Dallas Field Study (DFS); Ozone Precursors, Local Sources and Remote Transport Including Biomass Burning

Project AQRP 22-010

Ed Fortner, Brian Lerner, Conner Daube, Tara Yacovitch, Anita Avery, Megan Claflin, Elizabeth Lunny, Matt Lund, Scott Herndon

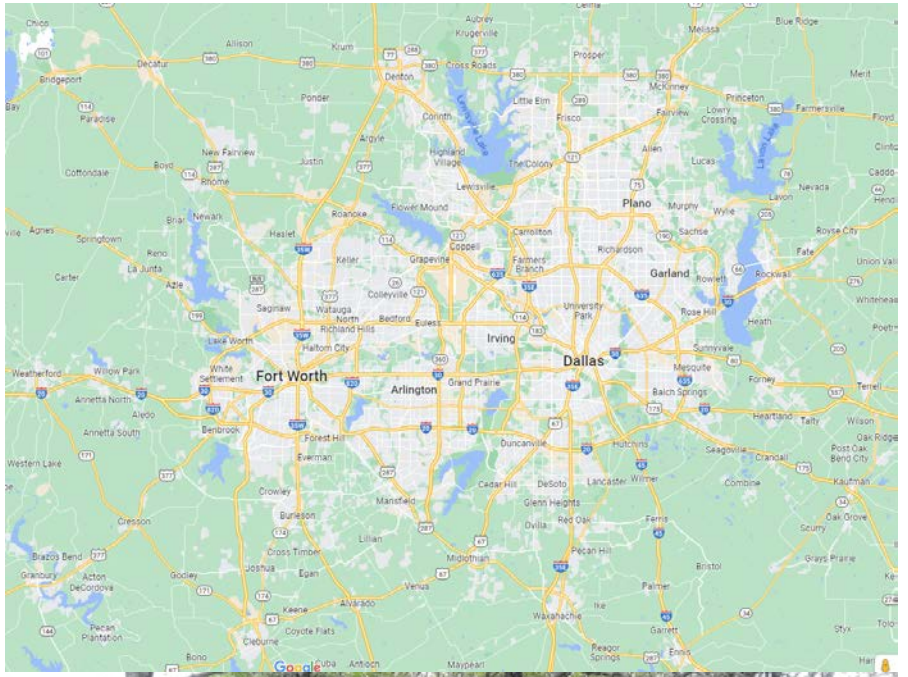
Aerodyne Research Incorporated; *Billerica MA USA*

AerodyneResearch
WWW.AERODYNE.COM

Project AQRP 22-010
Addresses these focus areas from Request For Proposals

Changing Emission Patterns in Texas

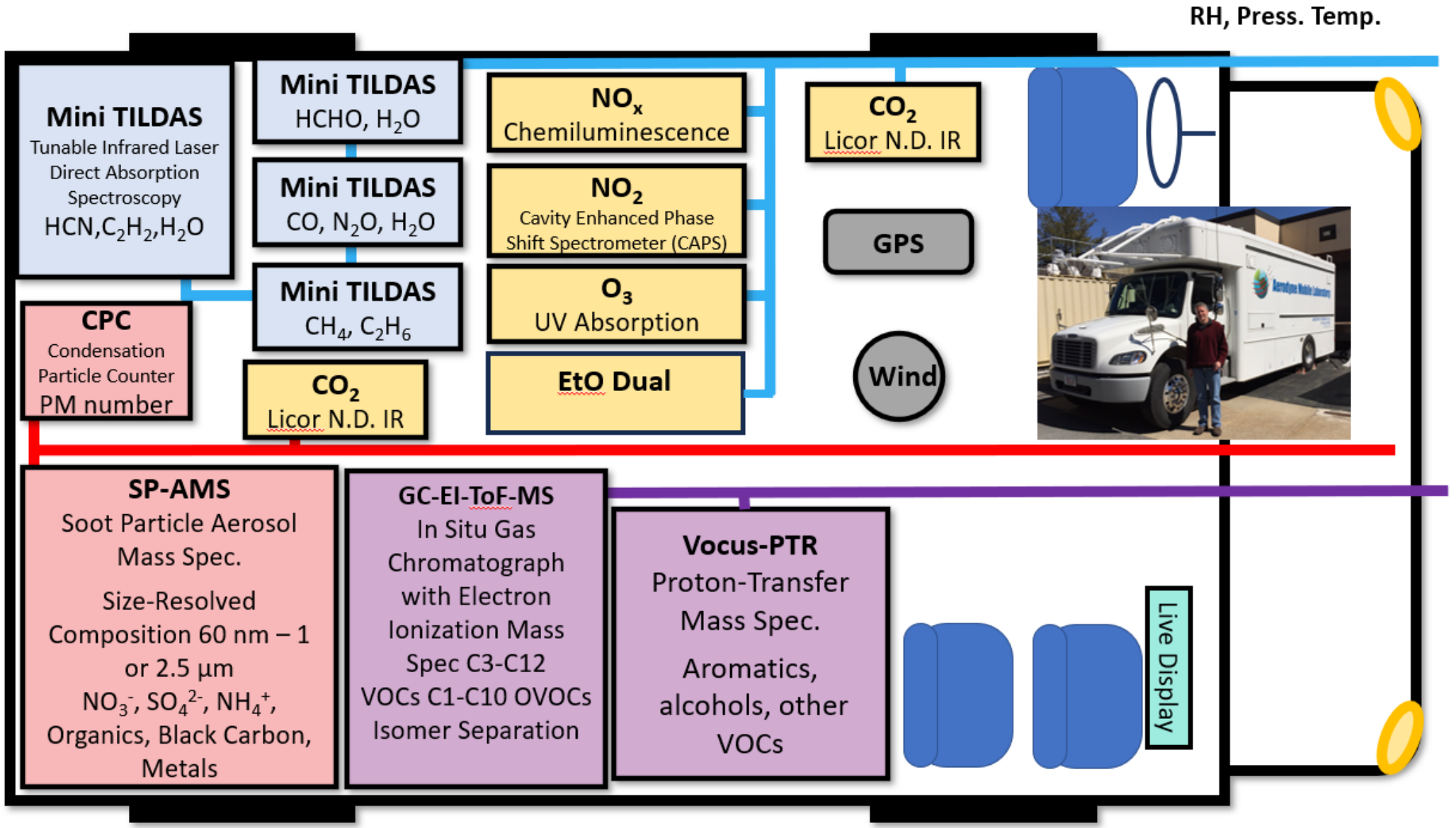
Focusing on DFW metropolitan area
Point Source emissions
Inflow and outflow



Domestic Fire Emissions

Inflow and outflow of biomass burning impacted airmasses
Measurement of wildfires at source

Instruments deployed on the AML

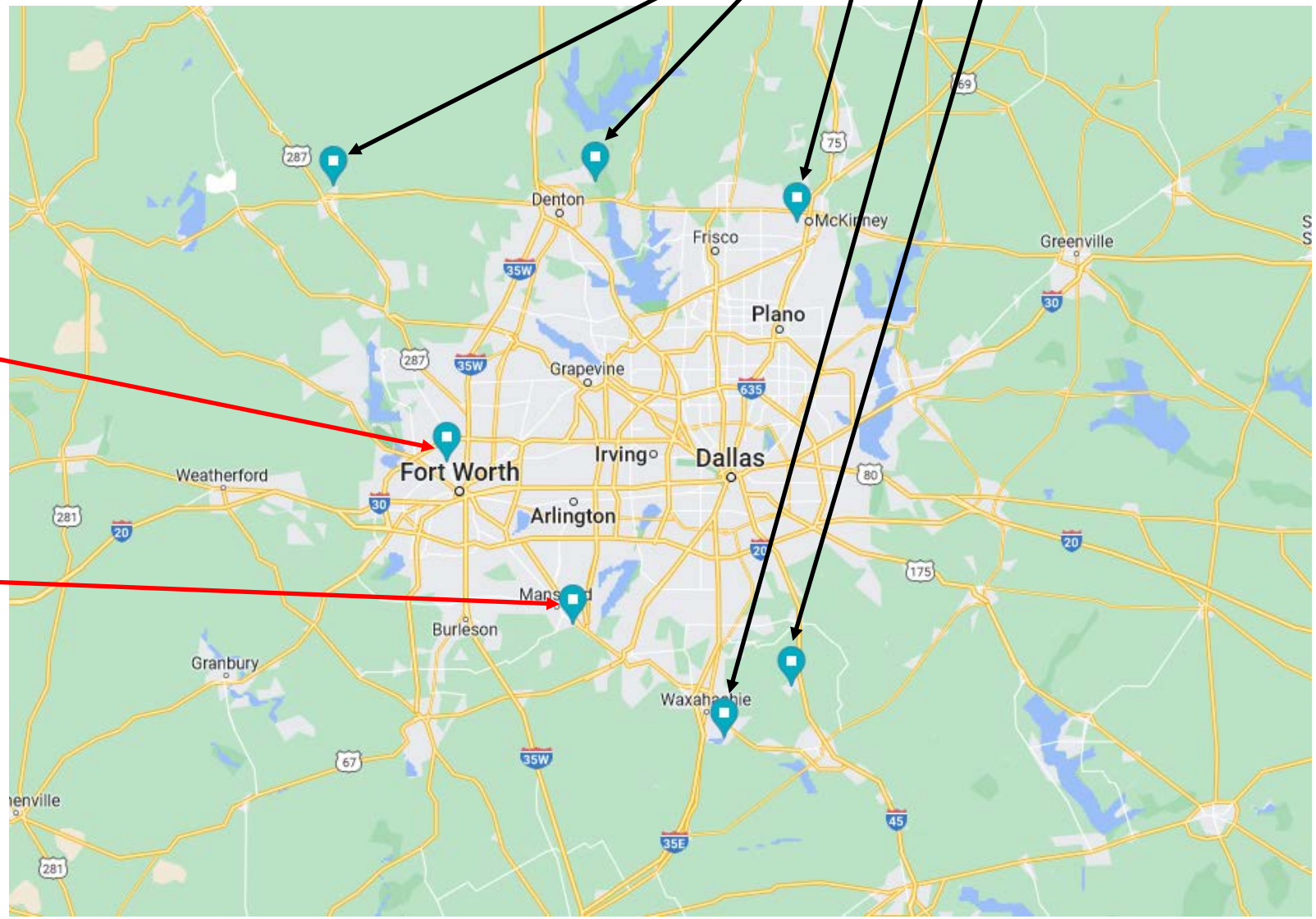


Where we were based

Meachum Field Apr 10 – 23

Co-located with Baylor (BC2 Network Trailer) and TCEQ Monitoring Station (CAMS 13)

Texan RV Ranch Apr 3 - 9



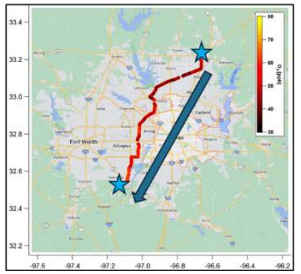
3 Mission Types

Mission 1; Sampling Industrial Point Sources in DFW

SubRegion	Best Wind	ACCOUNT	RN	COMPANY	SITE	COUNTY	REGION	SIC	DESCRIP	ORTING Y	CO TPY	NOX TPY	Pb TPY	PM10 TPY	PM2.5 TPY	SO2 TPY	VOC TPY	Address	ferree
	2	ED0168P	RN100213	DARTCO OF TEXAS LLC	DARTCO C	ELLIS	4	3089	PLASTICS	2021	25.19	11.23	0.0001	2.327	2.327	0.18	611.3681		NW/
Well Sampled too cl		TA01571	RN102505	GENERAL MOTORS LLC	ARLINGTC	TARRANT	4	3711	MOTOR VI	2021	39.5258	53.6743		6.6924	6.5323	0.2498	418.711		3 S/W/
Did S Try N	close Sout	ED0011D	RN100216	CHAPARRAL STEEL MIDLOTHIAN LP	CHAPARR	ELLIS	4	3312	BLAST FUF	2021	1335.708	411.1908	0.4274	148.0198	127.6279	315.138	332.1024		7 any w
Far SE	NE best E	NB0037F	RN100211	ARCOSA LWS LLC	STREETMA	NAVARRC	4	3295	MINERALS	2021	178.8458	575.9442	0.0104	109.9419	56.4331	3421.215	236.7326		NW/
		JHA012L	RN104928	ETC TEXAS PIPELINE LTD	GODLEY PI	JOHNSON	4	1321	NATURAL	2021	110.3915	48.2571		9.446	9.446	4.297	216.9312		any w
		ED0099J	RN100219	HOLCIM US INC	MIDLOTHI	ELLIS	4	3241	CEMENT, I	2021	2894.62	1249.646	0.0121	284.2941	165.8125	1898.776	188.0663		4 S/W/
		TA0156K	RN100212	LOCKHEED MARTIN CORPORATION	US AIR FO	TARRANT	4	3721	AIRCRAFT	2021	3.2714	9.231	0	11.2886	11.2636	2.1778	139.4426		
		JH0025O	RN100213	JOHNS MANVILLE	JOHNS MA	JOHNSON	4	3296	MINERAL '	2021	362.1823	42.4523	0.0002	183.5389	179.7602	21.5605	135.5055		any w
Well Samp	8	NB0089J	RN100220	PACTIV LLC	PACTIV CC	NAVARRC	4	3086	PLASTICS,	2021	6.0583	7.2465	0	22.242	21.5498	0.1241	104.0999		N/S a
	1	ED0051O	RN100223	OWENS CORNING INSULATING SYSTEMS LLC	WAXAHA(	ELLIS	4	3296	MINERAL '	2021	164.9748	73.4993	0.0001	259.8613	217.1173	14.4768	84.2756		8 S/N b
FAR S	all winds	NB0154A	RN102887	MAGELLAN PIPELINE COMPANY LP	FROST STA	NAVARRC	4	4613	REFINED F	2021	3.7934	1.5827				0.0406	81.1145		any w
close in	NE,N,NW	DBA039N	RN100641	POLY-AMERICA INC	POLY-AM	DALLAS	4	3089	PLASTICS	2021	12.35	14.7		18.46	15.136	0.091	77.89	, TX 75051	all go
		WN0021G	RN100223	ENLINK MIDSTREAM SERVICES LLC	BRIDGEPC	WISE	4	1321	NATURAL	2021	220.7436	299.7426	0	19.7529	19.7529	1.0123	71.267		5 any w
		ED0013W	RN102539	PRAXIS COMPANIES LLC	KORAL IN	ELLIS	4	3088	PLASTICS,	2021	0.2182	0.2598	0	0.0519	0.0277	0.0015	70.6563		6 S/E o
Well Samp	6	TA0236L	RN100225	BALL METAL BEVERAGE CONTAINER CORP	BALL MET/	TARRANT	4	3411	METAL CA	2021	5.9798	7.1186		0.5727	0.5517	0.0429	69.6195		
NORTH	NE,N,NW	DF005LJ	RN100211	PACCAR INC	PETERBILT	DENTON	4	3711	MOTOR VI	2021	10.7553	12.3585	0	10.5272	0.3568	0.085	64.704	1	
2 close in	SE,S,SW	DB0447B	RN100689	HENSLEY INDUSTRIES INC	DALLAS PL	DALLAS	4	3325	STEEL FOU	2021	67.2284	11.4075		7.265	7.1506	3.0224	63.4473	2108 Joe Field R	
Cant Find on Map		HQA001A	RN104600	COWTOWN GAS PROCESSING PARTNERS LP	COWTOW	HOOD	4	1311	CRUDE PE	2021	76.2791	89.6706	0	7.3758	7.3758	2.2795	62.7393		
Well Sampled		TA0054T	RN100223	BELL TEXTRON INC	PLANT 1	TARRANT	4	3721	AIRCRAFT	2021	10.8087	12.1485	0	4.9492	0.9694	0.1013	60.8695		
		DB1276U	RN100215	TEKNI-PLEX INC	DOLCO PA	DALLAS	4	5169	CHEMICAI	2021	0.5185	0.6173		0.049	0.049	0.0037	57.2955		
close in	any wind	DB0820B	RN102505	TEXAS INSTRUMENTS INCORPORATED	CENTRAL I	DALLAS	4	3674	SEMICONI	2021	44.1592	54.8238		10.2643	5.7823	6.2977	57.1955		
		WN0005E	RN100238	TARGA MIDSTREAM SERVICES LLC	DYNEGY C	WISE	4	1321	NATURAL	2021	41.91	100.12		5.58	5.58	35.1039	54.95		
		DB3613K	RN102302	WESTERN CABINETS INC	CEDAR HIL	DALLAS	4	2434	WOOD KIT	2021	0.0824	0.098	0	0.0321	0.0321	0.0006	54.6498		
close in	any wind	DB0155R	RN100664	TAMKO BUILDING PRODUCTS LLC	DALLAS PL	DALLAS	4	2952	ASPHALT I	2021	31.2668	7.4049	0	13.2361	9.8371	29.3555	53.9459		
West	any wind	HQA029C	RN106130	BLUESTONE NATURAL RESOURCES II LLC	TAYLOR S\	HOOD	4	1311	CRUDE PE	2021	4.872	0.822		0.228	0.228	0.015	53.1346	310 Bo Gibbs Bl	
West	any wind	PCA008H	RN105010	BKV MIDSTREAM LLC	WEST WA	PARKER	4	1311	CRUDE PE	2021	11.0563	28.1575		0.0917	0.0917	0.1701	52.6513	Aledo, TX 7600	
close in	any wind	DB0588F	RN100242	MAGELLAN PIPELINE TERMINALS LP	DALLAS TE	DALLAS	4	4226	SPECIAL W	2021	0	2.56	0	0	0	6.4	52.108	4200 Singleton B	
Cant Find on Map		WN0234K	RN102913	ENLINK MIDSTREAM SERVICES LLC	ALLISON C	WISE	4	1311	CRUDE PE	2021	21.0197	94.0067	0	8.9228	8.9228	0.5235	51.9046		
close in	any wind	DB0795V	RN100519	MOTIVA ENTERPRISES LLC	DALLAS TE	DALLAS	4	5171	PETROLEU	2021	2.7983	1.3916		0.0863	0.0751	0.0012	51.6126	3900 Singleton B	
		JH0376F	RN100773	TECHNICAL CHEMICAL CO	TECHNICA	JOHNSON	4	2899	CHEMICAI	2021	0.035	0.0028	0	0.035	0.035	0.0028	45.1843		
		DBA035J	RN110276	E R CARPENTER LP	EPS INSUL	DALLAS	4	3086	PLASTICS,	2021	1.4663	0.8728	0	0.1327	0.1327	0.0105	45.0617	419 Peregrine W	
Cant Find on Map		TA0038L	RN104475	BKV MIDSTREAM LLC	WEST LAK	TARRANT	4	1311	CRUDE PE	2021	13.8202	19.9183		0.1107	0.1107	0.0888	43.9842		
		DB5077A	RN100752	CITY OF DALLAS	MCCOMM	DALLAS	4	4953	REFUSE SY	2021	1.927	8.82	0	82.575	50.583	0.586	43.005		

