Routine and Systematic Air Quality Monitoring for better understanding coastal air quality and how ORD efforts are contributing

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How does EPA protect human health and the environment?

National Ambient Air Quality Standards (NAAQS) and **attainment designations (monitoring data)** followed by implementation planning (modeling)

season as an alternative to 1-hour average speciated VOC measurement[illegible] the primary VOC compound[illegible] measured using continuous [illegible] to low detectability of the pr[illegible] compounds or for logistical [illegible] programmatic constraints.

(e) The EPA Regional Adm[illegible] grant a waiver to allow repre[illegible] meteorological data from nea[illegible] stations to be used to meet th[illegible] requirements in paragraph 5(b) where the monitoring agency can demonstrate the data is collected in a manner consistent with EPA quality assurance requirements for these measurements.

(f) The EPA Regional Administrator may grant a waiver from the requirement to collect PAMS measurements in locations where CBSA-wide O_3 design values are equal to or less than 85% of the 8-hour O_3 NAAQS and where the location is not considered by the Regional Administrator to be an important upwind or downwind location for other O_3 nonattainment areas.

(g) At a minimum, the monitoring agency [illegible] activities to be performed. The EMP shall be submitted to the EPA Regional Administrator no later than October 1, 2019 or two years following the effective date of a designation to a classification of Moderate or above O_3 nonattainment, whichever is later. At a minimum, the EMP shall be reassessed and approved as part of the 5-year network assessments required under 40 CFR 58.10(d). The EMP will include monitoring activities deemed important to understanding the O_3 problems in the state. Such activities may include, but are not limited to, the following:

(1) Additional O_3 monitors beyond the [illegible] locations other than those required under paragraph 5(a) of this appendix, and

(4) Enhanced upper air measurements of meteorology or pollution concentrations.

* * * * *

■ 25. Appendix G of Part 58 is amended by revising table 2 to read as follows:

Appendix G to Part 58—Uniform Air Quality Index (AQI) and Daily Reporting

* * * * *

One example – 2015 Ozone NAAQS, 177 pages, thousands of public, non-profit, industry-group comments addressed, lawsuits nearly always follow

TABLE 2—BREAKPOINTS FOR THE AQI

These breakpoints							Equal these AQI's	
O_3 (ppm) 8-hour	O_3 (ppm) 1-hour[1]	$PM_{2.5}$ (µg/m³) 24-hour	PM_{10} (µg/m³) 24-hour	CO (ppm) 8-hour	SO_2 (ppb) 1-hour	NO_2 (ppb) 1-hour	AQI	Category
0.000–0.054	—	0.0—12.0	0–54	0.0–4.4	0–35	0–53	0–50	Good.
0.055–0.070	—	12.1—35.4	55–154	4.5–9.4	36–75	54–100	51–100	Moderate.
0.071–0.085	0.125–0.164	35.5—55.4	155–254	9.5–12.4	76–185	101–360	101–150	Unhealthy for Sensitive Groups.
0.086–0.105	0.165–0.204	[3]55.5—150.4	255–354	12.5–15.4	[4]186–304	361–649	151–200	Unhealthy.
0.106–0.200	0.205–0.404	[3]150.5—250.4	355–424	15.5–30.4	[4]305–604	650–1249	201–300	Very Unhealthy.
0.201-([2])	0.405–0.504	[3]250.5—350.4	425–504	30.5–40.4	[4]605–804	1250–1649	301–400	Hazardous.
([2])	0.505–0.604	[3]350.5—500.4	505–604	40.5–50.4	[4]805–1004	1650–2049	401–500	

The EPA moves to declare the Front Range a 'severe' air quality violator. Here's why that matters.

By Sam Brasch · Apr. 12, 2022, 11:56 am

There's a good chance Coloradans will feel the consequences of the downgrade at the gas pump.

If the EPA approves the downgrade, gas stations would be required to sell cleaner-burning gasoline across the northern Front Range one year after the effective date of the reclassification. Given the projected timeline to finalize the decision, state and regional air regulators expect the change will be enacted in the summer of 2024.

Reformulated gasoline is already required in California, parts of the northeastern seaboard and other urban areas struggling to control air pollution. Studies have shown the fuel helps improve air quality, but it tends to be more expensive than conventional fuel. Over the last year, federal data show the regular-grade reformulated fuel cost 35 cents more per gallon compared to conventional gasoline. The gap grew wider in March 2022, with regular-grade reformulated gasoline costing 51 cents more per gallon.

Silverstein said energy market volatility and recent global conflicts make it tough to predict prices for the reformulated fuel along the Front Range, but "it typically costs more for gasoline providers to make the higher-quality fuels."

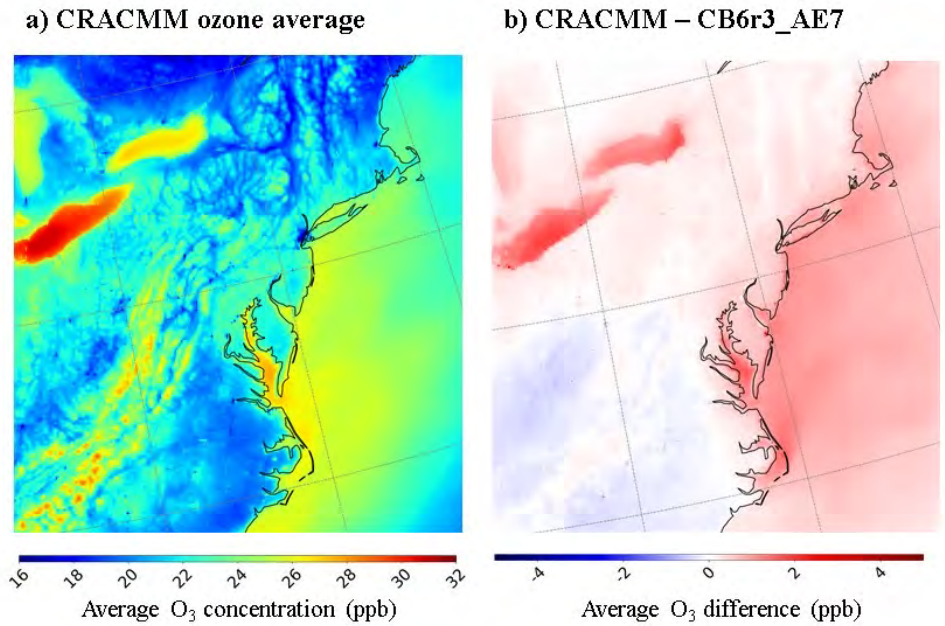
The job of making reformulated gas would likely fall to Suncor Energy, which operates Colorado's only oil and gas refinery in Commerce City. A spokesperson for the company, which is a financial supporter of CPR News, said the facility is already preparing to have fuel supplies ready "in the event it is required during the summer of 2023."

A downgrade would also require more state air pollution permits.

The Community Regional Atmospheric Chemistry Multiphase Mechanism (CRACMM)

- CRACMM developed by EPA in collaboration with NOAA/CIRES, William Stockwell, and McNeill group at Columbia University
- Fully integrates chemistry leading to ozone and SOA and considers explicit hazardous air pollutants[1]
- Available for the first time in the CMAQv5.4 release next month
- Initial development and testing for Northeast U.S. in 2018
  - AMORE representation of Wennberg et al. isoprene chemistry improved ozone and formaldehyde predictions[2]
  - SOA algorithms produced as much SOA as previous empirical representations
  - Similar ozone predictions as current operations, but significant differences in chemical intermediates such as HO_X as well as estimated ozone production efficiency compared to existing mechanism (CB6r3)[3]
- **Plan to move from research to operations (see fact sheet)**
- Robust predictions needed in CMAQ for air quality forecasts from NOAA and estimation of health risk such as in the EPA AirToxScreen
- **Ways of connecting to 2023 campaigns**
  - **Distribution of F0AM input files for box modeling (coming in fall 2022)**
  - **CMAQ-CRACMM simulations**

Summer 2018 predictions from Place et al.[3] in prep



[1]Pye et al. submitting to *Atmos Chem Phys*
[2]Wiser et al. submitting to *Geosci Model Dev*
[3]Place et al. in prep for *Atmos Chem Phys*
[4]https://www.epa.gov/AirToxScreen

See fact sheet regarding EPA plans at:
https://www.epa.gov/cmaq/cmaq-fact-sheets
https://github.com/USEPA/CRACMM Coming soon!

