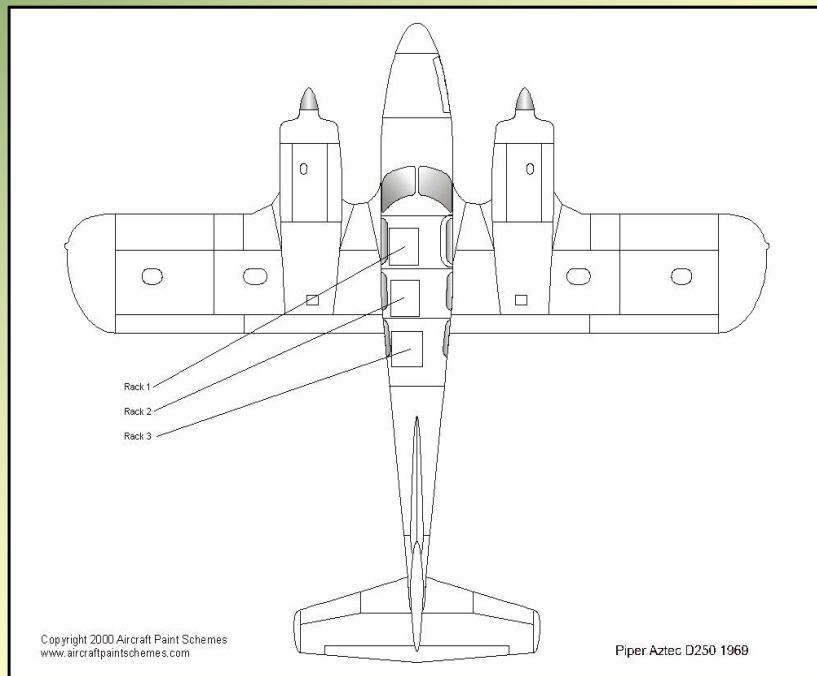


Aztec Scientific Payload

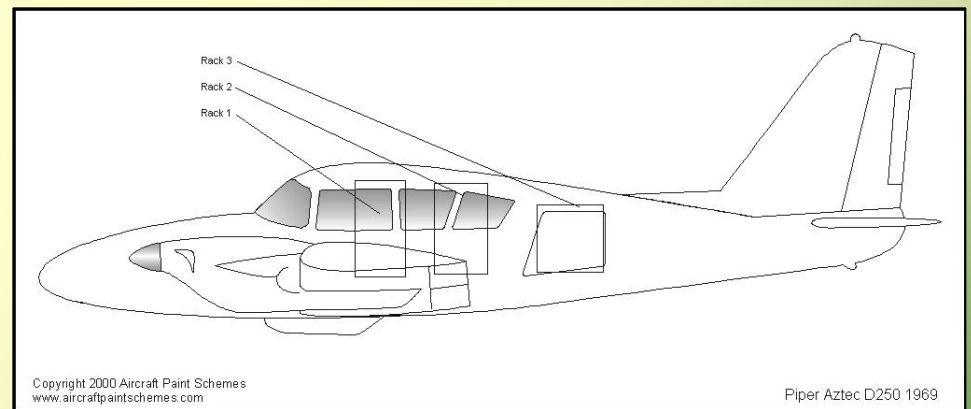
2006 Planned Aztec Measurements				
Measurement	Make and Model	Analytical Technique	Minimum Detection Limit	Recording Frequency
Reactive Alkenes	Hills Scientific	Chemiluminescence	0.5 ppbv	1 Hz
Ozone	2B Technology M205	Dual beam UV photometry	1 ppbv	0.5 Hz
NO	Modified TEI 42C	Chemiluminescence	0.4 ppbv	1 Hz
NO ₂	Modified Ecophysics CLD 77AM	Chemiluminescence with DMT NO ₂ photocell	0.2 ppbv	1 Hz
NO _y	Modified TEI 42C	Chemiluminescence with Mo converter	0.4 ppbv	1 Hz
CO	AeroLaser AL-5001	VUV Fluorescence	<2 ppbv	1 Hz
SO ₂	TEI 43C-TL	Pulsed fluorescence	0.2 ppbv	1 Hz
j(NO ₂)	Metcon	Filter radiometer	---	1 Hz
Light Scattering	TSI 3563	3-Wavelength nephelometry	1 inv Mm	1 Hz
Particle Counter	Grimm 1109	Laser spectrometry	1 particle/liter	0.17 Hz (6 s)
Position/Meteorology (Winds, Temperature, Pressure, Relative Humidity)	Aventech AIMMS-20	GPS/Differential pressure transducers, accelerometers, platinum RTD, RH sensor	Varies with parameter	1 Hz
Additional Potential Measurements				
VOCs	Lab TBD	Whole air samples	Varies	NA
HCHO	AeroLaser AL-4021	Hantzsch reaction	80 ppt	90 s