Mission 2; Inflow/Outflow/Photochemistry Experiments

1



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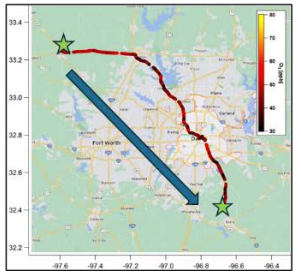

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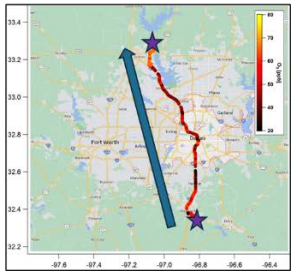


Mission 3; Sampling Wildfires

Point Sources of Interest Used

https://www.tceq.texas.gov/downloads/air-quality/point-source/2014_2021statesum.xlsx

As guide focused on Region 4 and sorted by top VOC TPY emitter for 2021 (most recent report year)

Orange saw plumes
Yellow did not

ACCOUN	RN	COMPAN	SITE	COUNTY	REGION	SIC	DESCRIP	RTING Y	CO TPY	NOX TPY	Pb TPY	PM10 TP	M2.5 TP	SO2 TPY	VOC TPY
ED0168P	RN10021	DARTCO C	DARTCO C	ELLIS	4	3089	PLASTICS	2021	25.19	11.23	0.0001	2.327	2.327	0.18	611.368
TA0157I	RN10250	GENERAL	ARLINGTC	TARRANT	4	3711	MOTOR VI	2021	39.5258	53.6743		6.6924	6.5323	0.2498	418.711
ED0011D	RN10021	CHAPARR	CHAPARR	ELLIS	4	3312	BLAST FUI	2021	1535.71	411.191	0.4274	148.02	127.628	315.138	332.102
JHA012L	RN10492	ETC TEXAS	GODLEY P	JOHNSON	4	1321	NATURAL	2021	110.392	48.2571		9.446	9.446	4.297	216.931
ED0099J	RN10021	HOLCIM L	MIDLOTH	ELLIS	4	3241	CEMENT, I	2021	2894.62	1249.65	0.0121	284.294	165.813	1898.78	188.066
TA0156K	RN10021	LOCKHEEI	US AIR FO	TARRANT	4	3721	AIRCRAFT	2021	3.2714	9.231	0	11.2886	11.2636	2.1778	139.443
JH0025O	RN10021	JOHNS MA	JOHNS MA	JOHNSON	4	3296	MINERAL	2021	362.182	42.4523	0.0002	183.539	179.76	21.5605	135.506
NB0089J	RN10022	PACTIV LL	PACTIV CC	NAVARRO	4	3086	PLASTICS,	2021	6.0583	7.2465	0	22.242	21.5498	0.1241	104.1
ED0051O	RN10022	OWENS CI	WAXAHAC	ELLIS	4	3296	MINERAL	2021	164.975	73.4993	0.0001	259.861	217.117	14.4768	84.2756
WN0021(	RN10022	ENLINK M	BRIDGEPC	WISE	4	1321	NATURAL	2021	220.744	299.743	0	19.7529	19.7529	1.0123	71.267
ED0013W	RN10253	PRAXIS CC	KORAL INI	ELLIS	4	3088	PLASTICS,	2021	0.2182	0.2598	0	0.0519	0.0277	0.0015	70.6563
TA0236L	RN10022	BALL MET	BALL MET	TARRANT	4	3411	METAL CA	2021	5.9798	7.1186		0.5727	0.5517	0.0429	69.6195
DF0051J	RN10021	PACCAR II	PETERBILT	DENTON	4	3711	MOTOR VI	2021	10.7553	12.3585	0	10.5272	0.3568	0.085	64.704
DB0447B	RN10068	HENSLEY I	DALLAS PI	DALLAS	4	3325	STEEL FOU	2021	67.2284	11.4075		7.265	7.1506	3.0224	63.4473
TA0054T	RN10022	BELL TEXT	PLANT 1	TARRANT	4	3721	AIRCRAFT	2021	10.8087	12.1485	0	4.9492	0.9694	0.1013	60.8695
DB1276U	RN10021	TEKNI-PLE	DOLCO PA	DALLAS	4	5169	CHEMICAI	2021	0.5185	0.6173		0.049	0.049	0.0037	57.2995
DB0820B	RN10250	TEXAS INS	CENTRAL I	DALLAS	4	3674	SEMICONI	2021	44.1592	54.8238		10.2643	5.7823	6.2977	57.1955
WN0005I	RN10023	TARGA MI	DYNEGY C	WISE	4	1321	NATURAL	2021	41.91	100.12		5.58	5.58	35.1039	54.95
DB3613K	RN10230	WESTERN	CEDAR HII	DALLAS	4	2434	WOOD KI	2021	0.0824	0.098	0	0.0321	0.0321	0.0006	54.6498
DB0155R	RN10066	TAMKO BU	DALLAS PI	DALLAS	4	2952	ASPHALT I	2021	31.2668	7.4049	0	13.2361	9.8371	29.3555	53.9459
PCA008H	RN10501	BKV MIDS	WEST WA	PARKER	4	1311	CRUDE PE	2021	11.0563	28.1575		0.0917	0.0917	0.1701	52.6513
DB0588F	RN10024	MAGELLA	DALLAS TE	DALLAS	4	4226	SPECIAL V	2021	0	2.56	0	0	0	6.4	52.106
DB0795V	RN10051	MOTIVA E	DALLAS TE	DALLAS	4	5171	PETROLEU	2021	2.7983	1.3916		0.0863	0.0751	0.0012	51.6126
JH0376F	RN10077	TECHNICA	TECHNICA	JOHNSON	4	2899	CHEMICAI	2021	0.035	0.0028	0	0.035	0.035	0.0028	45.1843
DBA035J	RN11027	E R CARPE	EPS INSUL	DALLAS	4	3086	PLASTICS,	2021	1.4663	0.8728	0	0.1327	0.1327	0.0105	45.0617
DB5077A	RN10075	CITY OF D	MCCOMM	DALLAS	4	4953	REFUSE SY	2021	1.927	8.82	0	82.575	50.583	0.586	43.005
TA1222P	RN10249	FLINT HILI	FORT WOI	TARRANT	4	5171	PETROLEU	2021	1.7708	0.731		0.0395	0.0058	0.0002	39.9604
ED0066B	RN10021	TXI OPERA	MIDLOTH	ELLIS	4	3241	CEMENT, I	2021	510.11	1495.19	0.0074	207.908	95.6833	669.6	39.6424
TAA045S	RN10300	BIMBO BA	TIA ROSA	TARRANT	4	2051	BREAD, CA	2021	0.6127	0.7294	0	0.1269	0.1269	0.0044	39.555
CP0396W	RN10021	ENCORE W	MCKINNE	COLLIN	4	3351	COPPER R	2021	172.602	15.0729	0.0312	12.1931	11.3635	0.1793	38.4687
DF0089H	RN10261	TETRA PAI	MATERIAL	DENTON	4	2656	SANITARY	2021	0.934	1.111	0	0.463	0.463	0.006	38.212
TA0172M	RN10021	FORT DEA	FORT WOI	TARRANT	4	2752	COMMER(	2021	0.09	0.11	0	0.01	0.01	0.001	37.2176
TA0235N	RN10264	MOLSON (	FORT WOI	TARRANT	4	2082	MALT BEV	2021	19.433	8.9051	0	1.8611	1.8546	0.1549	36.8391
DB0976P	RN10021	AQUATIC (	AQUATIC	DALLAS	4	3088	PLASTICS,	2021	0.02	0.02		0.002	0.002	0.0002	36.7129
PC0011B	RN10218	MAGELLA	ALEDO PR	PARKER	4	4613	REFINED F	2021	3.7083	1.8575	0	0.0018	0.0018	0.0034	36.3491
TAA062J	RN10060	PARKER-H	MANSFIEL	TARRANT	4	3052	RUBBER &	2021	0	0	0	0	0	0	35.3626
DF0223E	RN10054	WASTE M	DFW RECY	DENTON	4	4953	REFUSE SY	2021	269.86	79.2	0	25.15	20.48	45.59	35.21
JHA004D	RN10437	ENERGY TI	CLEBURNI	JOHNSON	4	4922	NATURAL	2021	19.2738	29.8051		3.5533	3.5533	0.202	33.1347
TA0051C	RN10221	BELL TEXT	PLANT 5A	TARRANT	4	3721	AIRCRAFT	2021	5.6046	4.0896	0	4.31	4.31	0.0319	33.0545
DB4237J	RN10200	CITY OF IR	HUNTER F	DALLAS	4	4953	REFUSE SY	2021	0.7201	0.7201	0	8.4701	1.45	0.0001	32.39
DBA014N	RN10507	OVERWRA	OVERWRA	DALLAS	4	2759	COMMER(	2021	1.06	1.25		0.092	0.092	0.0066	32.293
DB0408L	RN10164	PPG ARCH	PAINT MF	DALLAS	4	2851	PAINTS AN	2021	0.2118	0.252	0	1.1597	1.1597	0.0016	31.7187
TA0142V	RN10022	US VENTU	US OIL FO	TARRANT	4	5171	PETROLEU	2021	0.0555	0.034				0.0016	30.4521
DB0969M	RN10055	RMAX INC	FOAM BO/	DALLAS	4	3086	PLASTICS,	2021	0	0	0	0	0	0	27.21
TAA001A	RN10321	BIMBO BA	BIMBO BA	TARRANT	4	2051	BREAD, CA	2021	1.2892	1.5347	0	0.2201	0.2201	0.0092	26.8294
DB0135A	RN10056	HATCO IN	HATCO	DALLAS	4	2353	HATS, CAF	2021	0.754	0.898	0	0.429	0.068	0.0052	24.8401
ED0034O	RN10022	ASH GROV	MIDLOTH	ELLIS	4	3241	CEMENT, I	2021	149.4	531.154	0.0078	79.7479	71.112	7.6331	17.8399
ED0332D	RN10259	MIDLOTH	MIDLOTH	ELLIS	4	4911	ELECTRIC	2021	848.762	241.956	0	112.247	112.247	9.5874	15.7371
JH0398S	RN10082	TEXAS REC	TURKEY CI	JOHNSON	4	4953	REFUSE SY	2021	6.9504	1.2806	0	22.475	13.072	2.45	13.6438
ED0319S	RN10055	QUALICO	STRUCTUI	ELLIS	4	3441	FABRICAT	2021	0	0	0	0.0048	0.0048	0	10.602
ED0152H	RN10146	MARTECH	MARTECH	ELLIS	4	3299	NONMETA	2021	0	0	0	0.52	0.52	0	10.052
EDA010J	RN11073	BOMBARI	RED OAK I	ELLIS	4	3721	AIRCRAFT	2021	0	0	0	0	0	0	10.0194
ED0146C	RN10068	LIFOAM IN	LIFOAM IN	ELLIS	4	3086	PLASTICS,	2021	1.964	2.33	0	0.177	0.177	0.014	5.884

