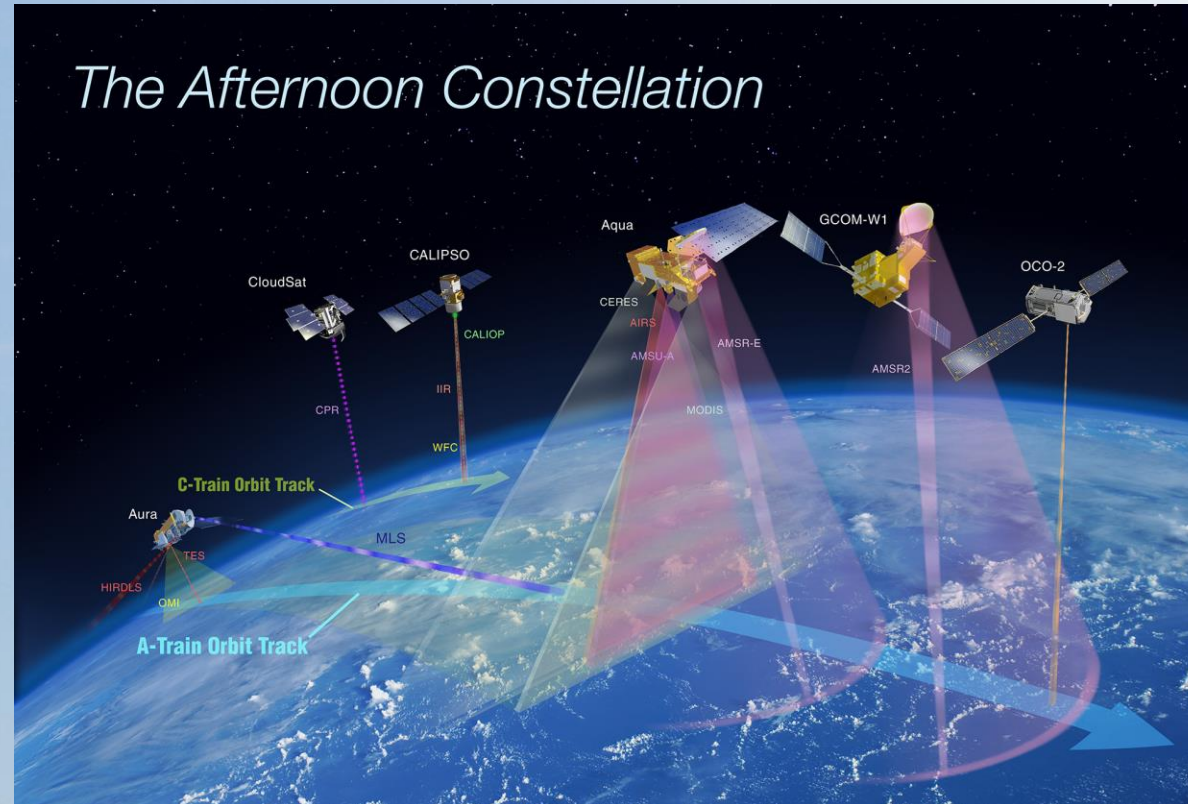


Connecticut DEEP

Using Satellite Data over 20 Years



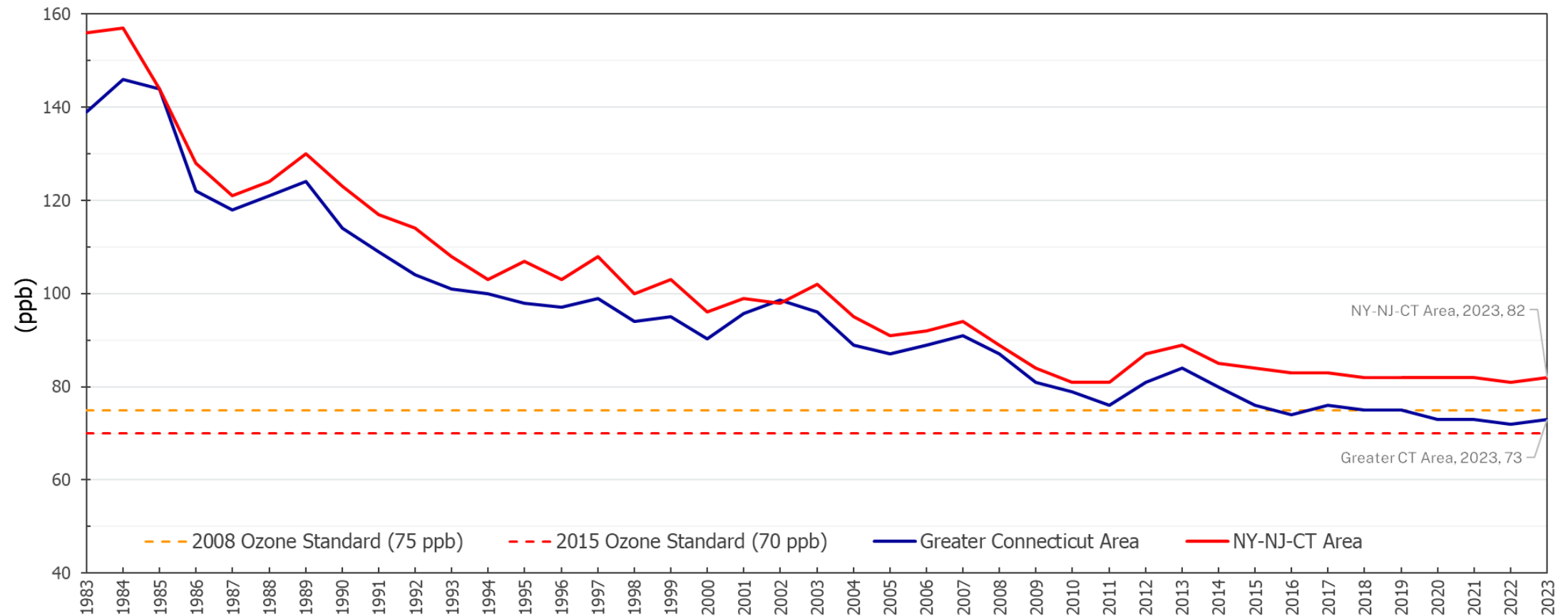
Connecticut
Department of Energy &
Environmental Protection

