



Recent Air Quality Research

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Air Modeling and Data Analysis

**Clean Air Force of Central Texas
Air Quality Professionals Forum**

July 14, 2022

Outline

- Air Quality Trends
- Research Programs
 - AQRP
 - Direct Funding
 - Rider 7
- Recent Major Field Study: TRACER-AQ
- References and Contacts

Why are we concerned about air quality?

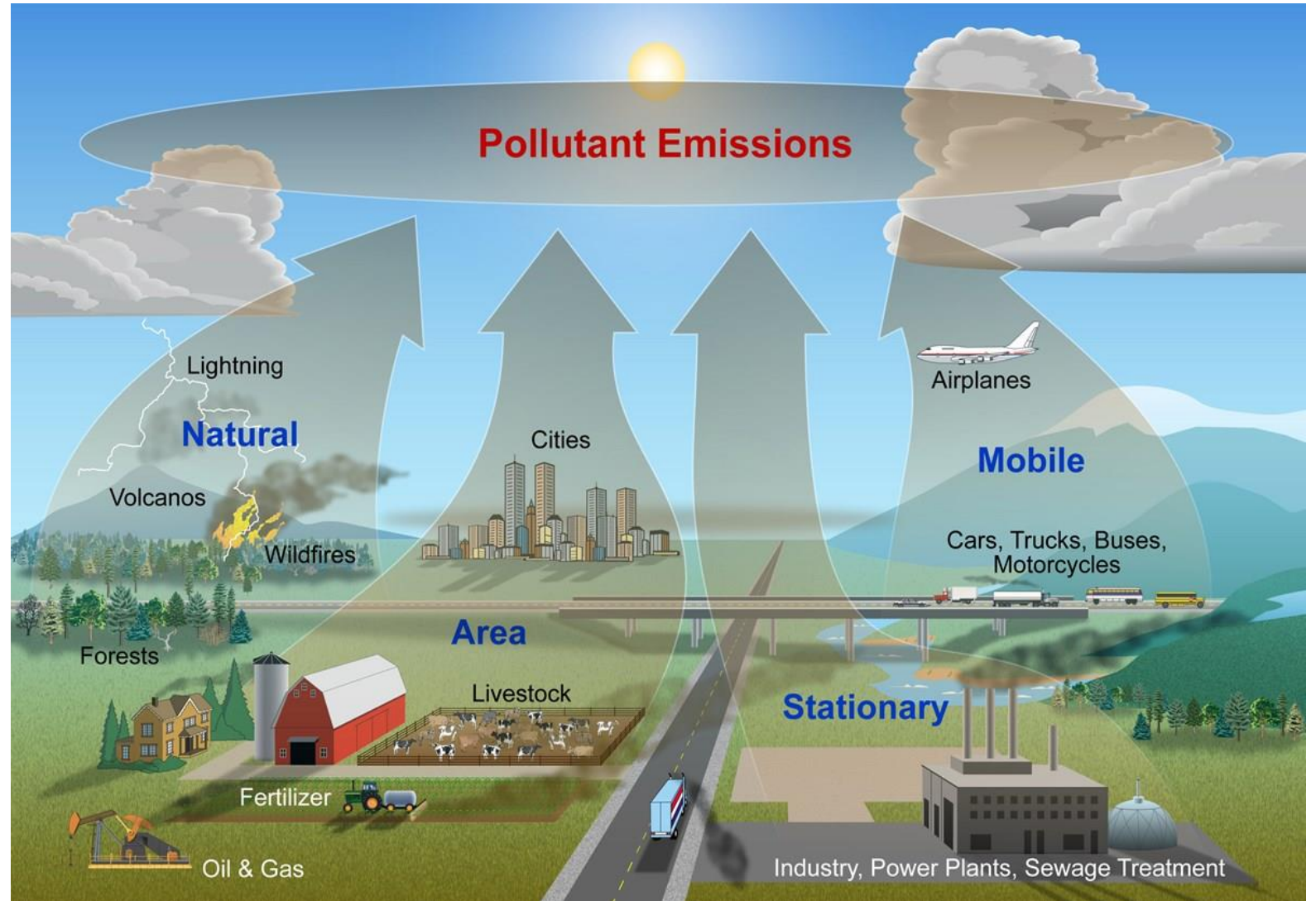
- Human health and the environment
- Health-based standards for six criteria air pollutants:
 - Ground-Level Ozone (O_3)
 - Particulate Matter (PM)
 - Nitrogen Dioxide (NO_2)
 - Sulfur Dioxide (SO_2)
 - Carbon Monoxide (CO)
 - Lead (Pb)
- Hazardous Air Pollutants



Healthy (top) and ozone-injured (bottom) tulip tree (yellow poplar) foliage. Source: National Park Service

Where does air pollution come from?

- Stationary or point sources
- Area sources
- On-road mobile
- Non-road mobile
- Natural



How do we (typically) measure air quality?

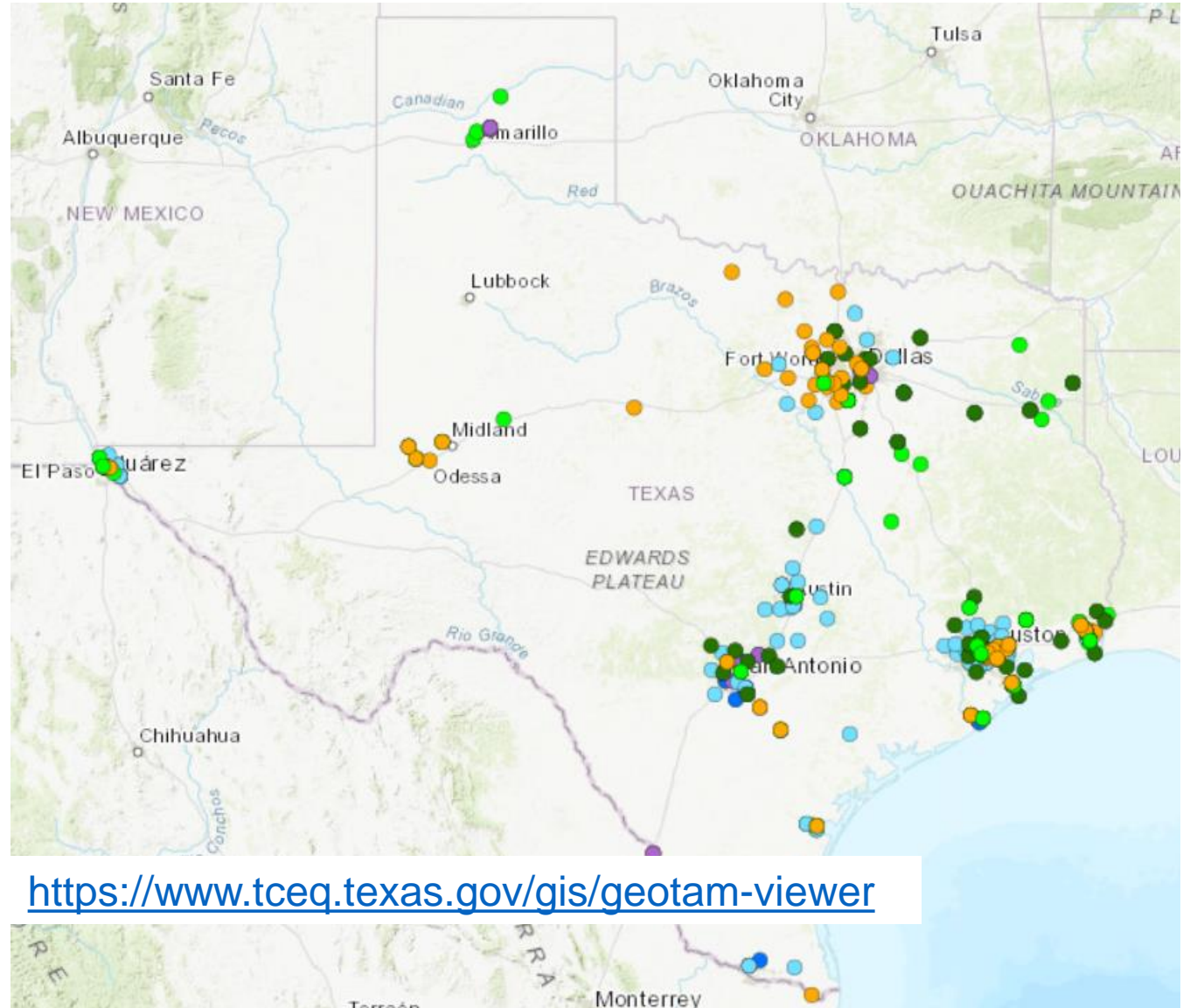


Air Quality Data Resources

EPA: <https://www.airnow.gov/>

TCEQ:

<https://www.tceq.texas.gov/agency/data/air-quality-data.html>



<https://www.tceq.texas.gov/gis/geotam-viewer>

Other methods to measure air quality?