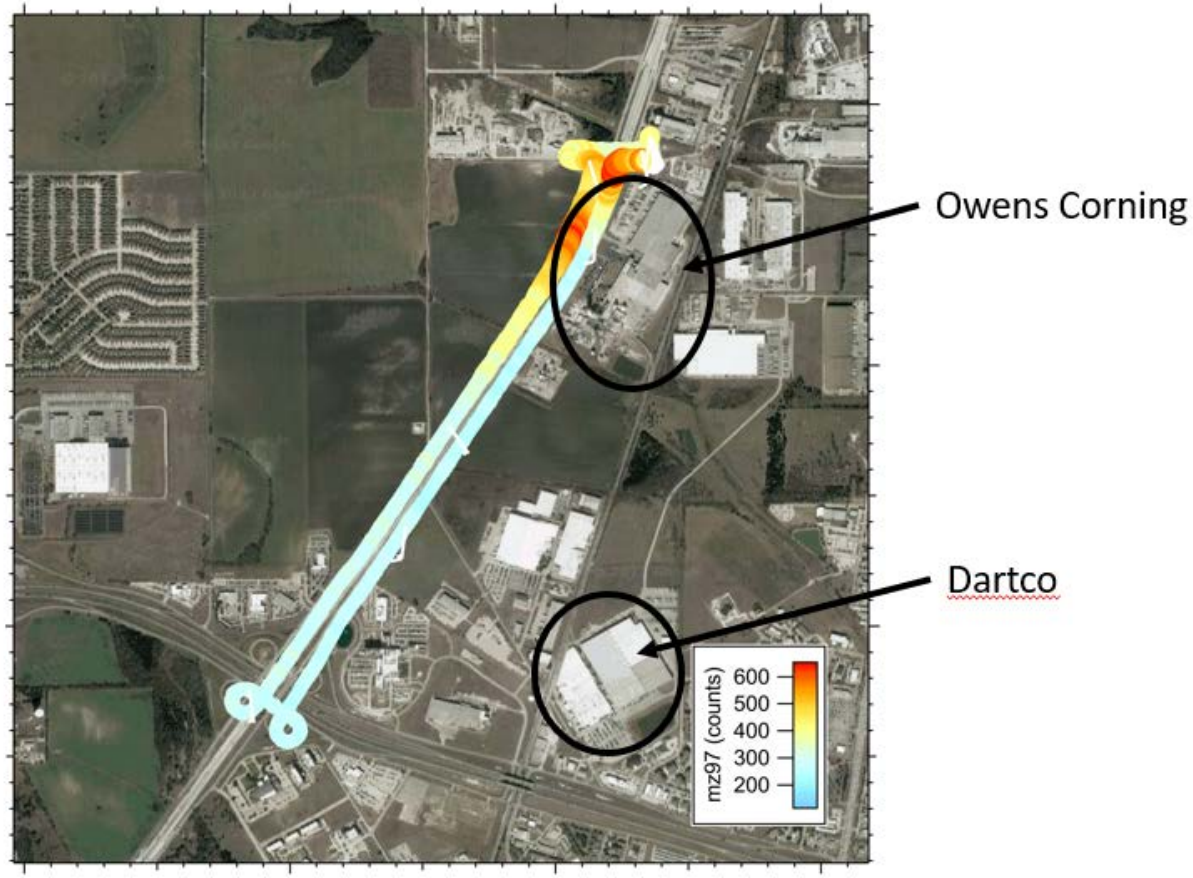
Owens Corning/DARTCO Waxahachie Point Source Measurements

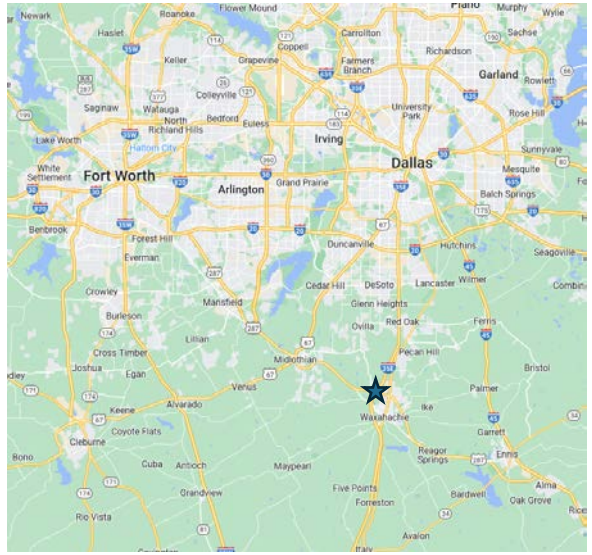
Multiple facilities visited multiple times with different wind flow each time

Needed the different wind flow to differentiate the sources

First trip winds out of south

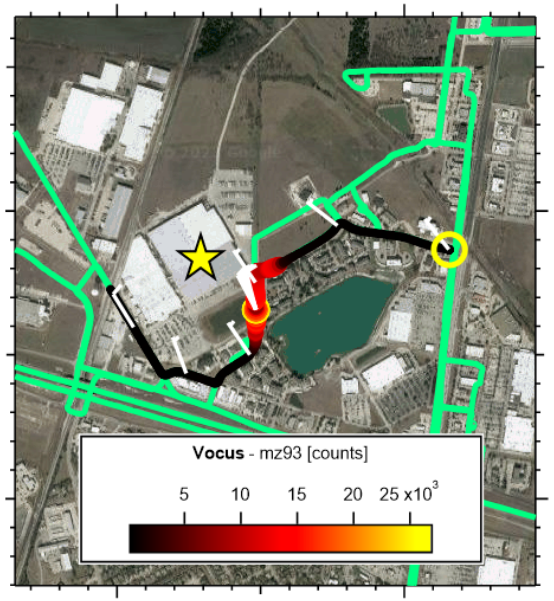
No road between the facilities





Second trip winds out of NW

Can Sample Dart Container well but not Owens Corning



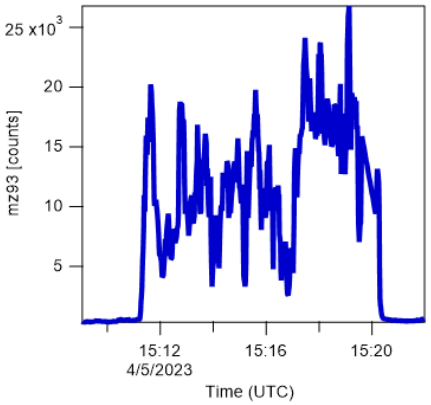
April 5th, 2023

Dart Container

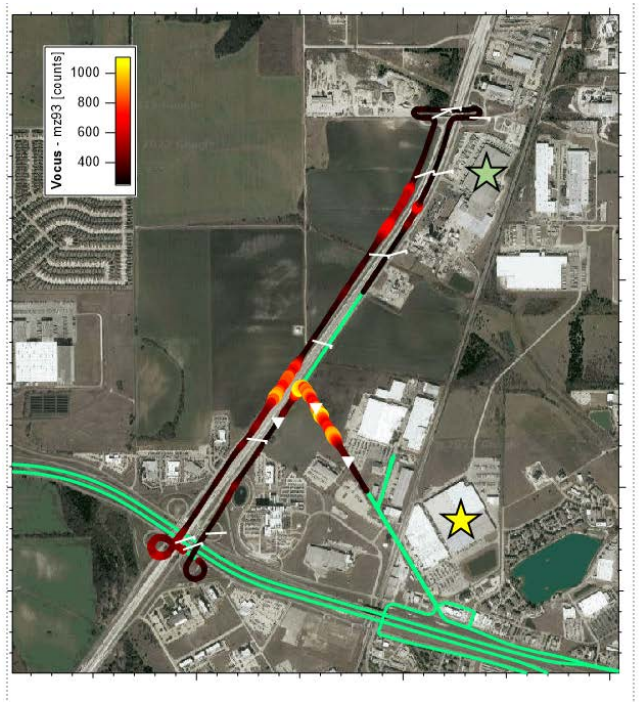
850 Solon Rd

Waxahachie, TX 75165

15:10 – 15:22 UTC



Third trip winds out of East able to sample both facilities and discriminate between them

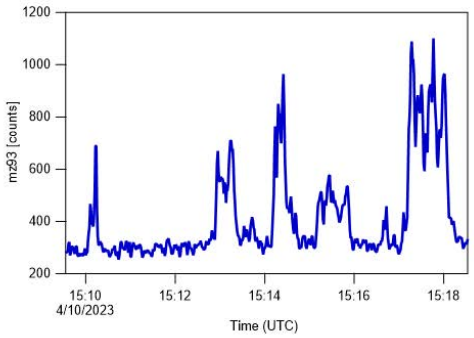


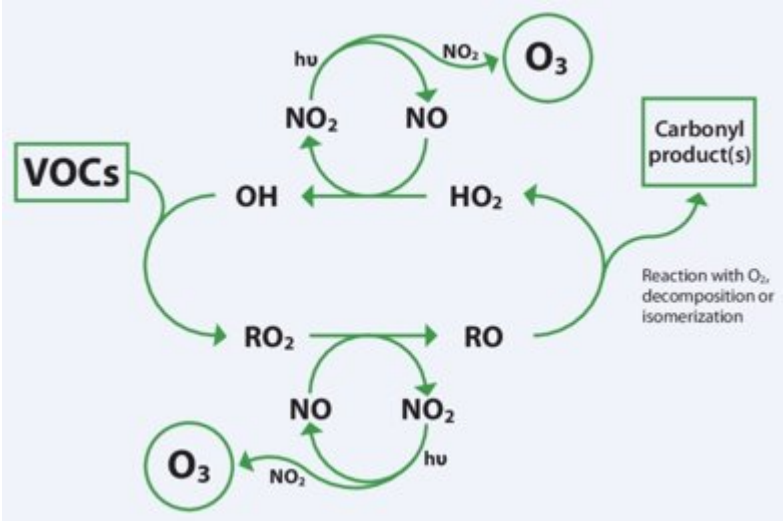
April 10th, 2023

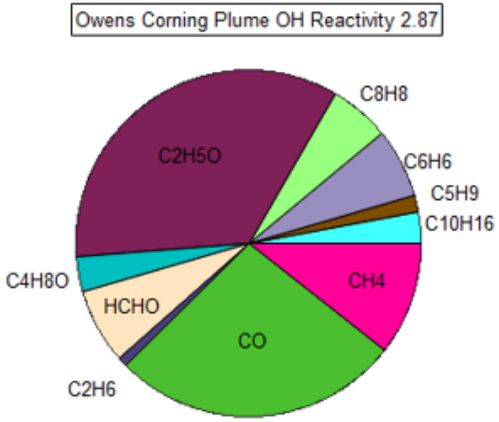
Dart Container
850 Solon Rd
Waxahachie, TX 75165

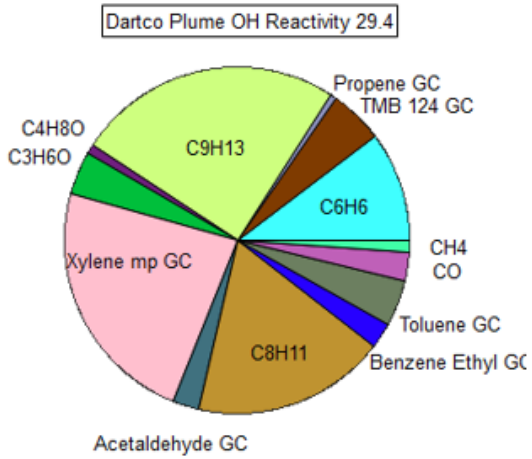
Owens Corning
3700 N Interstate 35E
Waxahachie, TX

15:09 – 15:19 UTC







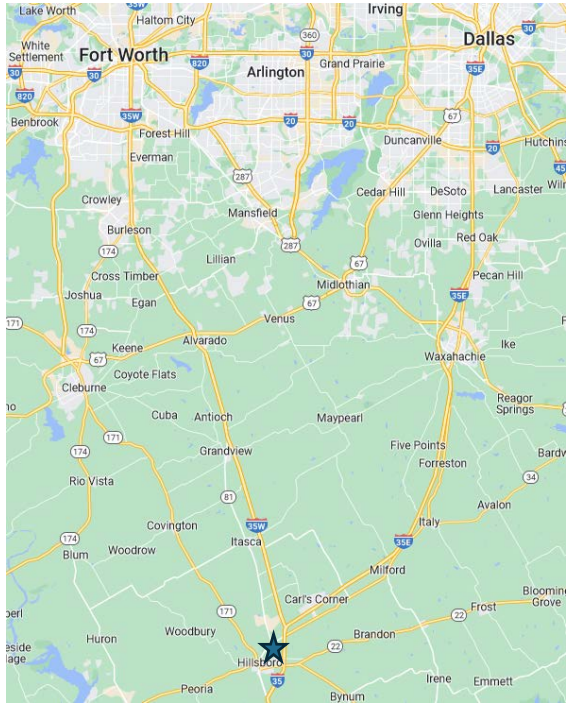


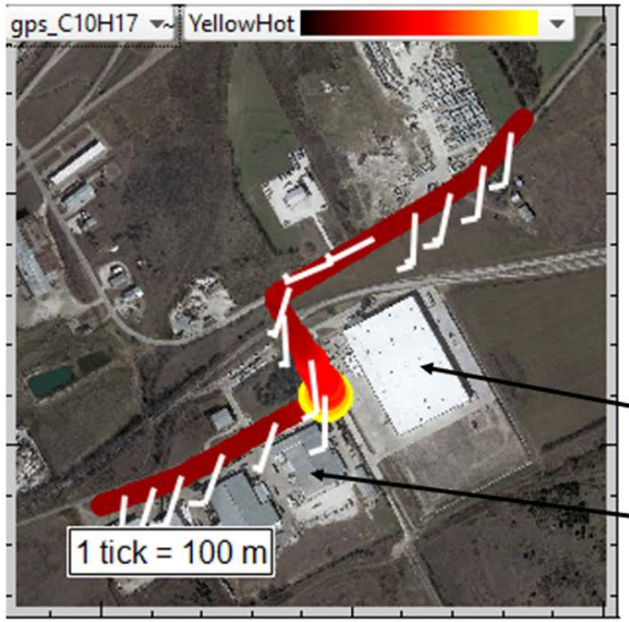
Hillsboro Clayton Homes Plume

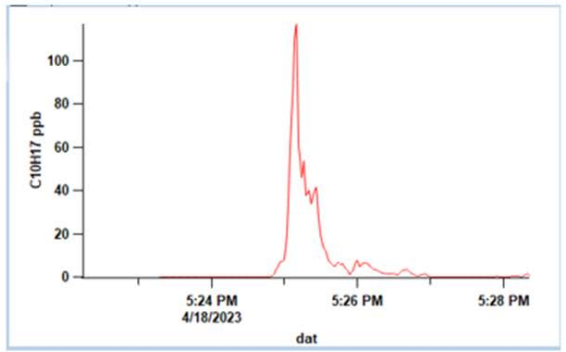
C10H17

OH Reactivity 97% due to C10H17 and 135 per second

Based on averaging Contributions from Camphene, Carene_3, Limonene_D, Limonene_iso, Mircene, Pinene_alpha, Pinene_beta, Terpinene_gamma, Terpinolene
Lowest k[OH] 52 Highest k[OH] 225