Platform Layout

Top view



Side view



Existing measurement systems



Left: Data system and power supplies



Right: Common vacuum pump for CO, NO₂, and NO_y



Left: Standard additions system (NO, NO₂, SO₂, CO & propene)



Right: Inlets on Piper Aztec during preflight checks

Instrument Racks

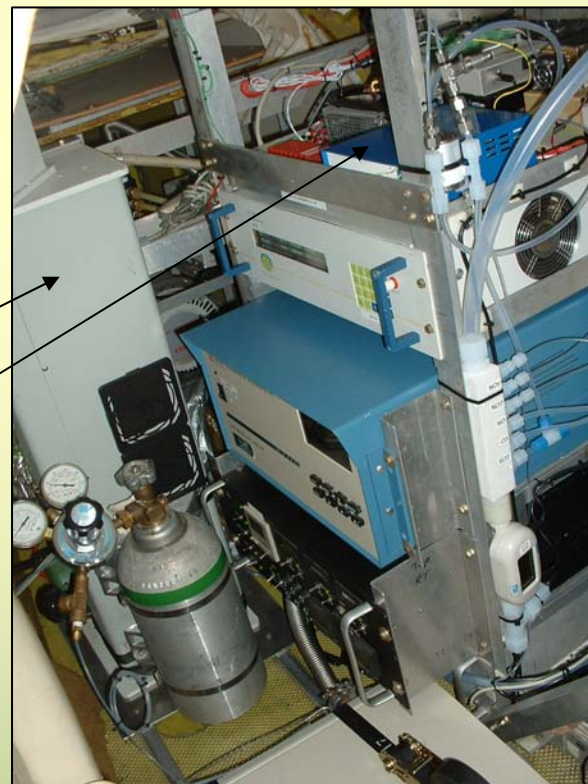


Left (top to bottom):
TEI SO₂, 2B Ozone,
Formaldehyde
(Aerolaser?), and TEI
NO

TSI nephelometer

Grimm aerosol
spectrometer

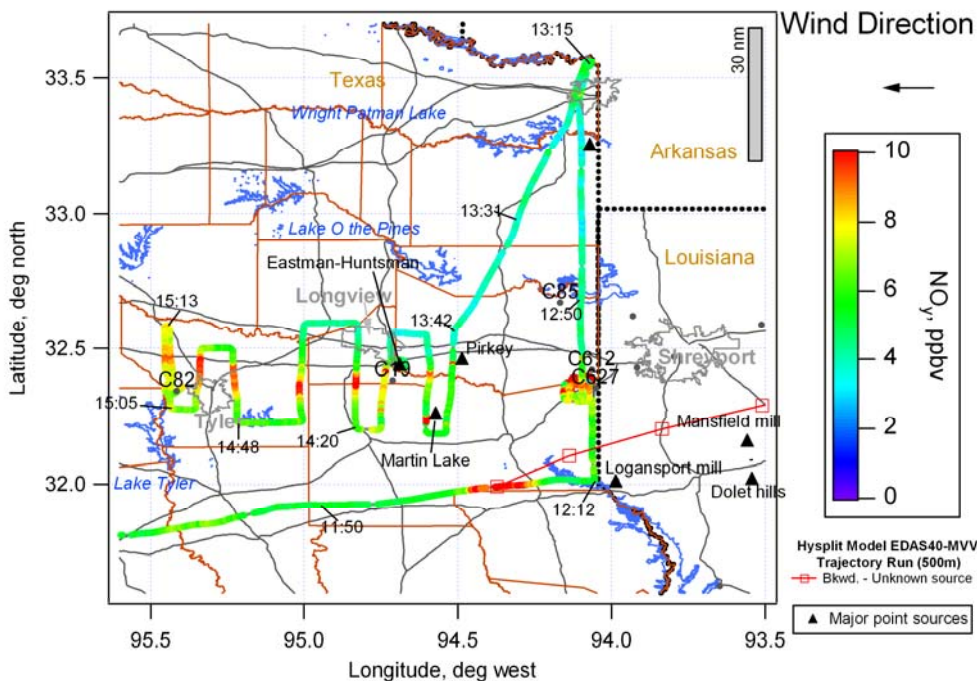
Right (top to bottom):
Ecophysics NO₂,
NO_y, and Reactive
alkenes detector
(RAD)



