

CURRENT PROJECTS



**Parameterization of the Subgrid-scale
Turbulent Chemistry Effects
in UAH-LRPM**

**Planning and Implementation of the
NE Texas Plume Study (NETPS)**

NETPS GOAL

To perform a field study in Summer 2005,
based on 60 h of aircraft flight time,
to generate a database aimed at
characterizing quantitatively
**the ozone impact in the DFW area
of large upwind NO_x emissions
on typical high ozone days**

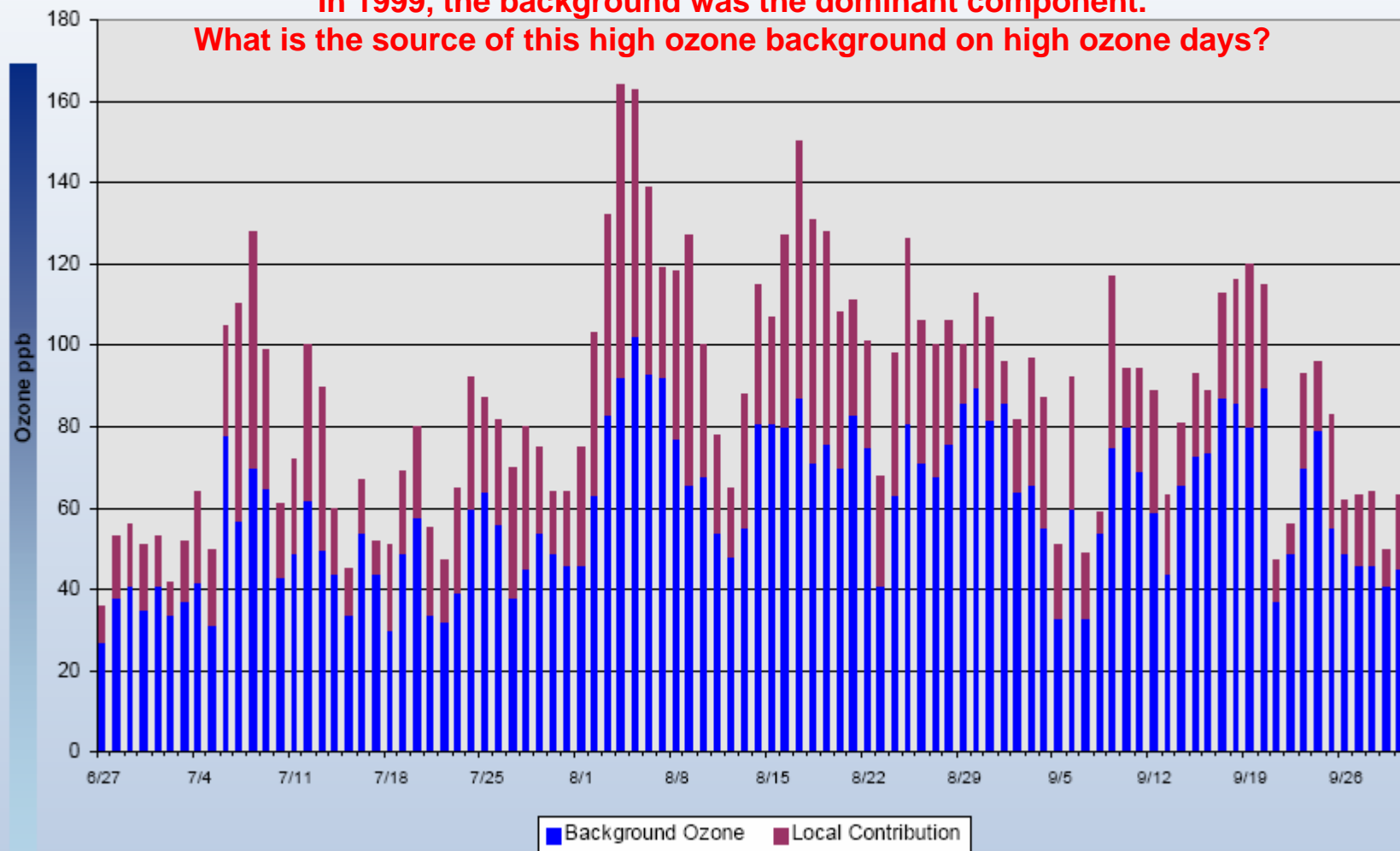


**Background and Conceptual Plan
of NETPS**
(in the following slides)

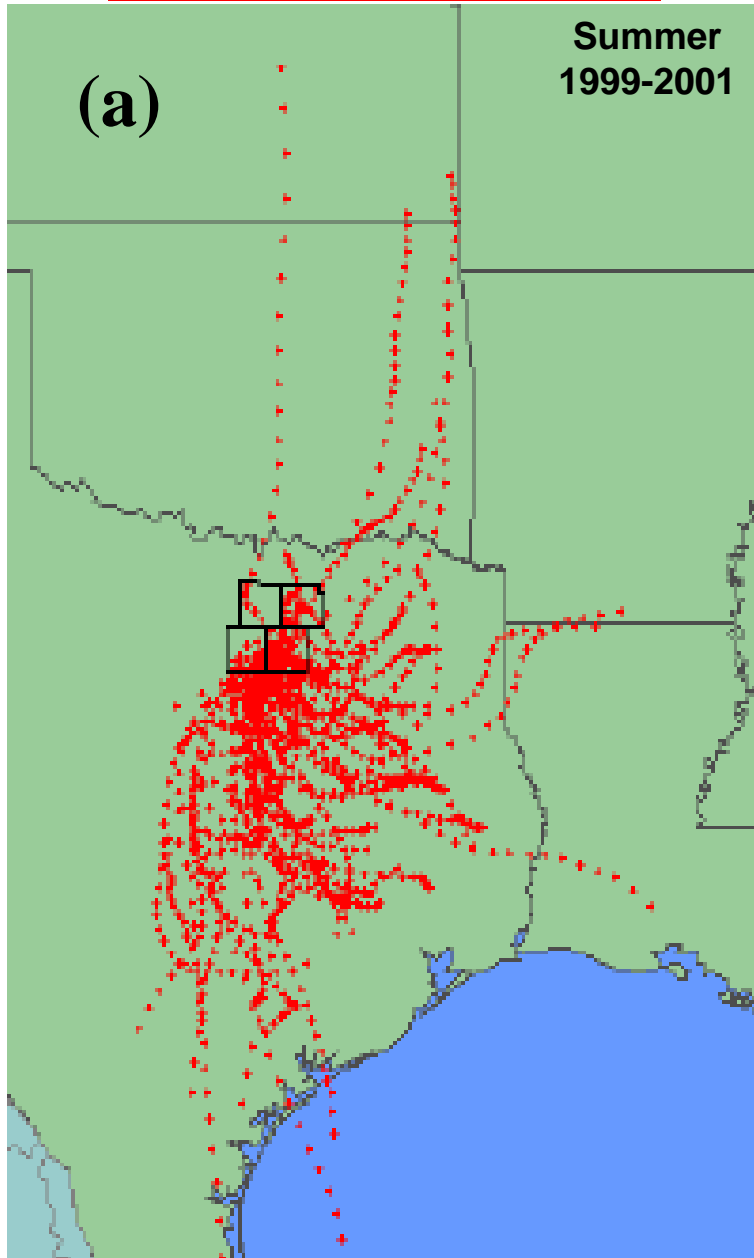
MOTIVATION

DFW Daily Peak 1-h Background and Local Contribution to Total Ozone Jul, Aug, Sep 1999