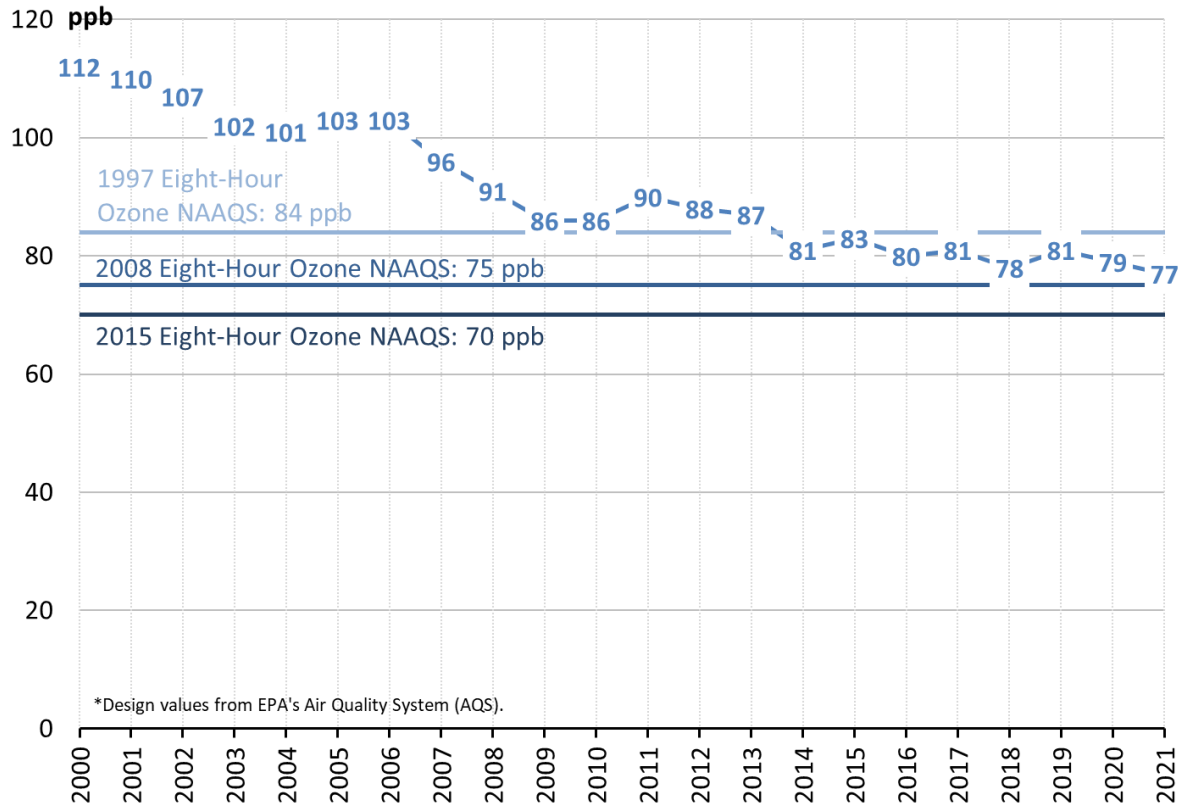
How is air quality data used at TCEQ?

- Determine compliance with the health-based standards.
- Analyze trends.
 - Where and when are high levels most likely?
 - Are there seasonal/diurnal patterns?
- Evaluate days/events with elevated concentrations.
 - Was it a local and/or transported event?
 - Were the weather and emission conditions like past events?
- Support TCEQ programs/requirements.

Trends in Criteria Pollutants: Ozone

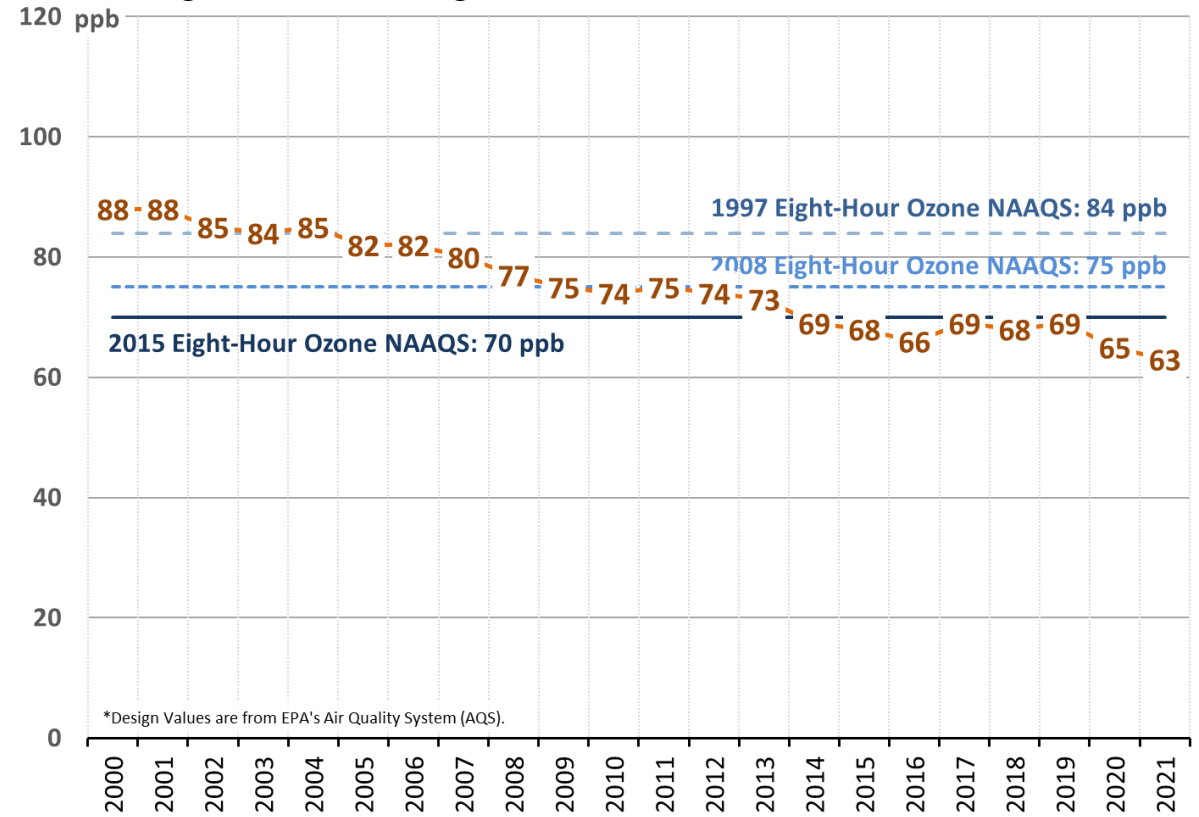
Texas Ozone

Eight-Hour Ozone Design Values* for Texas



Austin-Round Rock Ozone

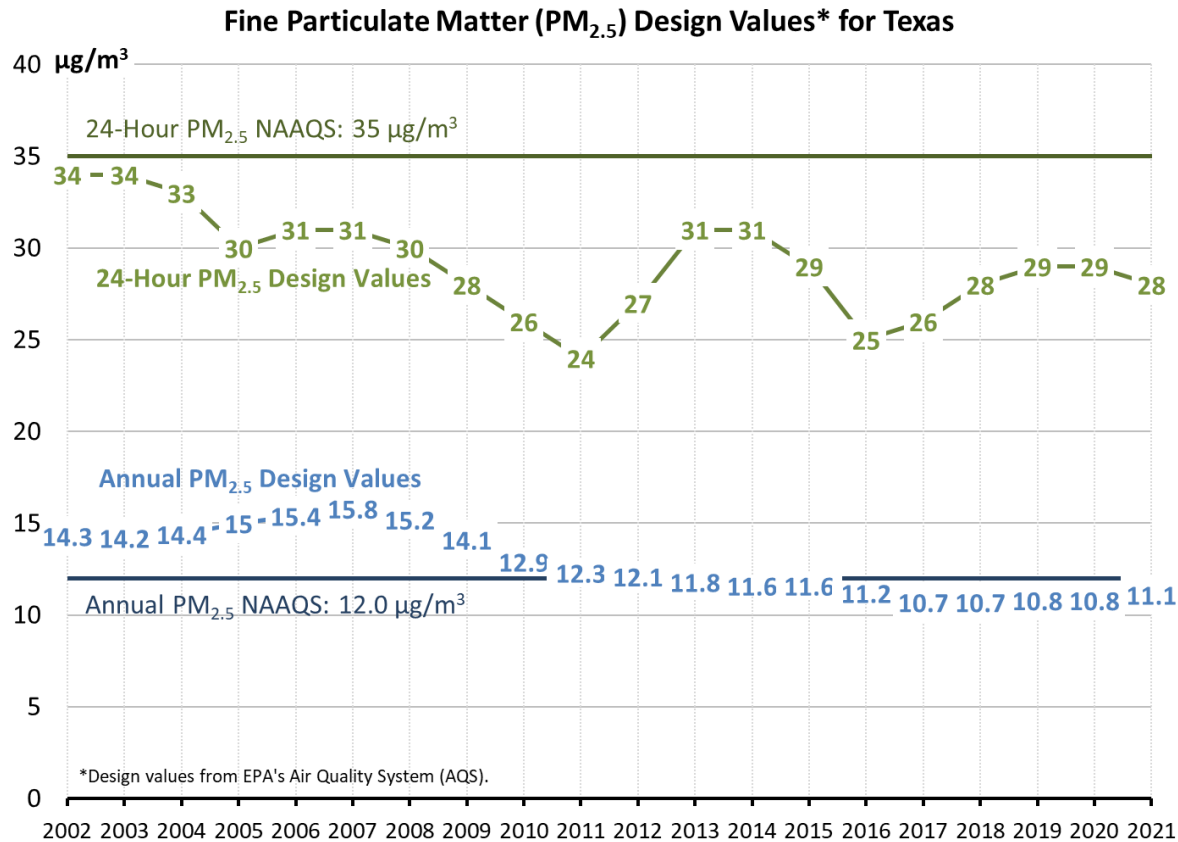
Eight-Hour Ozone Design Values* in the Austin—Round Rock Area