Example science flight (NETAC 2005): Intra and inter-state transport

Baylor Institute for Air Science 2005 Data
Piper Aztec Flight Date: Sunday, Sep 04, 2005
Flight start time = 10:55:11 AM CDT
Flight end time = 3:22:46 PM CDT

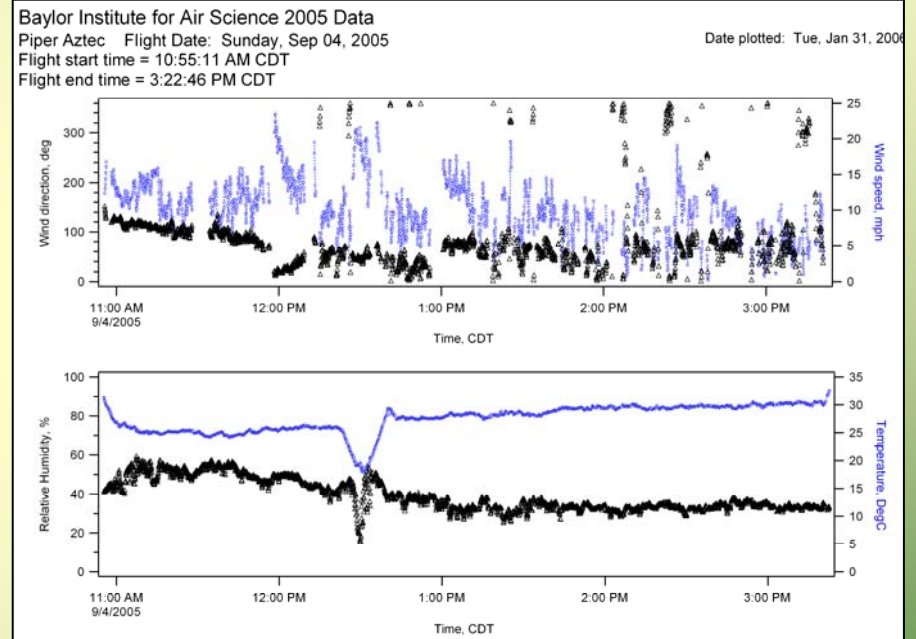
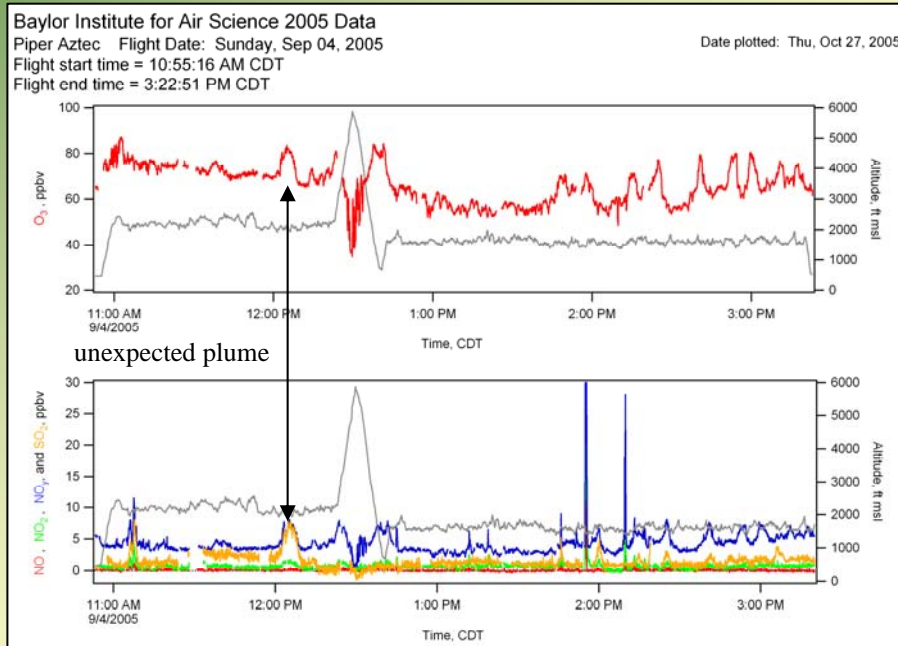
Date plotted: Wed, Feb 01, 2006