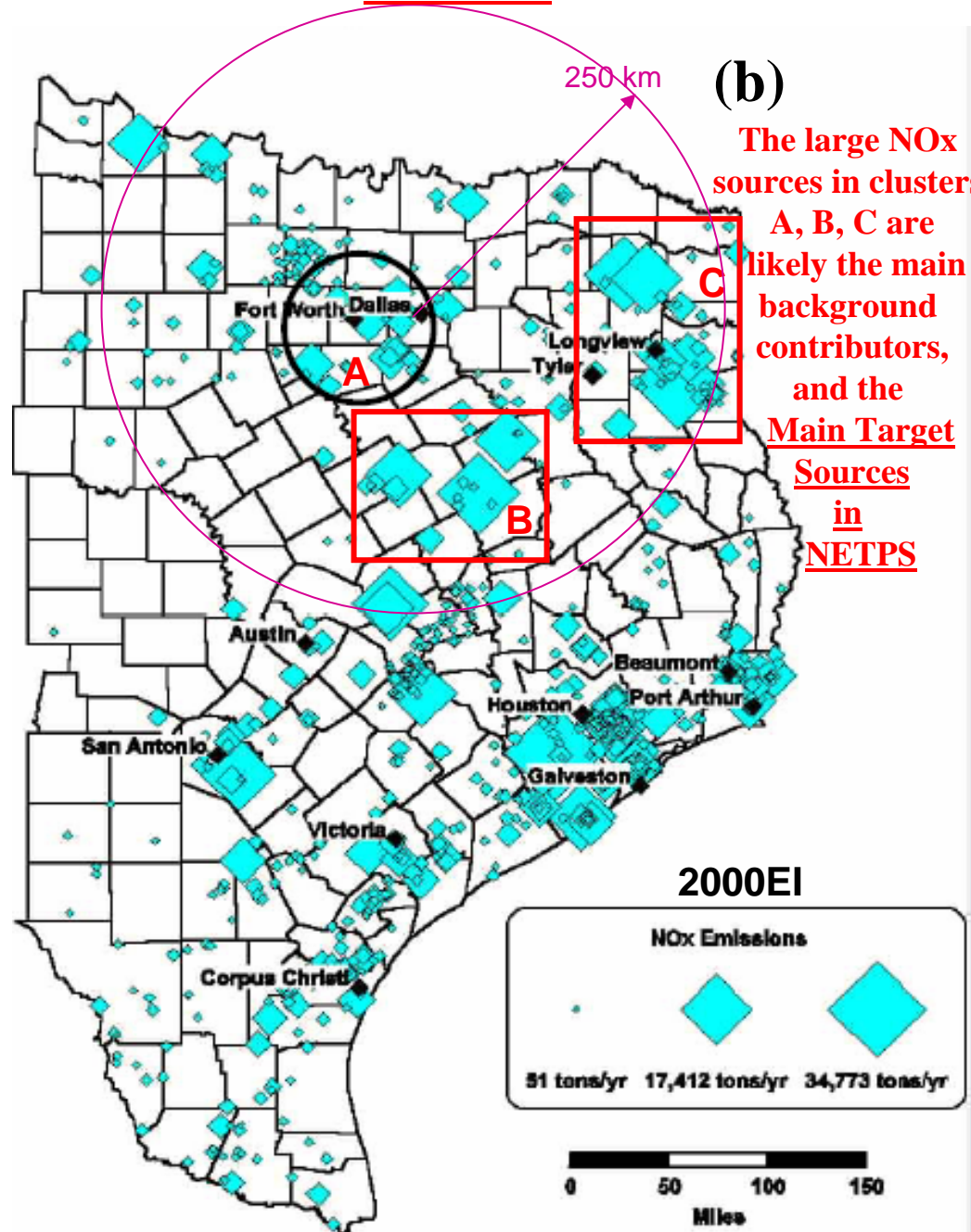
In 1999, the background was the dominant component.
What is the source of this high ozone background on high ozone days?



DFW 24h back trajectories on high ozone days (Climatology)