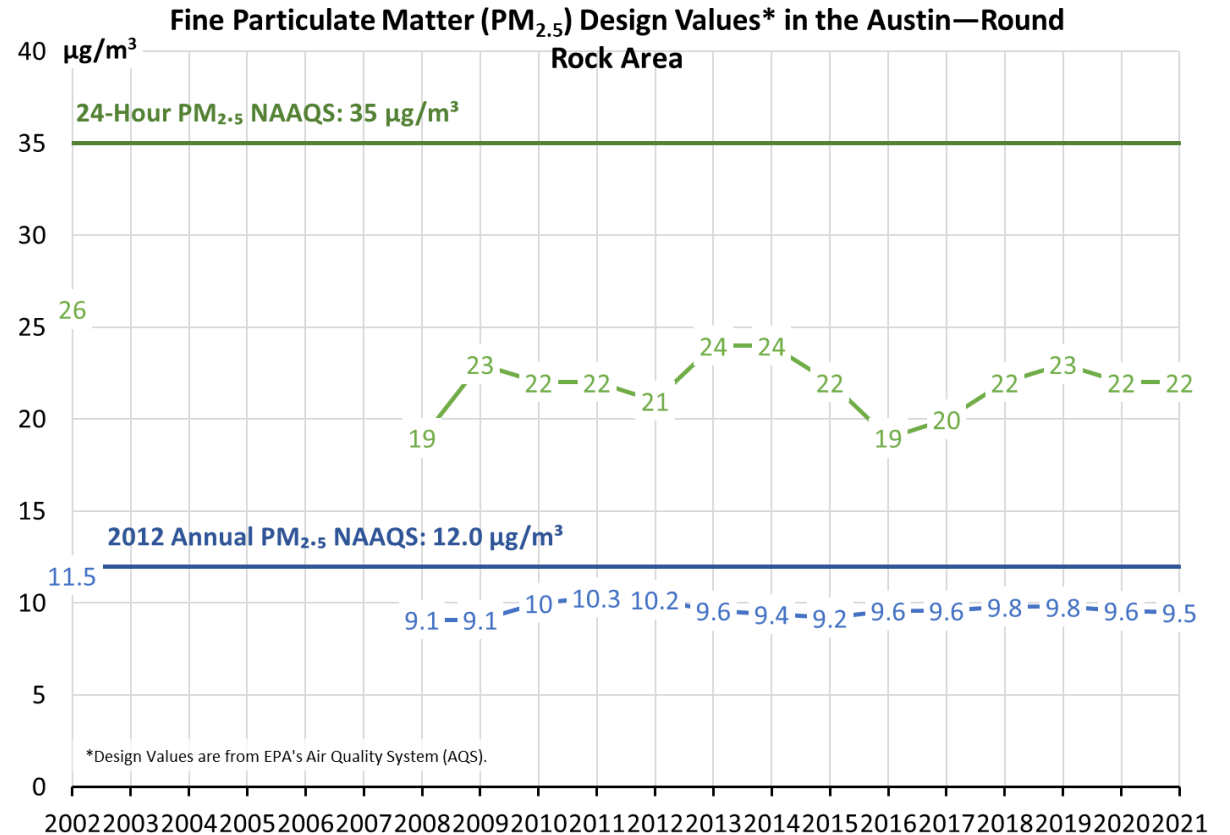
[Air Quality Successes - Criteria Pollutants - https://www.tceq.texas.gov/airquality/airsuccess/airsuccesscriteria](https://www.tceq.texas.gov/airquality/airsuccess/airsuccesscriteria)

Trends in Criteria Pollutants: PM_{2.5}

Texas Particulate Matter (PM_{2.5})



Austin-Round Rock Particulate Matter (PM_{2.5})

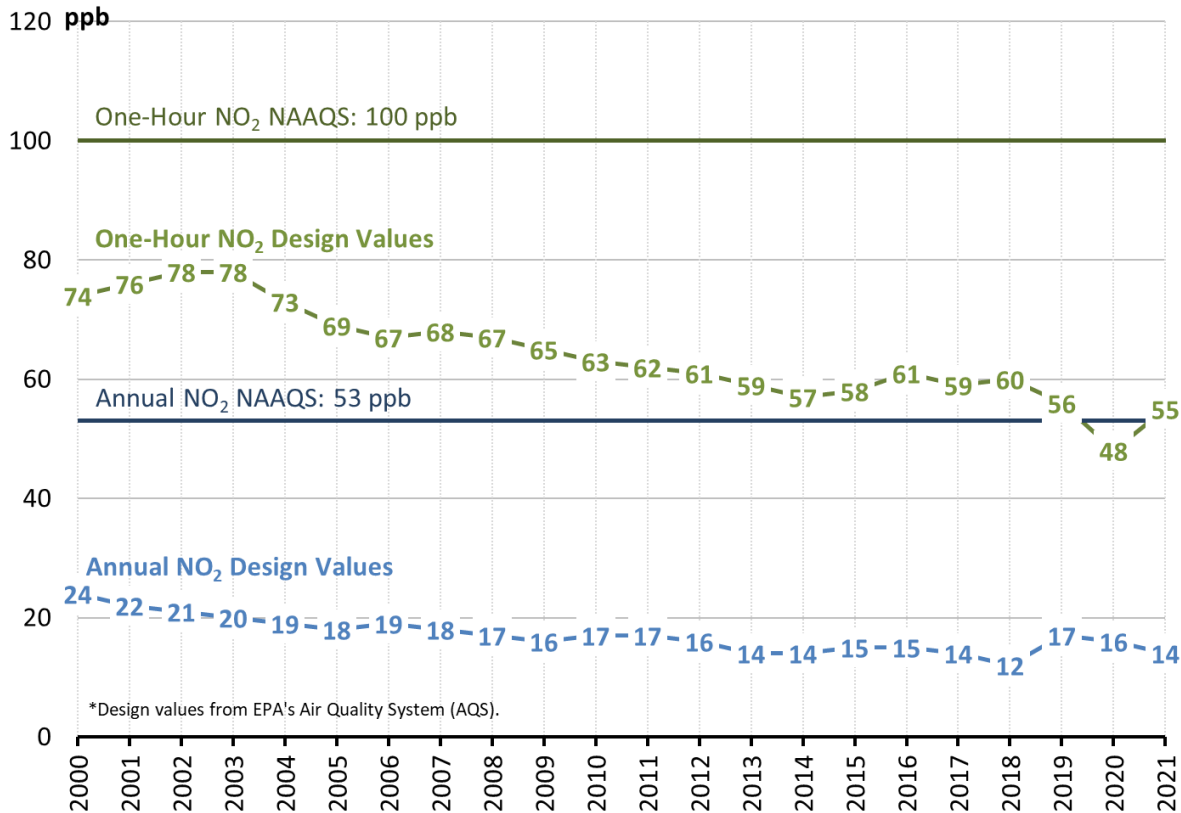


[Air Quality Successes - Criteria Pollutants - https://www.tceq.texas.gov/airquality/airsuccess/airsuccesscriteria](https://www.tceq.texas.gov/airquality/airsuccess/airsuccesscriteria)