The State/Local/Tribal/Federal air quality monitoring system

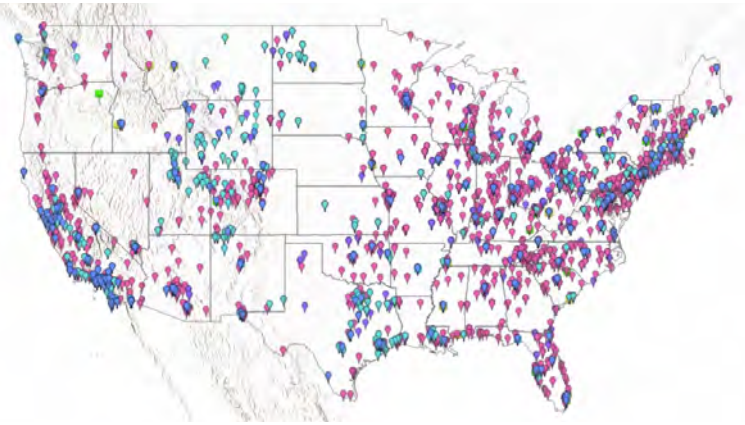
Table 1: National Ambient Air Quality Monitoring System

Network	Purpose	Start year	No. of sites[a]
State and Local Air Monitoring Stations (SLAMS) network			
Criteria pollutant networks	Provide air pollution data to the general public in a timely manner; support compliance with the National Ambient Air Quality Standards (NAAQS) and emissions strategy development, and support air pollution research studies.	1980	4,300+
Photochemical Assessment Monitoring Stations (PAMS)	Measure ozone precursors to better characterize the nature and extent of ozone problems in nonattainment areas.	1994	69
$PM_{2.5}$ Chemical Speciation Network (CSN)	Provide data on the chemical composition of particulate matter less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$) to assess trends, develop emissions control strategies, and support health studies, among other things.	2002	154
Near-Road NO_2 Network	Measure nitrogen dioxide (NO_2) and other pollutants near roads in larger urban areas where peak hourly levels are expected to occur.	2010	74
National Core (NCore) network	Support air quality model evaluations, long-term health assessments, compliance through comparison to the NAAQS, and ecosystem assessments.	2011	78
Networks for assessing air toxics			
National Air Toxics Trends Stations (NATTS) network	Identify trends in air toxics levels to assess progress toward emission reduction goals, evaluate public exposure, and characterize risk.	2003	24
State and local air toxics monitoring	Support state and local air toxics programs and identify geographic areas at high risk.	1985	240+
Specialized networks			
Interagency Monitoring of Protected Visual Environments (IMPROVE)	Establish current visibility conditions in visibility-protected federal areas, identify emissions sources, document trends, and provide regional haze monitoring.	1985	110
Clean Air Status and Trends Network (CASTNET)	Assess environmental results of emissions reductions programs, such as a program to reduce acid rain, and pollutant impacts to sensitive ecosystems and vegetation.	1991	96
National Atmospheric Deposition Program (NADP)	Provide data on the amounts, trends, and geographic distributions of ammonia, mercury, and other pollutants found in precipitation that can affect the environment.	1978	473

Source: GAO analysis of Environmental Protection Agency information. | GAO-21-38

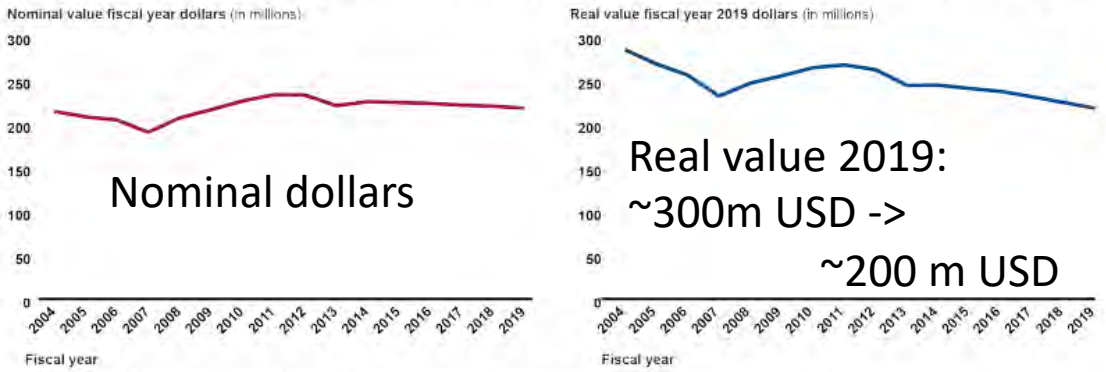
[a]These numbers include sites on tribal lands that report data to the Environmental Protection Agency.

Pink – Ozone
Blue – CO
Teal – NO2



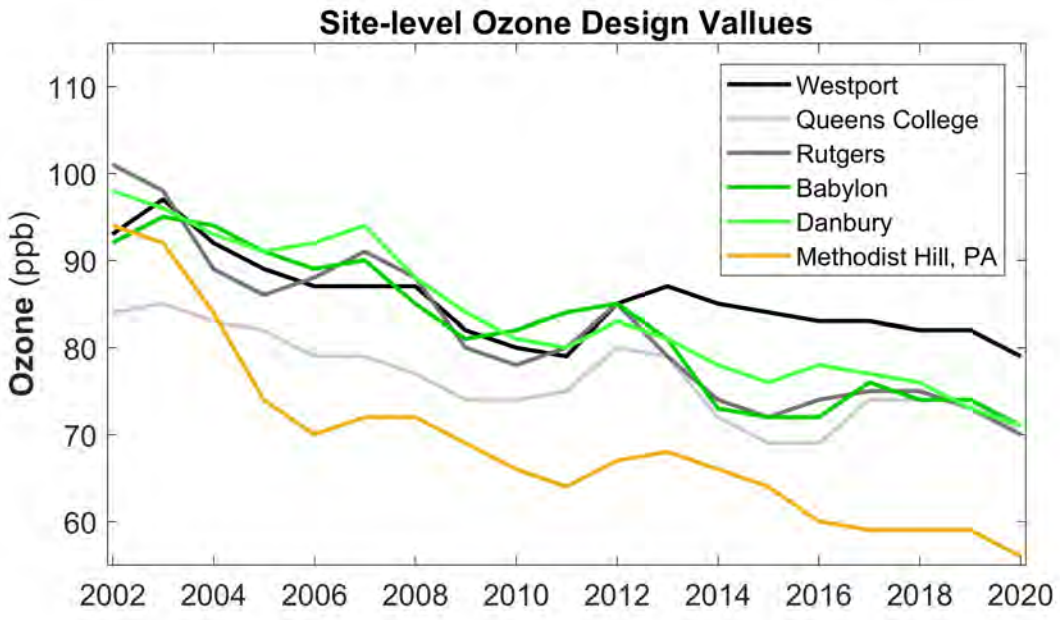
Air quality monitoring networks for a three example criteria pollutants (pollutants that EPA/states are required to ensure attain health standards)

Figure 7: Annual EPA Grant Funding for State and Local Air Quality Management, Which Includes Air Quality Monitoring



Source: GAO analysis of Environmental Protection Agency (EPA) and U.S. Department of Commerce, Bureau of Economic Analysis, data. | GAO-21-38

Source GAO-21-38: Publicly Released: Dec 07, 2020.