Michael Geigert
Bureau of Air Management



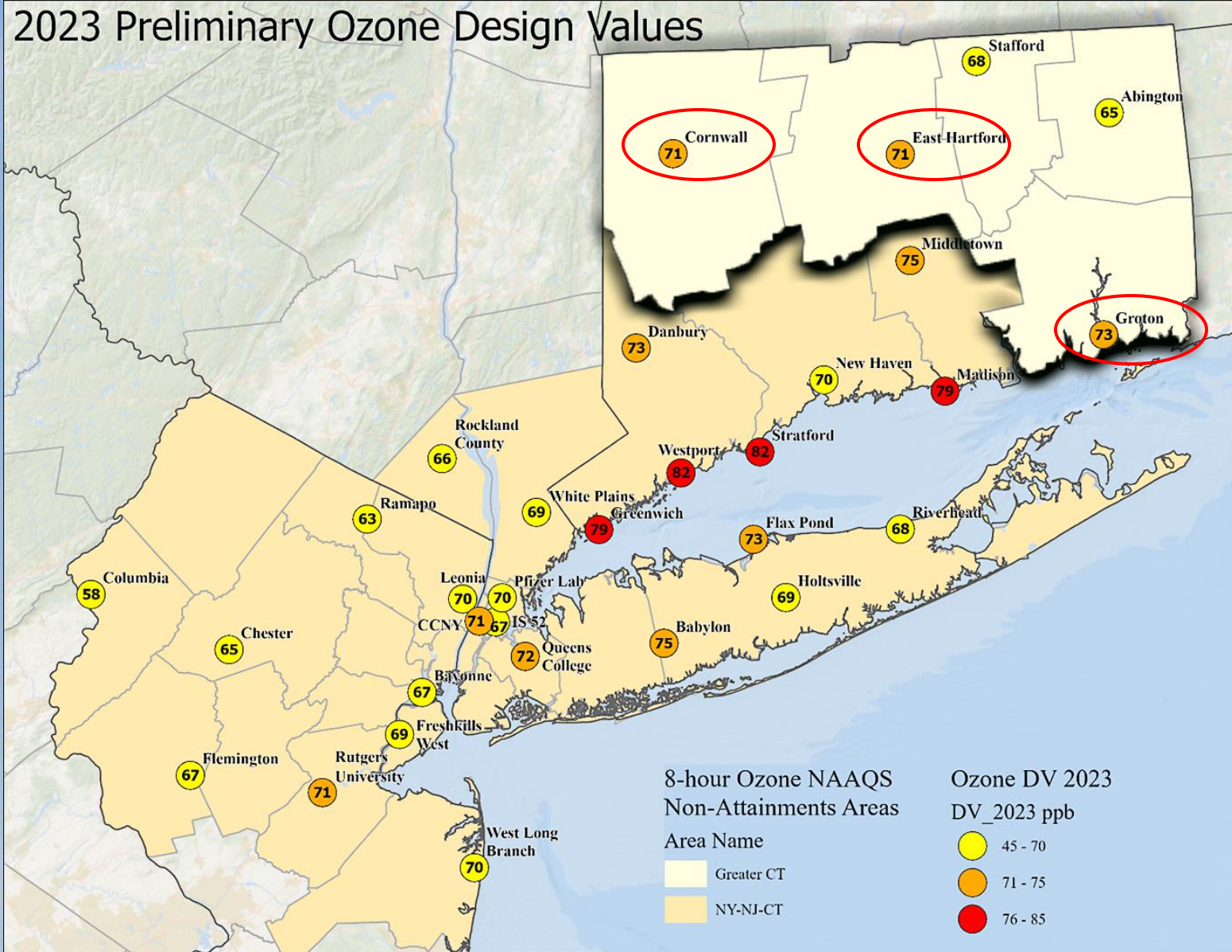
Introduction

Ozone Design Value Trends
Connecticut's Two Nonattainment Areas



- Connecticut continues to be locked into a pattern of ozone non-attainment.
- Greater Connecticut was decreasing, but ozone levels increased in 2023 due to influence of wildfire smoke.

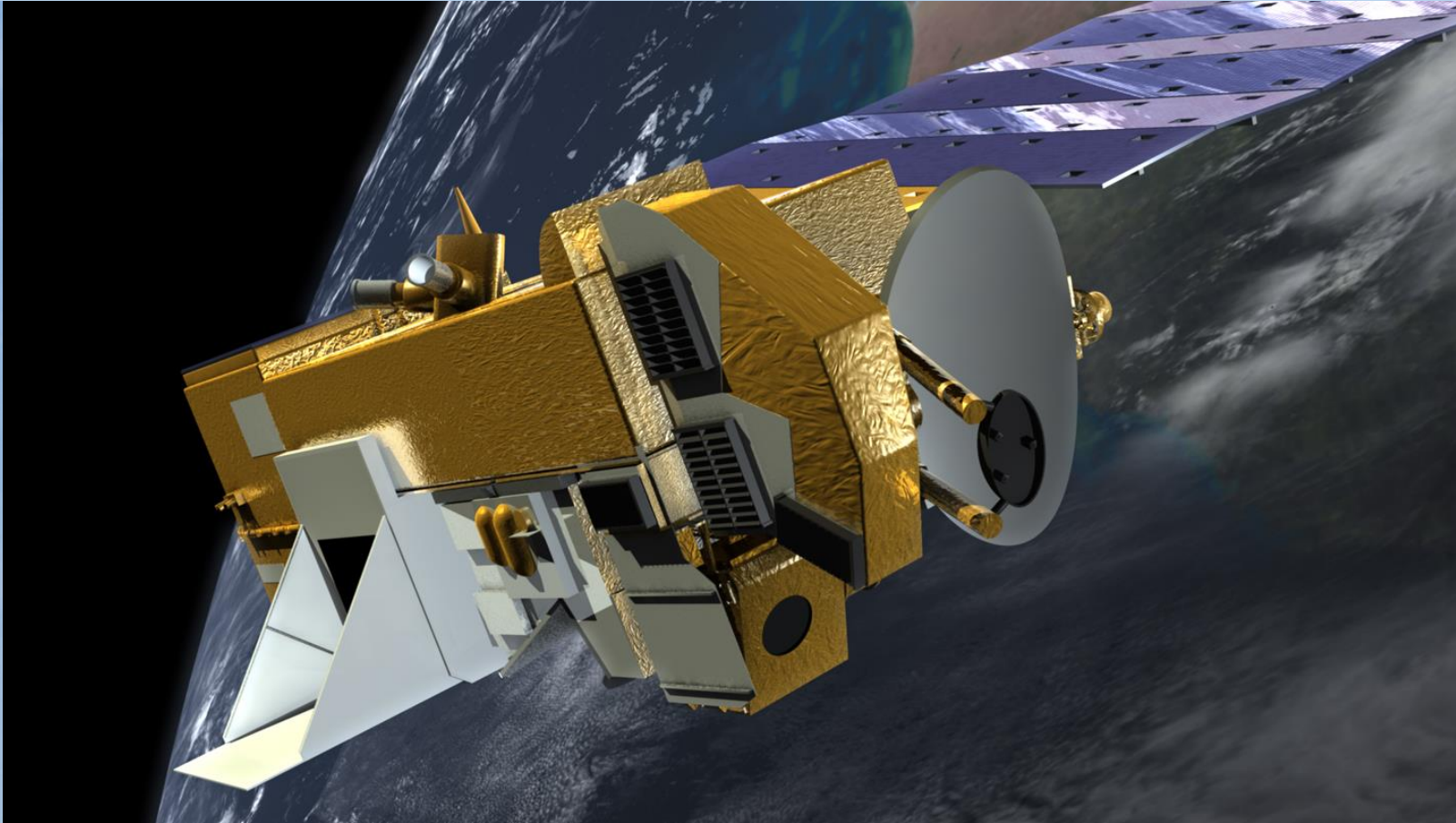
2023 Preliminary Ozone Design Values



- CT submitted an Exceptional Event request for public comment.
- Southwest Connecticut will not attain the 2015 ozone NAAQS for several years, so it was determined not to be “Regulatorily Significant” for an exceptional event request.
- Only three non-attainment monitors in Greater Connecticut are being requested for an EE concurrence.

2015 Ozone NAAQS = 70 ppb

In the Beginning, there was AURA



The Aura spacecraft was successfully launched on July 15, 2004. Aura was launched into a sun-synchronous, near polar (98.2 degree inclination) orbit. It orbits 705 km (438 miles) above the Earth with a sixteen-day repeat cycle and 233 revolutions per cycle. The ascending node is in daylight and crosses the equator at approximately 1:45 PM. The Aura spacecraft is flying in formation with other Earth observing satellites called the A-Train.

OMI Parameters

The instrument observes Earth's backscattered radiation with a wide-field telescope feeding two imaging grating spectrometers. Each spectrometer employs a CCD detector. Onboard calibration includes a white light source, LEDs, and a multi-surface solar-calibration diffuser. A depolarizer removes the polarization from the backscattered radiation.