Trends in Criteria Pollutants

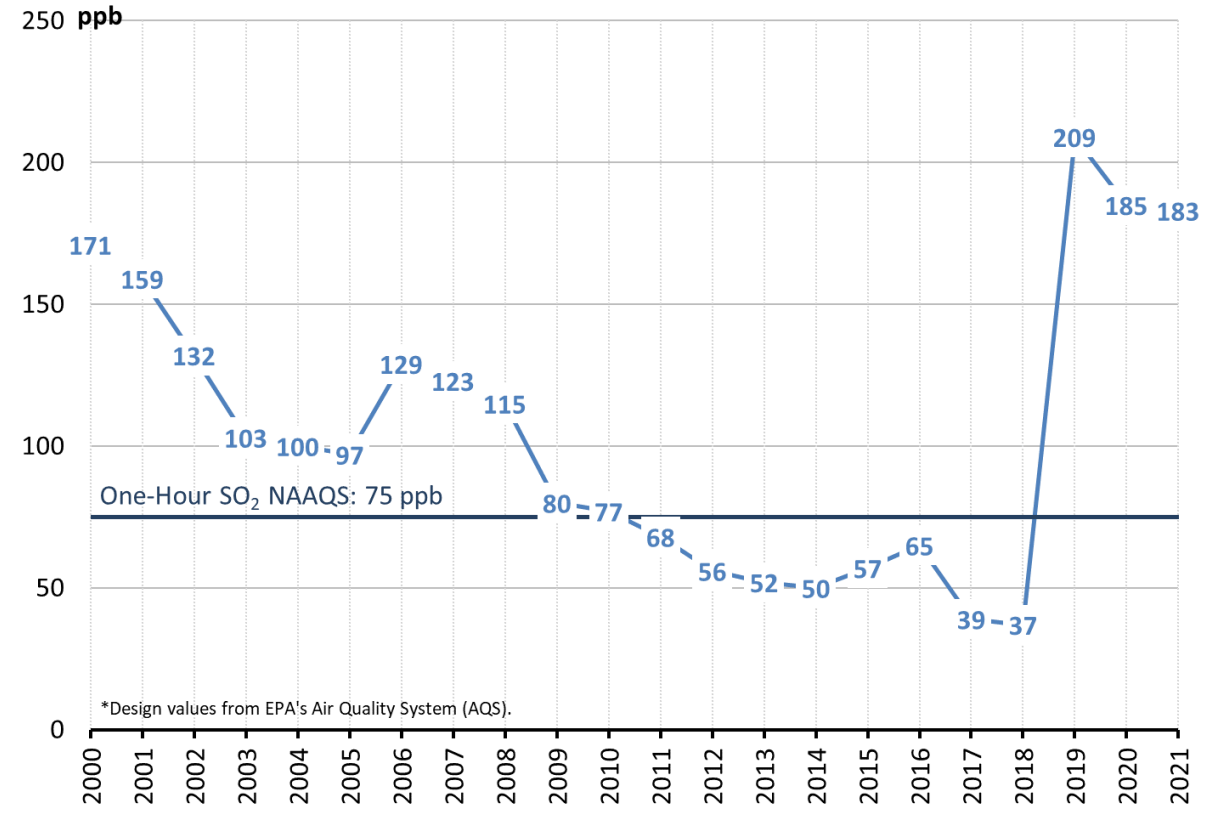
Nitrogen Oxides

Nitrogen Dioxide (NO₂) Design Values* for Texas



Sulfur Dioxide

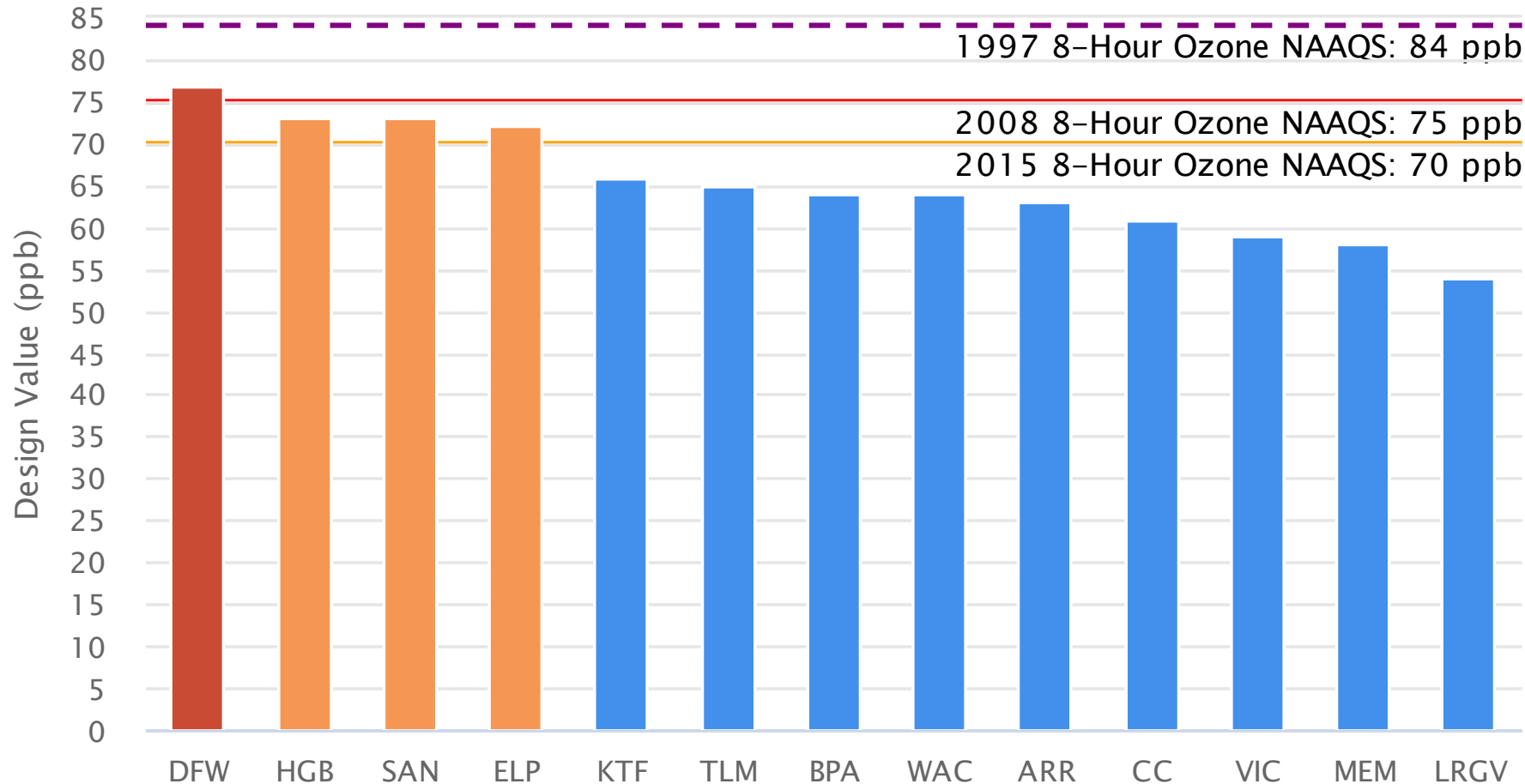
One-Hour Sulfur Dioxide (SO₂) Design Values* for Texas



[Air Quality Successes - Criteria Pollutants - https://www.tceq.texas.gov/airquality/airsuccess/airsuccesscriteria](https://www.tceq.texas.gov/airquality/airsuccess/airsuccesscriteria)