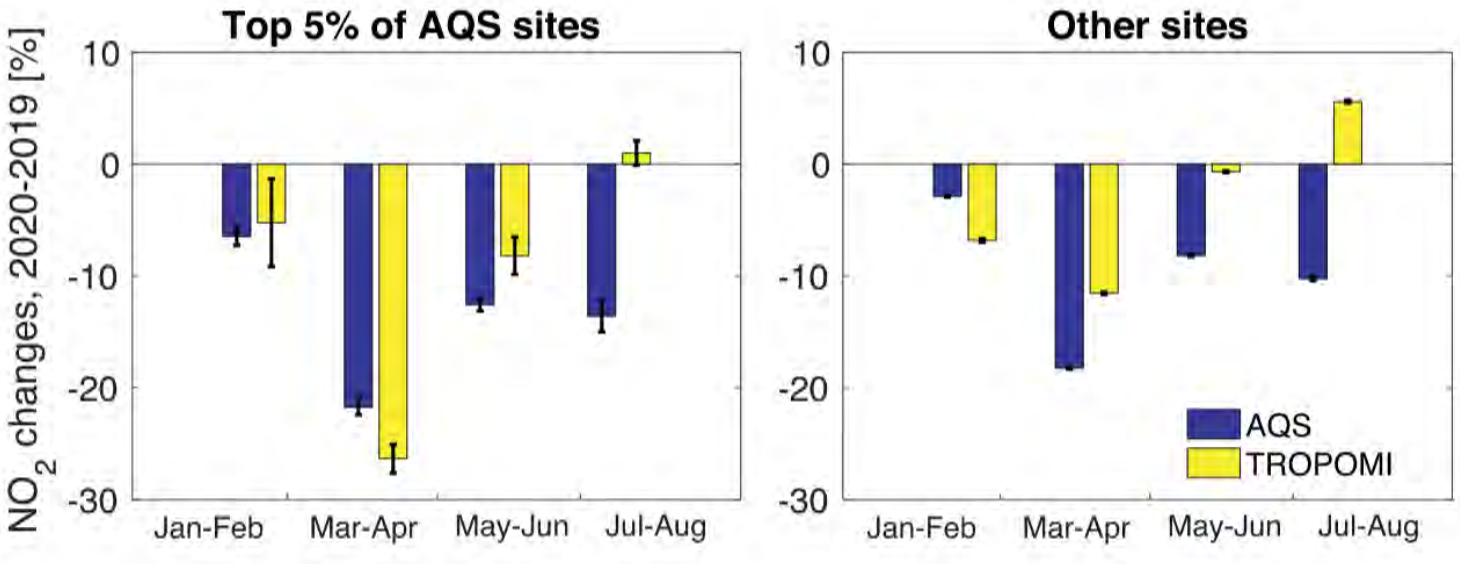


←Consistent, long-term measurements are critical to our conceptual and numerical models of air emissions, chemistry, deposition and transport.

Coastal Connecticut and other shoreline locations have had different interdecadal ozone trends than interior locations

Routine surface measurements have guided→ interpretation of satellite data and improvements to retrievals, especially in the absence of systematic validation programs

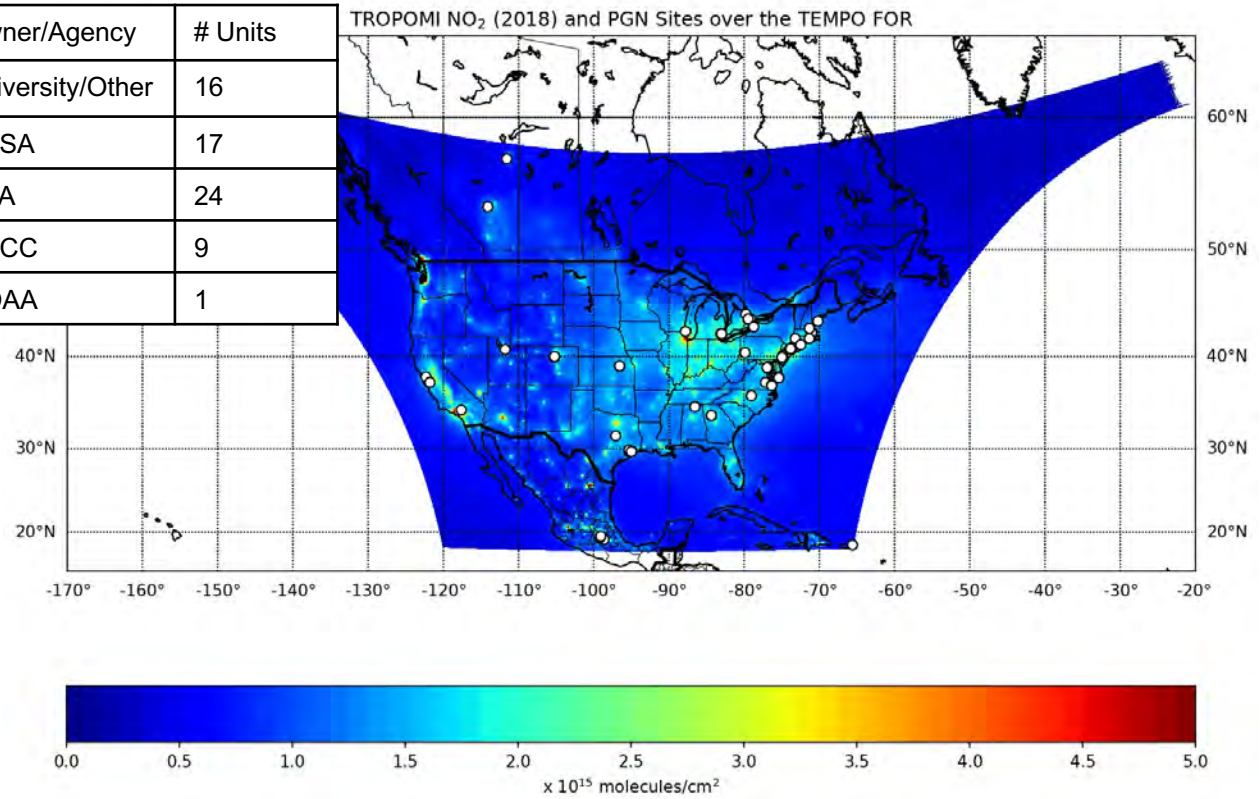
Background NO2 must be considered when doing satellite data trend analysis for understanding anthropogenic NOx emissions



Qu et al., 2021

EPA is a key partner with NASA and ESA in transitioning remote sensing research measurements into operational networks in USA for use in TEMPO validation

Owner/Agency	# Units
University/Other	16
NASA	17
EPA	24
ECCC	9
NOAA	1

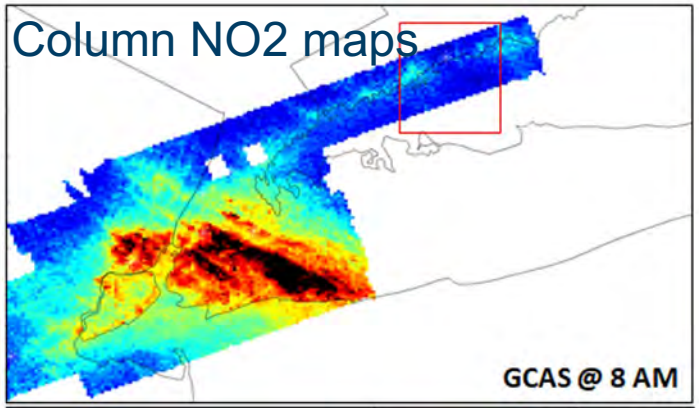


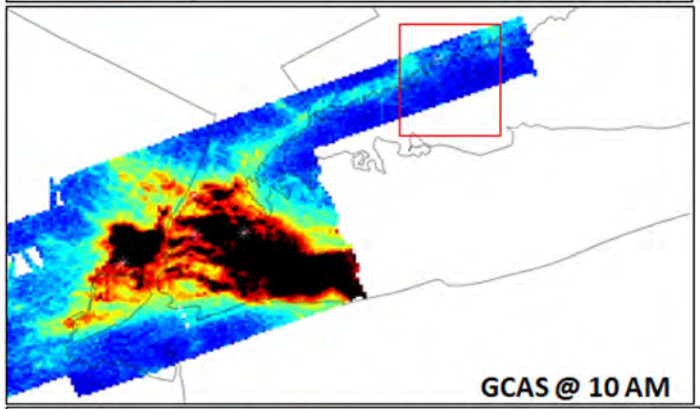
In North America both EPA and Environment and Climate Change Canada (ECCC) PGN sites are collocated within the existing AQ Networks to support routine and systematic validation for TEMPO and other satellites on a long-term basis..