Item

Parameter

Visible:

350 - 500 nm

UV:

UV-1, 270 to 314 nm, UV-2 , 306 to 380 nm

Spectral resolution:

1.0 - 0.45 nm FWHM

Spectral sampling:

2-3 for FWHM

Telescope FOV:

114 (2600 km on ground)

IFOV:

3 km, binned to 13 x 24 km

Detector:

CCD: 780 x 576 (spectral x spatial) pixels

Mass:

65kg

Duty cycle:

60 minutes on daylight side

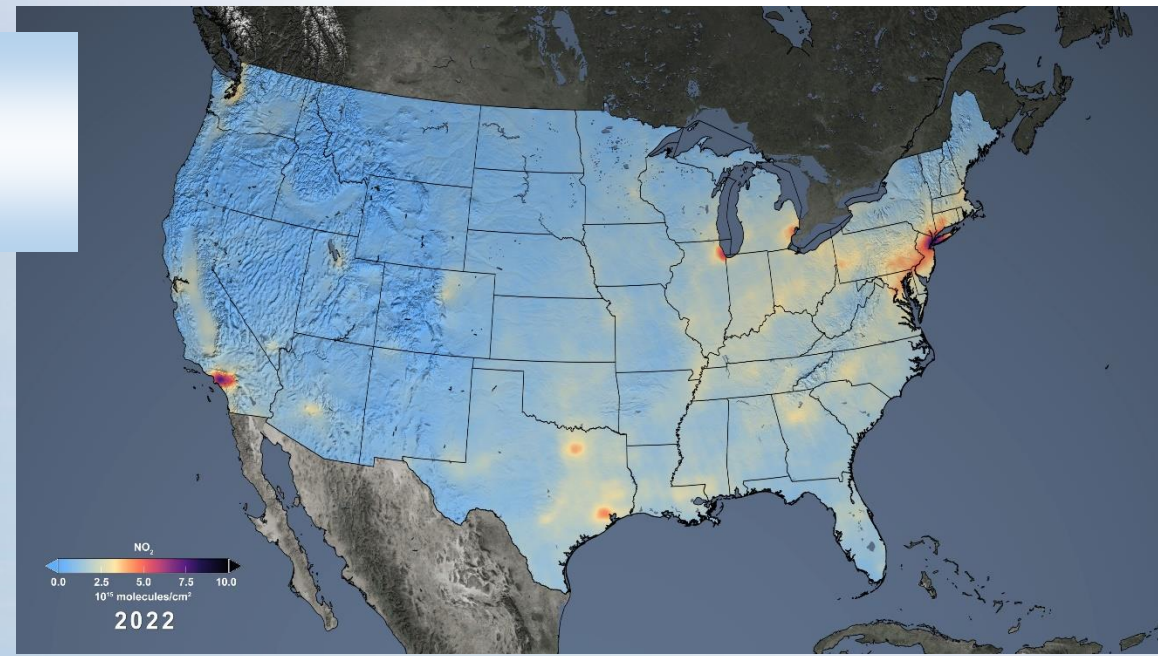
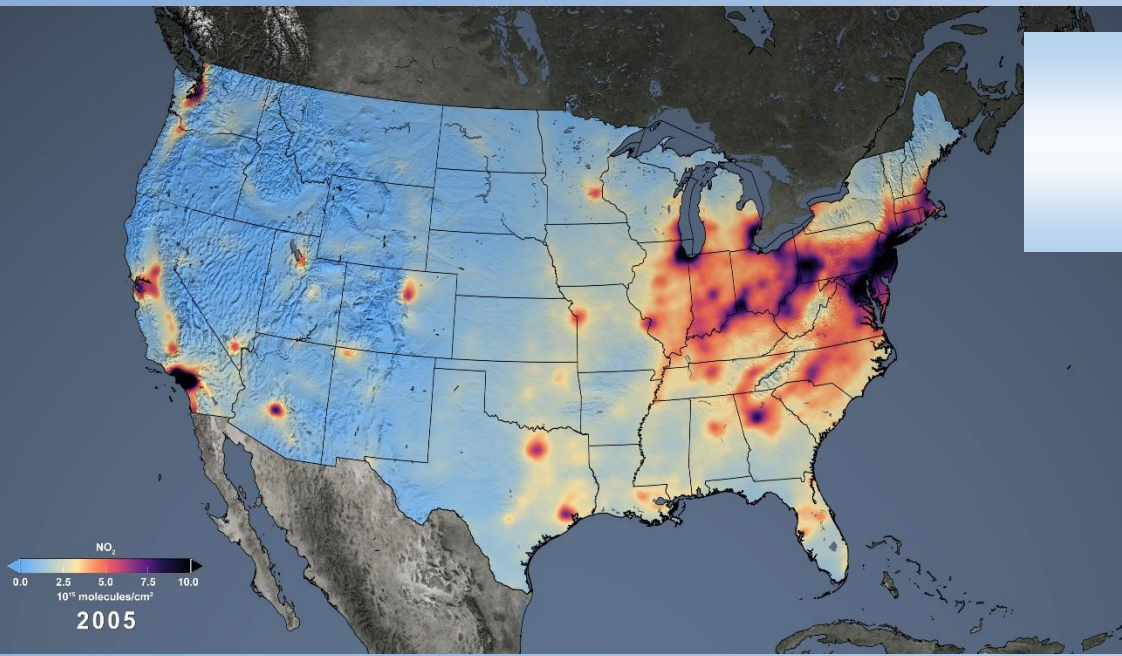
Power:

66 watts

Data rate:

0.8 Mbps (average)

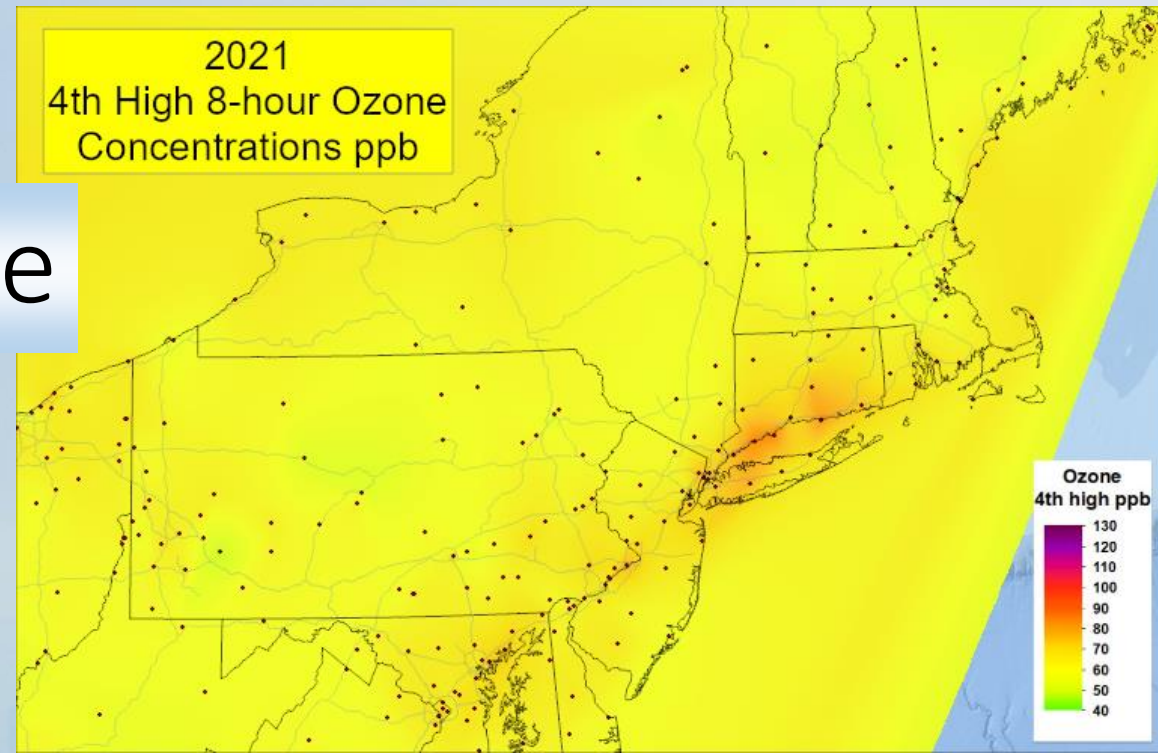
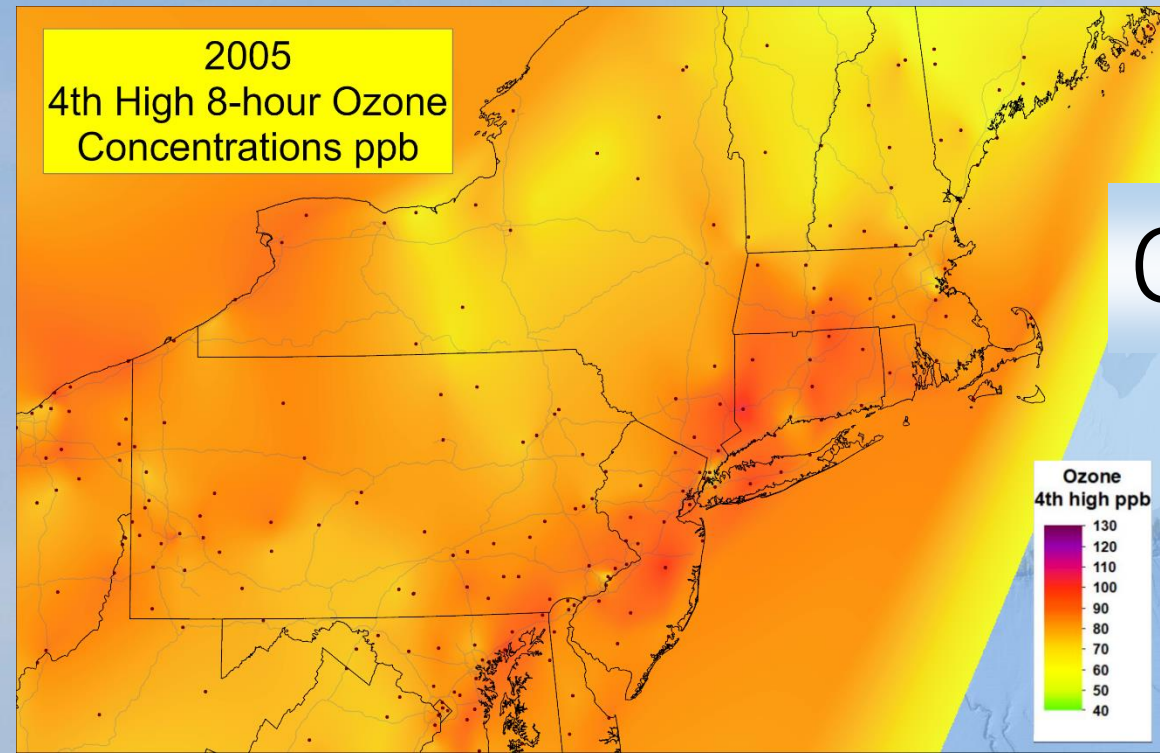
OMI NO₂



