2024 GeoXO ACX Meeting Connecticut DEEP Stakeholder Needs

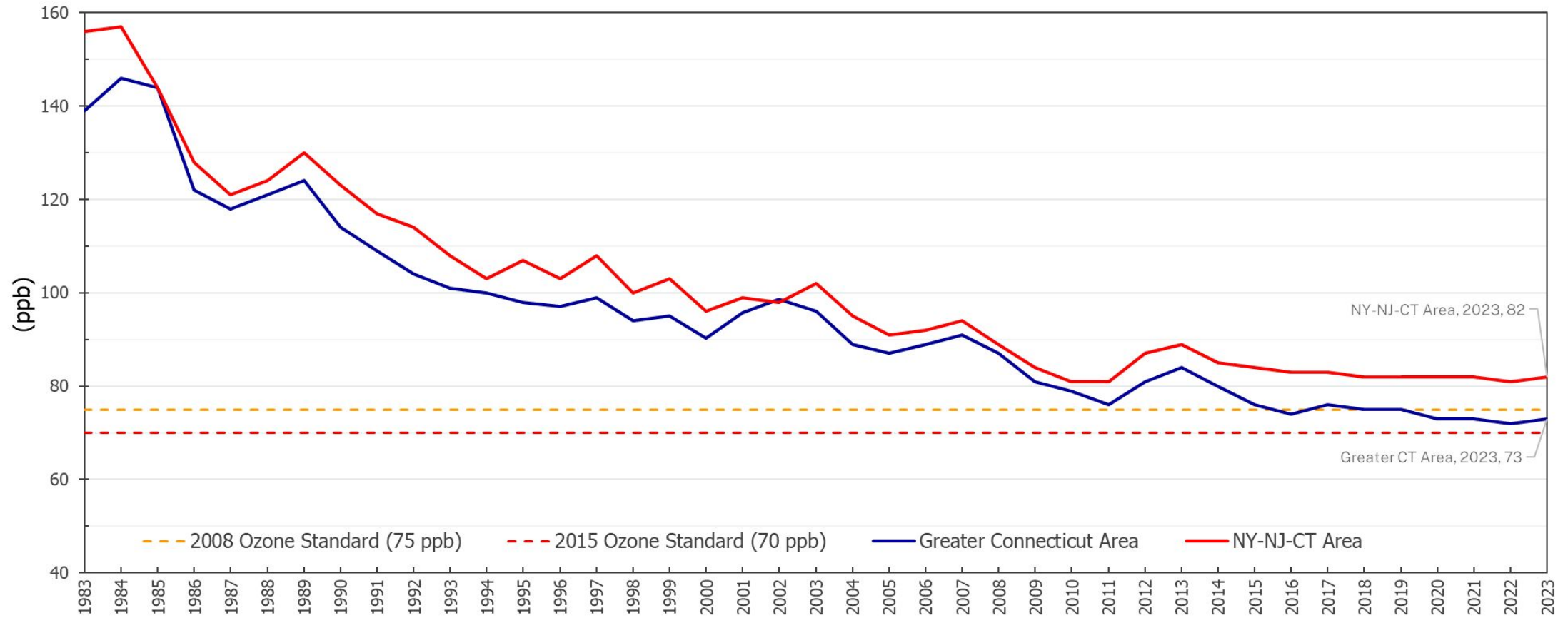**Michael Geigert**
Bureau of Air Management