	PM2.5 (FRM)	PM2.5 (continuous - FEM)	PM10/PM10-2.5 (FRM)	PM10/PM-10.2.5 (continuous FEM)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, continuous)	Utrafines (Continuous)	Particle Count continuous)	Sulfate (semi-continuous)	Ozone	SO2	CO	Direct NO2	NO/NOy	Ozone precursors AutoGC	Carbonyl	Toxics (NATTS)	**Total Column NO2/HCHO/O3 (PGN)**	**Profile NO2/HCHO (PGN)**	**Spectral AOD (AERONET)**	**Continuous Mixing Height (PBLH) (UCN)**	Wind Speed/Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
Queens College II (CUNY Queens College Campus)	1/3	X	1/6	X	1/3		X			X	X	X	X	X	X		1/6	1/6	X	X	X	X	X	X			
New Haven – Criscuolo Park	1/3	X	1/3	X	1/3		X				X	X	X	X	X				X	X	X	X	X	X	X	X	X
Cornwall – Mohawk Mountain	1/3	X		X		1/3	X				X	X	X		X				X	X	X	X	X	X	X	X	X
New Brunswick-Rutgers	1/3	X	1/6	X	1/3		X			X	X			X	X	X	1/6	1/6	X	X	X	X	X	X	X	X	X

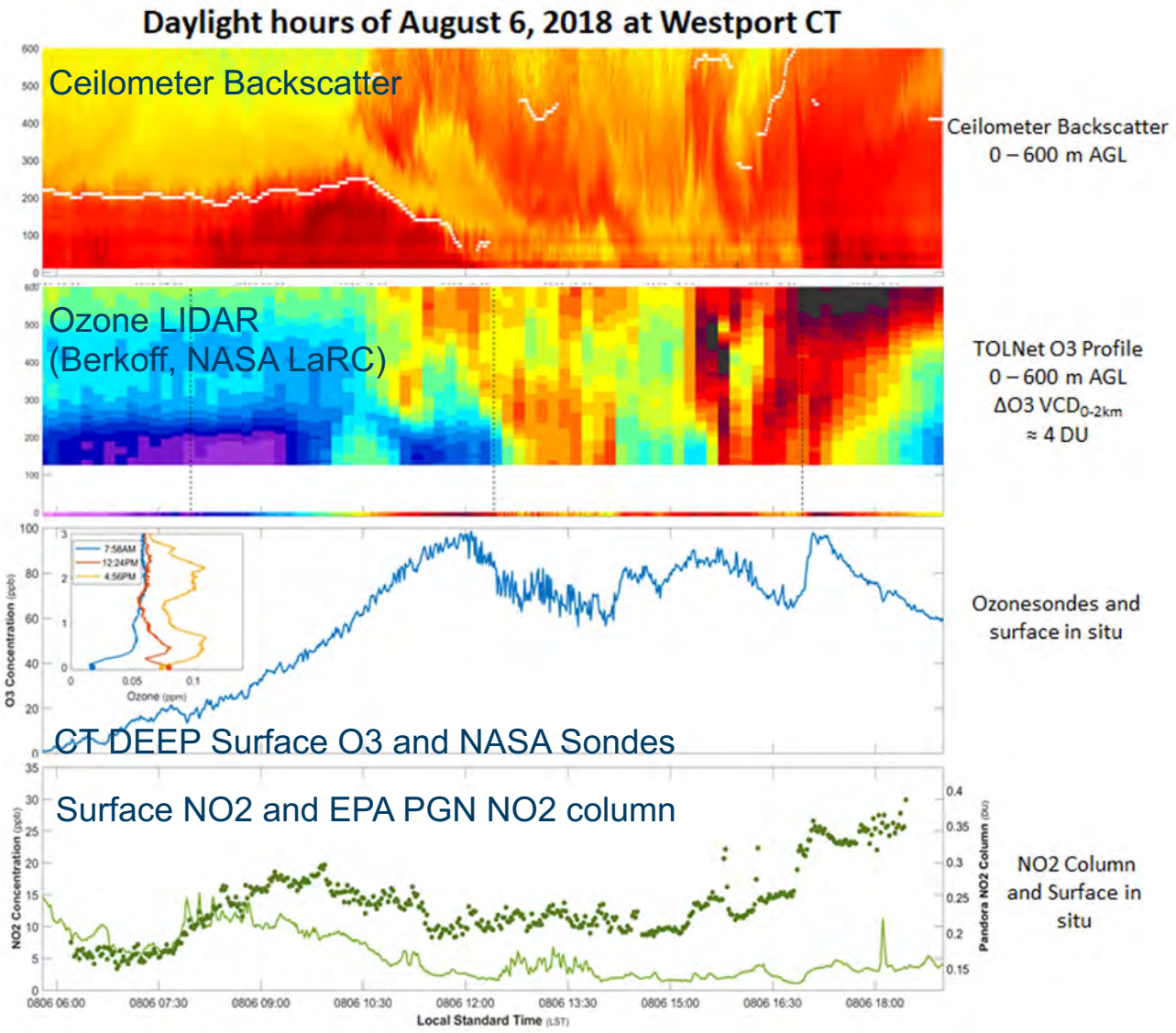
Existing networks provide critical long-term contextual information and allow for leveraging of resources and to build a more integrated 3-dimensional characterization.