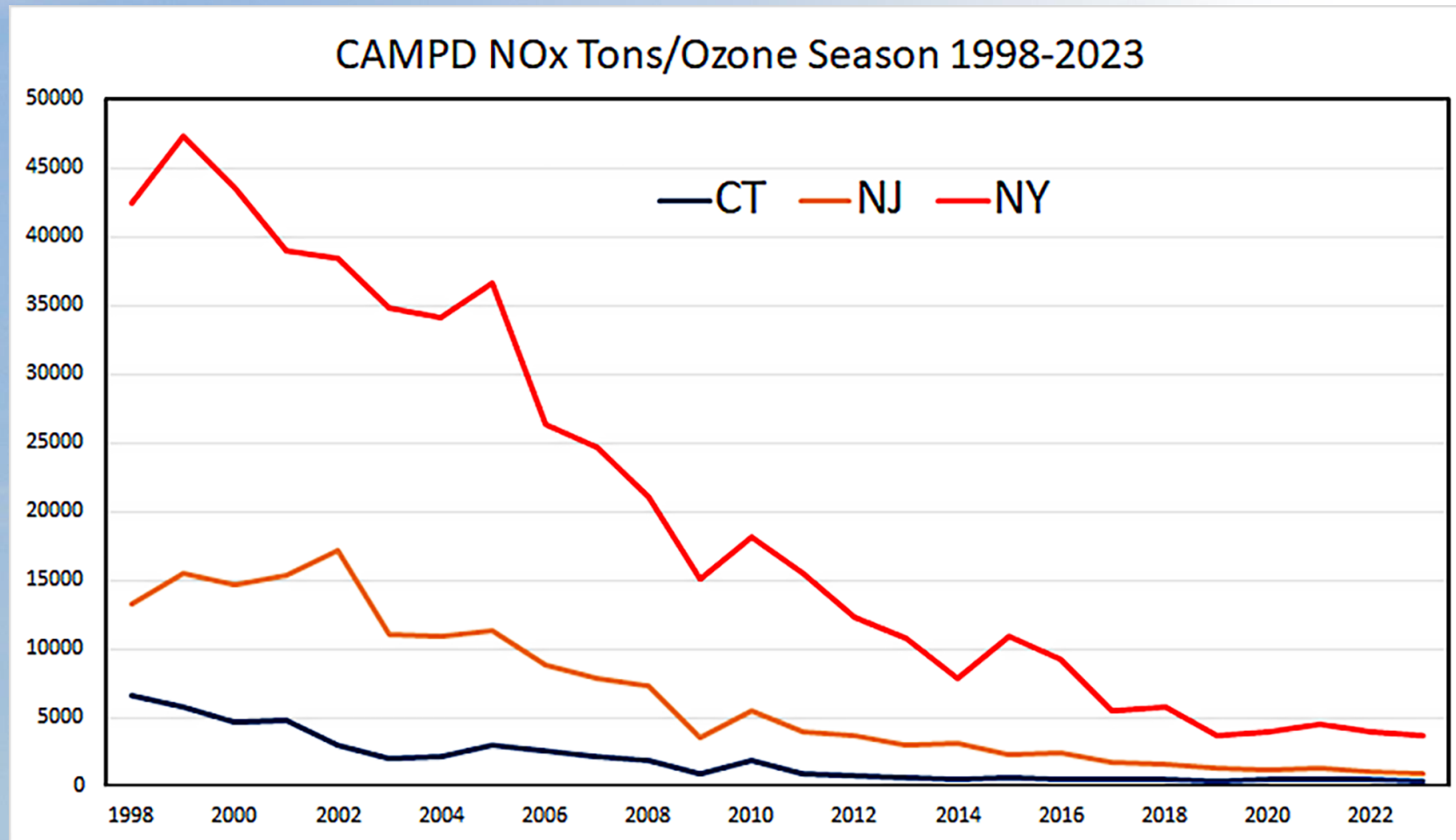
2005
4th High 8-hour Ozone
Concentrations ppb

2021
4th High 8-hour Ozone
Concentrations ppb

Ozone



CAMPD EGU NO2 Trends 1998-2023



In the early years, EGU NOx emissions dominated the ozone production, but now mobile sources dominate.

TROPOMI Copernicus Sentinel-5 (2018)