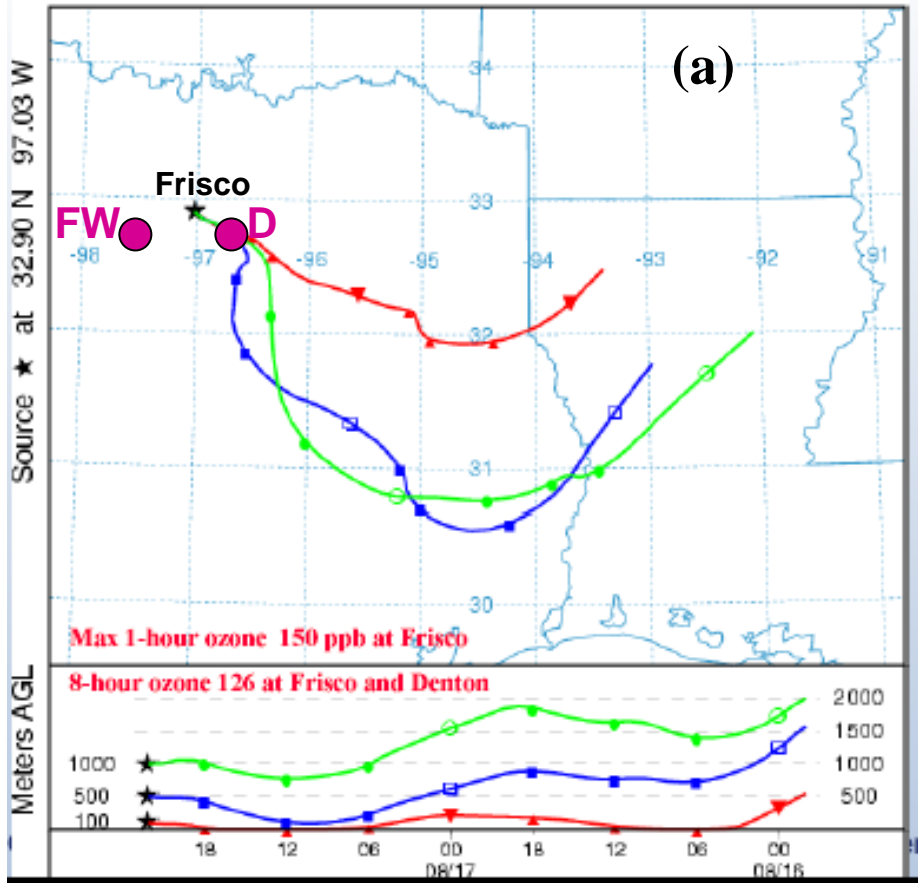


Major NO_x Point Sources in E. Texas

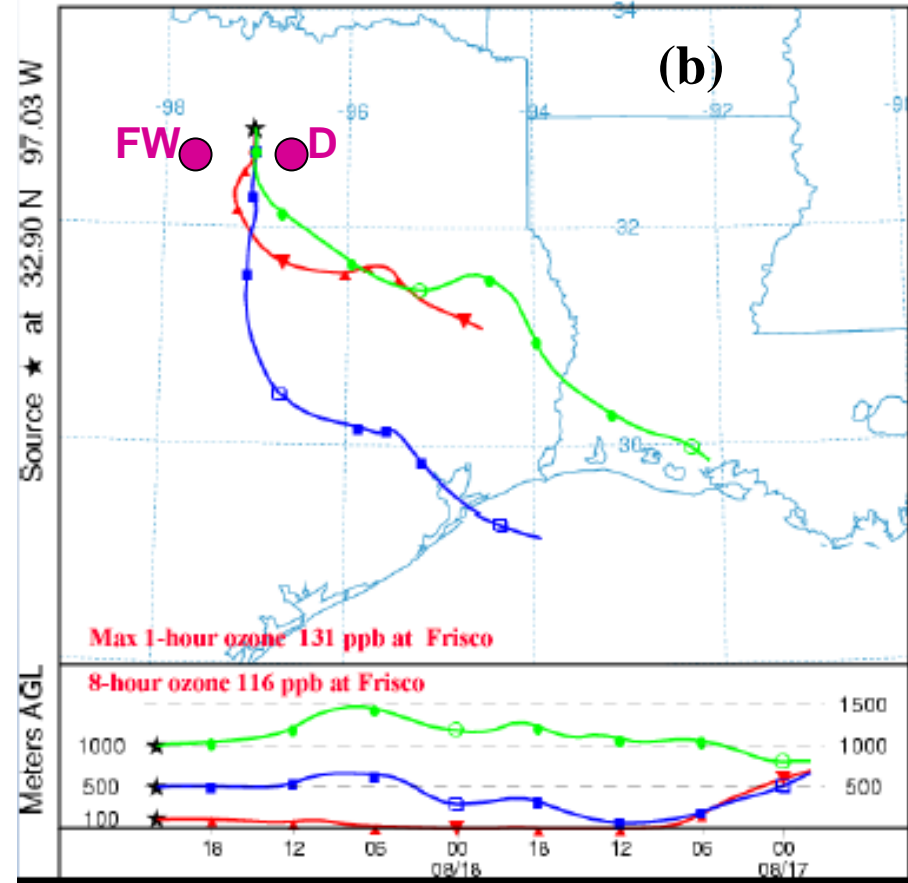


48-h Back Trajectories from Frisco on Two Particular High Ozone Days

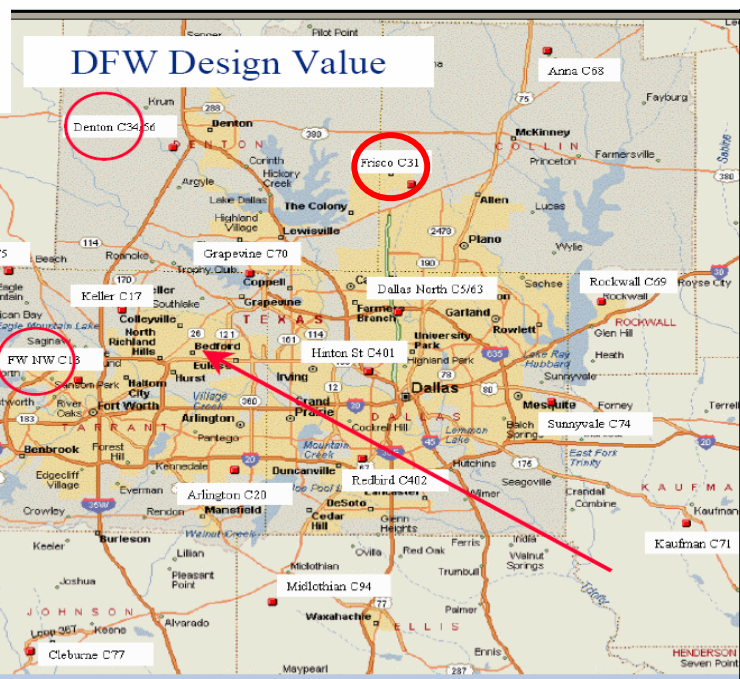
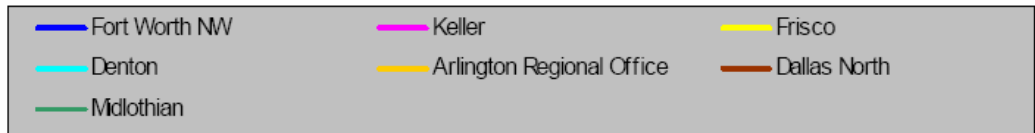
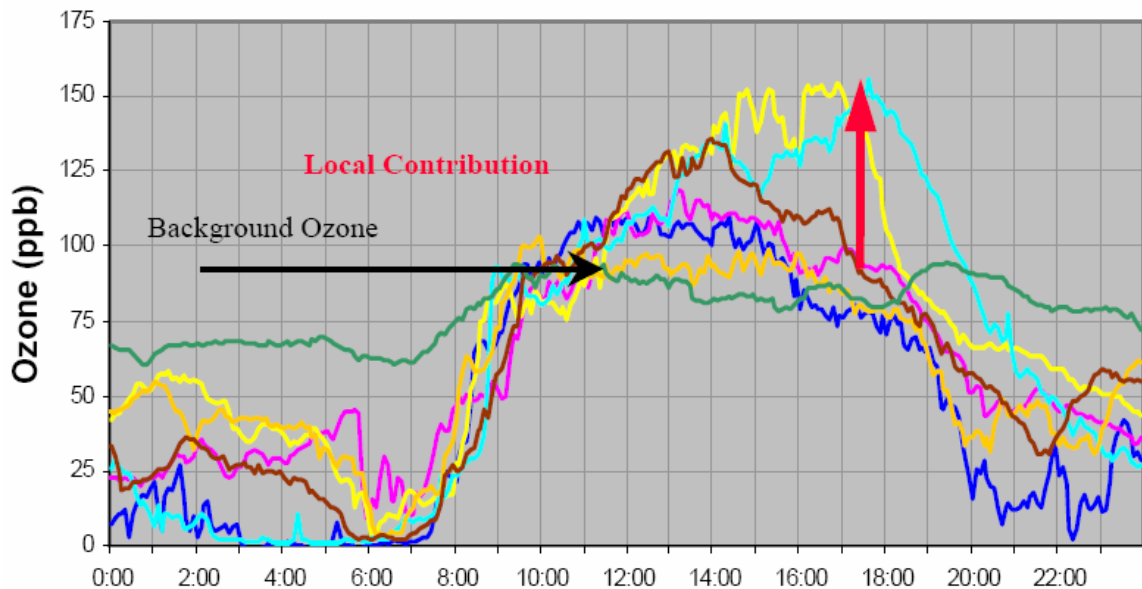
Tuesday, August 17, 1999