Preliminary* 2022 Eight-Hour Ozone Design Values

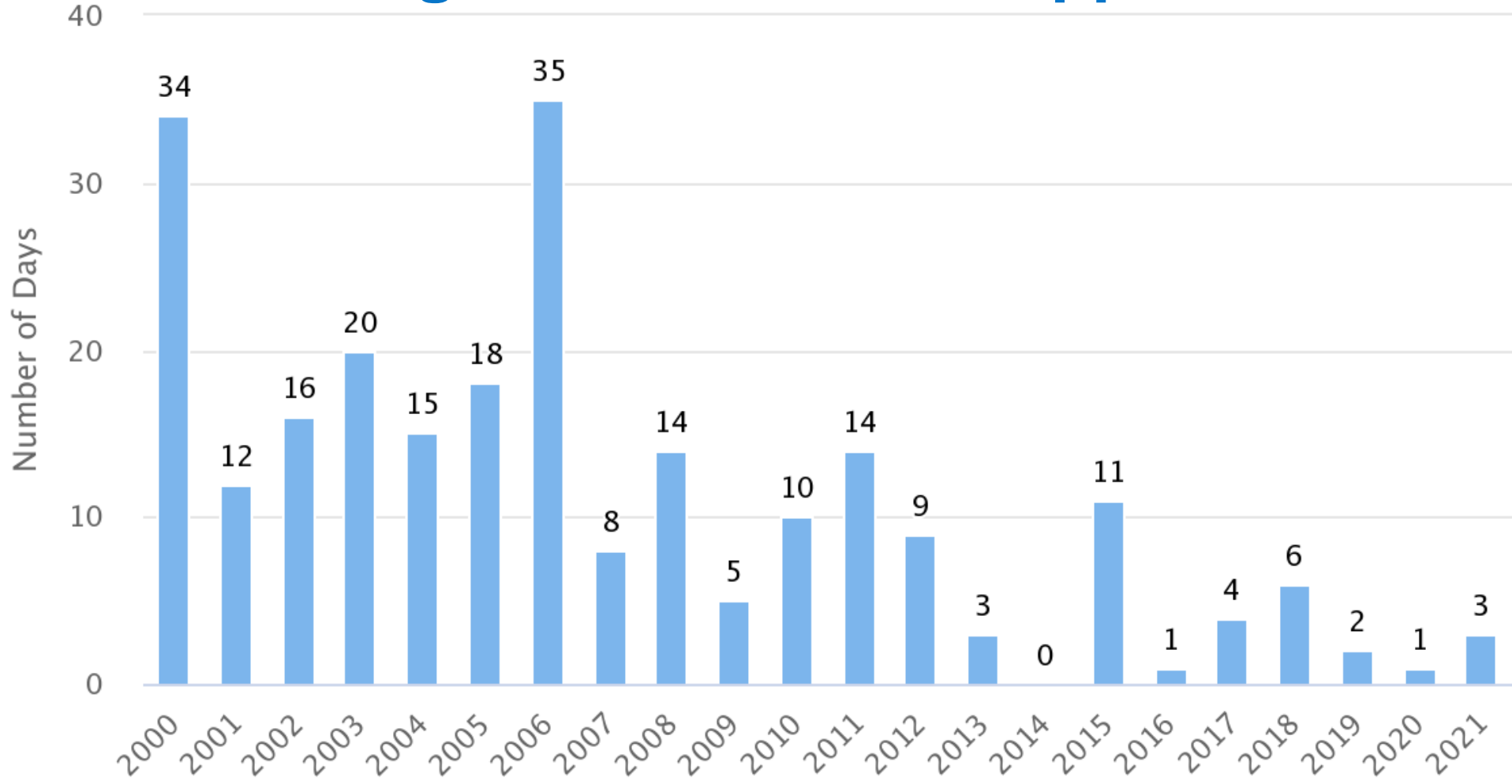
updated on 2022-07-13 19:15



- DFW = Dallas-Fort Worth
- HGB = Houston-Galveston-Brazoria
- SAN = San Antonio
- ELP = El Paso
- KTF = Killeen-Temple-Fort Hood
- TLM = Tyler-Longview-Marshall
- BPA = Beaumont-Port Arthur
- WAC = Waco
- ARR = Austin-Round Rock
- CC = Corpus Christi
- VIC = Victoria
- MEM = Mission-Edinburg-Mercedes
- LRGV = Lower Rio Grande Valley

*Regulatory monitor data as of 7/13/2022 and subject to change.

Austin-Round Rock Number of Days Maximum Daily Eight-hour Average Ozone Above 70 ppb



Highcharts.com

Austin-Round Rock Preliminary* 2022 Fourth Highest Maximum Daily Eight-Hour Averages

Area	Monitoring Site	POC	Highest			Second Highest			Third Highest			Fourth Highest		
			Date	Time	Value	Date	Time	Value	Date	Time	Value	Date	Time	Value
Austin														
	Austin North Hills Drive C3/A322	2	06/29/2022	1200	75	05/26/2022	1100	68	07/01/2022	1000	67	03/26/2022	1100	66
	Audubon C38	1	06/29/2022	1100	68	04/14/2022	1300	64	03/16/2022	1100	64	05/26/2022	1000	63
	Dripping Springs School C614	1 N	06/29/2022	1100	87	05/26/2022	1100	83	03/02/2022	1100	83	05/27/2022	1200	75
	CAPCOG Lake Georgetown C690	1 N	06/29/2022	1200	88	06/30/2022	0900	73	07/13/2022	1300	72	07/12/2022	1200	71
	Lockhart C1604	1 N	05/26/2022	1100	98	06/29/2022	1000	80	06/04/2022	1100	69	05/27/2022	1200	69
	St. Edwards University C1605	1 N	06/26/2022	1200	54	06/21/2022	1000	52	06/25/2022	1000	51	05/20/2022	0900	47
	CAPCOG Bastrop CAMS1612	1 N	05/26/2022	1100	89	06/29/2022	1300	75	06/04/2022	1200	72	03/26/2022	1100	67
	CAPCOG Elgin C1613	1 N	05/26/2022	1100	84	06/29/2022	1100	75	03/02/2022	1000	72	05/27/2022	1100	69
	CAPCOG East Austin C1619	1 N	06/29/2022	1200	78	05/26/2022	1100	72	03/26/2022	1100	70	07/01/2022	1000	67
	CAPCOG Round Rock Brushy Creek W C1620	1 N	06/29/2022	1200	80	07/12/2022	1100	77	07/13/2022	1100	72	06/27/2022	1000	70
	CAPCOG San Marcos Staples Road C1675	1 N	05/26/2022	1100	90	06/29/2022	1000	82	06/04/2022	1100	75	03/02/2022	1100	73

*Data as of 7/13/2022 and subject to change.

Research and Development Program

Air Quality Research Program,
TCEQ-Funded Projects,
and Rider 7

Air Quality Research Program

- The TCEQ, through the Texas Emission Reduction Program (TERP), provides funding.
- The University of Texas at Austin administers the program.
- Research topics are identified by an Advisory Council, the TCEQ, and an Independent Technical Advisory Committee (ITAC).
- Goal is to improve the scientific understanding of air pollutant emissions in Texas.
- AQRP has sponsored:
 - Air quality measurements programs in and around Corpus Christi, Dallas/Fort Worth, El Paso, Houston and San Antonio;
 - Studies of industrial flare emissions;
 - Evaluations of fire and biogenic emission impacts; and
 - Improvements to the air quality models used to evaluate air quality regulations.



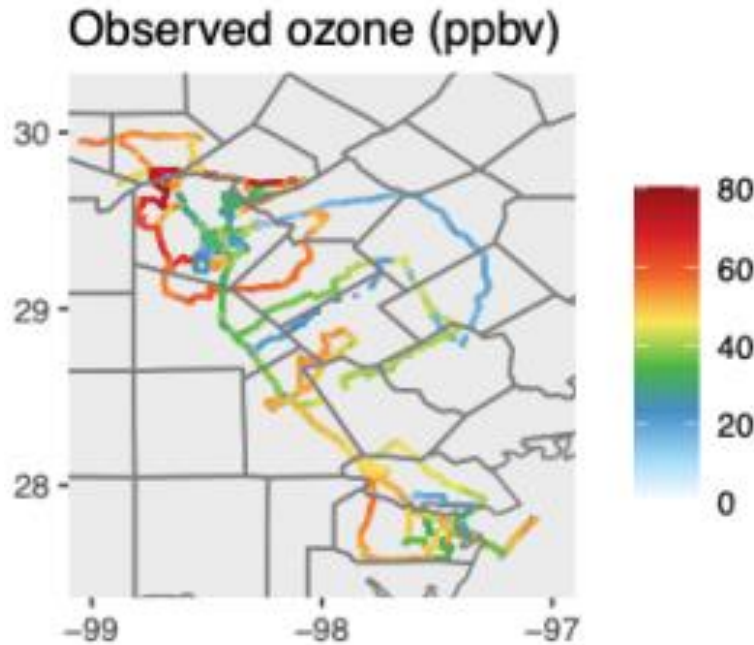
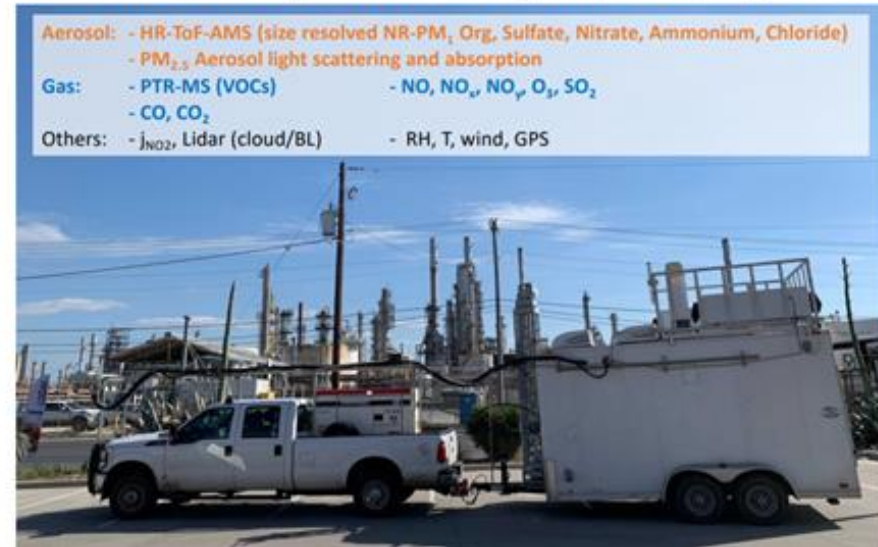
<http://aqrp.ceer.utexas.edu/>

AQRP FY20-21: 2021 Corpus Christi and San Antonio Field Study

(Rice University, University of Houston, Baylor University)

- Follow-up to the 2017 San Antonio Field Study.
- Conducted April - May 2021.
- Stationary and mobile measurements.