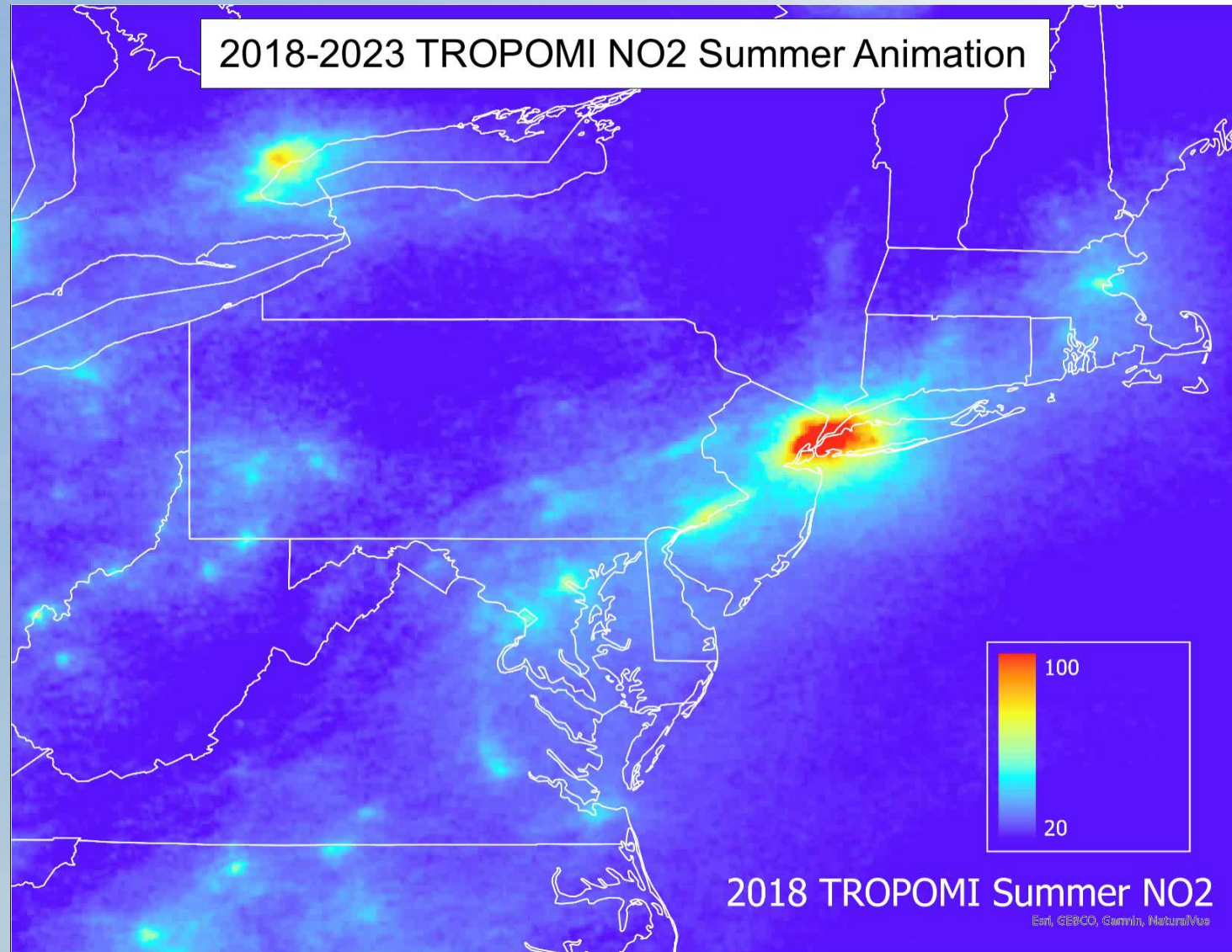


The TROPOMI instrument was successfully launched on 13 October 2017 at 11:27 CEST/09:27 UTC and a series of important calibration and instrument tests were successfully completed during the six-month Commissioning Phase which concluded in late-April 2018

- TROPOMI was a major advancement for measuring urban-scale NO₂.
- Since August 2019, resolution is 5.5 km × 3.5 km



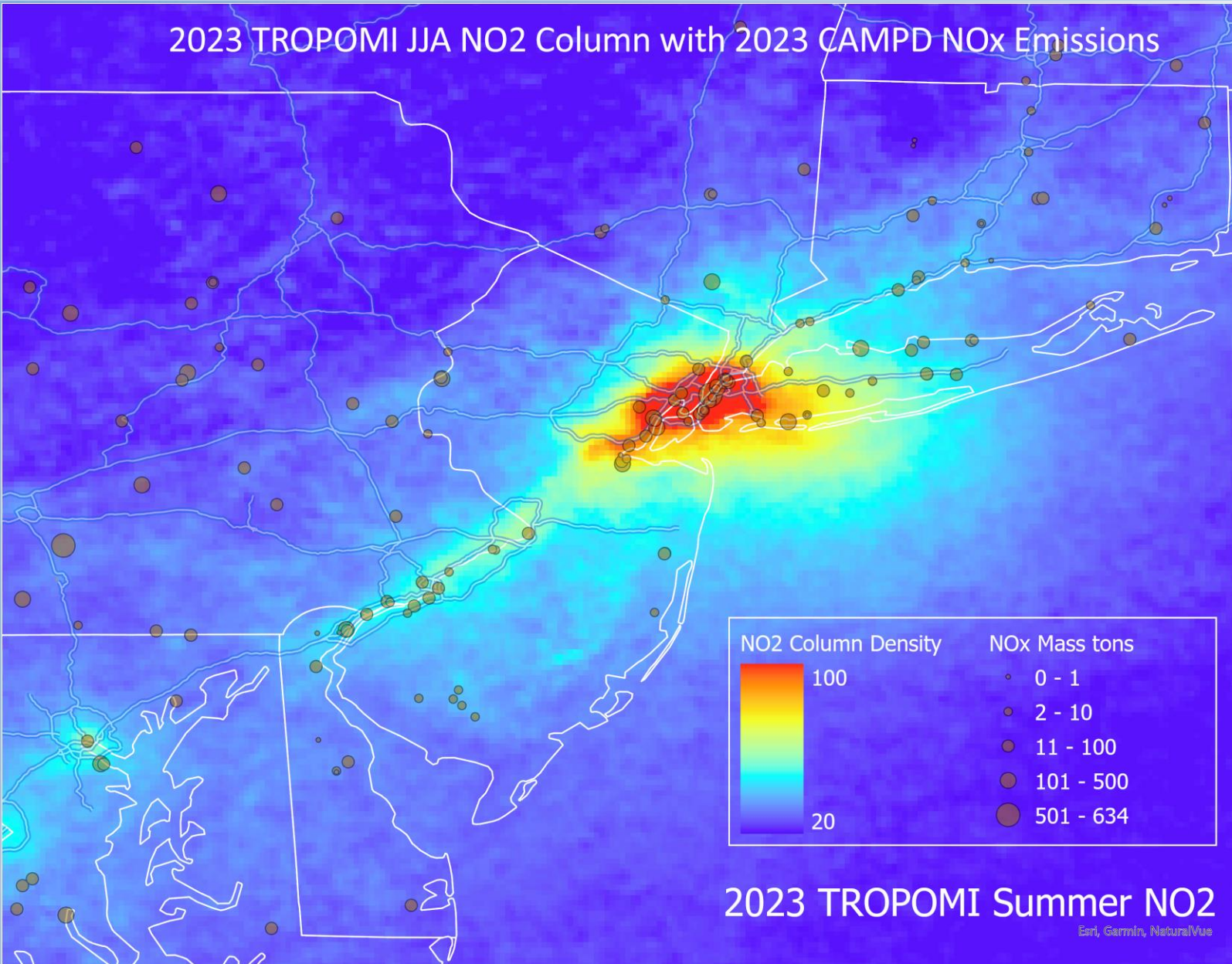
TROPOMI 2018-2023 Summer NO2 Animation



Note the well-documented COVID effect during 2020.