- Saw expected sources (i.e., Shreveport, Longview, and Tyler urban plumes; Martin Lake, Pirkey, and Eastman-Huntsman industrial plumes)

- Unexpected plume on transit leg just west of TX-LA border with coal-fired signature

Example: Time-series Plots

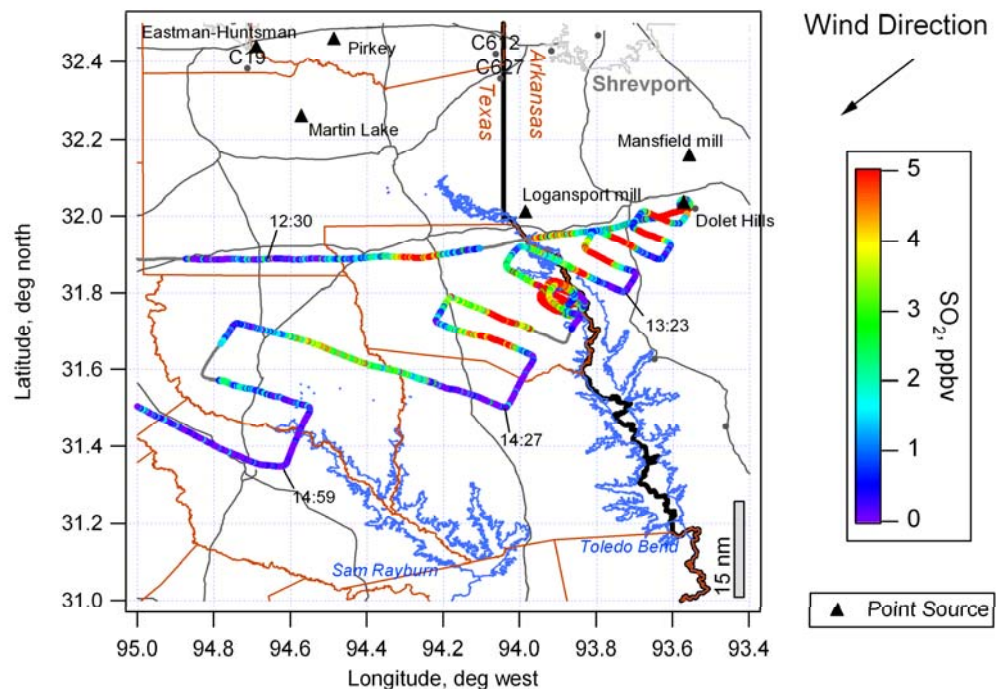


Standard “first-look” time-series and spatial plots are ready within 24 hours, typically by the next morning.

Dolet Hills EGU

Baylor Institute for Air Science 2005 Data
Piper Aztec Flight Date: Thu, Sep 08, 2005
Flight start time = 11:26:33 AM CDT
Flight end time = 3:59:38 PM CDT