An example of the “3D” monitoring System

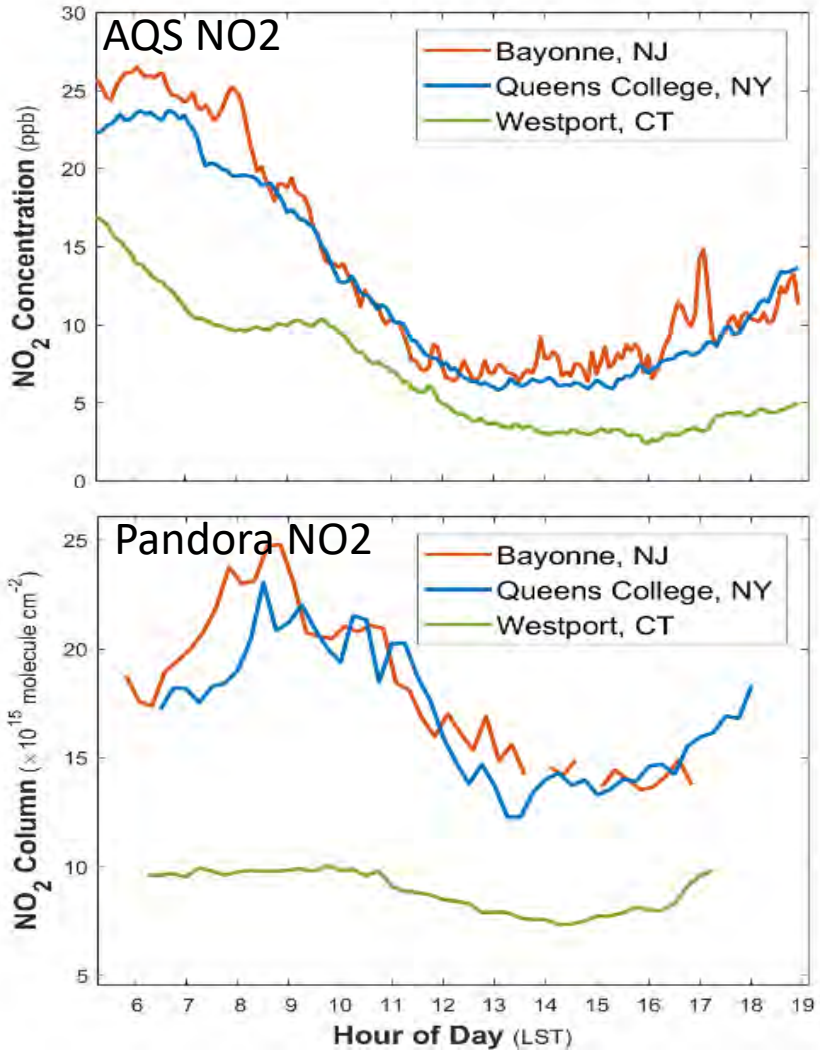


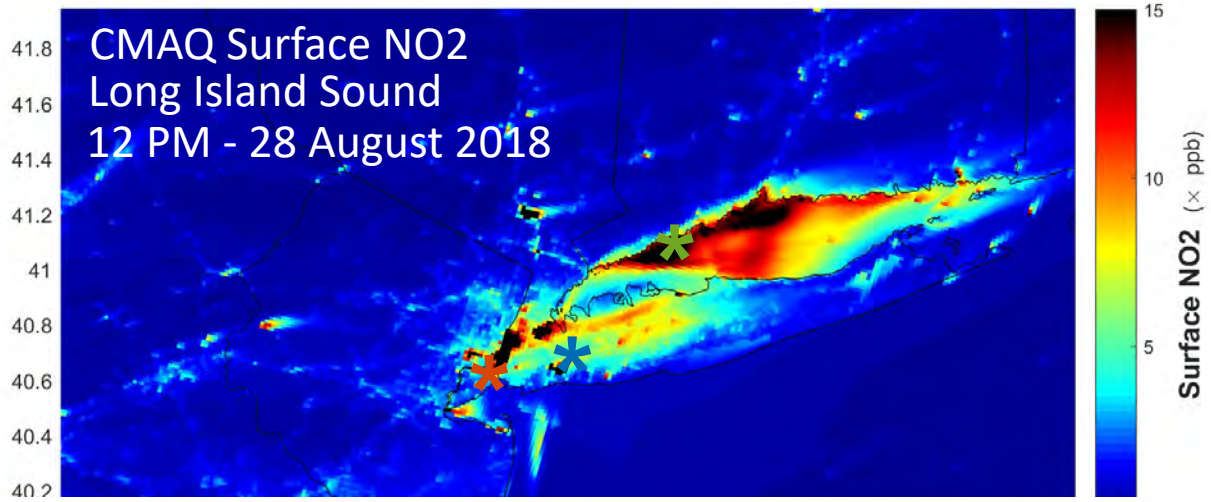


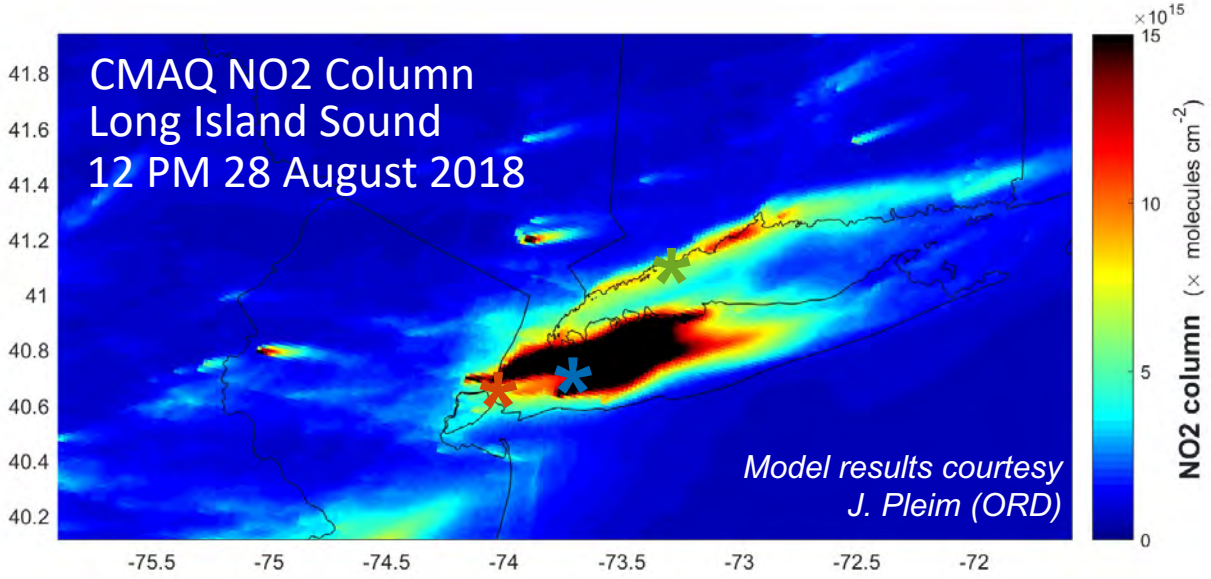
A single example of select variables demonstrates the value added by combining measurements to better understand both process and satellite validation. Preliminary analyses over longer-term data show an ability to gain statistics and perform “experiments”



NO_2 Column ≠ NO_2 Surface Concentration: a common issue for AQ management and satellite data applications