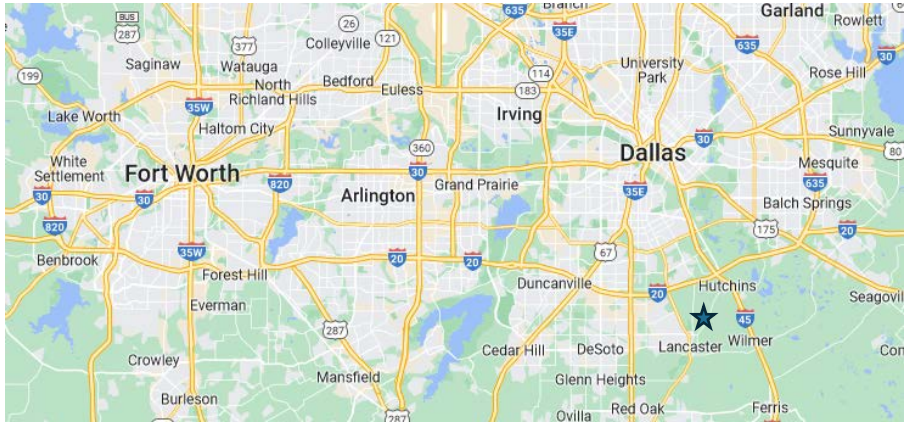


Johns Manville

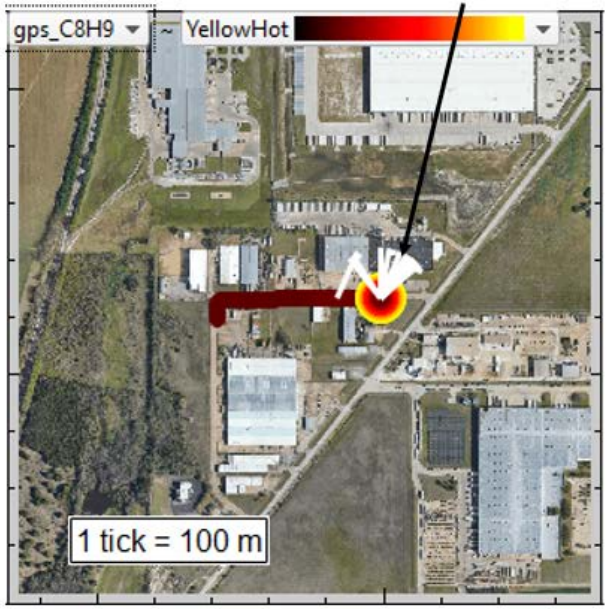
Clayton Homes

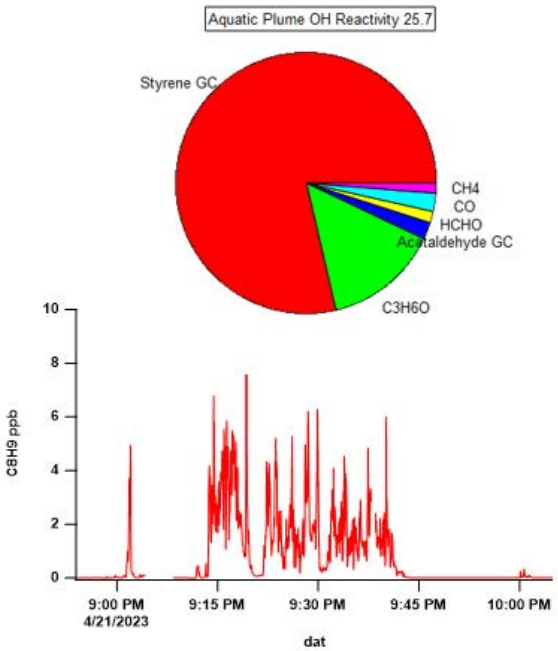
Aquatic Lancaster TX

Styrene



Aquatic





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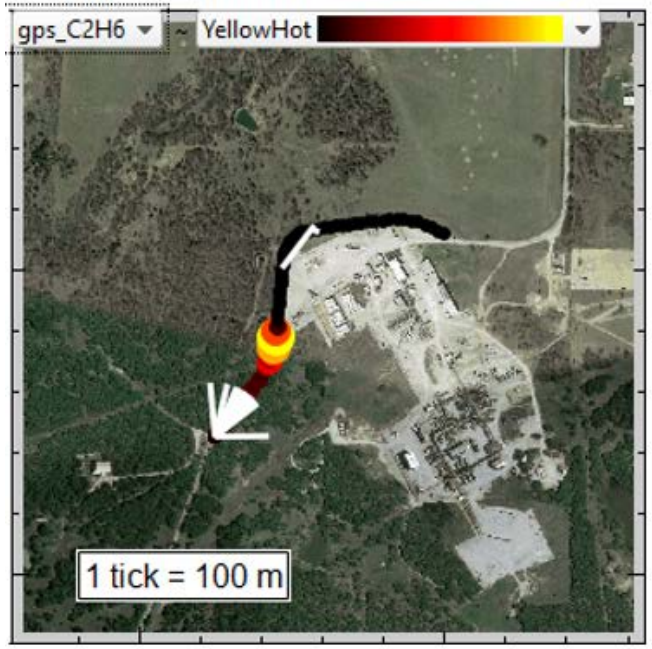
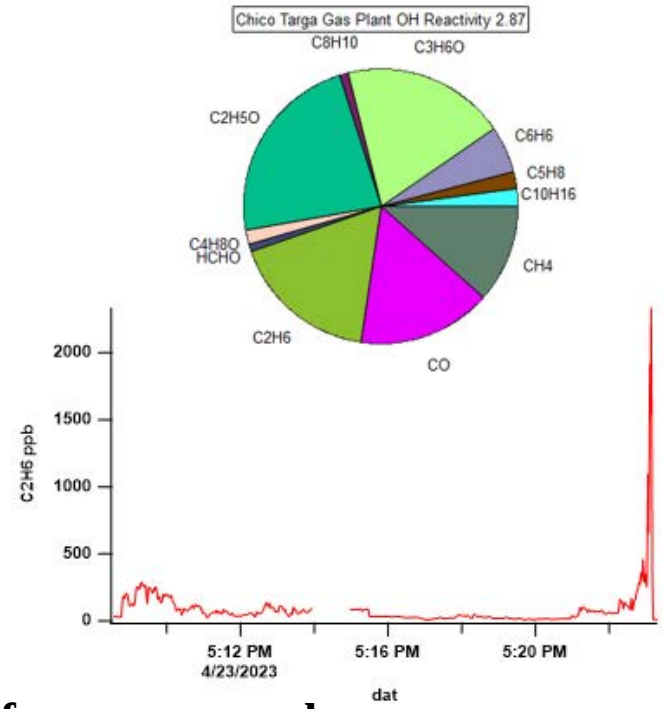
Chico Targa Gas Plant

Ethane/Methane



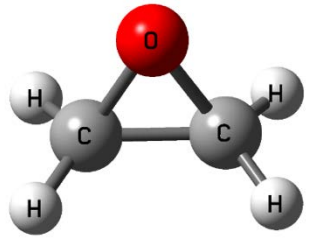


Not much of an ozone producer although very intense plume
Still a concern from health and combustion standpoints

Measurement of Opportunity Ethylene Oxide (ETO)

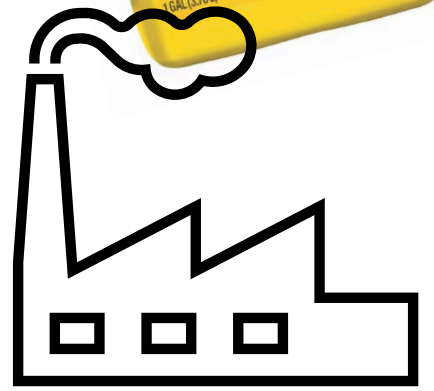
Ethylene Oxide Background

- Toxic
  - Even at part-per-trillion levels
  - 10 ppt = one grain of sand out of 25 pickup truck beds
- Very reactive
  - Penetrates lungs, becomes free-radical = carcinogen
  - Useful for sterilization
    - Medical equipment (especially plastics)
      - Large-scale sterilization companies
      - Hospital sterilizers
    - Grains/powders (agriculture)
  - Used to make other chemicals
    - Ethylene glycol (antifreeze)



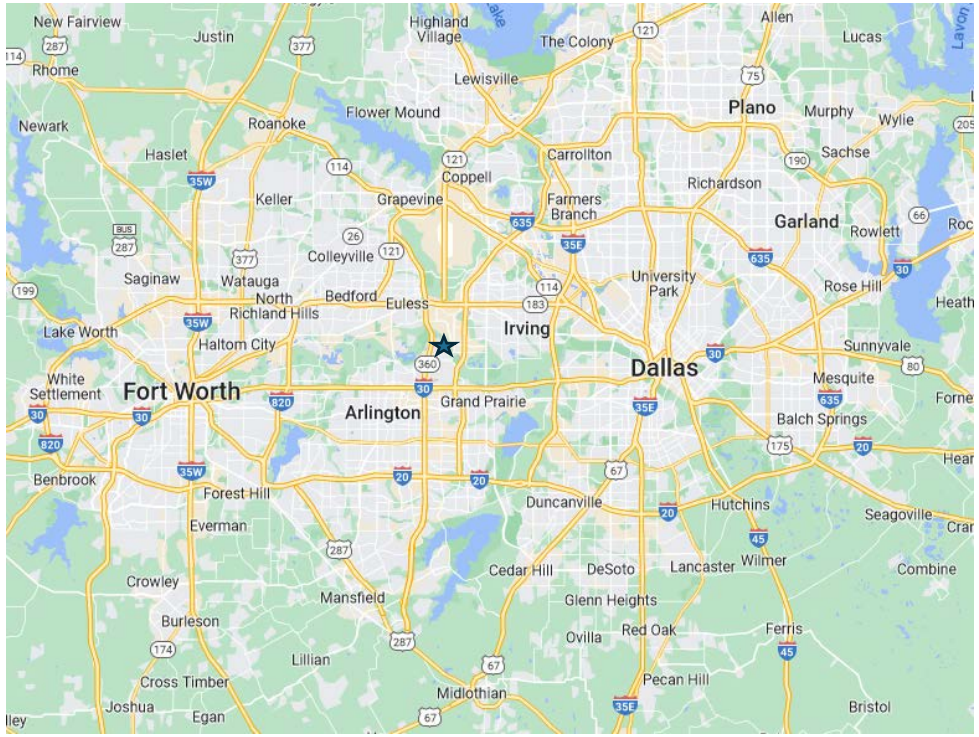
Antifreeze

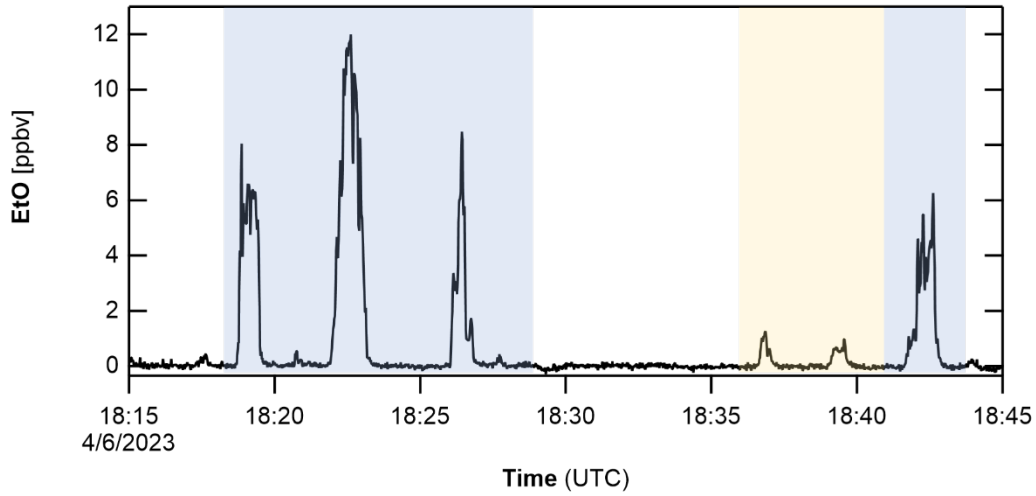
3M ethylene oxide sterilizer and cartridges



Pacemaker

ETO Measurements

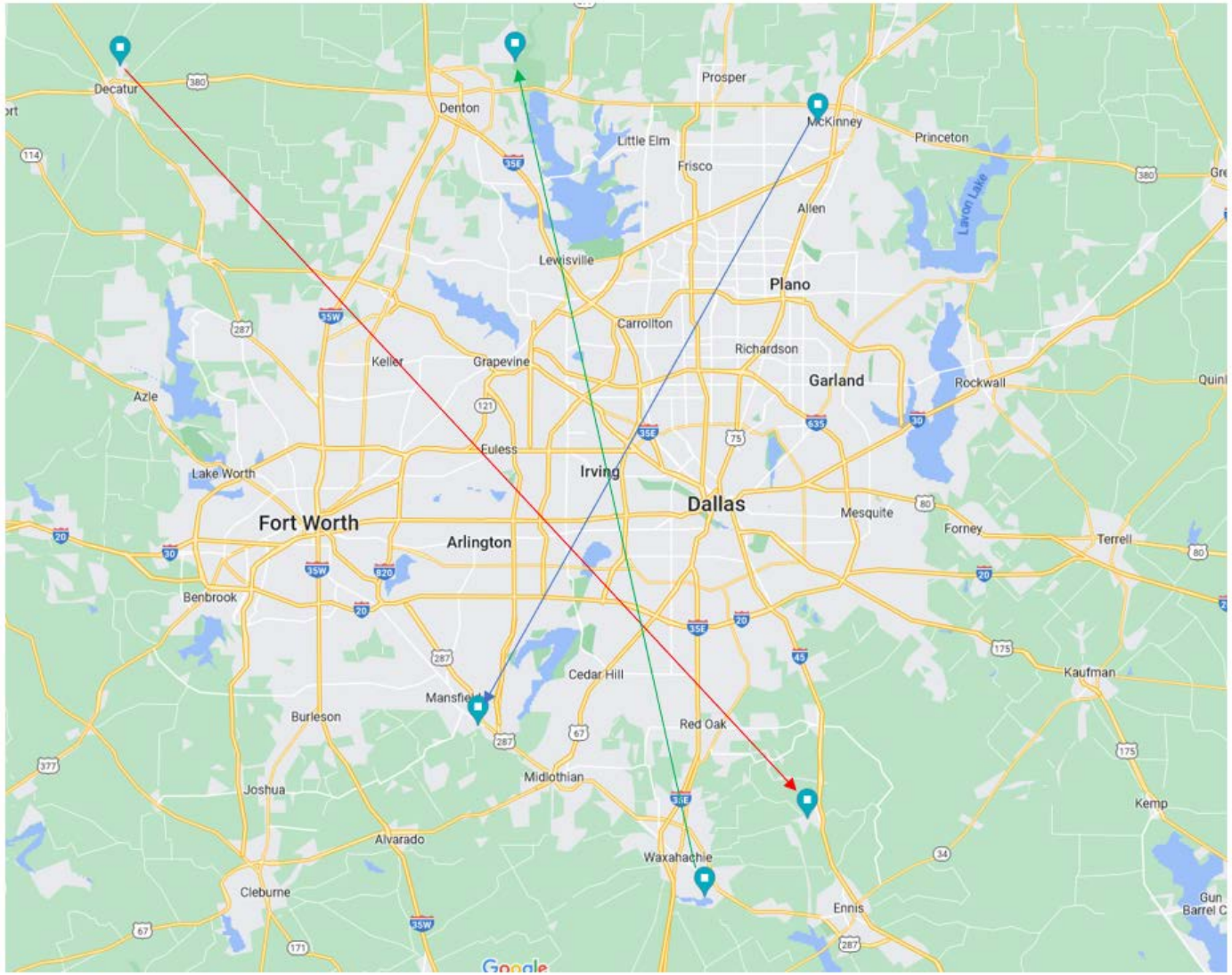




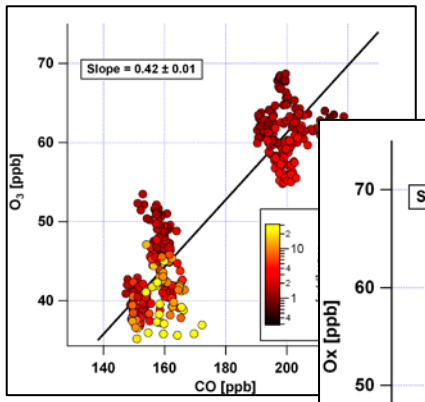
Upwind/Downwind of DFW Measurements

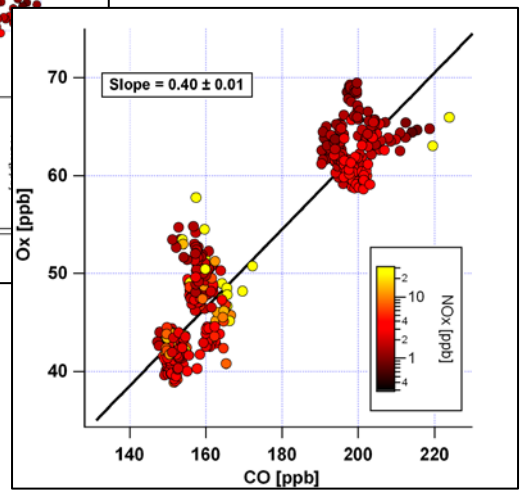
4 trips completed 2 on weekdays 2 on weekends with a variety of wind directions