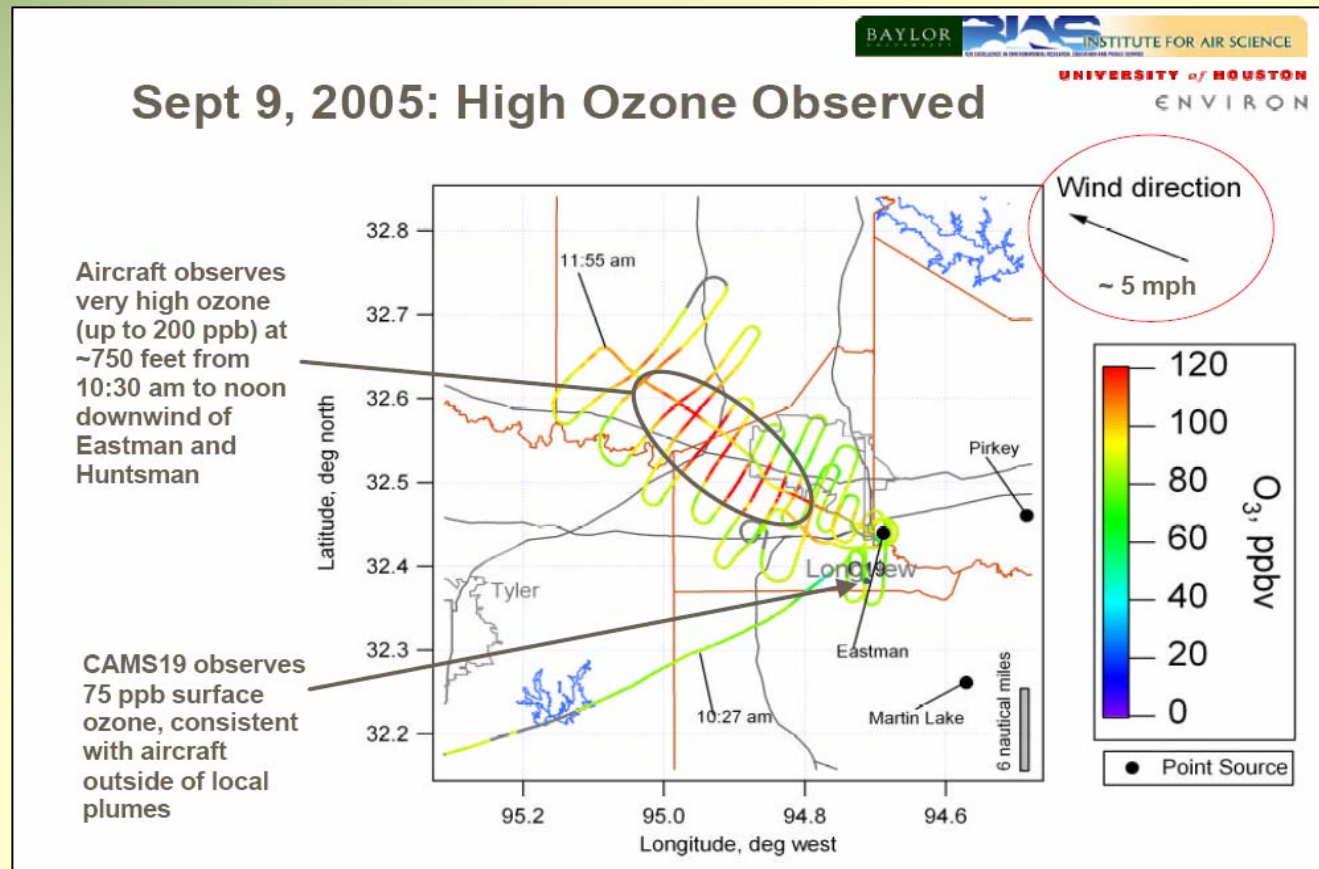
Date plotted: Thu, Feb 02, 2006



- After seeing the unexpected plume on earlier flights, it was suspected the source may have been in Louisiana. The Dolet Hills EGU was investigated as a potential source.

- The unexpected plume was still seen in the same area.