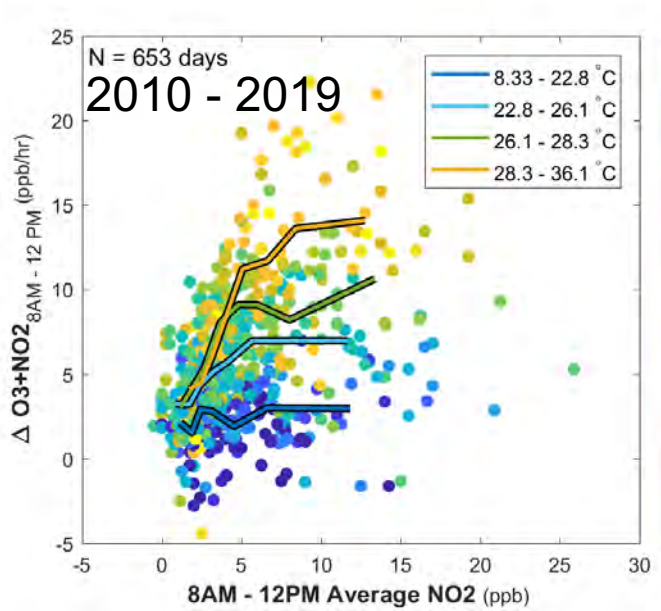


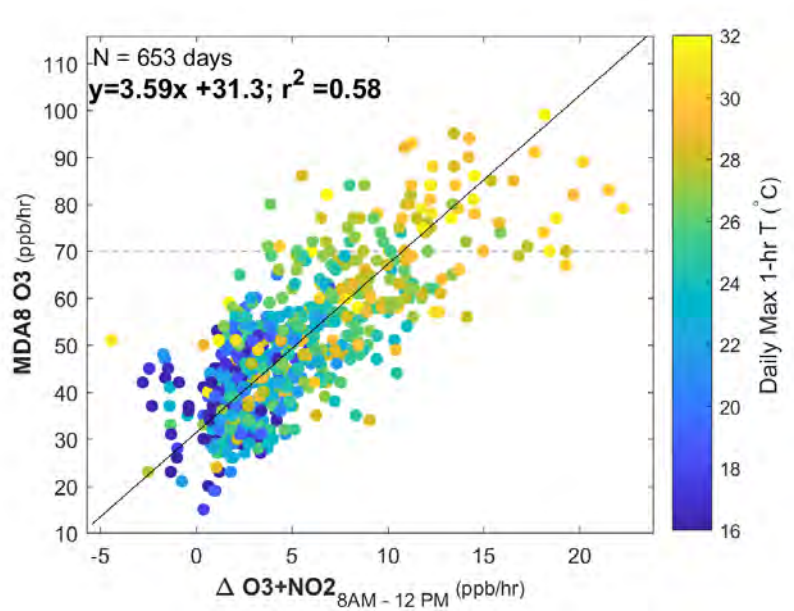


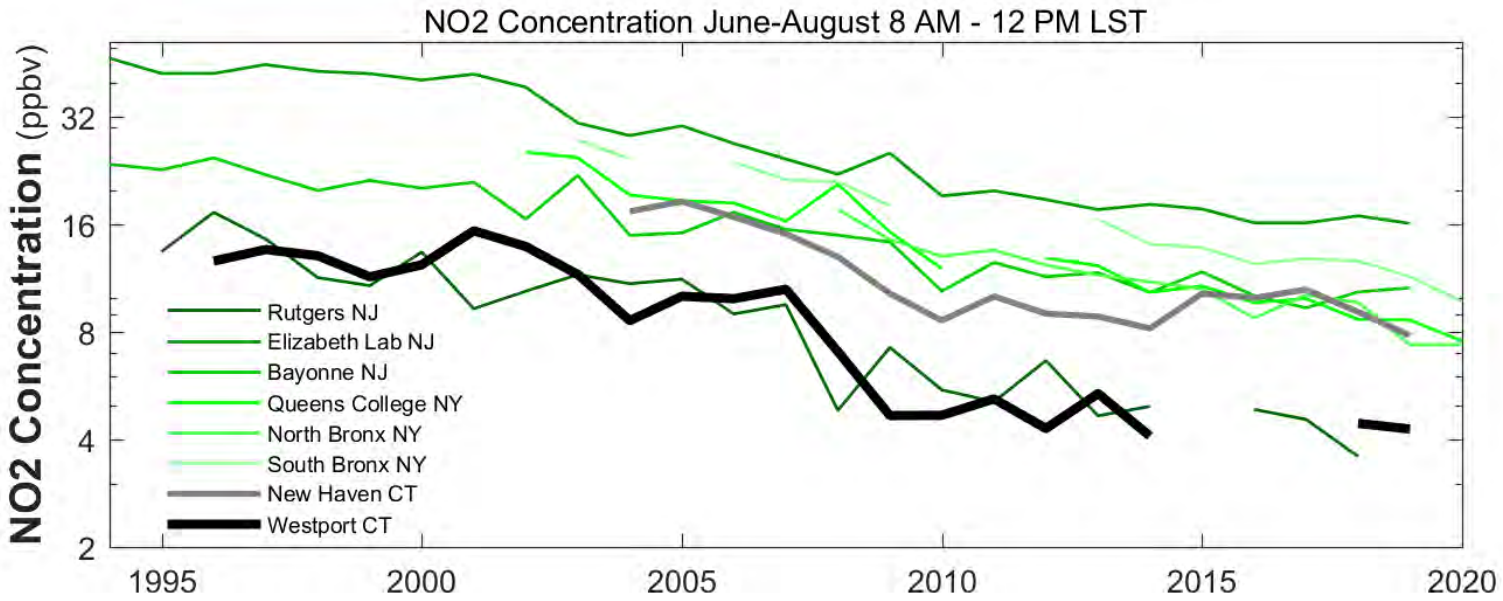


Shallow morning layers advecting ashore are ideal for isolating chemical processes

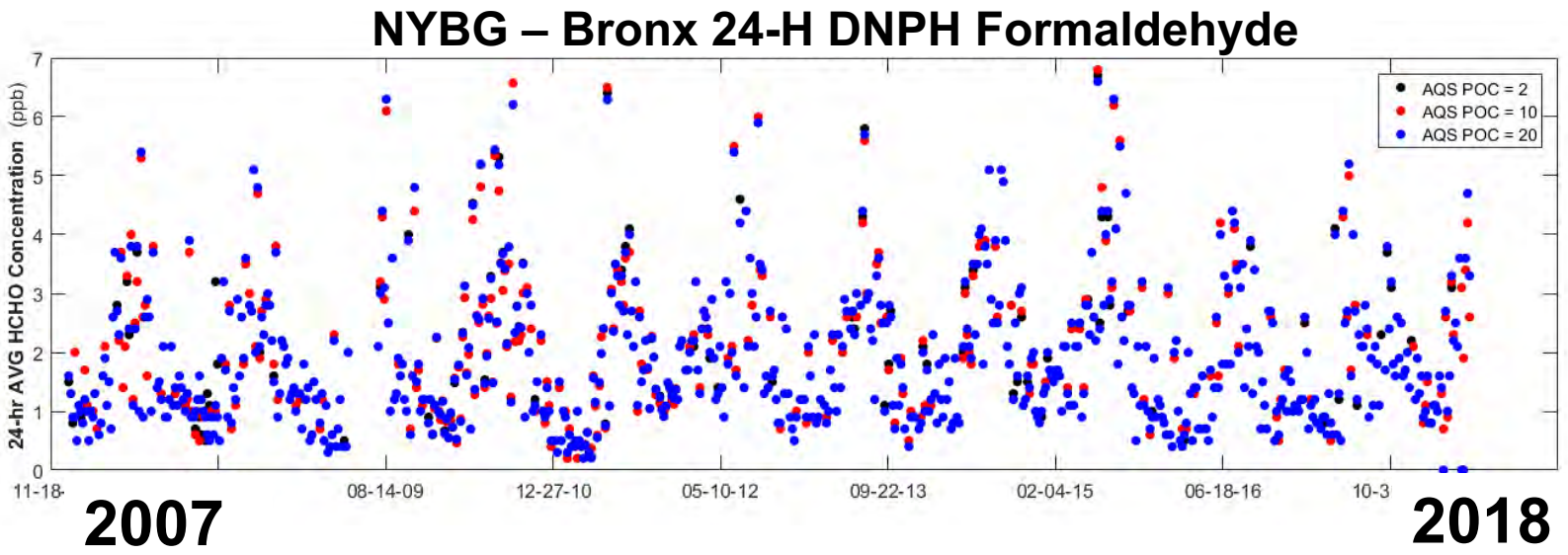
The morning growth rate of O3+NO2 at Westport is consistent with our understanding of photochemical O3 formation, a function of NOx and temperature (top left). The morning rate of O3 increase is empirically predictive of MDA8 O3 (top-right, 11 ppb / hr ~ MDA8 = 71ppb, r^2 = 0.58). The slow decreasing trend of NO2 at Westport (black, bottom) since 2008 may help to explain the lack of improvements on ozone air quality.