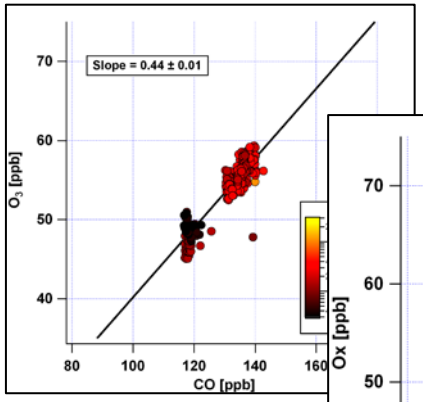
Mission Plan was spending 2-3 hours at upwind then transit across DFW spend 5-6 hours at downwind

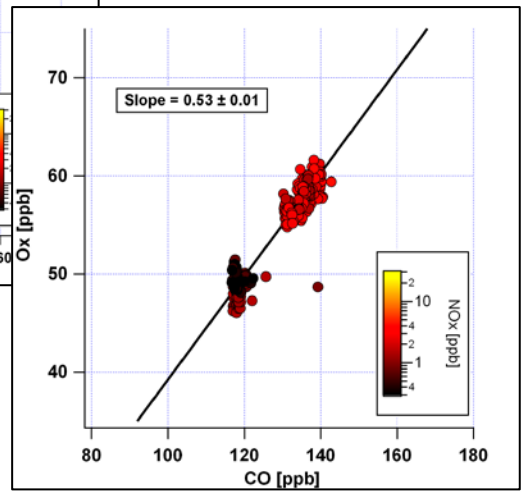


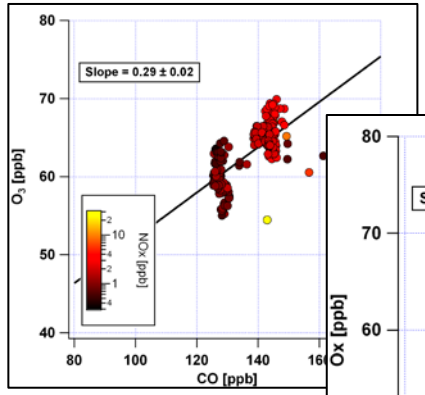
O_3 and Ox (O_3 + NO_2) versus CO

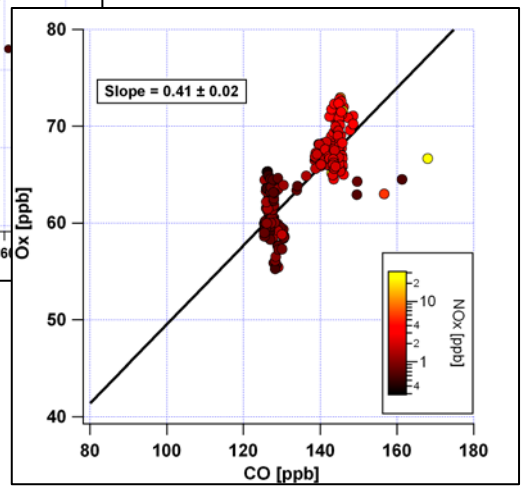












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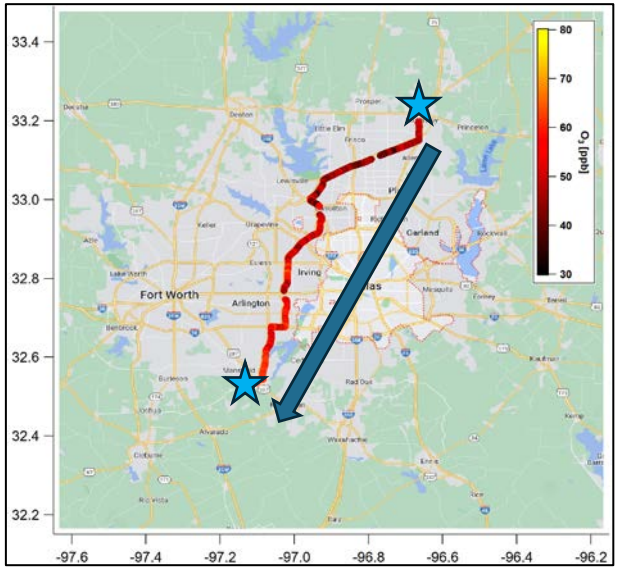

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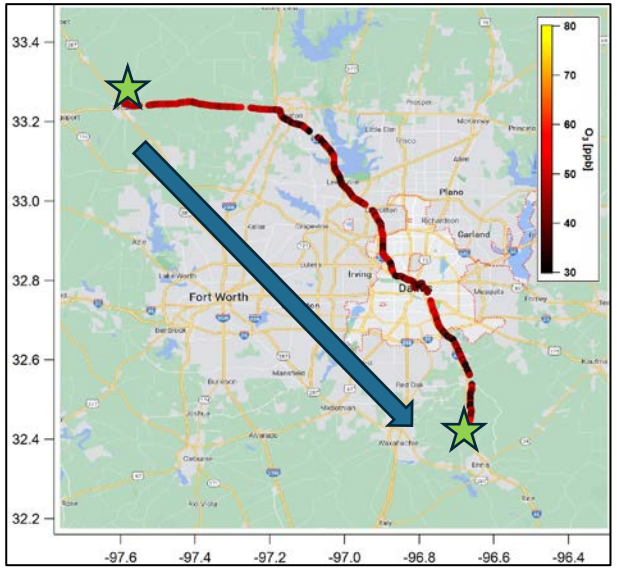

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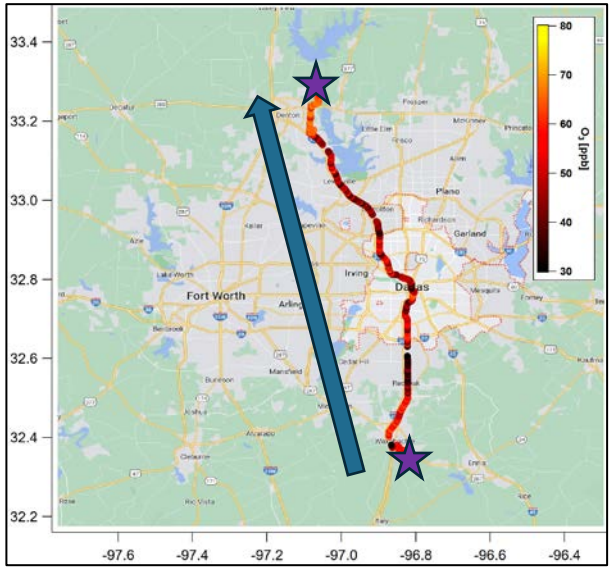
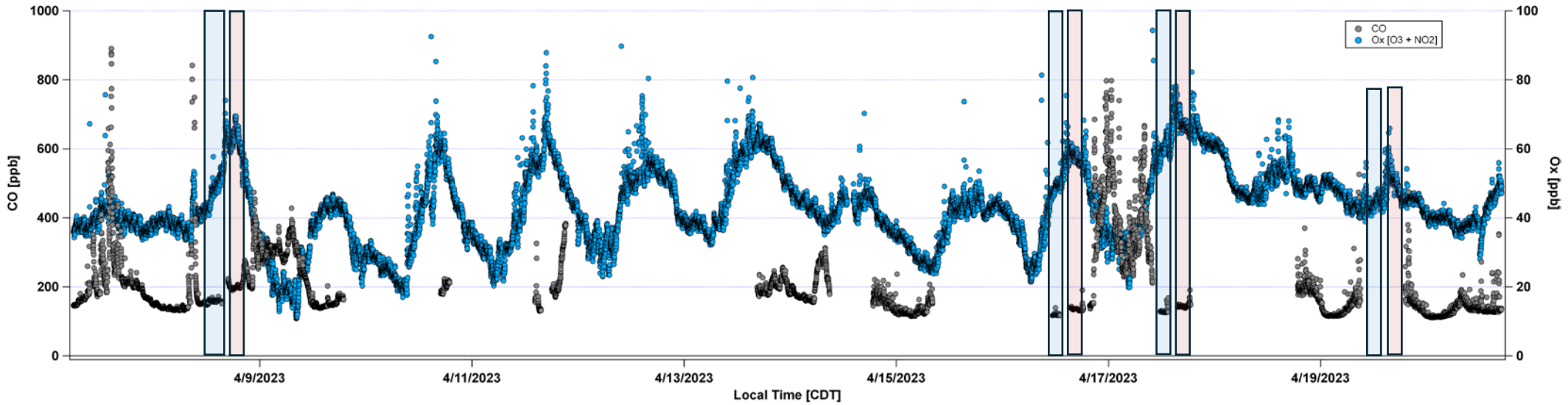


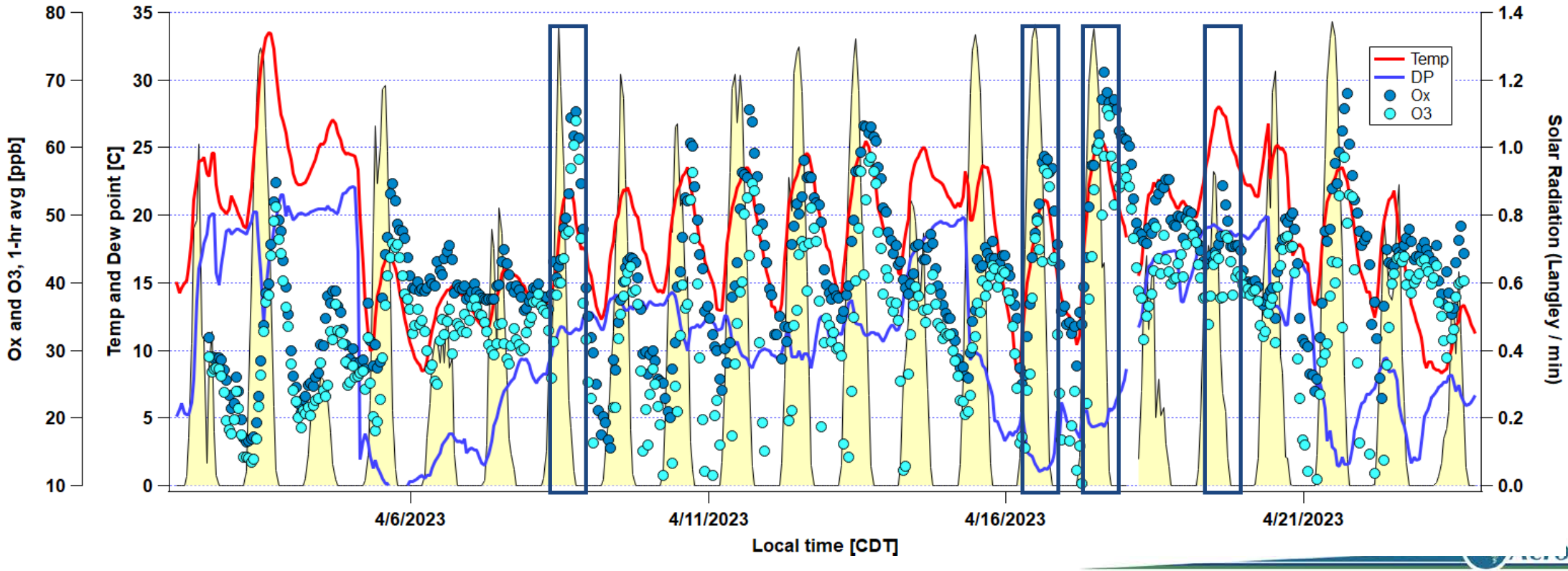
Upwind / Downwind experiments

Date	Upwind (morning)	Downwind (afternoon)	Max 1-min O_3 [ppb]	Comments
8-Apr (Sat)	McKinney (9:25 CDT)	Mansfield (16:50 CDT)	68	Downwind at RV park (home base)
16-Apr (Sun)	Decatur (10:37 CDT)	Palmer (15:16 CDT)	59	Late start of upwind due to Vocus DAQ P/S failure
17-Apr (Mon)	Waxahachie (11:45 CDT)	Denton (15:50 CDT)	62	Some boat traffic at 1st upwind site, so moved
19-Apr (Wed)	Waxahachie (10:40 CDT)	Denton (16:19 CDT)	51	Repeat of 17-Apr experiment, but better parking spot at each site *** No CO data available this day ***