Mobile Air Quality Laboratory 2 (MAQL2)



- **Preliminary observations:**

- Offshore activities affect Corpus Christi.
- Local activities impact both Corpus Christi and San Antonio.
- Large differences in composition and concentration of air pollutants were monitored.
- Modeling was able to accurately simulate the meteorology and air quality observations.

http://aqrp.ceer.utexas.edu/projectinfoFY20_21/20-003/20-003%20Final%20Report.pdf

AQRP FY20-21: Texas Urban Vegetation BVOC Emission Source Inventory (Ramboll)

Results:

- Satellite-based landcover products (30-meter+) underestimate urban tree cover.
- 60-centimeter aerial imagery with onsite/virtual surveys better identify urban trees.

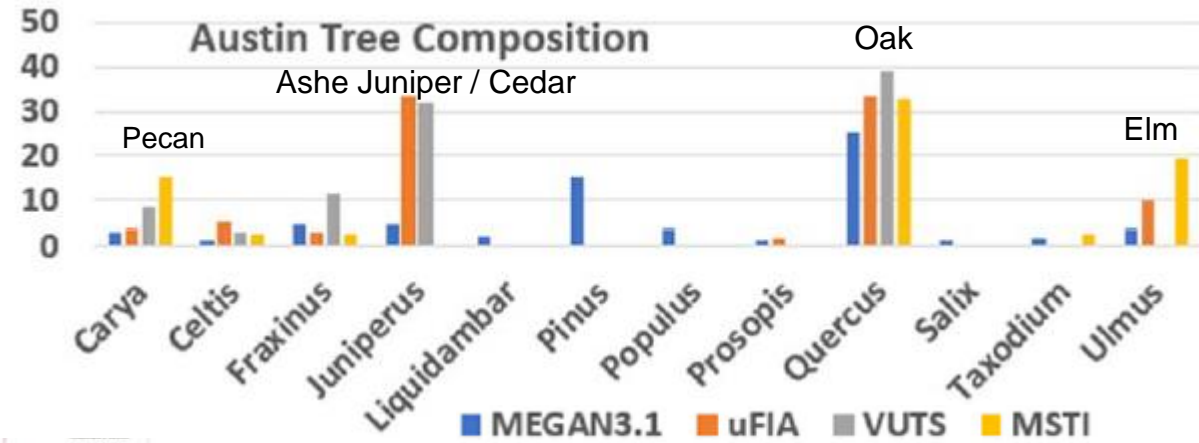


Figure 3-2. Change in percent tree cover between global/regional estimates and urban tree cover estimation approach.

Air Quality Research Program: 2022-2023 Priorities

- Each biennium the AQRP announces a Request For Proposals and selects projects for funding from the proposals that are submitted.
- For the 2022-2023 biennium, research proposals were accepted until May 26, 2022. **Awards are expected this summer.**
- Research Priorities for this biennium include:
 - TRACER-AQ and over-water measurements;
 - Photochemical air quality models;
 - Improvements to emission inventories;
 - Satellite and other remote sensing data;
 - Domestic fire emissions;
 - Trends in wind-blown dust in Texas; and
 - Changing emission patterns in Texas.



<http://aqrp.ceer.utexas.edu/>

TCEQ Air Research



- Funded by the TCEQ, through the Texas Emission Reduction Program (TERP) and other sources.
- Research topics are identified by TCEQ technical staff and management.
- Goal is targeted research projects.
- TCEQ has funded:
 - Development of emissions inventories;
 - Model development;
 - Research-grade monitoring;
 - Investigation of exceptional events; and
 - Analysis of international emissions sources.
- TCEQ projects and reports can be found at:
<https://www.tceq.texas.gov/airquality/airmod/project/>

Relevant TCEQ Air Research Projects: 2021-2022

On-road:

- Statewide inventory for the 2020 National Emissions Inventory (NEI) (TTI, 2022)
- Statewide non-link inventory for 2019, 2023, and 2026 (TTI, 2021)
- San Antonio link-based inventory for 2019 and 2023 (TTI, 2021)
- Inspection and maintenance program evaluation (ERG, 2022) – ongoing
- Inspection and maintenance fee analysis (ERG, 2022) – ongoing

Off-road:

- 2020 statewide and 2011-2050 trend emissions inventories for locomotives and airports (TTI, 2021)
- Airport and locomotive emission estimation methodology improvements (TTI, 2022) – ongoing

Other:

- Analysis of 2021 Corpus Christi and San Antonio Field Study data (University of Houston, 2023)
- Satellite smoke plume tracking (AER, 2022)

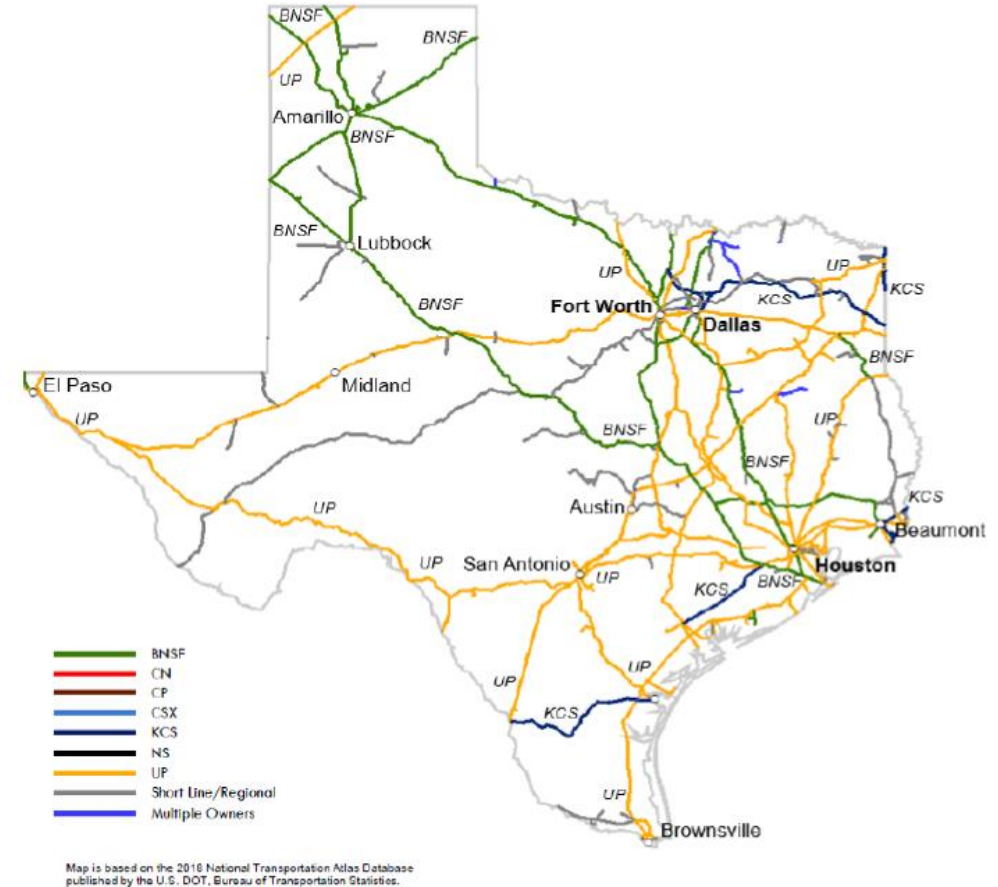


Figure 2. Map of Major Railroad Carriers in Texas.
TTI, 2021

Rider 7 Program – FY22-23 Capital Area Council of Governments

\$1,009,018.93 total for the biennium.