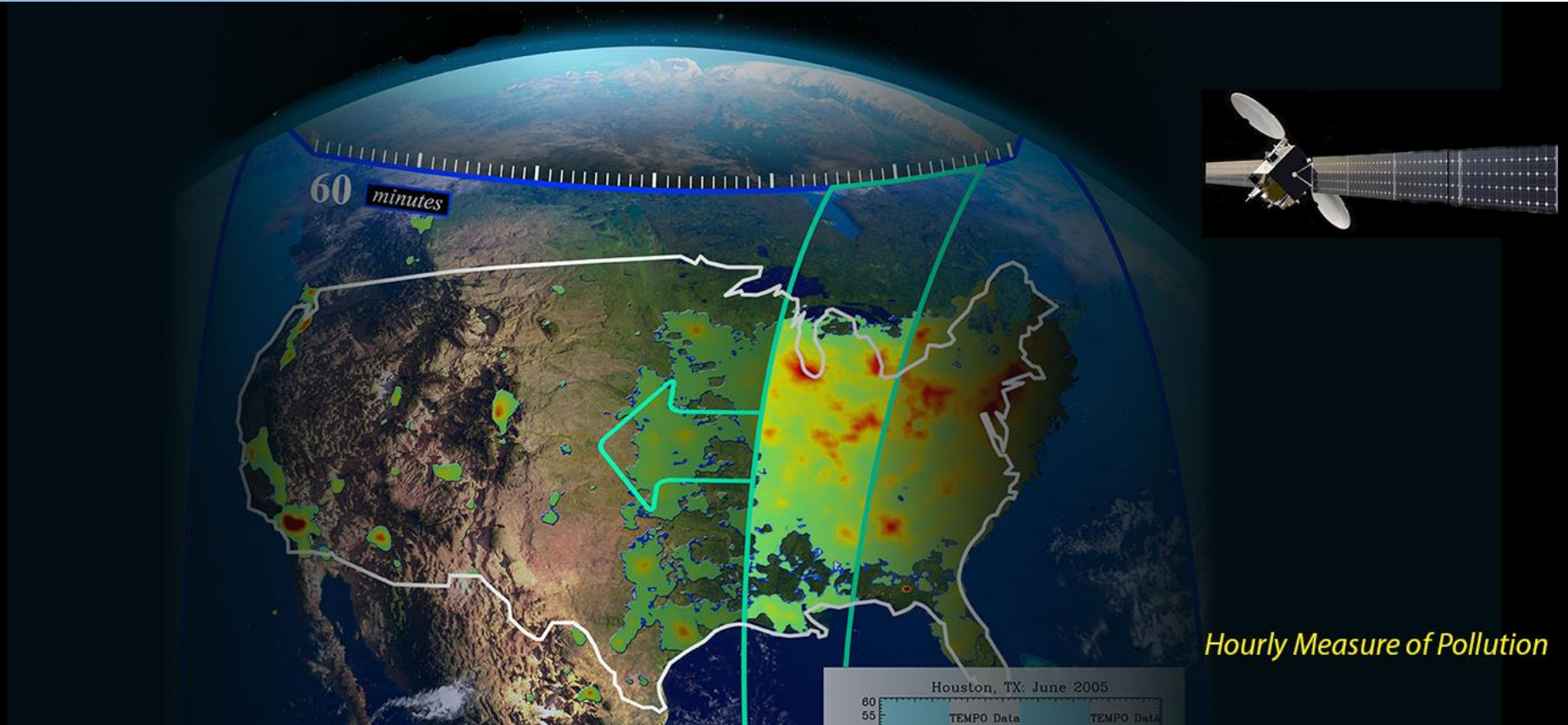
2023 Summer TROPOMI NO2 Column

2023 TROPOMI JJA NO2 Column with 2023 CAMPD NOx Emissions



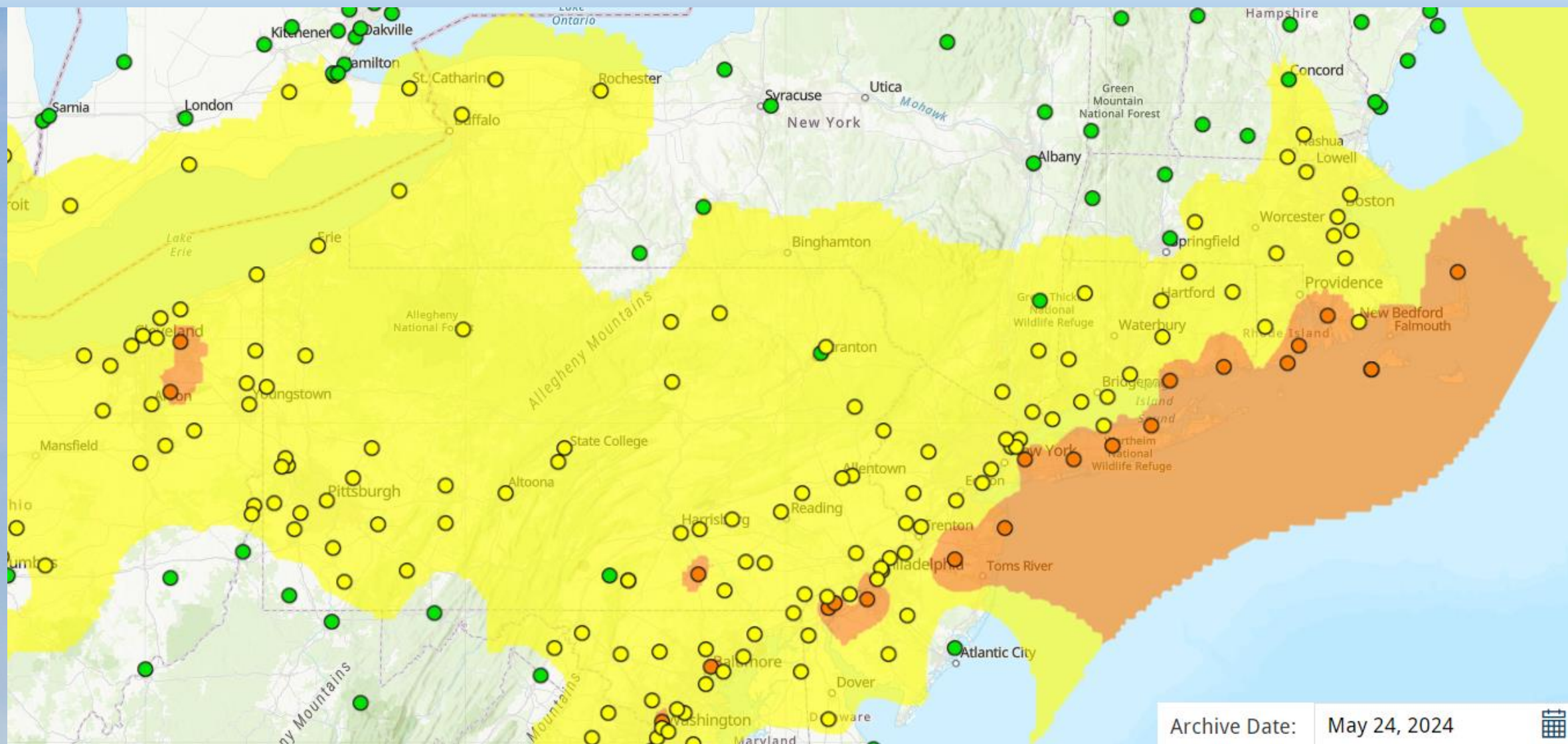
- The TROPOMI NO2 column was a major advancement in tracking urban level NO2 trends.
- Although EGU NO2 emissions around NYC have significantly declined over recent decades, there remains an enormous amount of NO2 sources still contributing to ozone non-attainment in Connecticut.
- The EGU NOx emissions cannot account for the abundance of NO2 still being detected by satellites