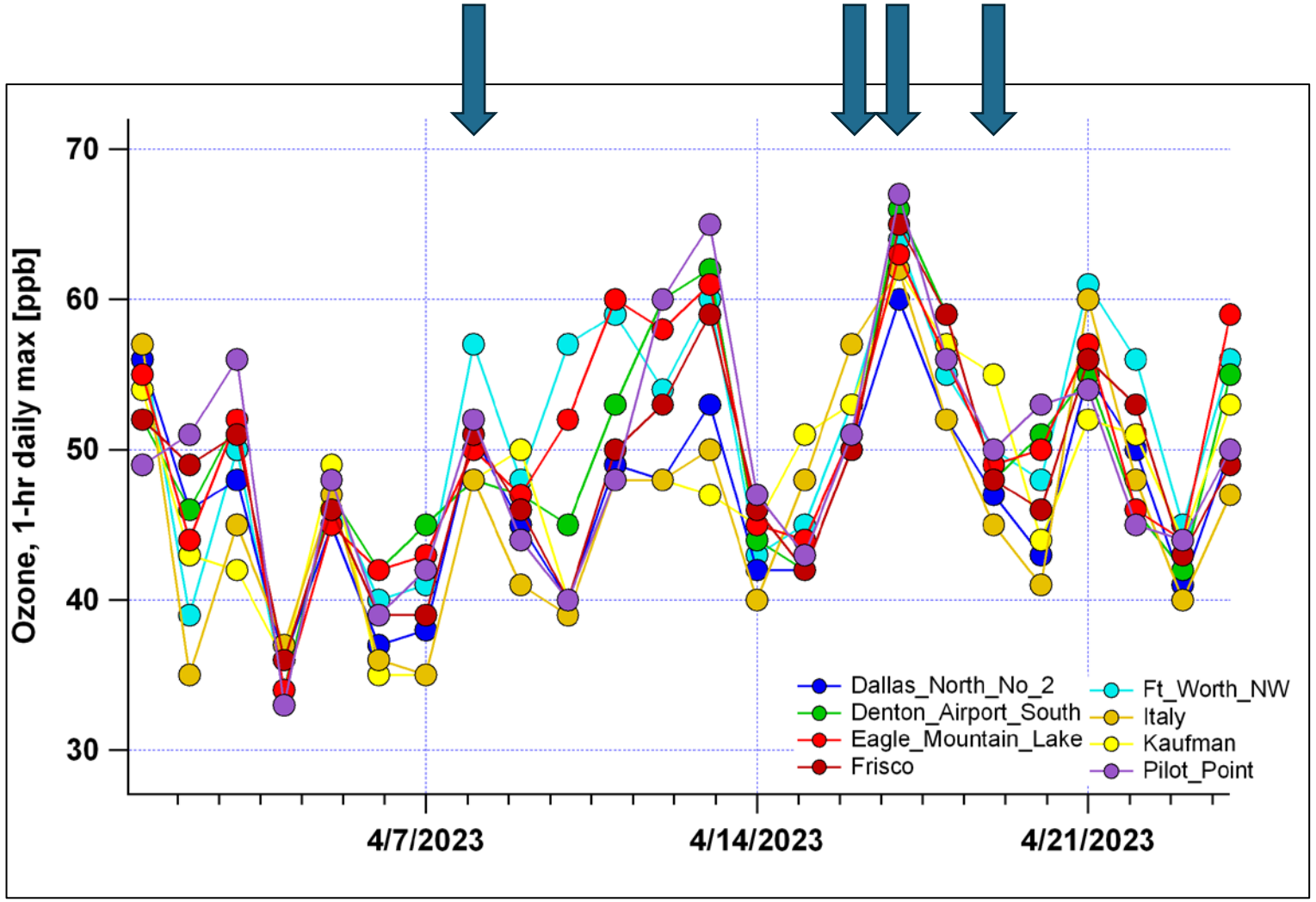


Upwind / Downwind experiments

				Averaged 1100 – 1700 CDT		
Date	Max 1-min O_3	Max 1-hr Ox	Ox / CO	Temp [C]	Dew Pt [C]	Solar [Ly/min]
8-Apr	68	65.3	0.40	20.7	11.5	0.66
16-Apr	59	58.8	0.53	20.2	1.3	0.85
17-Apr	62	**71.2**	0.41	24.9	4.7	0.77
19-Apr	51	54.4	-	27.4	18.9	0.49



Comparing with TCEQ Stations



Data from TCEQ
(https://www.tceq.texas.gov/cgi-bin/compliance/monops/peak_monthly.pl)

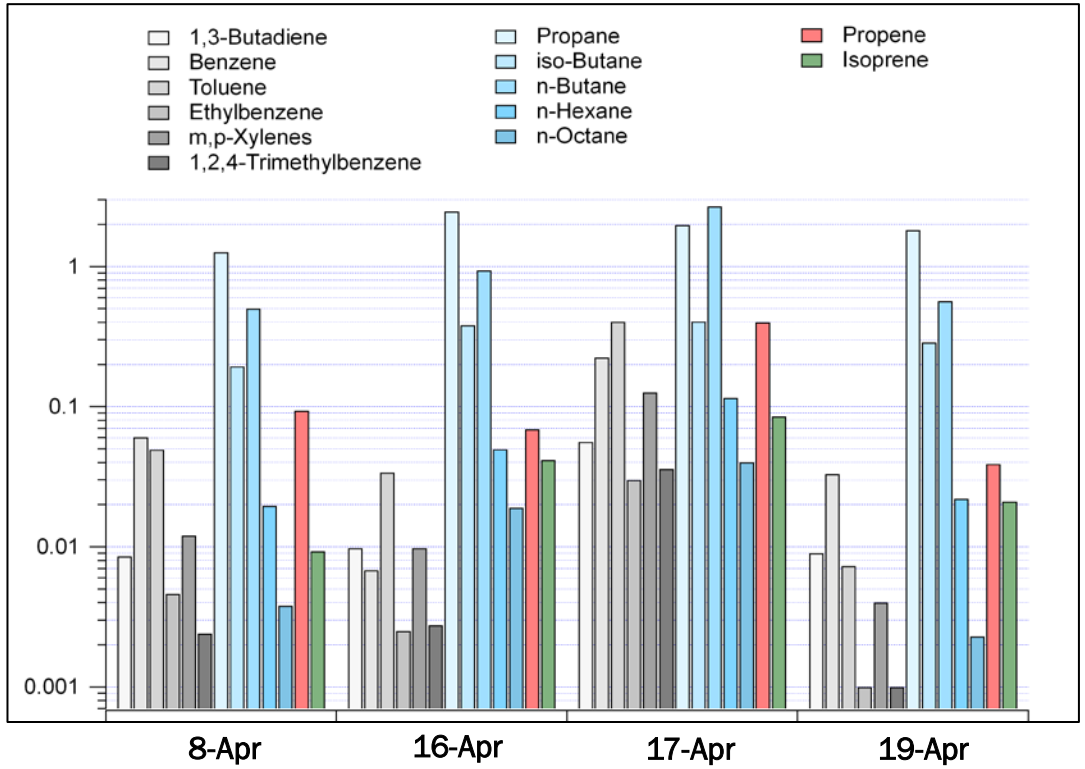
Daily maximum ozone in ppb, 1-hr average, from eight TCEQ monitoring sites around the DFW region.

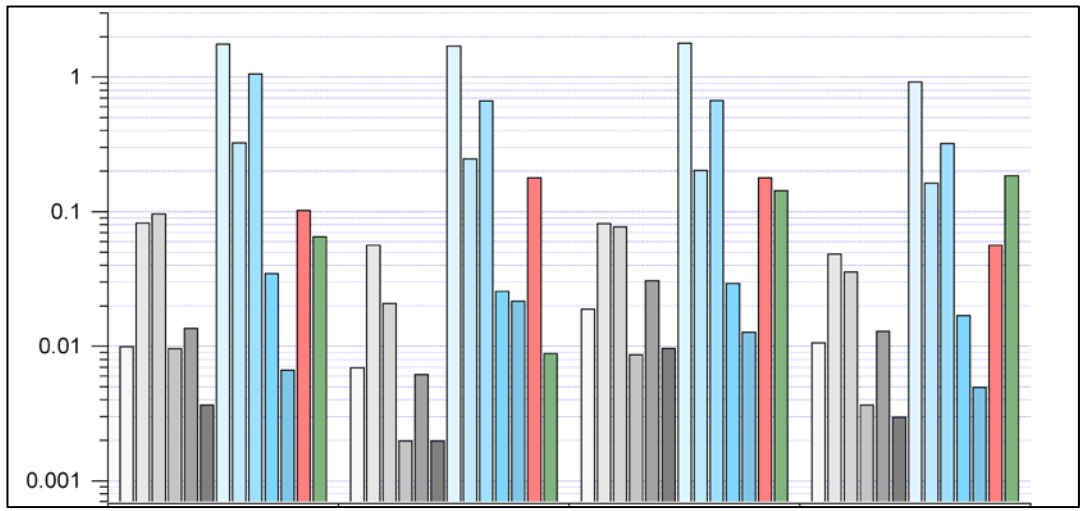
Arrows indicate days where ARI conducted upwind / downwind studies (8-Apr, 16-Apr, 17-Apr, 19-Apr).

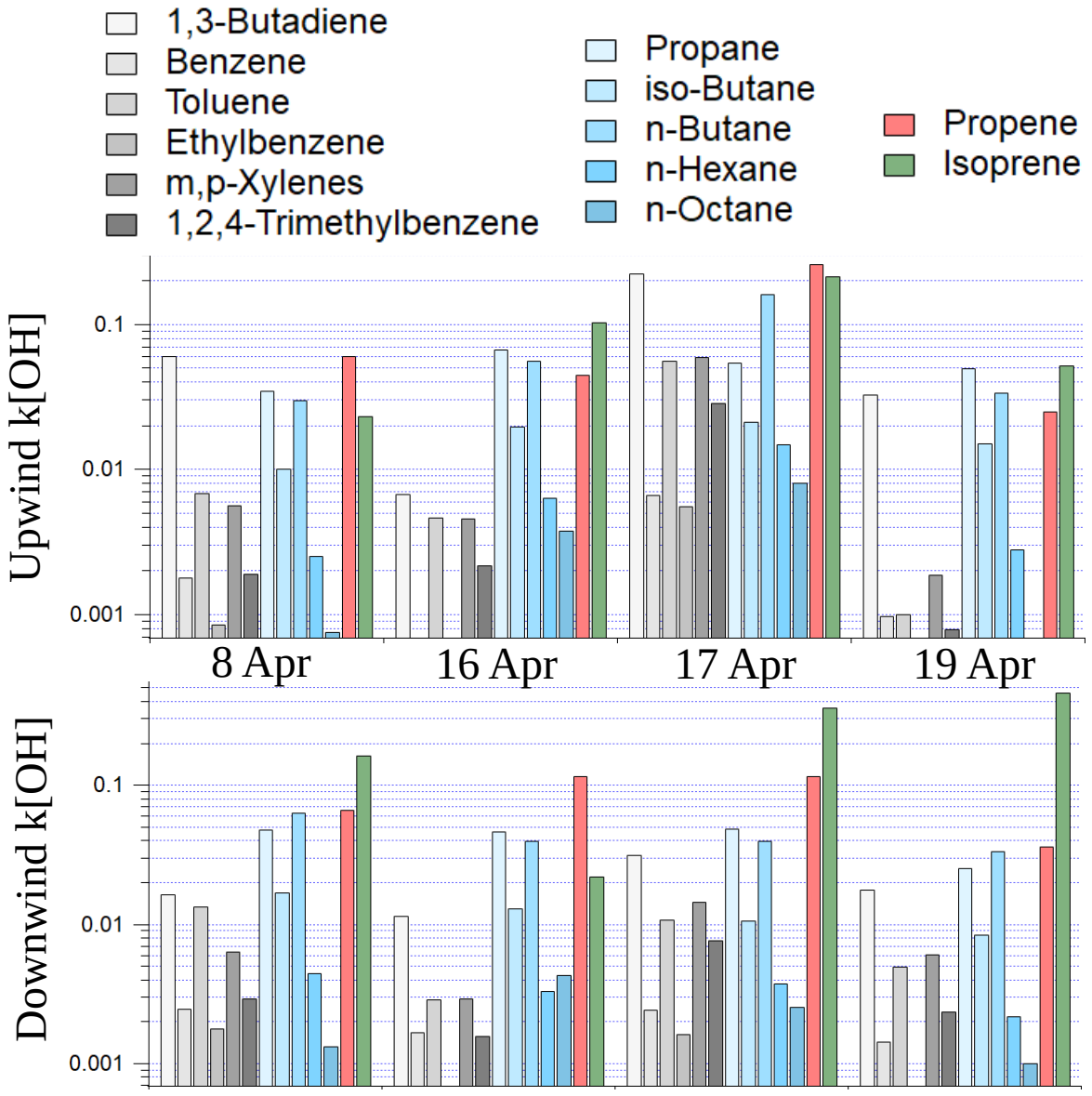
Note that 17-Apr was the day of highest maximum ozone across all monitoring sites for the campaign.

Also note 16 and 17 Apr show highest readings at the downwind Italy and Pilot Point respectively