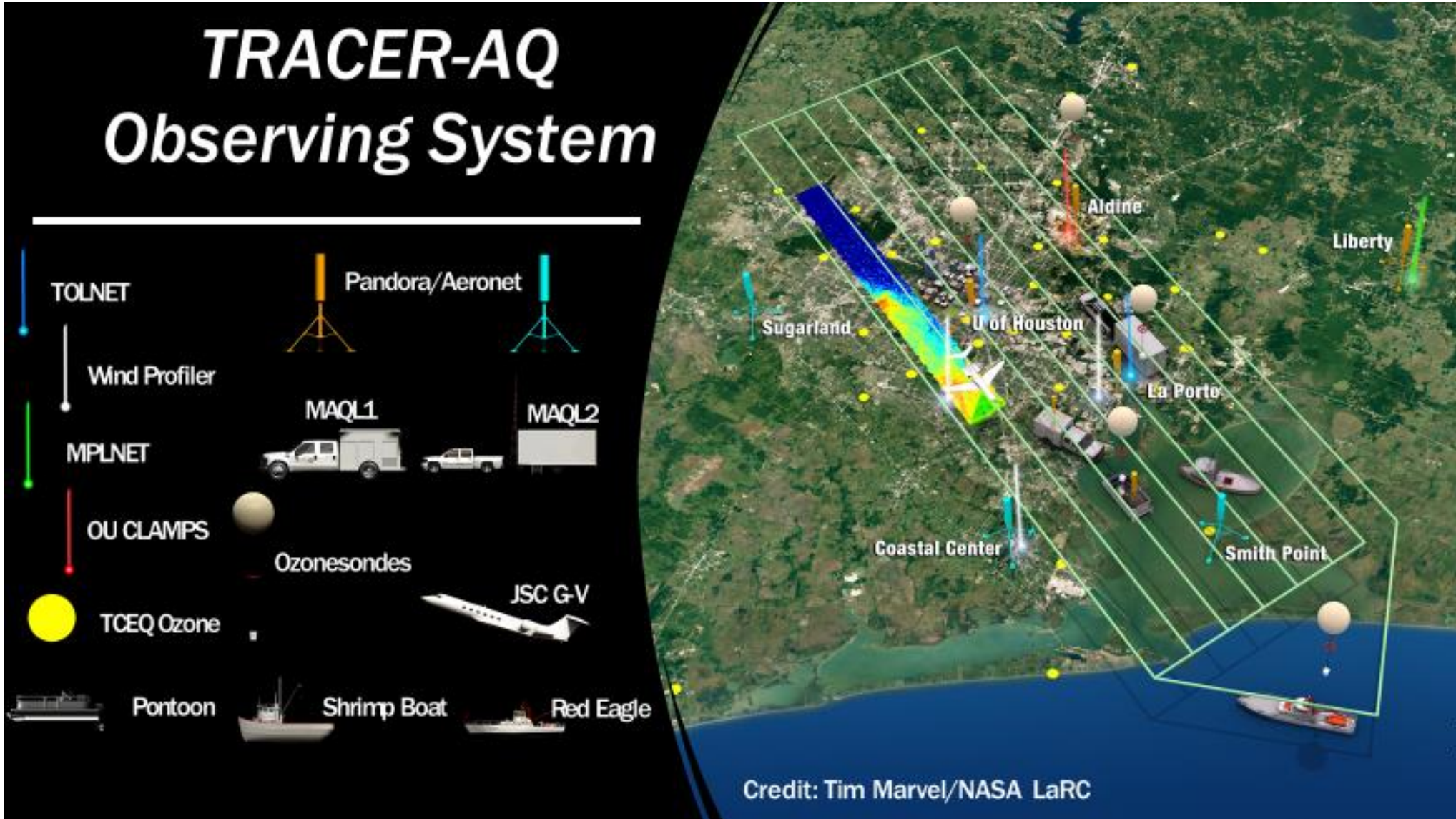
Emission inventory tasks:

- EPA and TCEQ Emission Inventory Review (Due 8/31/22)
- On-Road, Non-Road, and Non-Point Projects (Due 11/30/23)
 - Collection of vehicle activity from fleet monitoring software.
- Review of 2021 and 2022 Point Source Emissions Inventory Data (Due 7/31/22 and 7/31/23)
 - Evaluation of point sources on high ozone days and comparison to average ozone season day values
- Refinements to Select Point Source Emissions Inventories (Due 8/31/22 and 8/31/23)
 - Analysis of Decker Creek and Lehigh Cement data
- 2023 Emissions Inventory Conference (Report due if attended)
- Review of 2020 National Emissions Inventory Public Release (Due 11/30/23)

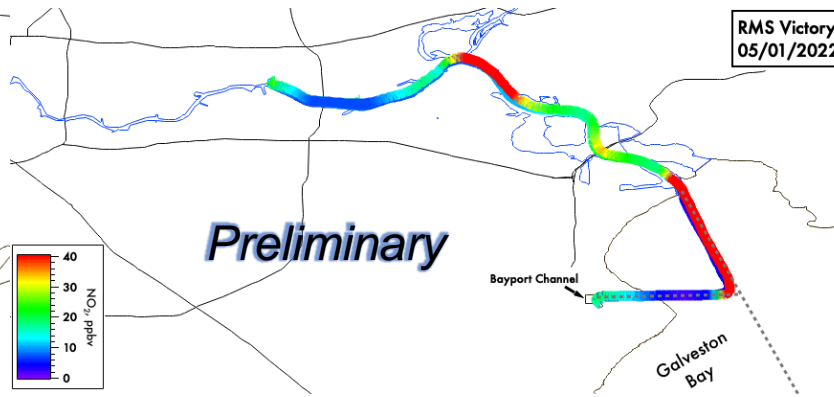
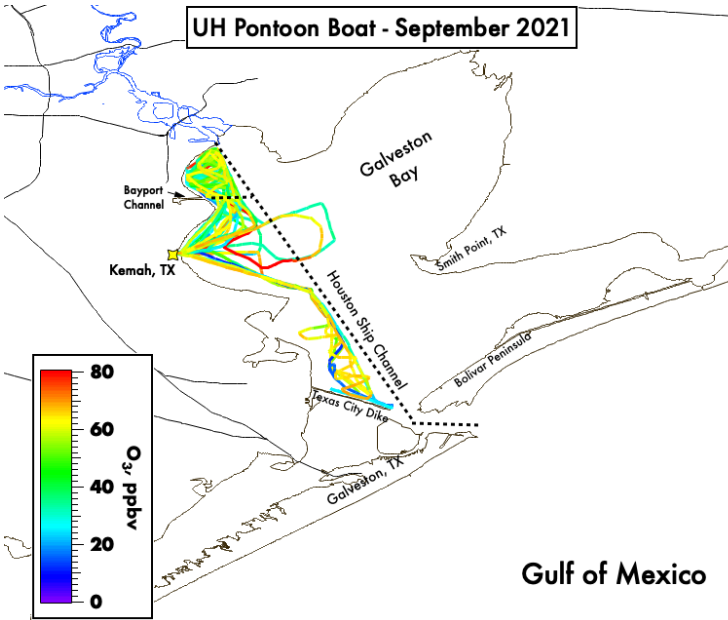
Monitoring tasks:

- Ongoing monitoring at existing CAPCOG sites
- Support for St. Edward's University ozone monitoring site
- Installation and operation of two new ozone monitoring sites (Taylor and Kyle/Buda)

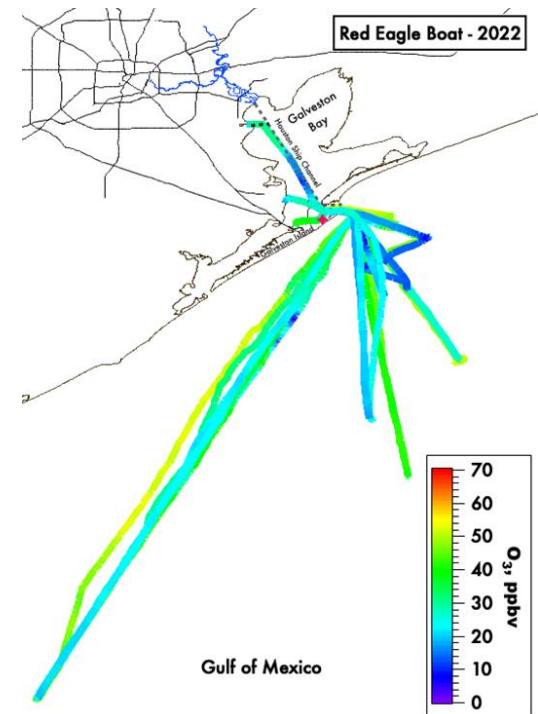
2021 TRacking Aerosol Convection ExpeRiment – Air Quality



How does the coastal environment influence ozone formation?