TEMPO



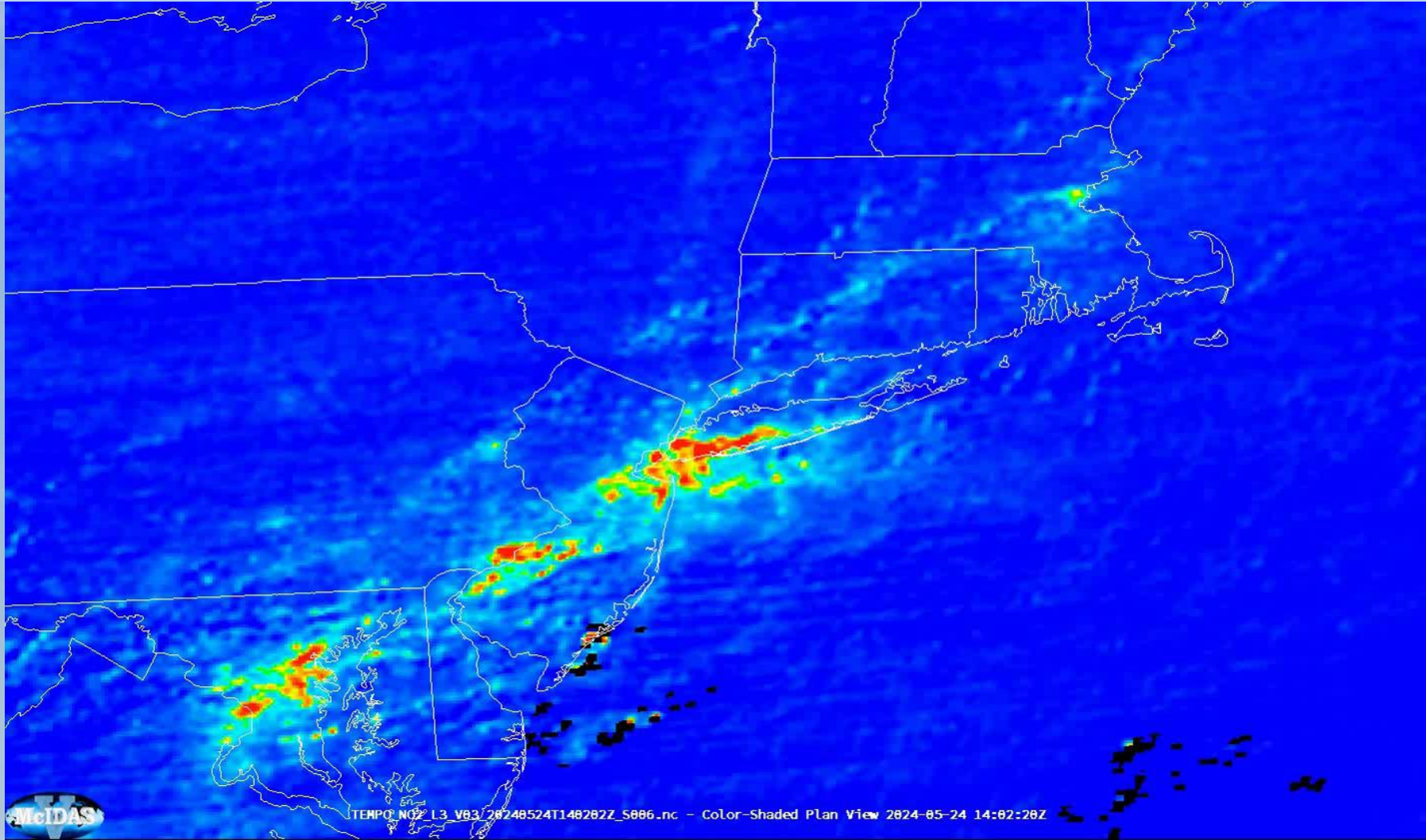
This is the satellite we all have been waiting for!

May 24, 2024 Ozone Event



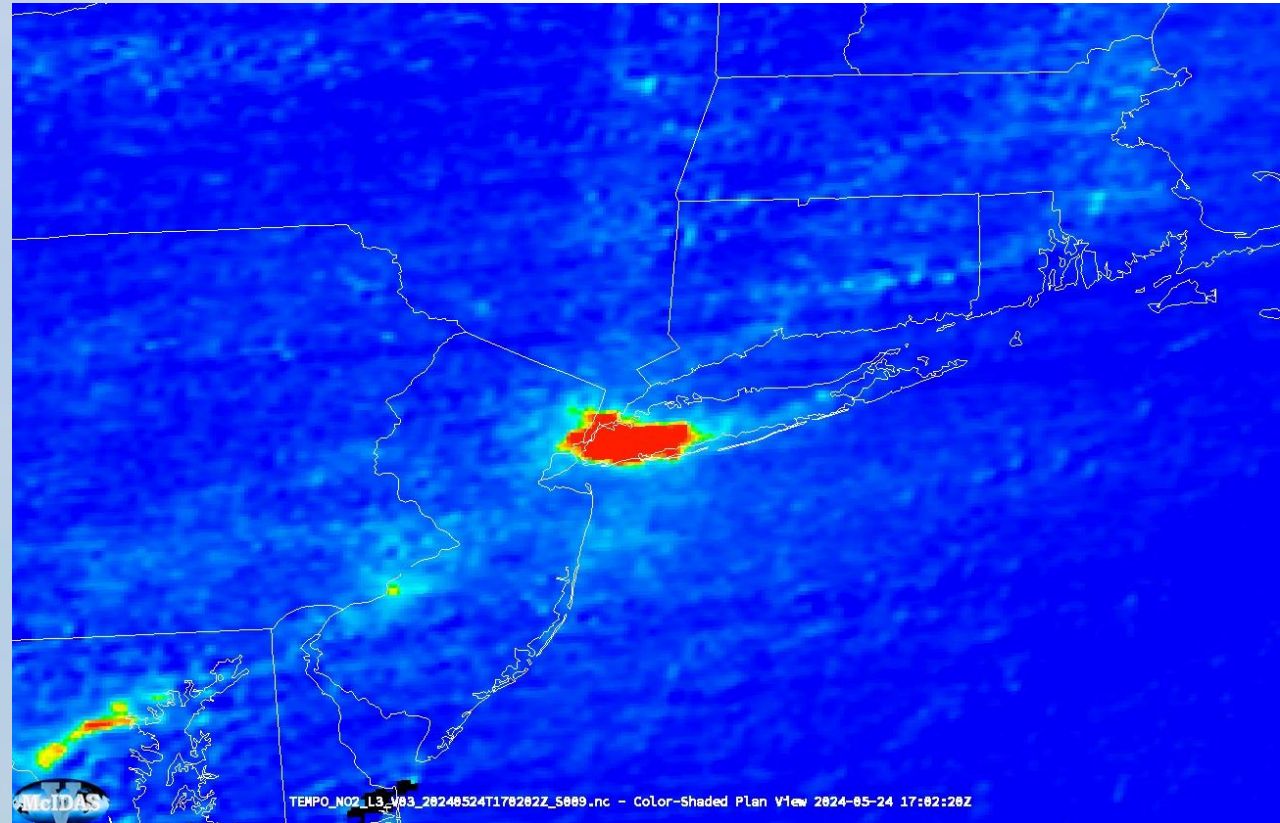
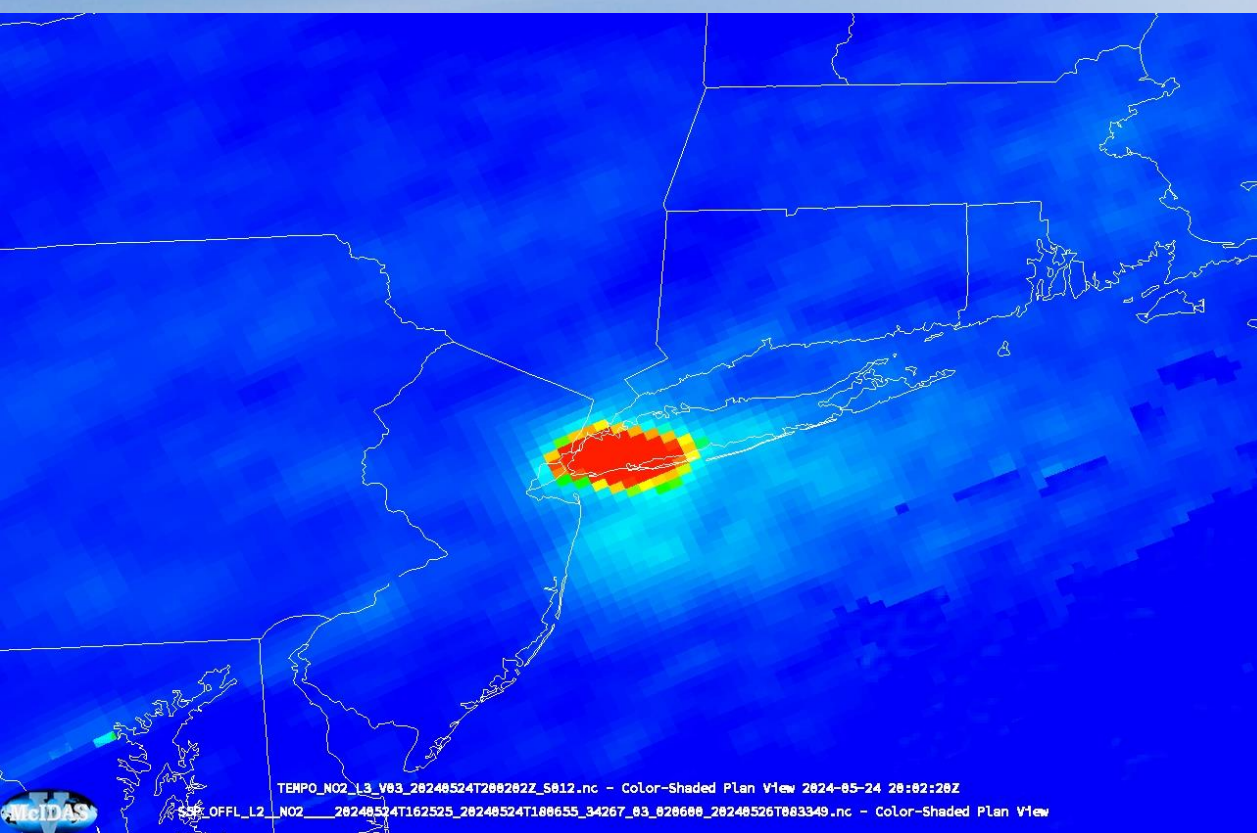
May 24th was the first major ozone event in the Northeast. I chose this date to plot the TEMPO NO₂ column.