Wednesday, August 18, 1999

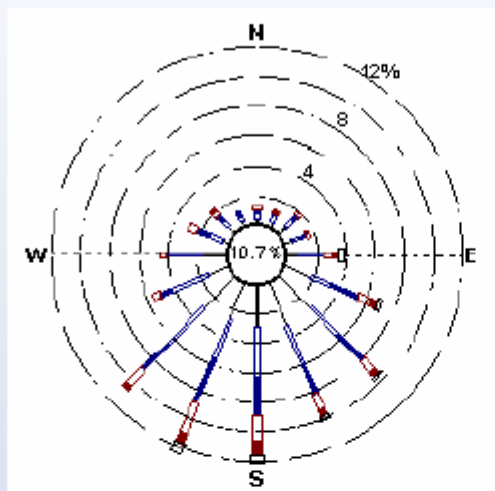


DFW Ozone August 17, 1999

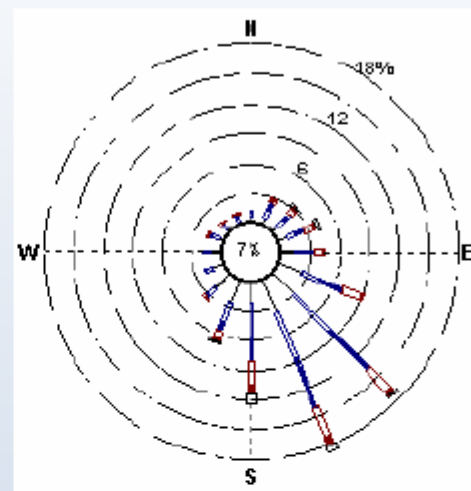


Surface Wind Roses for Dallas (1991-2001)

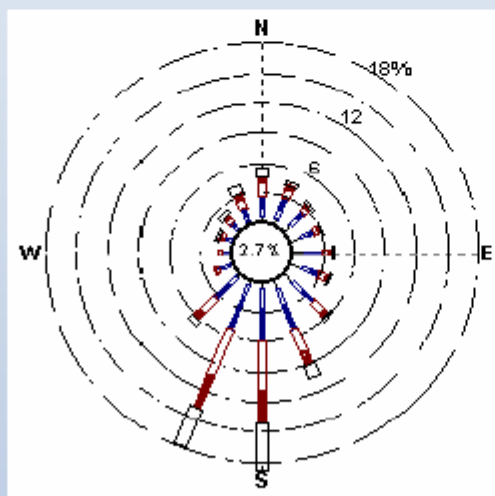
High Ozone Days
Morning Winds,
(7-10 AM)



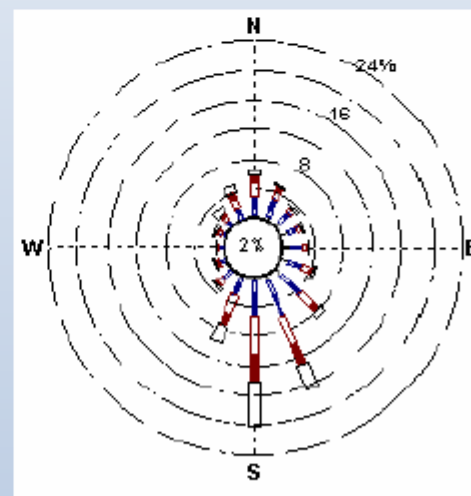
High Ozone Days
Afternoon Winds,
(13-16 PM)



Low Ozone Days
Morning Winds,
(7-10 AM)

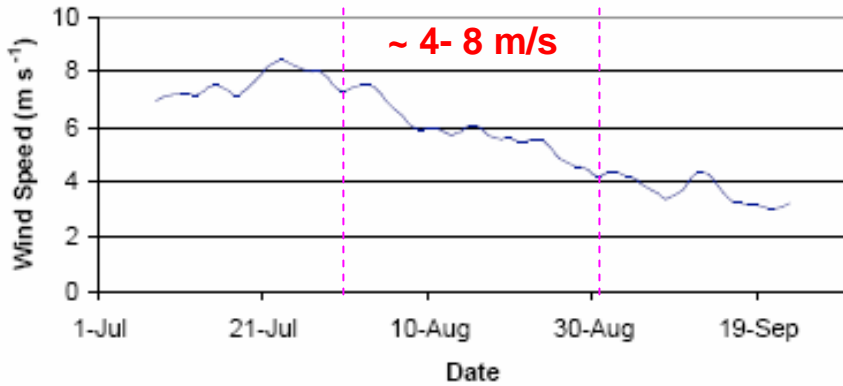


Low Ozone days
Afternoon Winds
(13-16 PM)



NOCTURNAL

Nocturnal Wind Speed
15-day running mean



DFW

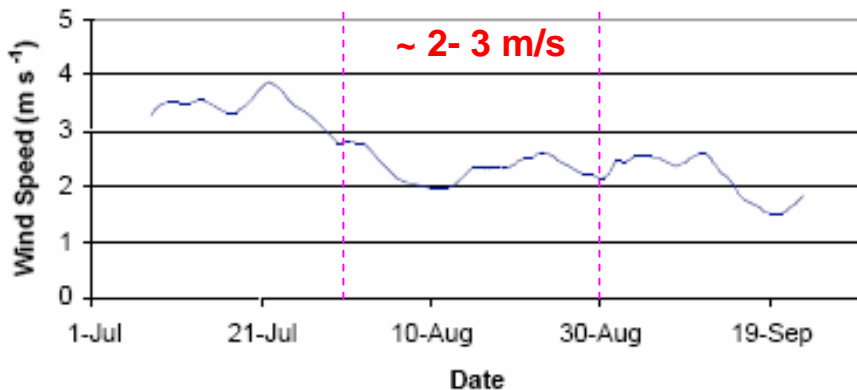
CLIMATOLOGICAL TRANSPORT WIND DATA (925 mb, 1998-2004)

Taken from
Tobin and Nielsen-Gammon, 2005 study of
desired met conditions for NETPS

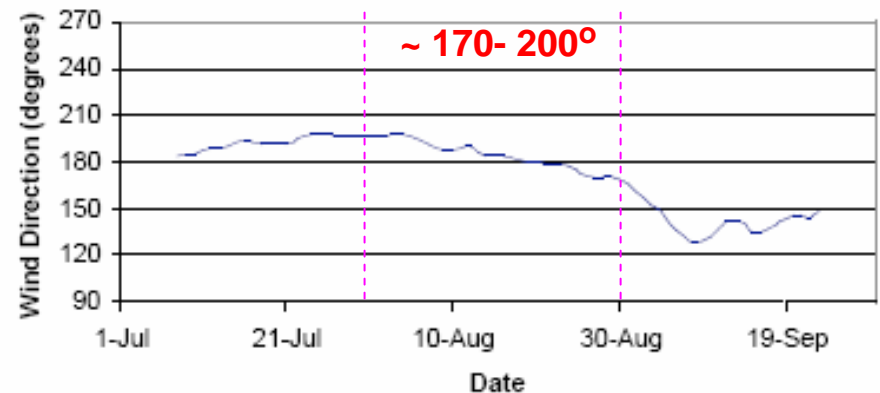
1. WS(CBL)
 2. WS(NBL)
 3. WD
 4. WD variability
 5. Precip
- } by Zone

DAYTIME (CBL)