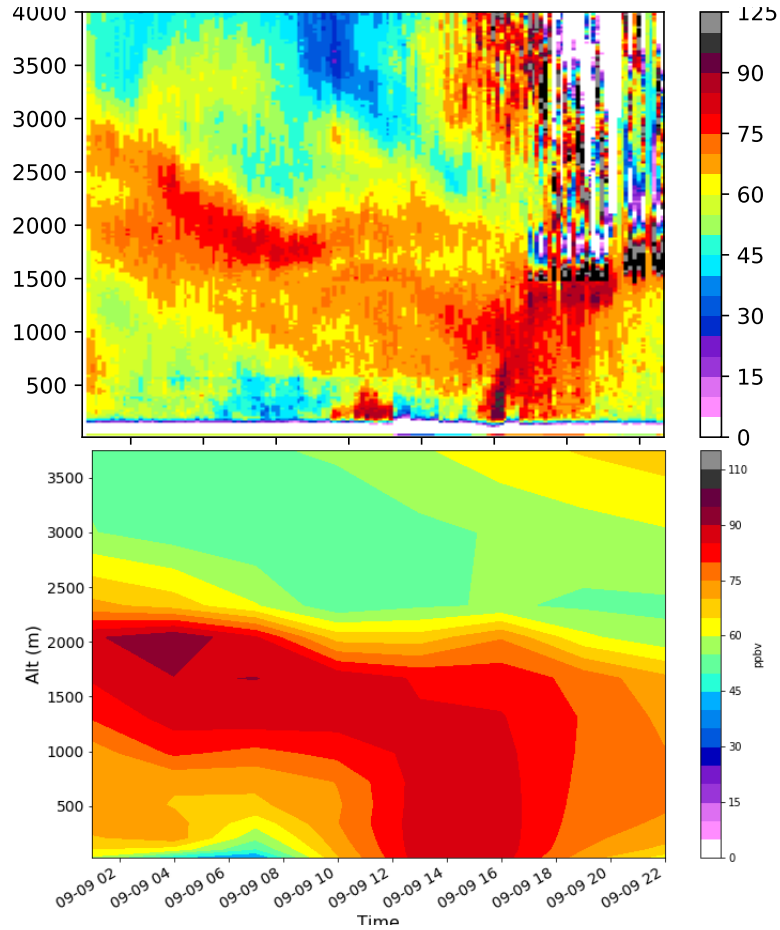


University of Houston



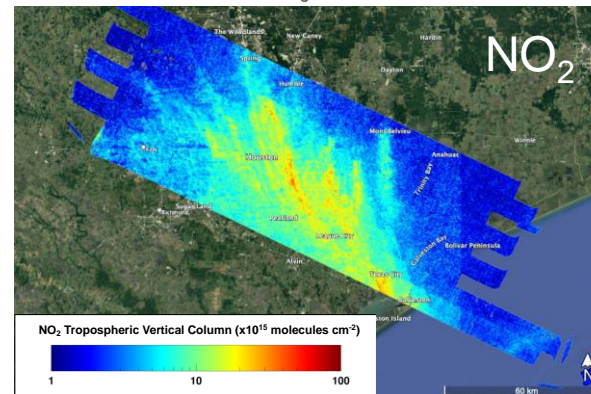
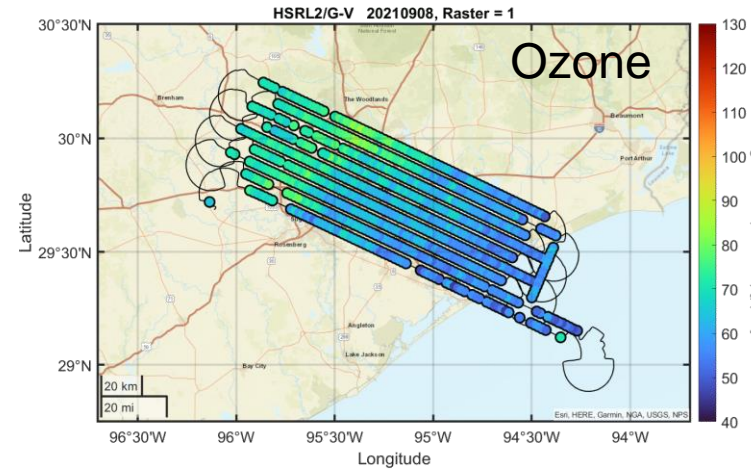
How do pollutants vary spatially, vertically, and temporally?

Lidar (2021)

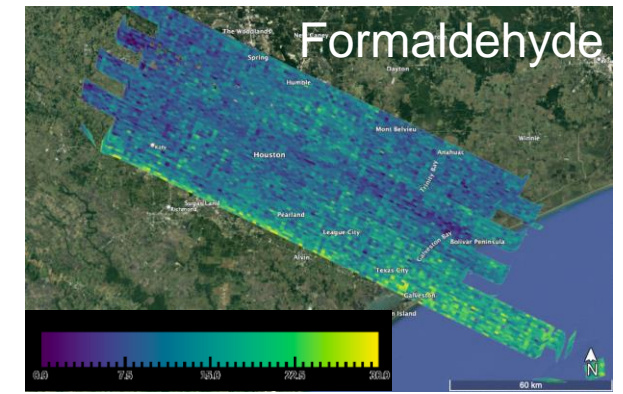
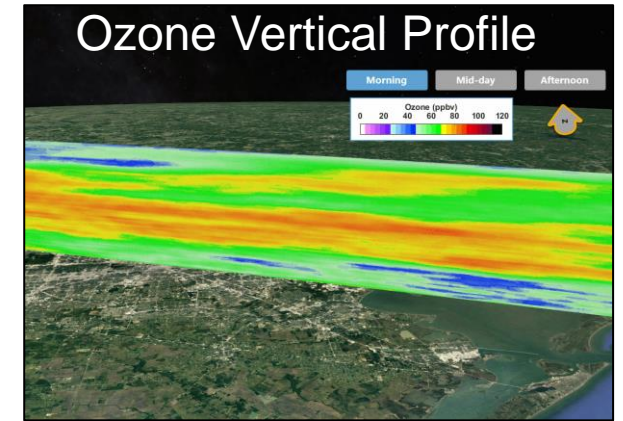


Dr. John Sullivan, NASA

Aircraft remote sensing (2021)



NO₂ = Nitrogen Dioxide



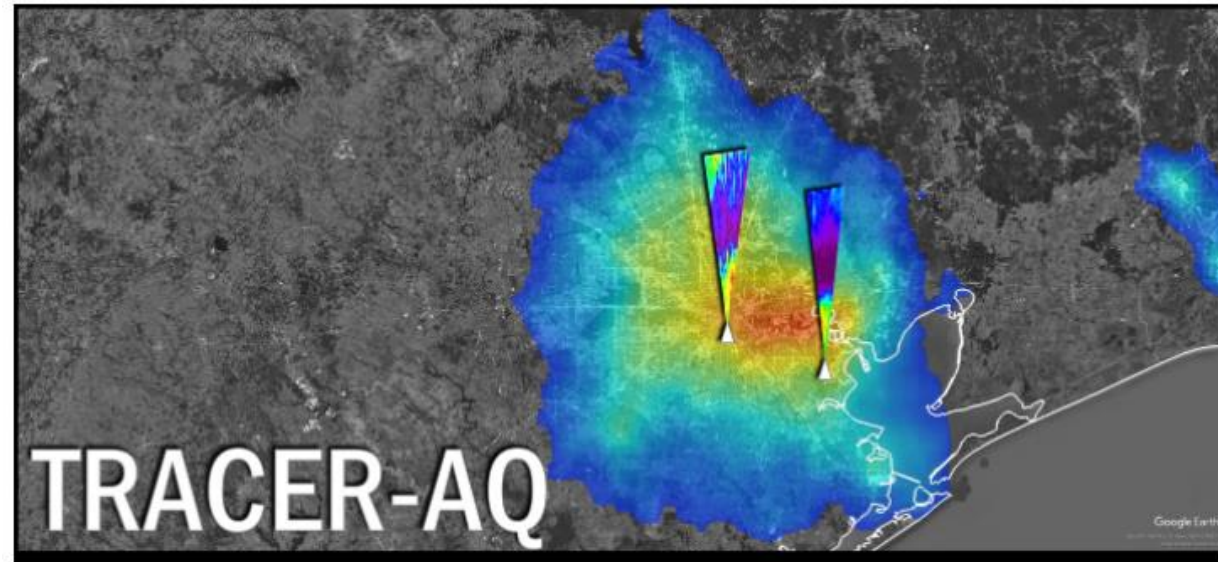
Dr. Laura Judd, NASA

TCEQ Research Projects: TRACER-AQ

- TRACER-AQ data:

<https://www-air.larc.nasa.gov/missions/tracer-aq/>

- TRACER-AQ 2 - Houston
 - August – September 2022
 - Mobile labs
 - Pontoon boat
 - Two commercial service boats
 - Drone



Contact

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Air Modeling and Data Analysis