VOC's Upwind/Downwind

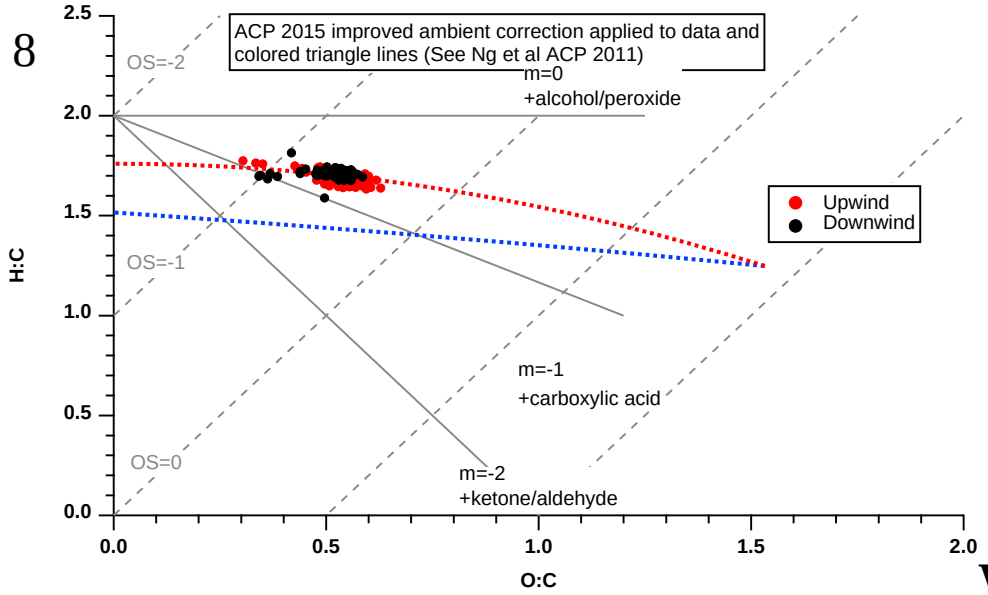




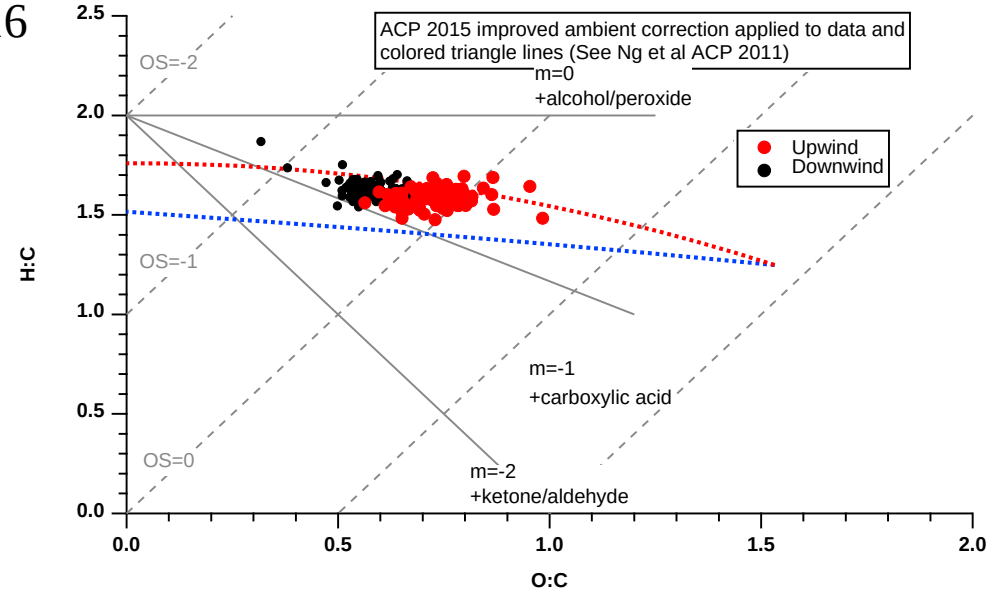


AMS Organics Upwind Downwind Organics H:C O:C

Apr 8

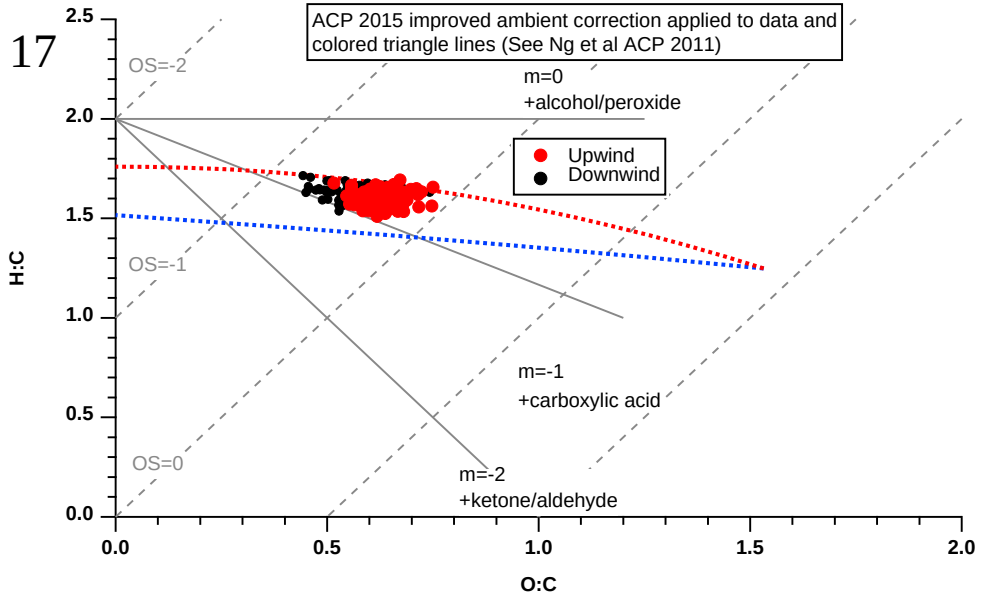


Apr 16

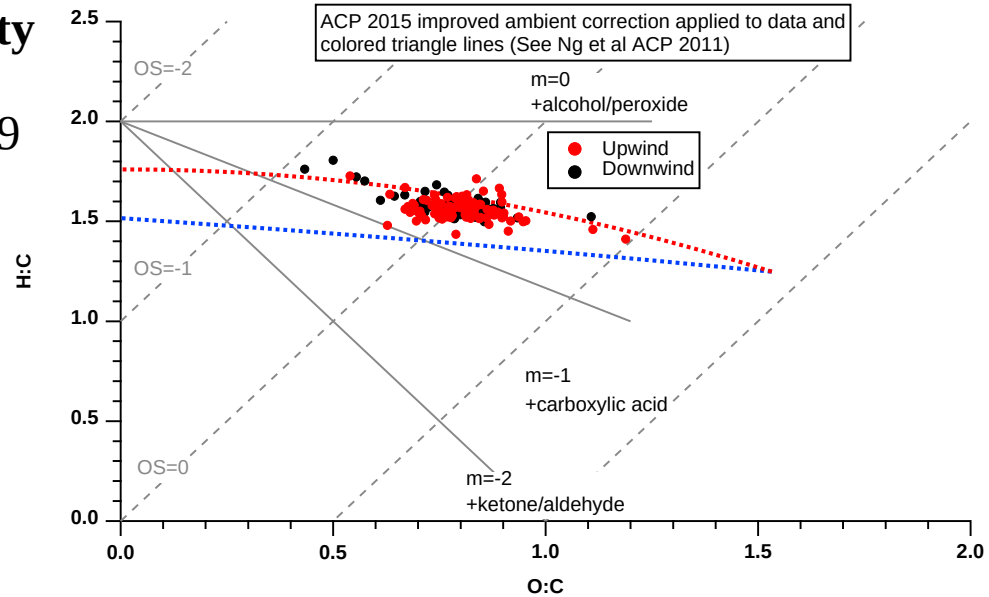


We See Fresh Emissions from City

Apr 17

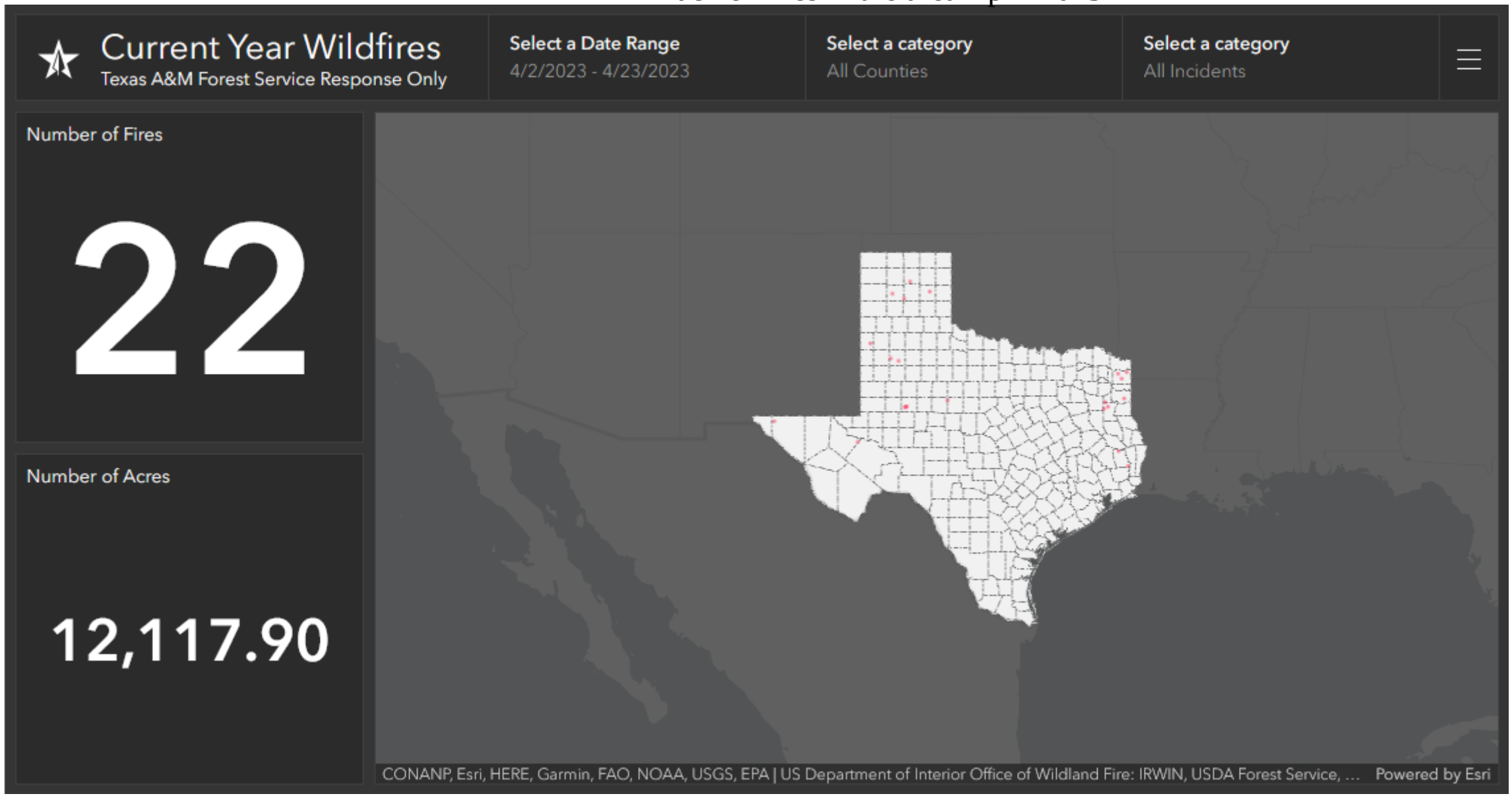


Apr 19



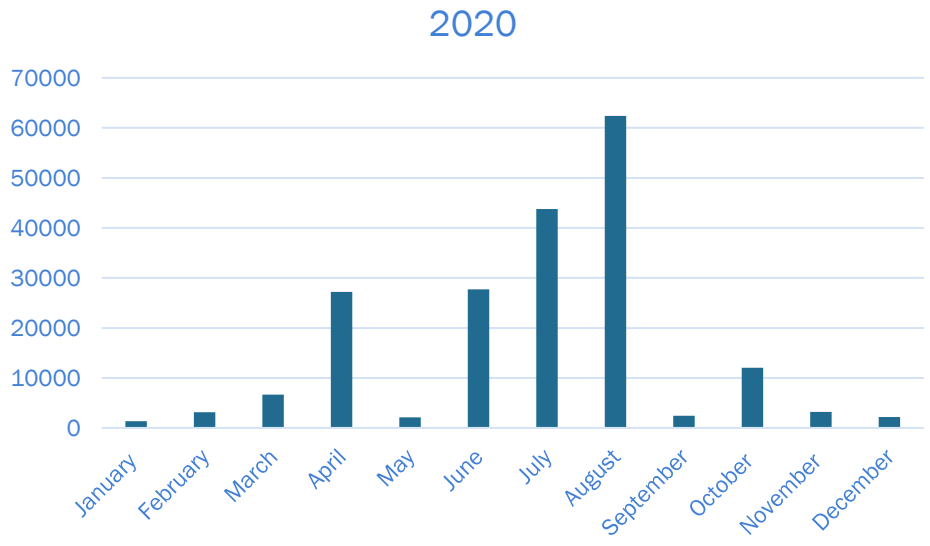
Biomass Burning Measurements

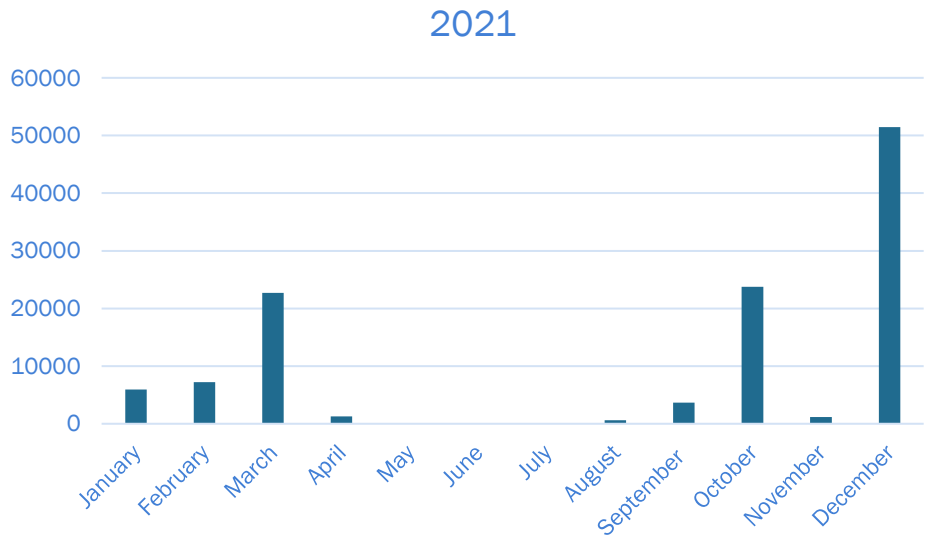
Lack of fires in the area April 2023

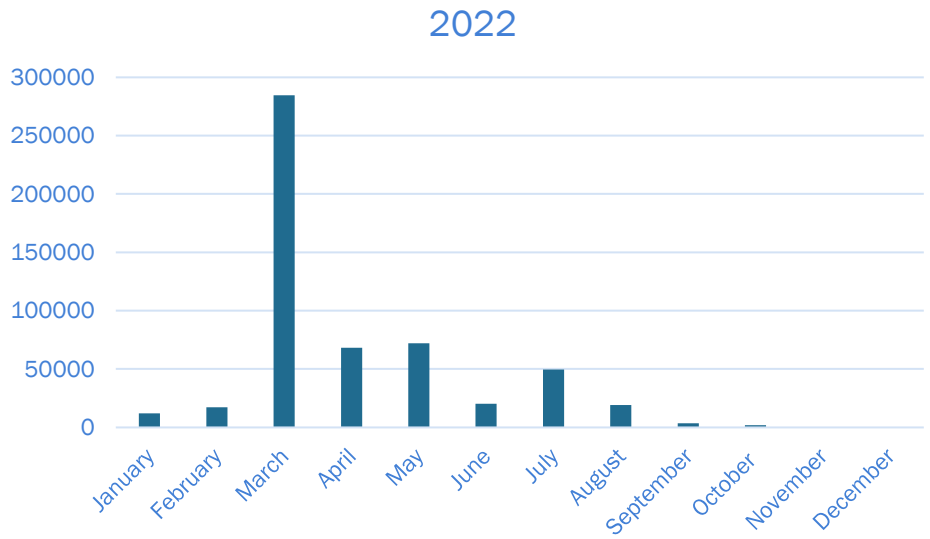


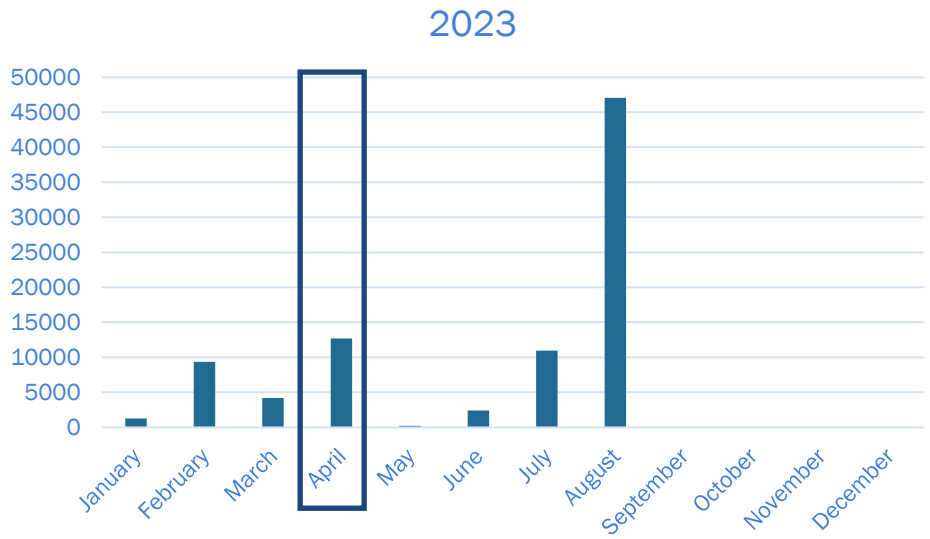
https://fire-information-tfsgis.hub.arcgis.com/