Daytime Wind Speed
15-day running mean



Total Wind Direction
15-day running mean



NETPS Study Area and Target Sources

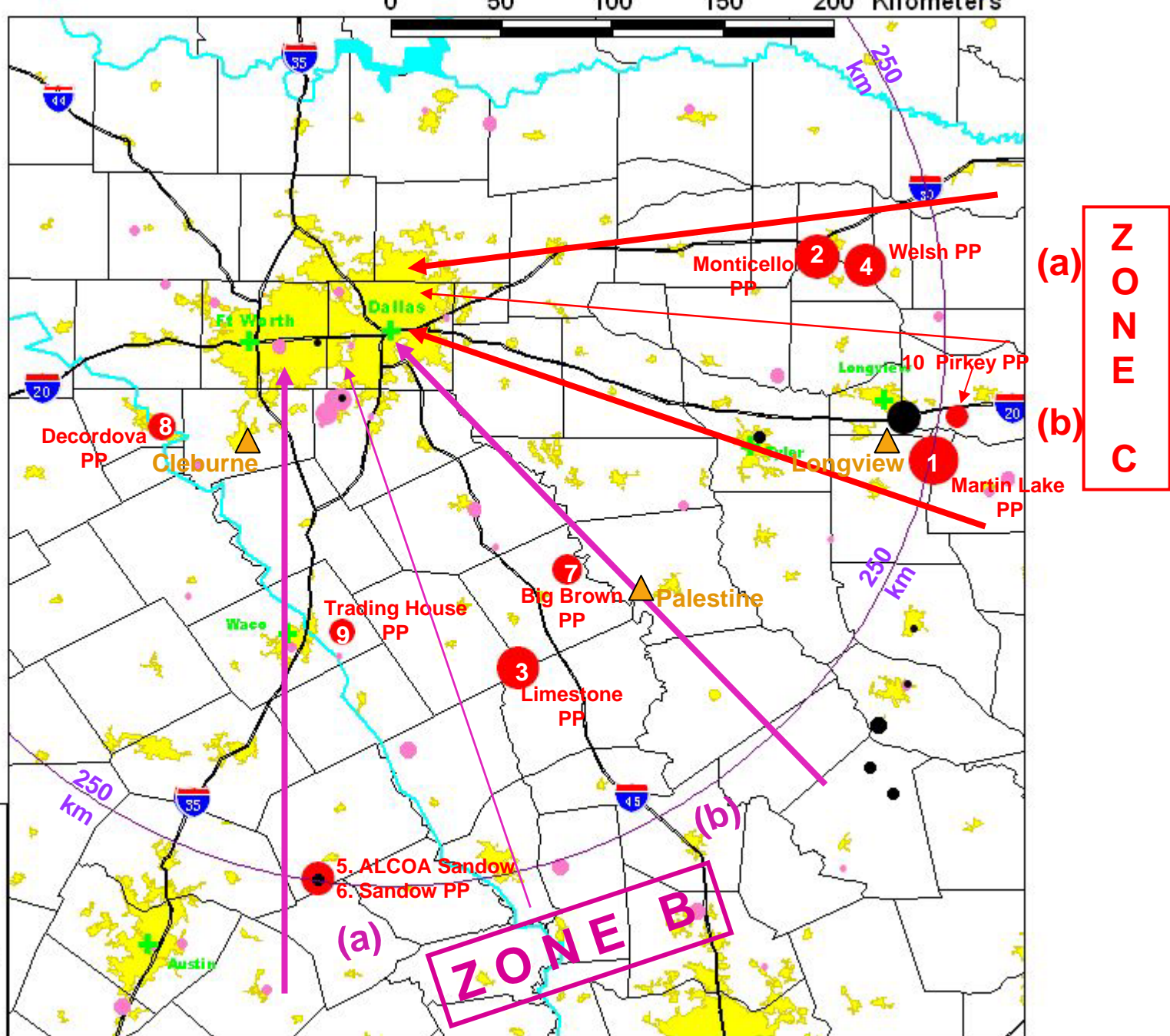
Priority
2 (Zone B)
3 (Zone C)
Sources

▲ Profiler

2002 EI

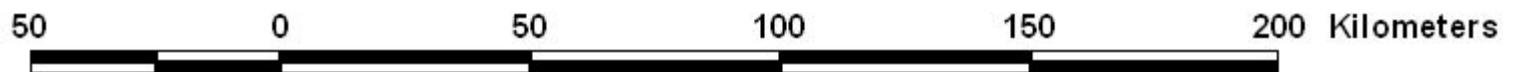
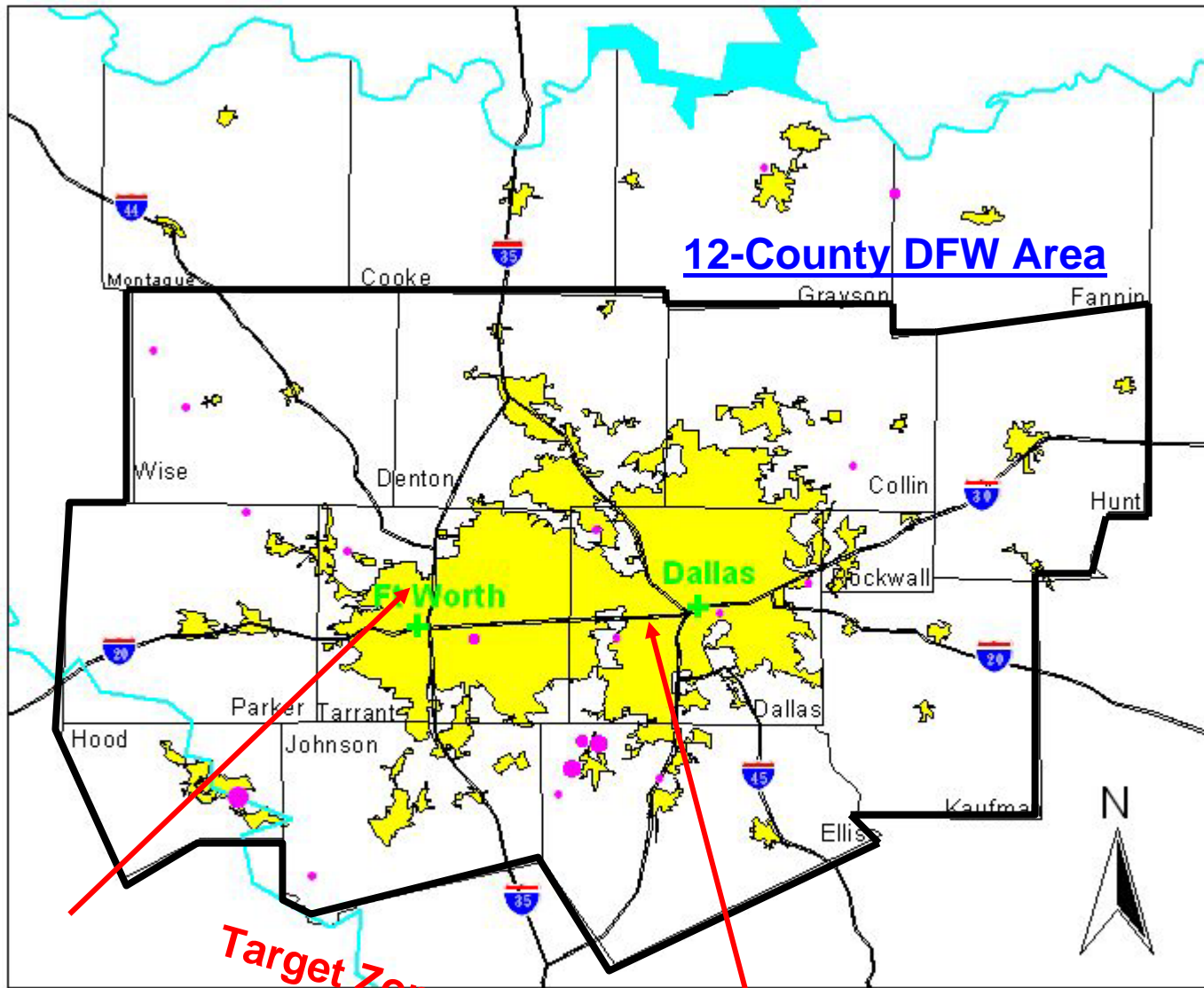
Legend