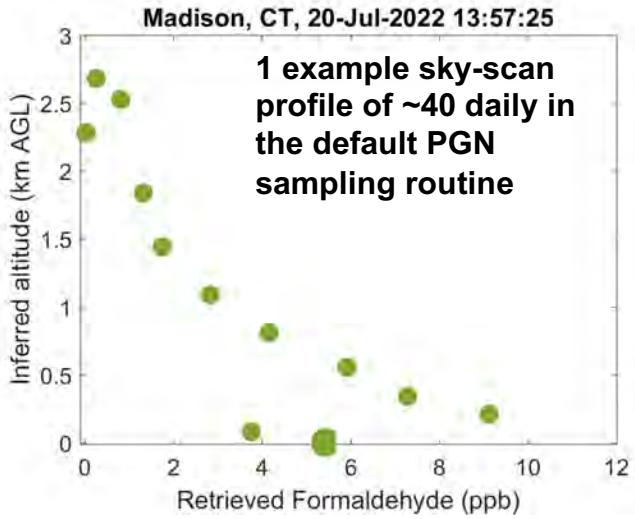
Routine monitoring suggests relatively stable oxidized VOC abundance over the last decade

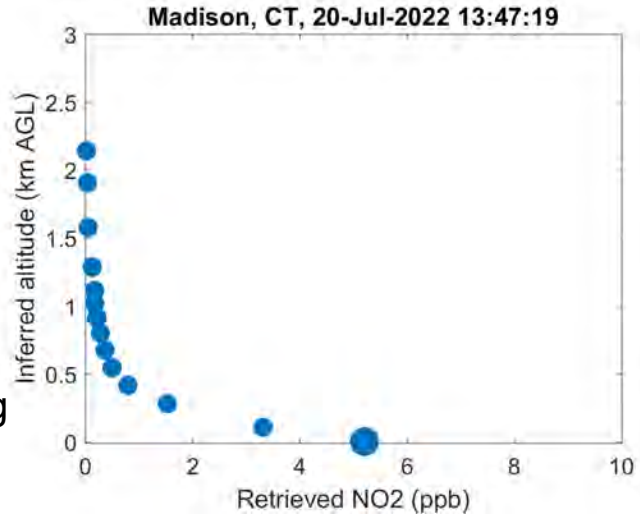


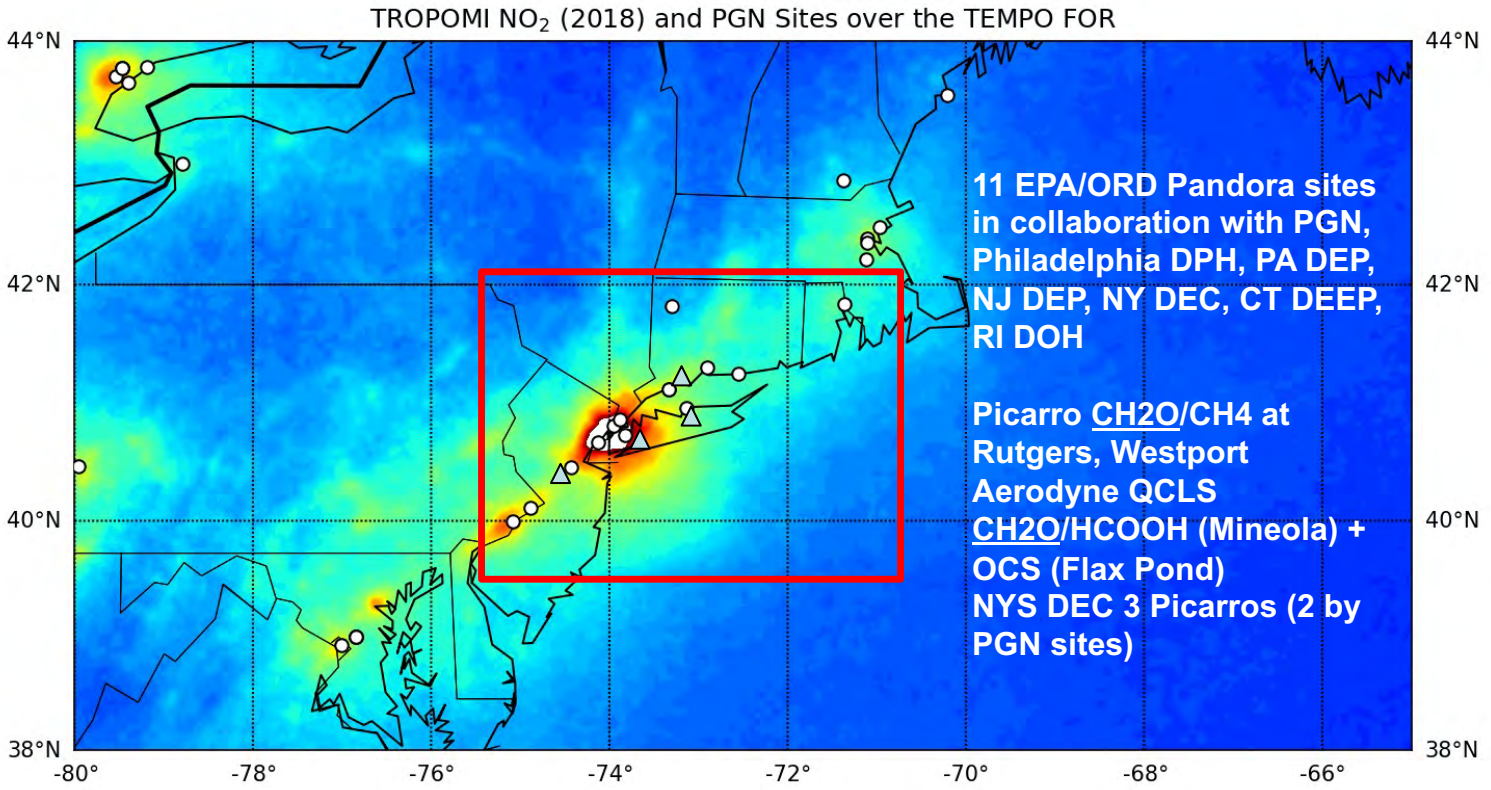
- Formaldehyde amount is a function of VOC oxidation ($\sum_i k_{OH+VOCi} \times [VOC_i] \times [OH]$)
- Either past emission reductions have only marginally impacted total VOC reactivity (e.g., biogenic VOC are relatively more important that anthropogenic VOC) or the rate of oxidation (i.e., OH concentration) has increased to compensate for emission decreases.

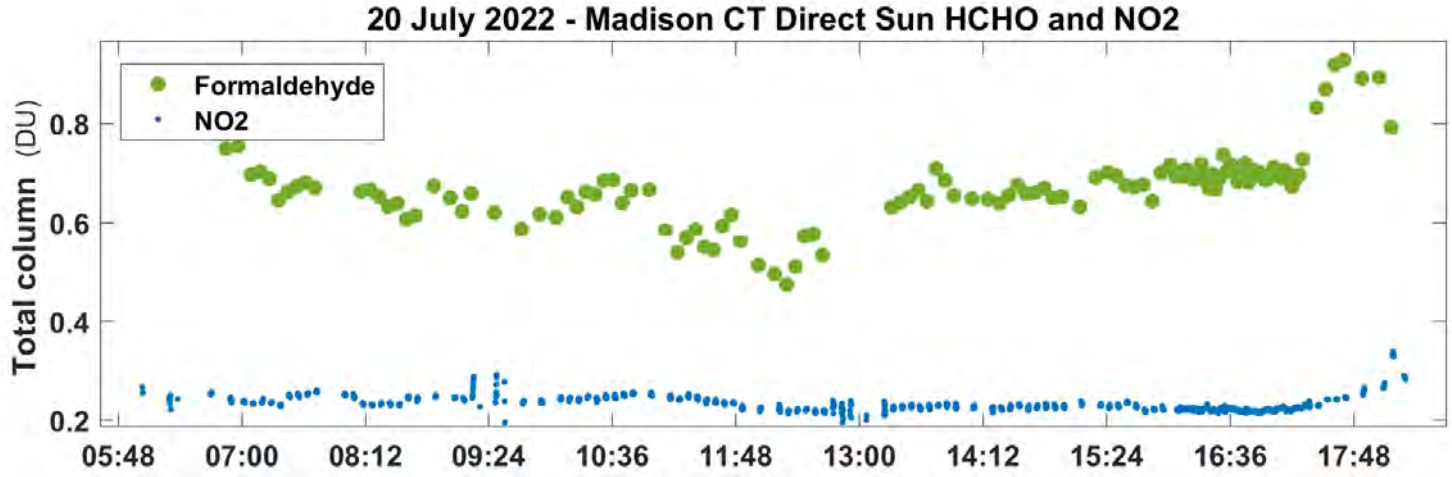
ORD efforts in 2023

- Continuity of operations at PGN/UCN locations
- Addition of 4 continuous formaldehyde samplers to help evaluate PGN profiles (top-left)
- Addition of 3D wind LIDAR at Westport
- Near-shore over water total column, in situ sampling (*tentative*)
- Airborne profiling of NO2, HCHO and O3 (*Date TBD*)









