Overview of Analyses and Findings from the Rural Monitoring Network during TexAQS II

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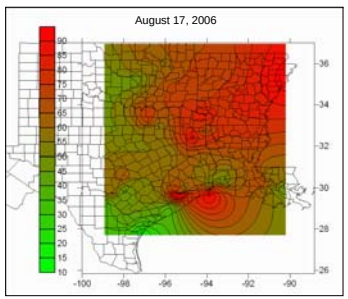
Details of Newly Implemented Rural Monitoring Network for TexAQS II

- Several rural monitoring sites were added to the ground monitoring network as part of the TexAQS II study
- One goal of this network is to characterize pollutant transport and background ozone levels that contribute to non-attainment areas.

CAMS	Site Description	Surface Measurements	Latitude	Longitude	Project
638	Smith Point Hawkins Camp C96/C638	O3, met	29.546	-94.787	NTRD
639	Newton NTRD C639	O3, met	30.885	-93.742	NTRD
645	Wamba NTRD C645	O3, met	33.500	-94.120	NTRD
646	San Augustine Airport NTRD C646	O3, neph, met, 2.5 filter	31.539	-94.170	NTRD
648	Clarksville NTRD C648	O3, neph, met, 2.5 filter	33.620	-95.060	NTRD
641	Beeville Airport C641	O3, met	28.360	-97.790	TEXAQS II
649	Halletsville C649	O3, met	29.447	-96.933	TEXAQS II
650	Italy High School C650	O3, met	32.178	-96.878	TEXAQS II
651	Temple C651	O3, met	30.998	-97.339	TEXAQS II
652	Wichita Falls TEXAQSII C652	neph, met, 2.5 filter	33.870	-98.460	TEXAQS II
653	Millpond Park San Saba C653	neph, met, 2.5 filter	31.187	-98.712	TEXAQS II
654	Hamshire C64/C654	O3, neph, NOx, 2.5 teom, met	29.864	-94.318	TEXAQS II
655	Eagle Pass C319/C655	neph, 2.5 teom, met	28.702	-100.451	TEXAQS II
647	Palestine C647	O3, met	31.779	-95.706	TEXAQS II
657	Port O Connor C657	O3, 2.5 teom, met	28.434	-96.455	TEXAQS II
667	Isla Blanca C667/C323	O3, neph, met	26.073	-97.167	TEXAQS II
Site ID	**Site Description**	**Upper Air Measurements**	**Latitude**	**Longitude**	**Project**
SNRTX	Sonora NOAA	wind, RASS	30.260	-100.570	TEXAQS II
NBFTX	New Braunfels TCEQ	wind, RASS	29.700	-98.120	TEXAQS II
BVLTX	Beeville NOAA	wind, RASS	28.370	-97.790	TEXAQS II
BRZI9	Brazos A19 TCEQ	wind, RASS	28.200	-95.600	TEXAQS II
HVETX	Huntsville NOAA	wind, RASS	30.720	-95.640	TEXAQS II
MDYTX	Moody NOAA	wind, RASS	31.340	-97.370	TEXAQS II
LVWTX	Longview NOAA	wind, RASS	32.380	-94.710	TEXAQS II

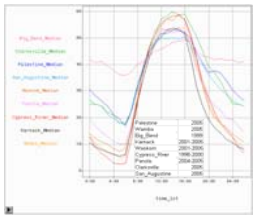
Improvement in Ozone Spatial Distributions in Rural Areas

Rural monitors provide significant benefit in reducing uncertainty in contouring and reveal more detailed ozone concentration gradients over broad geographic areas

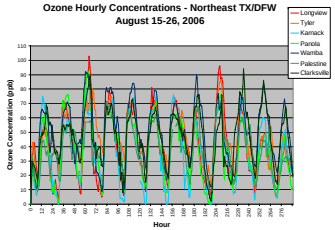


Consistent Observation of Rural Monitoring Network – Low Night-time Ozone Concentrations

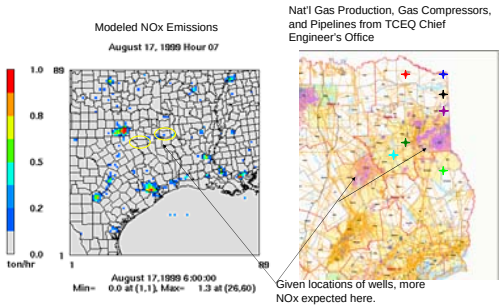
- Several rural sites consistently exhibit very low night-time ozone concentrations
- Diurnal patterns from the previous 5 summers of rural monitors in Texas confirm this finding
- Photochemical modeling has not been able to capture this observation



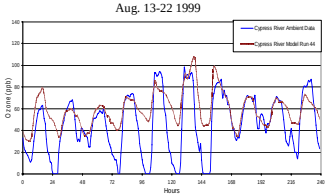
Big Bend site represents a prototypical rural site with higher night-time ozone values due to less NOx titration



Hypothesis: NO_x emissions from oil and gas production responsible for rural night-time ozone titration and are underestimated in emissions inventories input into photochemical models.



CAMx Results vs. Ambient Data – Cypress River Site
Aug. 13-22 1999



Note: Cypress River is located near the gas production region in Northeast Texas

Sensitivity analyses performed to determine if base cases for current SIP modeling capture the rural ozone titration at sites near natural gas production operations

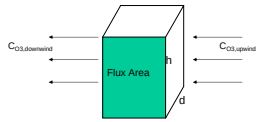
- Increasing low-level NO_x emissions
- Looking at the accuracy of other ozone scavengers
- Possible vertical mixing issues/landcover/deposition
- Sensitivity to meteorology inputs

Use of Rural Network to Characterize Regional Ozone Transport

Ozone Flux Calculations Using Surface Monitor Data

Methodology:

- Define upwind and downwind planes and identify surface monitors
- Estimate perpendicular wind speed, mixing height and ozone concentrations at monitors
- Results are flux of excess ozone (plume – background) in molecules/s
- CAMx photochemical model Process Analysis tool is also capable of flux calculations



Flux = avg. wind speed*dC_{O3}*area

- $dC_{O3} = C_{O3,downwind} - C_{O3,upwind}$
- Area = mixing height (h)*horizontal width of plume (d)
- Assumes uniform concentration in mixing height

Aircraft Lidar Data vs. Ground Monitoring Network - Flux Calculation Comparison

Metro area	Date	Wind direction	Wind speed (m/s)	Time (UTC)	Background O3 (ppb)	Ozone Flux (molec./s)	Ozone Flux (ground network) (molec./s)
Houston	12-Aug	S	4.8	23:04 - 23:34	~30	**4.0*1026**	**2.2*1026**
Houston	14-Aug	S	4	22:59 - 23:26	~35	**4.6*1026**	**4.1*1026**
Houston	30-Aug	N	4.4	22:18 - 22:50	~60	**4.4*1026**	**4.0*1026**
DFW	13-Sep	N	4.1	21:50 - 22:30	~60	**1.4*1026**	**1.3*1026**

- Aircraft flights/Lidar data are infrequent
- Surface monitors are capable of providing reasonable flux estimates

Summary of Conclusions

Preliminary analysis of data from rural sites indicate:

- Rural monitors increase the accuracy of spatial distributions of rural ozone concentrations
- Analysis of diurnal patterns in ozone data reveal low night-time ozone concentrations for several rural monitors in Northeast Texas; photochemical modeling has been unable to reproduce this finding
- Data from rural network may be used to characterize regional transport of ozone