- Top 10 NOx
- Next 40 NOx
- Top 10 VOC



1 → ~ 18 Ktons/y (50.6 t/d)
10 → 5 Ktons/y (13.6 t/d)

PRIORITY 1 TARGET SOURCES

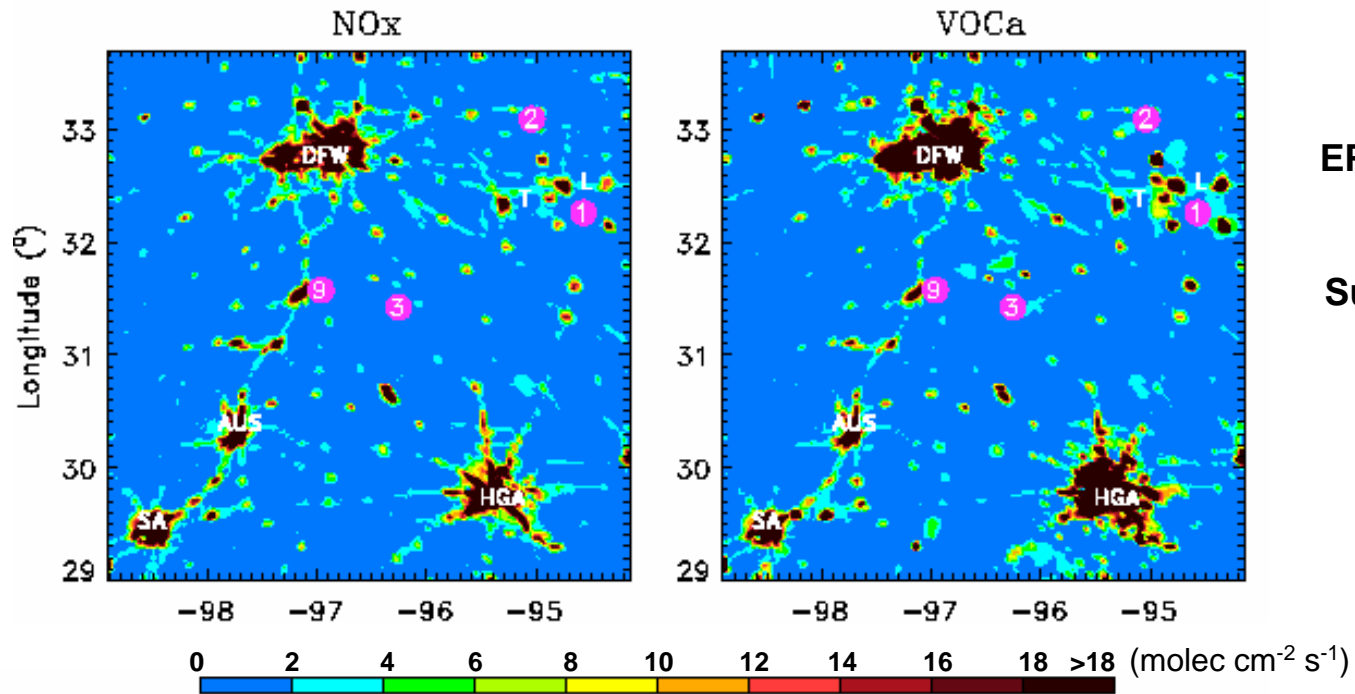


Key Data for the Top NO_x Point Sources South and East of DFW
(2002 EI)

<u>Source Name</u>	<u>Cluster</u>	<u>Q(NO_x)</u>	<u>Q(VOC)</u> (tons/d)	<u>Q(C2-C4 Alkenes)</u>	<u>Stack Height (m)</u>	
					<u>NO_x</u>	<u>VOC</u>
1. Martin Lake Power Plant	C	50.6*			137.8	
2. Monticello Power Plant	C	43.6			128.2	
3. Limestone Power Plant	B	36.9			171.6	
4. Welsh Power Plant	C	36.5			91.5	
5. ALCOA Sandow Plant	B	23.2	2.1 (6)	0.8 (2)	118.0	60.5
6. Sandow Power Plant	B	21.0			121.9	
7. Big Brown Power Plant	B	19.8			122.0	
8. Decordova Power Plant	A	16.0			60.4	
9. Trading House Power Plant	B	14.7			55.4	
10. H.W. Pirkey power Plant	C	13.6			160.1	
11. Midlothian Plant (Ellis CO)	A	11.6			61.0	
12. Holcim LP (Ellis CO)	A	11.5	1.7 (9)	0.2 (7)	39.0	44.9
13. Texas Operations	C	7.1	11.7 (1)	5.5 (1)	27.5	6.3
14. N. Texas Cement Plant (Ellis CO)	A	7.0			45.7	

* Uniform annual aggregation → ~18 000 tons/y

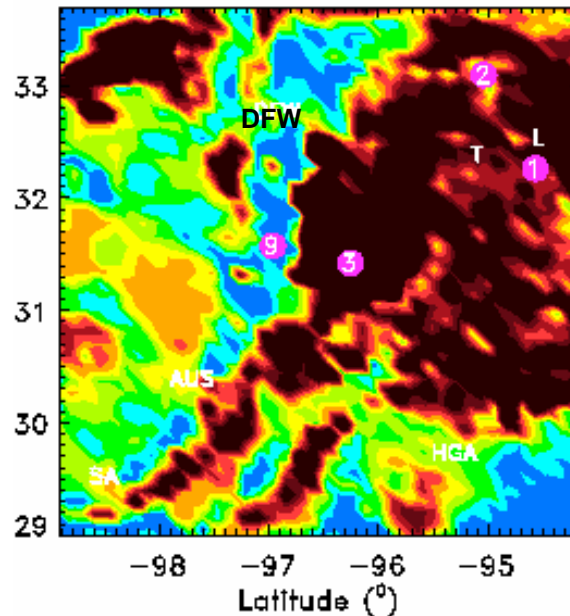
cf. ~ 120 000 tons/y for largest coal-fired power plants
in the USA, e.g., TVA's Cumberbund PP