ENVIRONMENT

EPA sues Zug Island DTE factory for sulfur dioxide emissions

Carol Thompson
The Detroit News

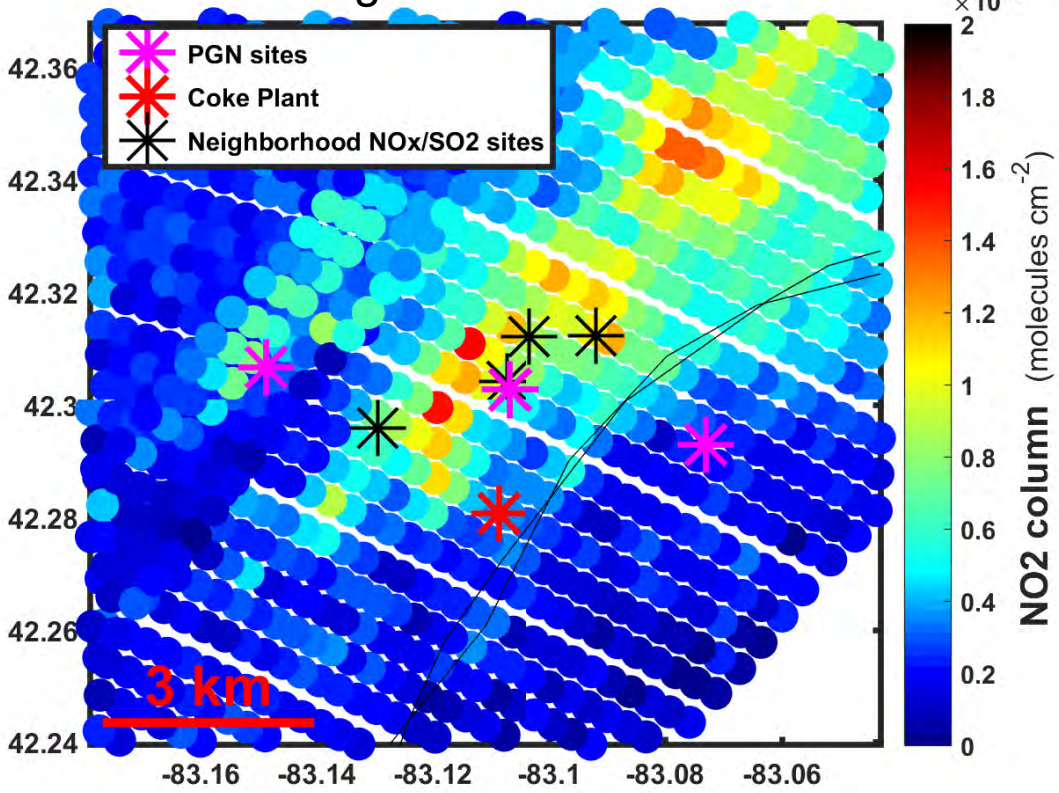
Published 4:17 p.m. ET June 3, 2022

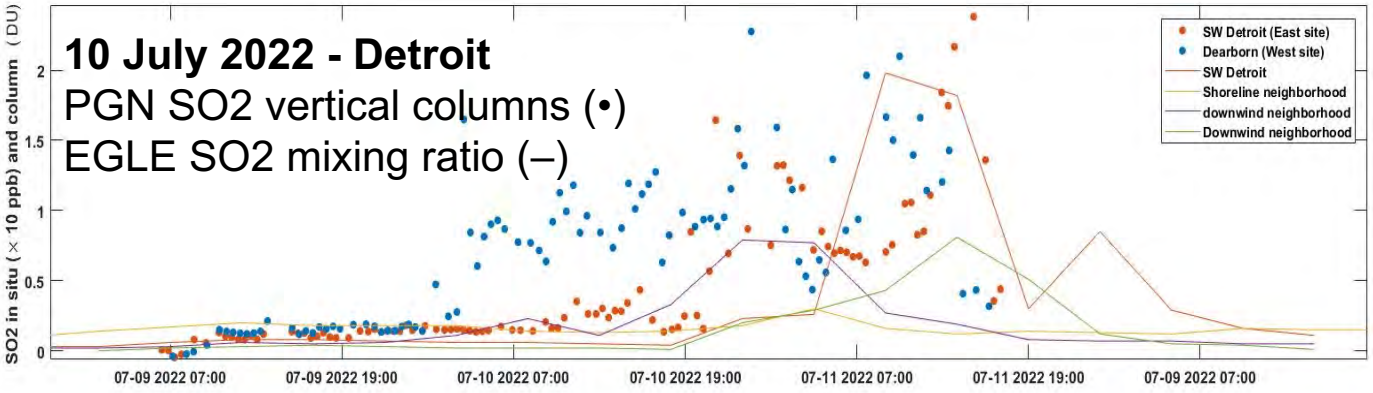
View Comments

The federal government has sued the EES Coke Battery plant on Zug Island, alleging the facility violated the Clean Air Act by significantly increasing its

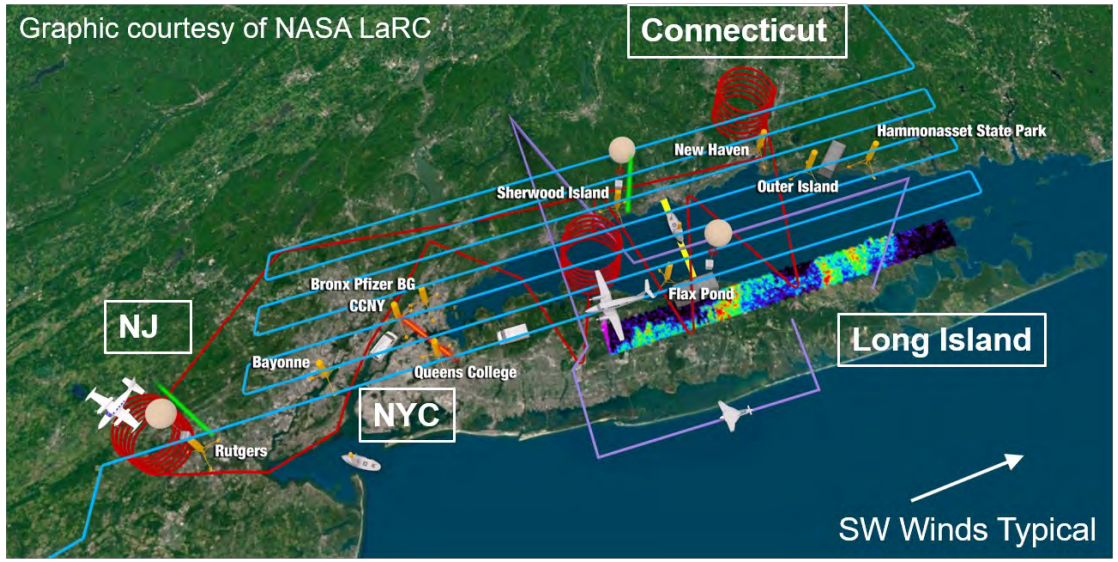
The EES Coke quenching tower erupts with steam as water is dumped on hot coke fresh from the ovens on a typical Zug Island day. The coke battery, once part of National Steel, is now owned by DTE. *David Guralnick, The Detroit News*

GCAS NO2 during MOOSE2021 – Detroit/Windsor





Lessons learned



- ORD efforts over 5 years to support several monitoring modernization efforts are becoming operational. We need help investigating all the data going forward
- Collaborative field studies have shown that a “3D” picture of air pollution can be inferred via various operational techniques.
- More sophisticated measurements along shoreline environment will improve emission source attribution and test mechanism development
- PAMS re-design and Enhanced Monitoring Plans have thus far been a huge success in adding to these types of smaller focused missions