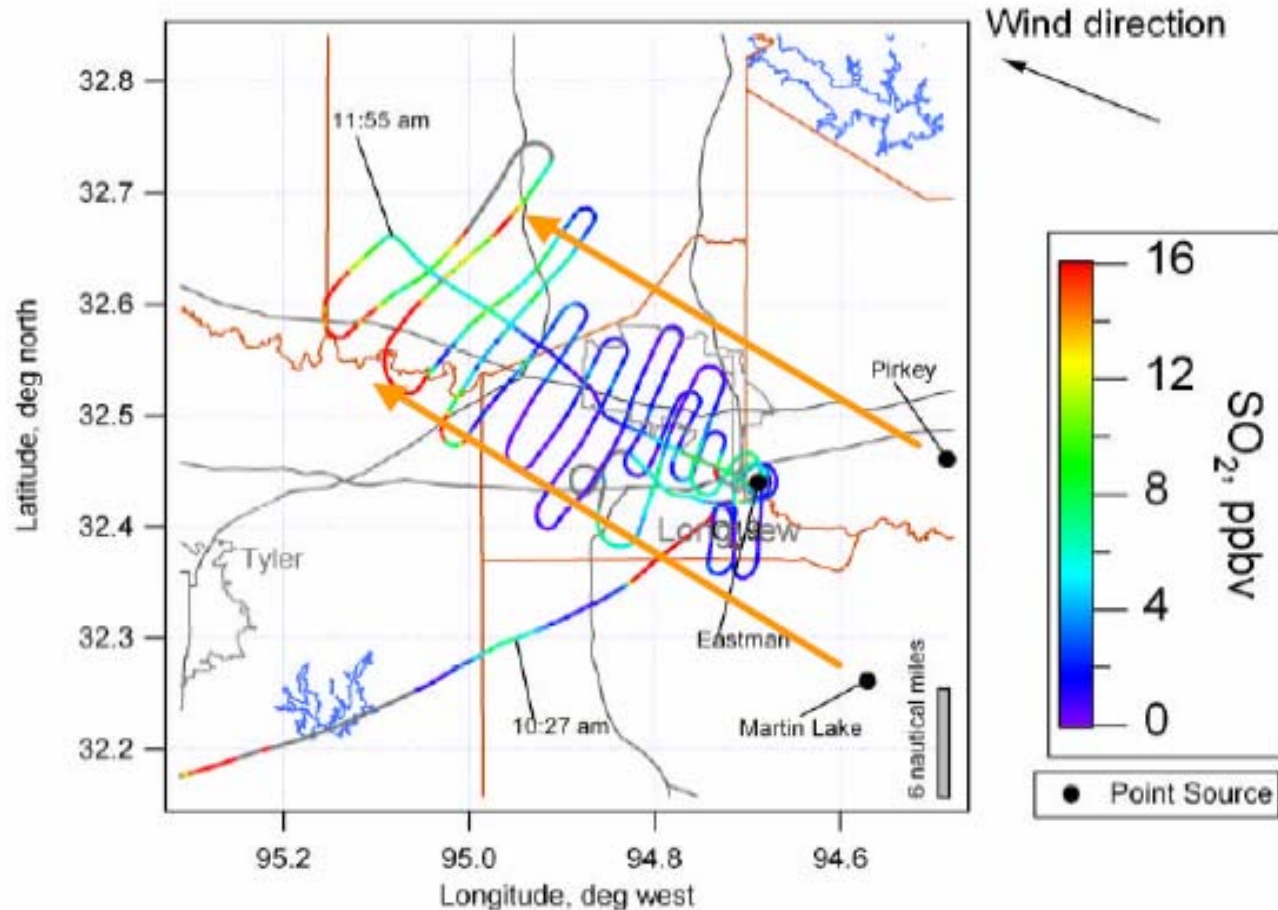
High ozone event



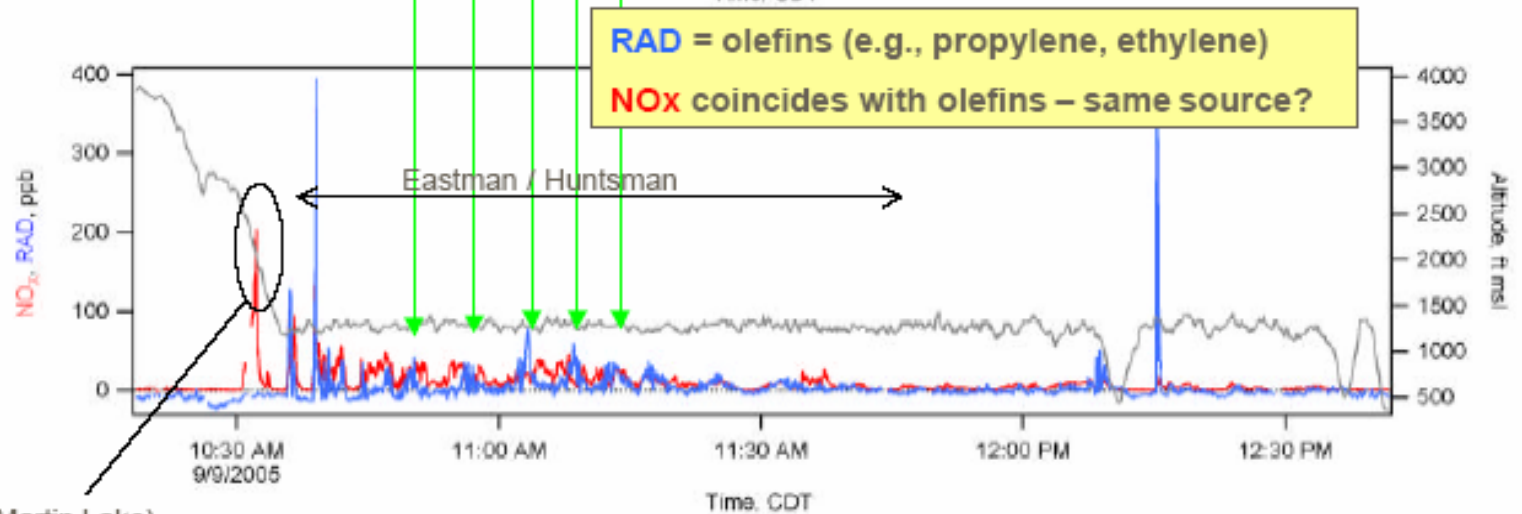
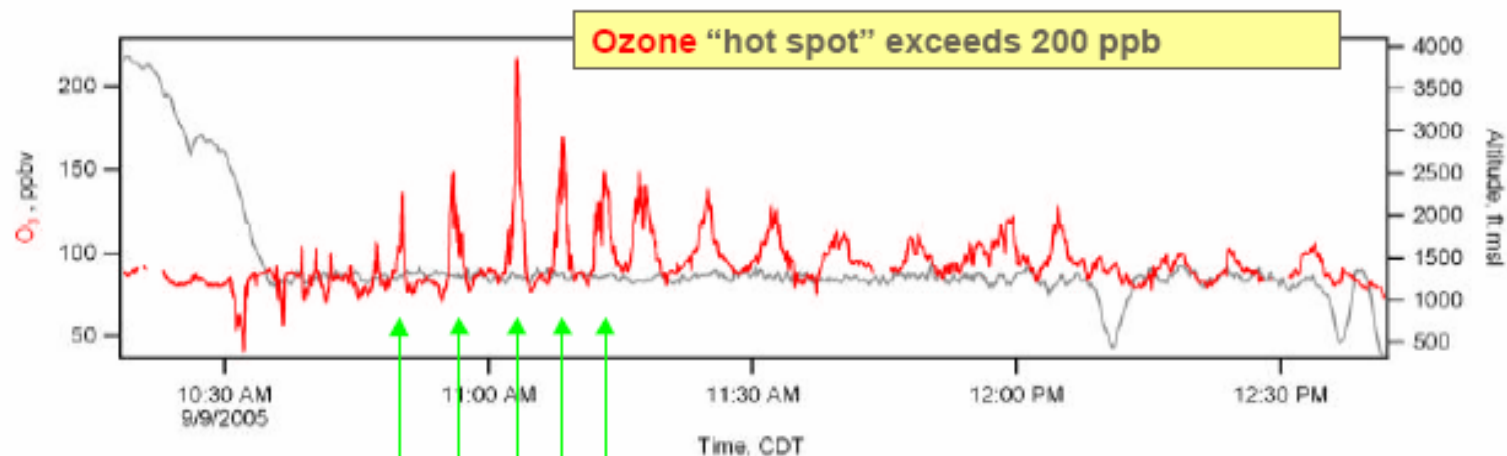
Sept 9, 2005: SO₂ shows EGU plumes

The Eastman and Huntsman plume is between two EGU plumes

The Martin Lake plume is at higher altitude (~1500 feet) at ~10:30, and mixes down to the surface by ~noon



Sept 9, 2005: Ozone from olefins/NOx



(Martin Lake)

Plans for 2006

- NETAC - 40 hours same objectives as 2005
 - Inter-state transport: Background ozone
 - Inter/intra-state transport: Urban plumes
 - Inter/intra-state transport: Industrial plume tracking
 - May explore sources in western Louisiana
- Potential work with NOAA Twin Otter
 - PBL meteorology
 - Ozone transport
 - Other TexAQS II objectives
 - Platform intercomparisons

Acknowledgments

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