TEMPO Tropospheric NO₂, May 24, 2024 (14z-20z)



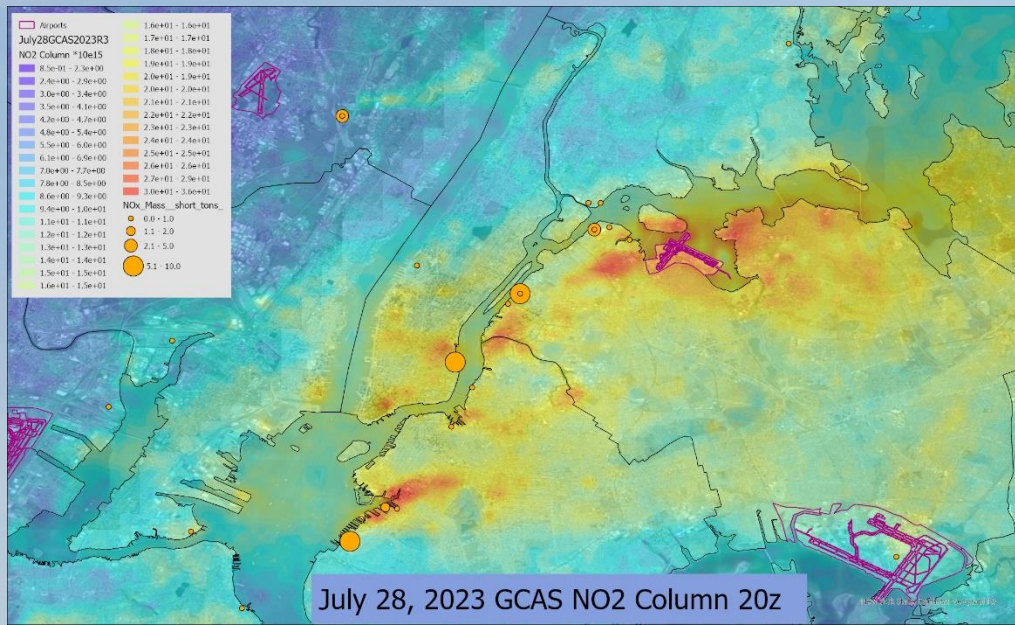
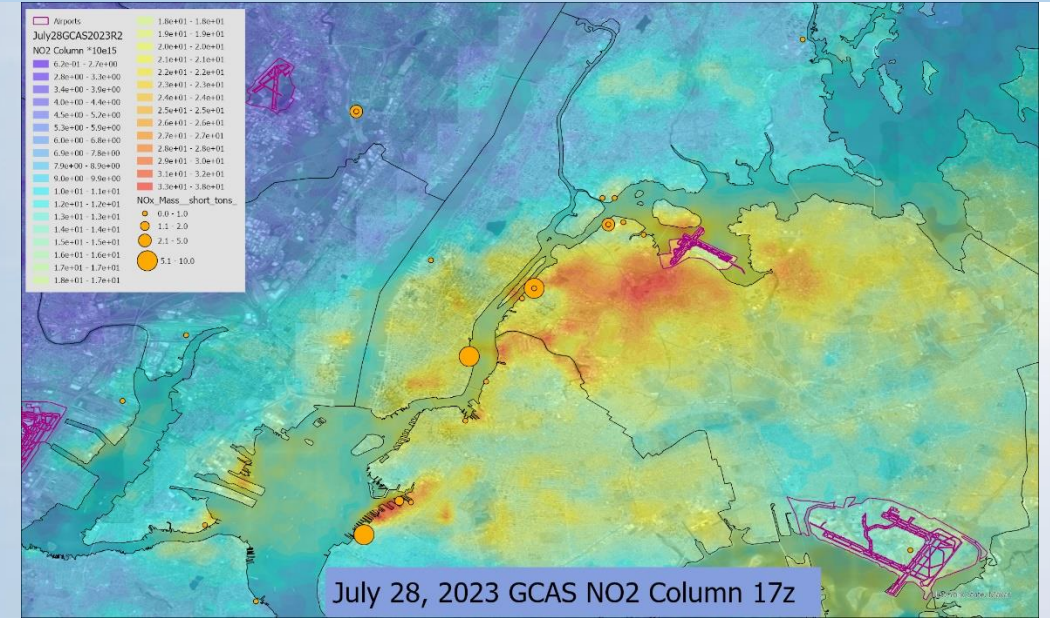
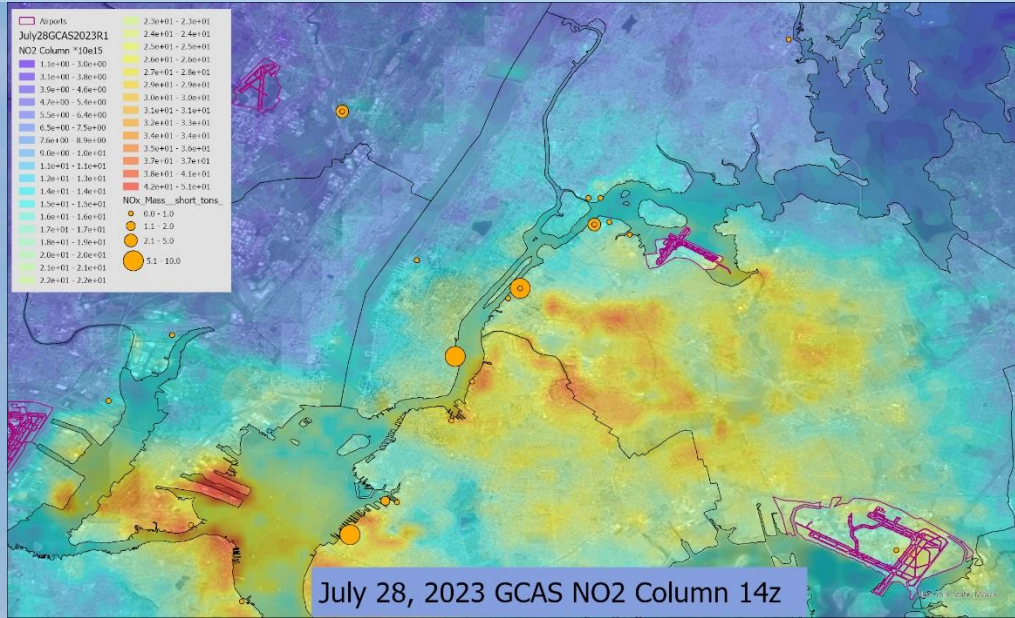
Data is now available for download. This is an animation of the gridded TEMPO_NO2_L3_V03 for May 24, 2024. Thanks to Brad Pierce and his McIDAS team for making this easy to plot!

TEMPO vs. TROPOMI May 24, 2024 17z



This is a comparison of the 17z TROPOMI vs. the TEMPO tropospheric column.

Synergistic TEMPO Air Quality Science (STAQS) GCAS



Thanks to the 2023 STAQS study, Laura Judd conducted overflights of NYC to produce high resolution (250m) NO₂ images that can show the NO₂ sources.

Although this is beyond the reach of satellite instruments, it is a vision for the future!

Questions

Thanks to all the HAQAST collaborators for your assistance over the years!