4 km grid
EPA-99 v.3 EI

Average
Summer Day

Surface Emissions



12 km grid
TCEQ-99 EI

1300-1400 CDT
13 Aug 1999

**8h-max Ozone
Climatology
(6-y average)**

**Preferred timing
for NETPS** when
b/g most polluted
and T-highest

~ mid-Jul to end-Aug

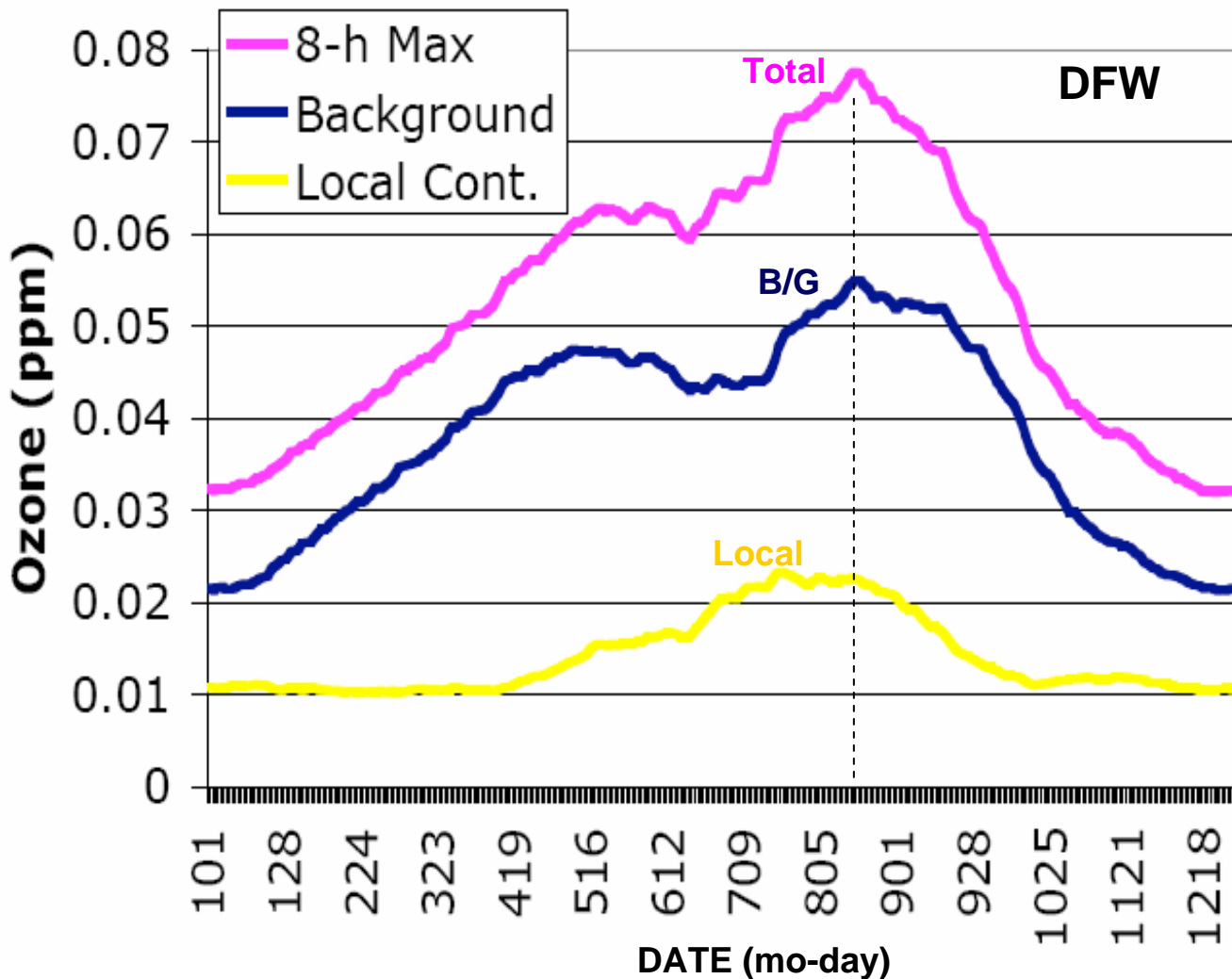
Study period

August 2005

August also good
for desired
5 met conditions

1. WS(CBL)
2. WS(NBL)
3. WD
4. WD variability
5. Precip

for each Zone



Expected # of suitable days in August, by Zone

Priority 1: Zone A: ~ 8 days	} ~6 Planned Missions
Priority 2: Zone B: ~ 6-7 days	
Priority 3: Zone C: ~ 3 days	

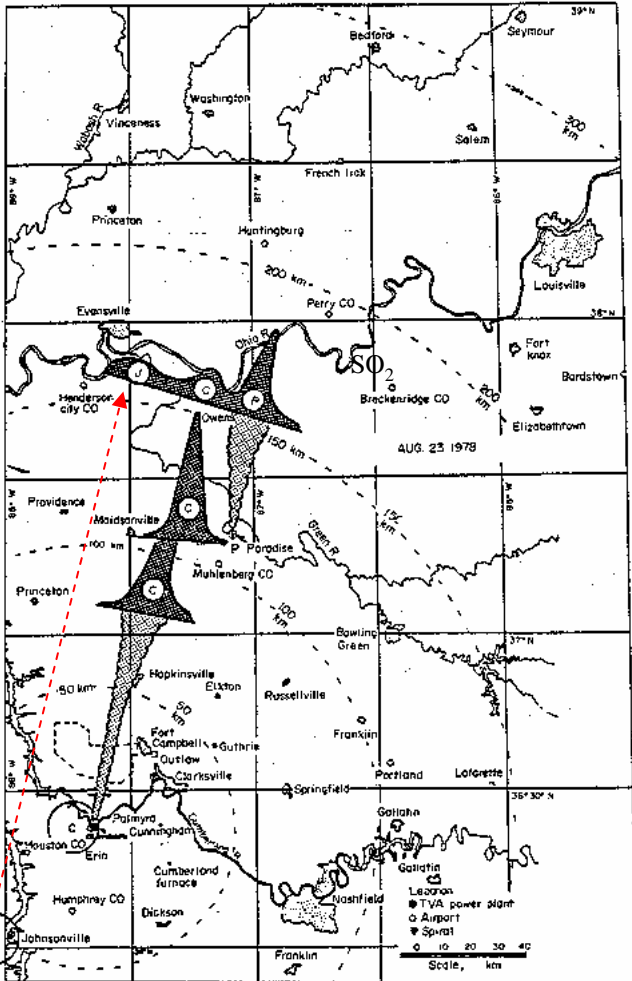
NETPS Experiment Scenarios

<u>ZONE</u>	<u>SOURCE(s)</u>	<u>Downwind Distance to DFW Line **</u>		<u>~ Plume Release Time*</u>	<u>Start-End Sampling Time</u>	<u>Plume Age at start of detailed Lagrangian Sampling at ~ 0900</u>
		<u>Distance(km)</u>	<u>Time (h)</u>			
		**assuming WS ~ 3 m/s (CBL), ~ 6m/s (ALOFT)		* Assuming ~1400 arrival at DFW line		
A	Decordova PP	~ 80	~ 6.2	~0800	0730-1530	~ 1.2h
A	Ellis CO sources	~ 40	~ 3.7	~1030	0930-1530	-
B	Trading House PP (Sandow sources)	~140 ~260	~ 9 ~14.5	~0500 ~2330	0730-1530	~ 4 h ~ 9.5h
B	Limestone PP Big Brown PP	~175 ~150	~10.5 ~ 9.5	~0330 ~0430	0700-1530	~ 5.5h ~ 4.5h
C	Martin Lake PP Eastman Chem	~260 ~245	~14.5 ~13.8	~2330 ~0000	0630-1530	~ 9.5h ~ 8.8h
C	Monticello PP Welsh PP	~200 ~225	~11.7 ~12.8	~0200 ~0100	0700-1530	~ 6.7h ~ 7.9h