Wildfire Acreage Burned in State of Texas



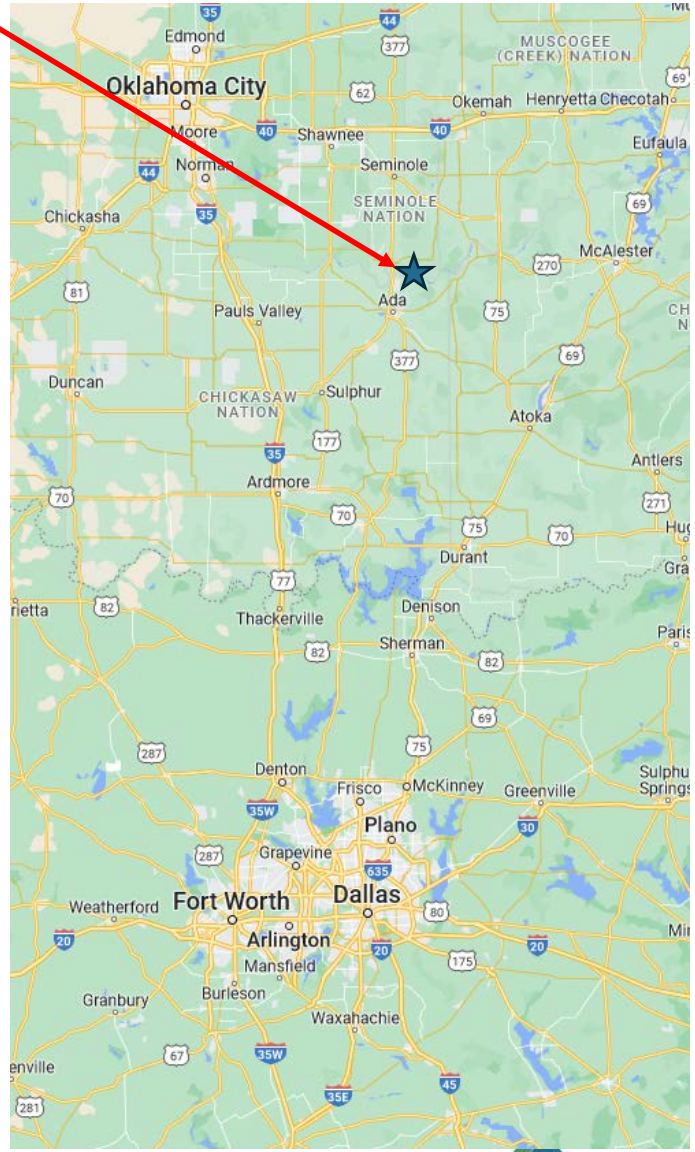






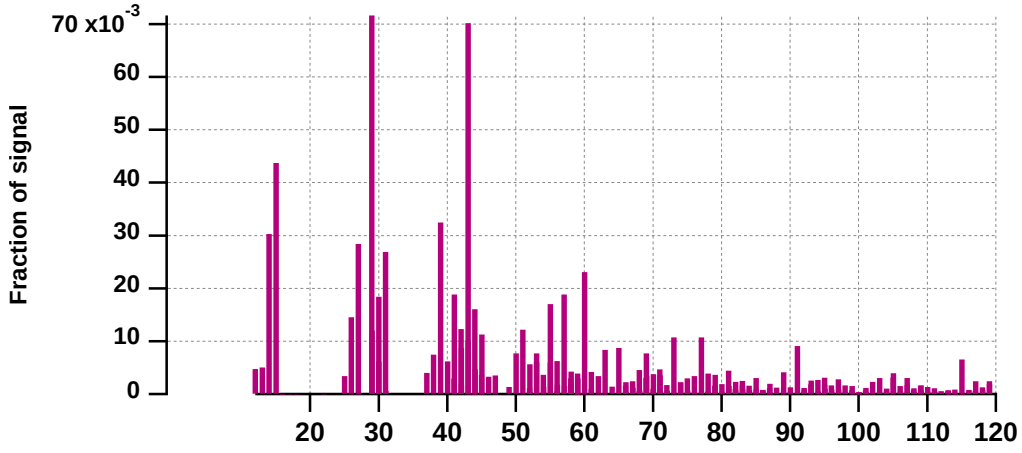
https://fire-information-tfsgis.hub.arcgis.com/

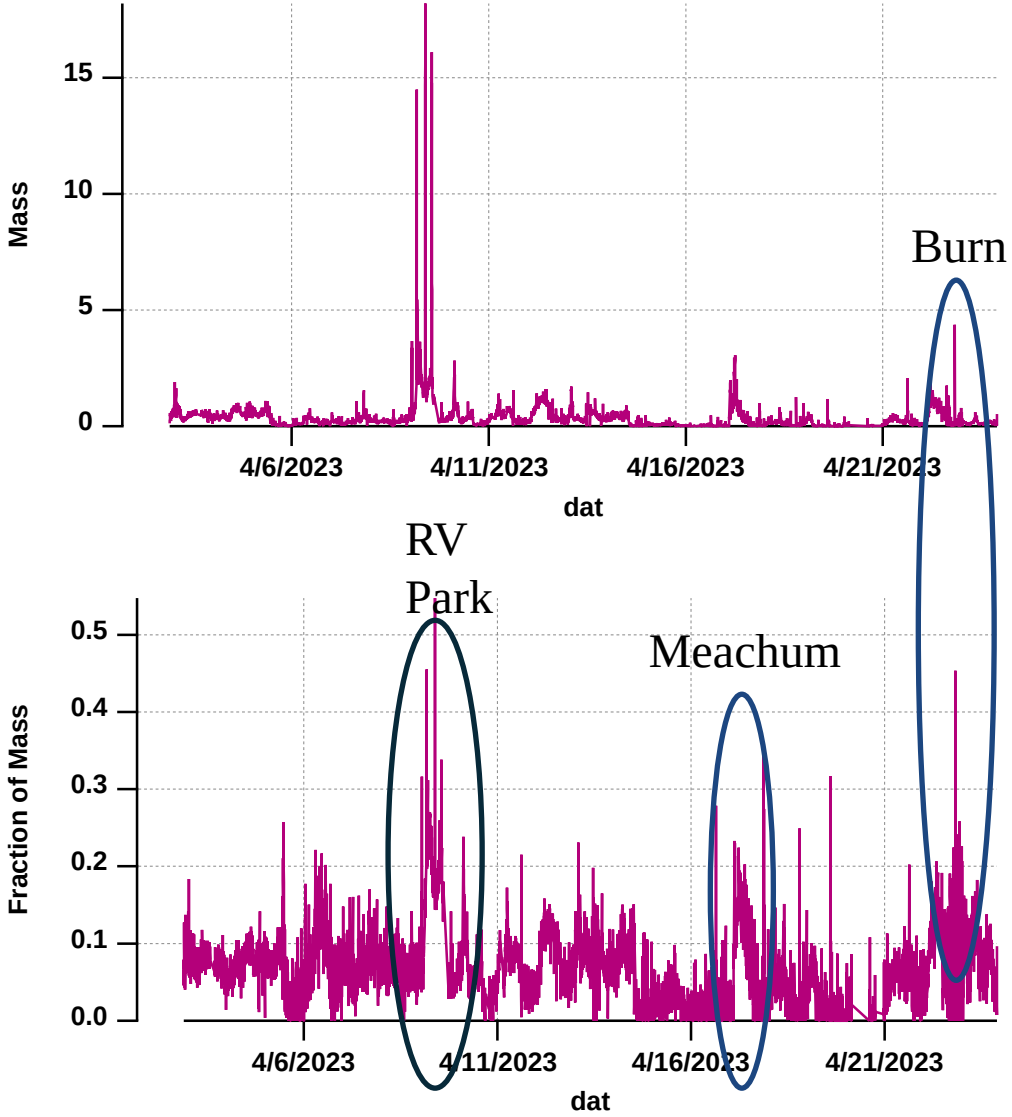
AML Transited to Wewoka OK to Measure Wildfire at Source 22 April



Signal Obtained at Burn Site Compared with Signal Throughout Campaign

Looking at SPAMS Organic Aerosol Signal Conducted Positive Matrix Factorization (PMF)





Conclusions

1. Able to measure and determine source of numerous plumes during point source measurements.

2. Able to get an idea of overall VOC reactivity for these plumes better informing the impact of these plumes on O3 production.

3. Upwind downwind measurements advanced knowledge regarding the evolution of airmasses in the DFW region. In determining what seems to be the greatest predictor of O3 production the input O3 concentration has large impact as does sunlight and wind speed. O3 did not exceed 70 ppb during the campaign

4. Able to find biomass burning impacted air at the source (wildfire) and relate that aerosol organic signal to biomass burning impacted air at stationary measurement sites in DFW

Future Opportunities

1. Further analysis and modeling of both the point source and upwind downwind measurements will improve knowledge of the exact chemical speciation of some point sources and the evolution of airmasses over time.

a.) **Specific Areas Include** PMF of VOC's
Further PMF of Aerosols
Modeling of SOA development
Comparison with TCEQ CAMS Measurements AutoGC etc…

2. Visits to some of these mentioned facilities by TCEQ may provide follow on information regarding the prevalence and severity of these plumes.

3. The ability to measure biomass burning with a greater temporal flexibility is highly desirable. Its hard to predict with much certainty one year ahead when conditions will be optimum for wildfire activity. The ability to have equipment on-call would be very useful. Not sure how to best accomplish that.

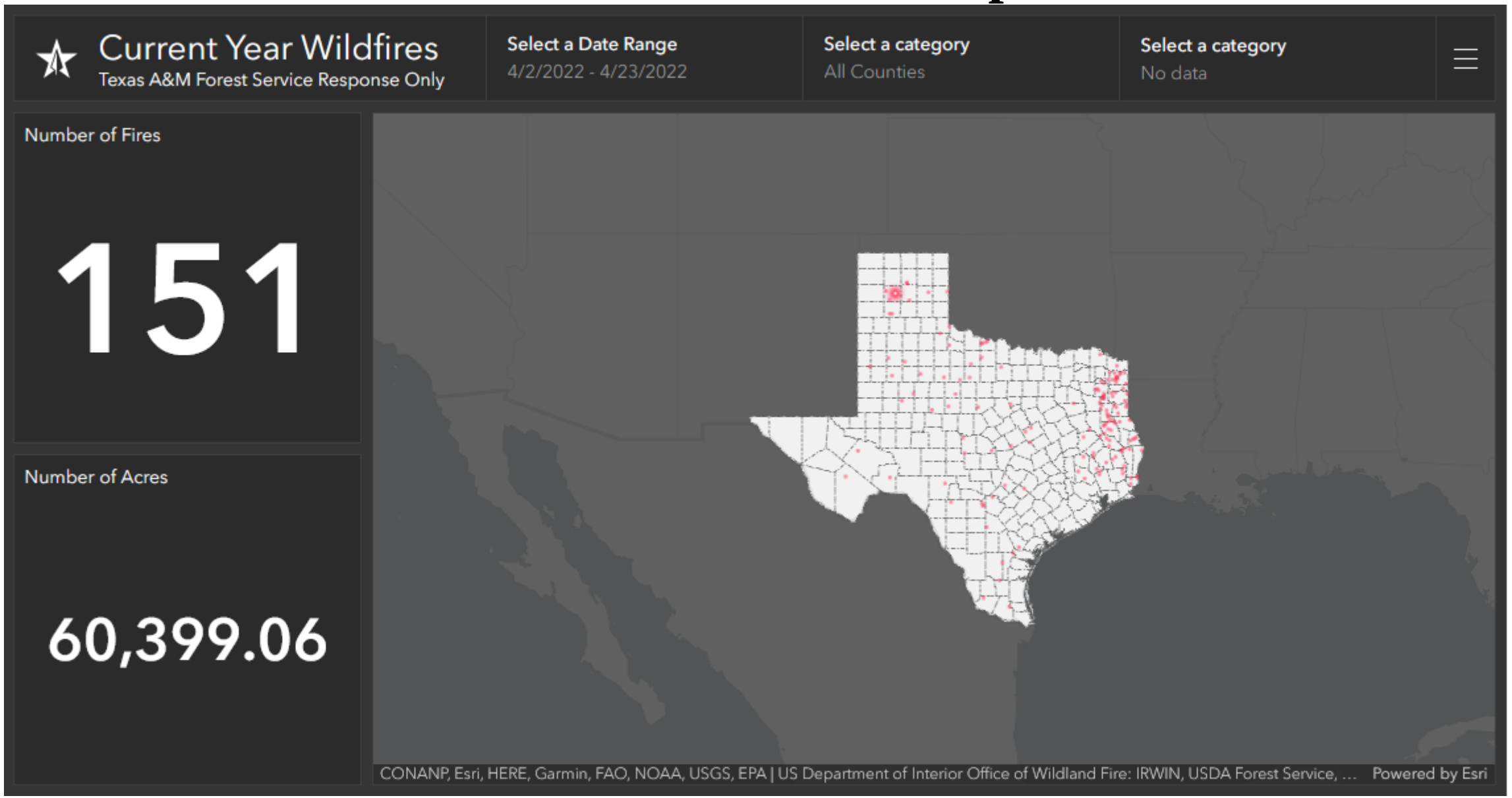
Thank You!

Acknowledgements:

The efforts of Dakota Shaw at Fort Worth Meachum Field, Vince Torres and RoseAnna Goeway of AQRP, Sascha Usenko at Baylor (AQRP #22-006) and the TCEQ team towards obtaining the necessary infrastructure and clearances to base out of Meachum Field are greatly appreciated. The employees of Texan RV Ranch are also greatly appreciated for their hospitality during our stay there.

This research [publication/article/presentation] was supported by funding from the Texas Commission on Environmental Quality (TCEQ). The findings, opinions, or conclusions expressed do not necessarily represent those of the TCEQ.

Same April Time Period 2022



https://fire-information-tfsgis.hub.arcgis.com/

Connecting Science Questions to Work Plan

1. How do local sources of industrial based Volatile Organic Compounds (VOCs) impact photochemistry particularly Ozone (O_3) formation in the DFW Metropolitan area?

2. What is the typical upwind input value of both primary VOC and particulate as well as secondary gas and particle phase species into the DFW metropolitan area?

3. What impact do biomass burning plumes upwind of the metropolitan area have on the daily photochemistry within the DFW metropolitan area?

4. How do locally produced biomass burning plumes evolve upwind of DFW and the I-35 corridor?

Dallas Field Study (DFS); Ozone Precursors, Local Sources and Remote Transport Including Biomass Burning

Attempting to address these points

From Request for Proposals

Domestic fire emissions: Multiple AQRP projects have focused on international transport of particulate matter and ozone into Texas from agricultural burning and wildfire sources in Mexico, and this remains an area of continuing interest, however, there is limited information on the impact of domestic wildfires and fires at the wildland-urban interface on particulate matter, particulate matter precursor, ozone and ozone precursor concentrations in Texas. 2021 was a record wildfire year in many parts of the United States, and the large scale air pollutant transport associated with these fires may lead to new insights. Questions of interest include, but are not limited to:

- What are concentrations of PM and ozone, and their precursors, transported into Texas, from domestic wildfires and wildland-urban fires?
- Is the atmospheric chemistry of fire plume interaction with urban air accurately captured in photochemical models?
- What role do domestic and international smoke emissions have in exceptional events?

Changing emission patterns in Texas: Population growth and changes in personal and industrial activity since 2010 have altered emission patterns in Texas. These drivers of emission changes may be altering the chemical sensitivity of ozone formation in Texas. Assessing the emission impacts of population growth in areas of with limited current monitoring (e.g., the Interstate-35 corridor), is an emerging question of interest. Also of interest are changes in the emission impacts of industrial sources that have experienced significant change. New industrial source categories have been added (e.g., LNG export facilities); some existing sources (e.g., electricity generation, certain types of chemical manufacturing) have changed feedstocks or fuels, potentially changing the chemical sensitivity of ozone or VOC source apportionment. In other sectors, such as oil and gas production, the level of activity is changing. Finally, responses to the COVID-19 pandemic may have permanently changed the patterns of emissions from some sources, and the chemical sensitivity of ozone formation. Analyses that quantify these changes and their impact on the chemical sensitivity of ozone formation are of interest.

Aerodyne TILDAS for EtO detection

Tunable Infrared Laser Direct Absorption Spectrometer

- No pre-treatment or pre-concentration
- In-situ measurements
  - No storage concerns
- Selective and sensitive
  - <50 ppt (1s 1sigma);
  - Average down to << 10 ppt with aggressive backgrounding
- Mobile, rapid 1Hz measurements possible
  - Point source detection

TILDAS-FD-EtO with 413 m Cell