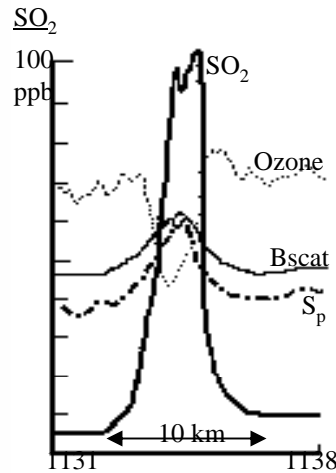
Lagrangian Chemical Evolution of A Power Plant Plume (PPP)

Cumberland PPP of 8/23/1978

(~0700-0800 release)
Q-Lagrangian plume



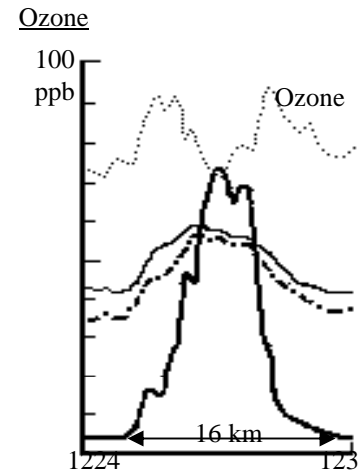
C = Cumberland above
J = Johnsonville
P = Paradise
(all three are large TVA power plants within about 150 km of Nashville TN)



Stage 1

VOC-limited

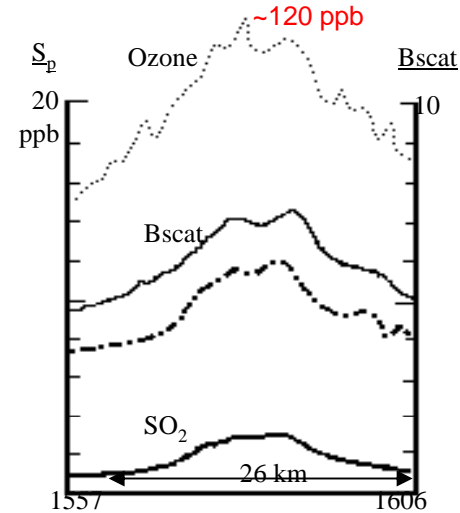
~80 km
downwind



Stage 2

Transition
~110 km downwind

We should aim to make plume measurements in all three stages



Stage 3

NO_x-limited

160 km
downwind

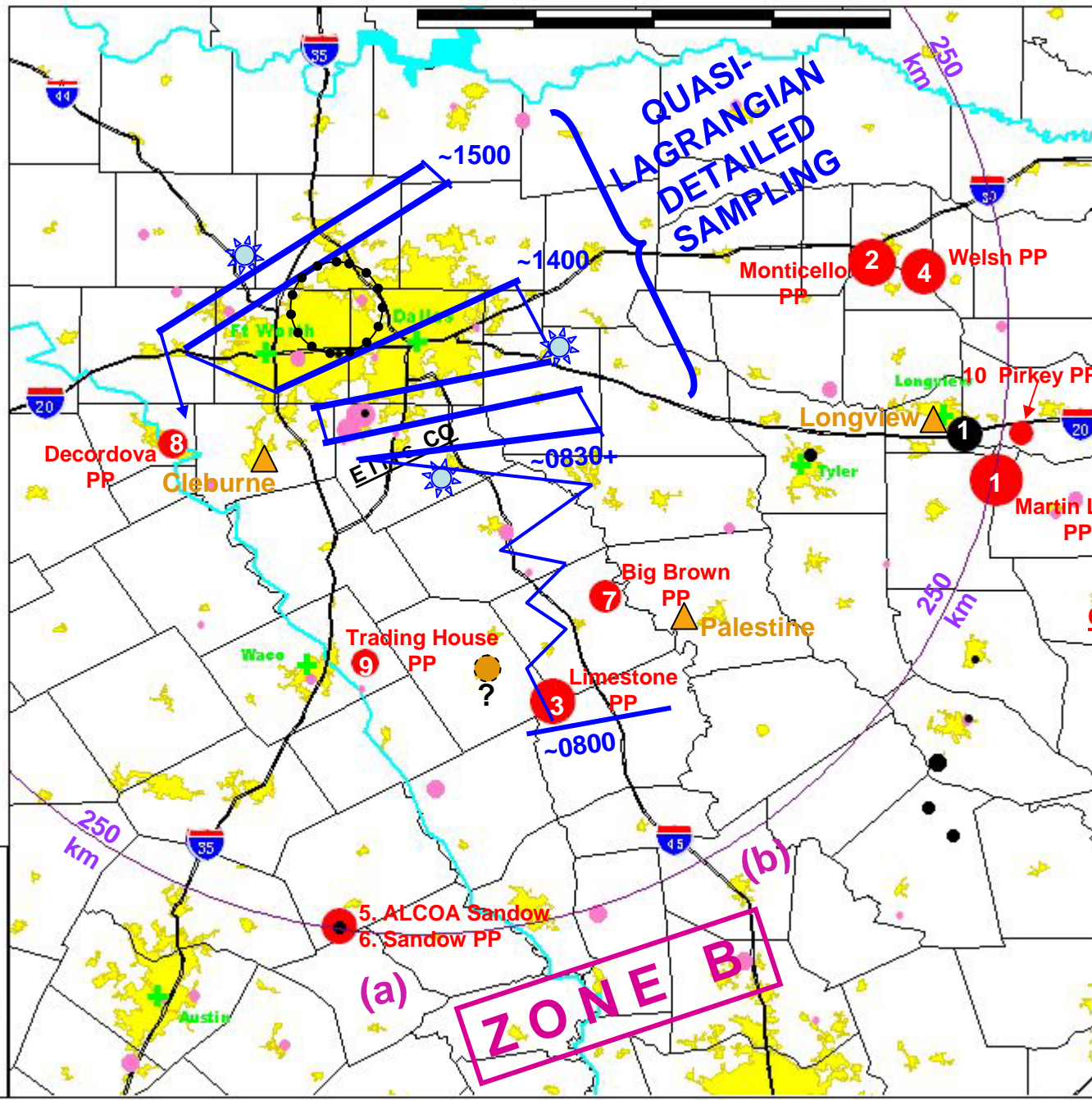
Sample Aircraft Mission for Limestone/BB Impact on DFW



- Met Monitoring**
- Profiler
 - Rawinsonde
 - C-Band Radar ?

Legend

- Top 10 NOx
- Next 40 NOx
- Top 10 VOC



Mission Show

- ~0330 Limestone
- ~0430 Big Brown
- releases picked up downwind
- ~0900, just before fumigation, then followed past DFW (~1400 until ~1500

Flight Time
0700 – 1530

Overall Flight Hours

Zone A	20h
Zone B/A	25h
Zone C	9h
TOTAL	54h

Flight hours

of missions