Connecticut
Department of Energy &
Environmental Protection

Introduction

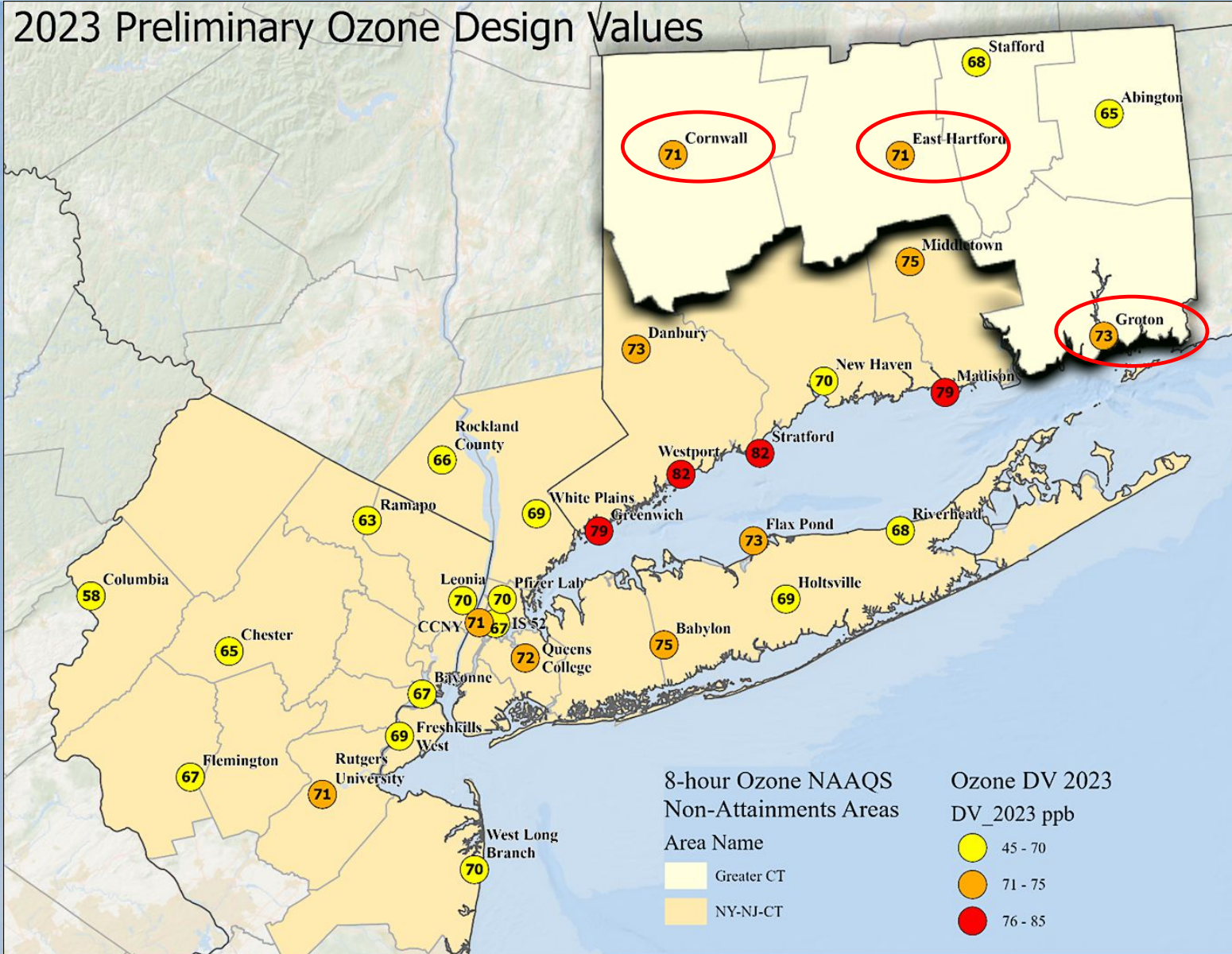Ozone Design Value Trends
Connecticut's Two Nonattainment Areas

- Connect 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


2023 Preliminary Ozone Design Values

- **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

2023 Summer TROPOMI NO2 Column

2023 TROPOMI JJA NO2 Column with 2023 CAMPD NOx Emissions

NO2 Column Density

100

20

NOx Mass tons

0 - 1
2 - 10
11 - 100
101 - 500
501 - 634
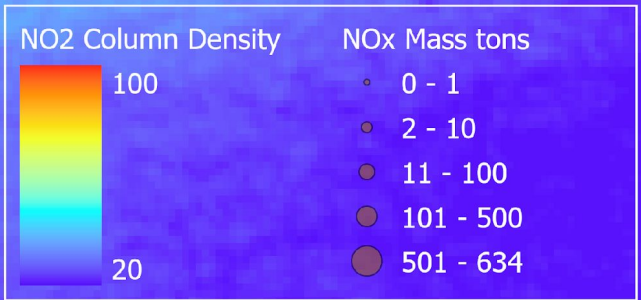
2023 TROPOMI Summer NO2

Esri, Garmin, NaturalVue

- **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.**
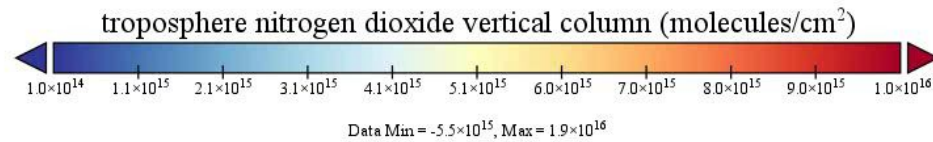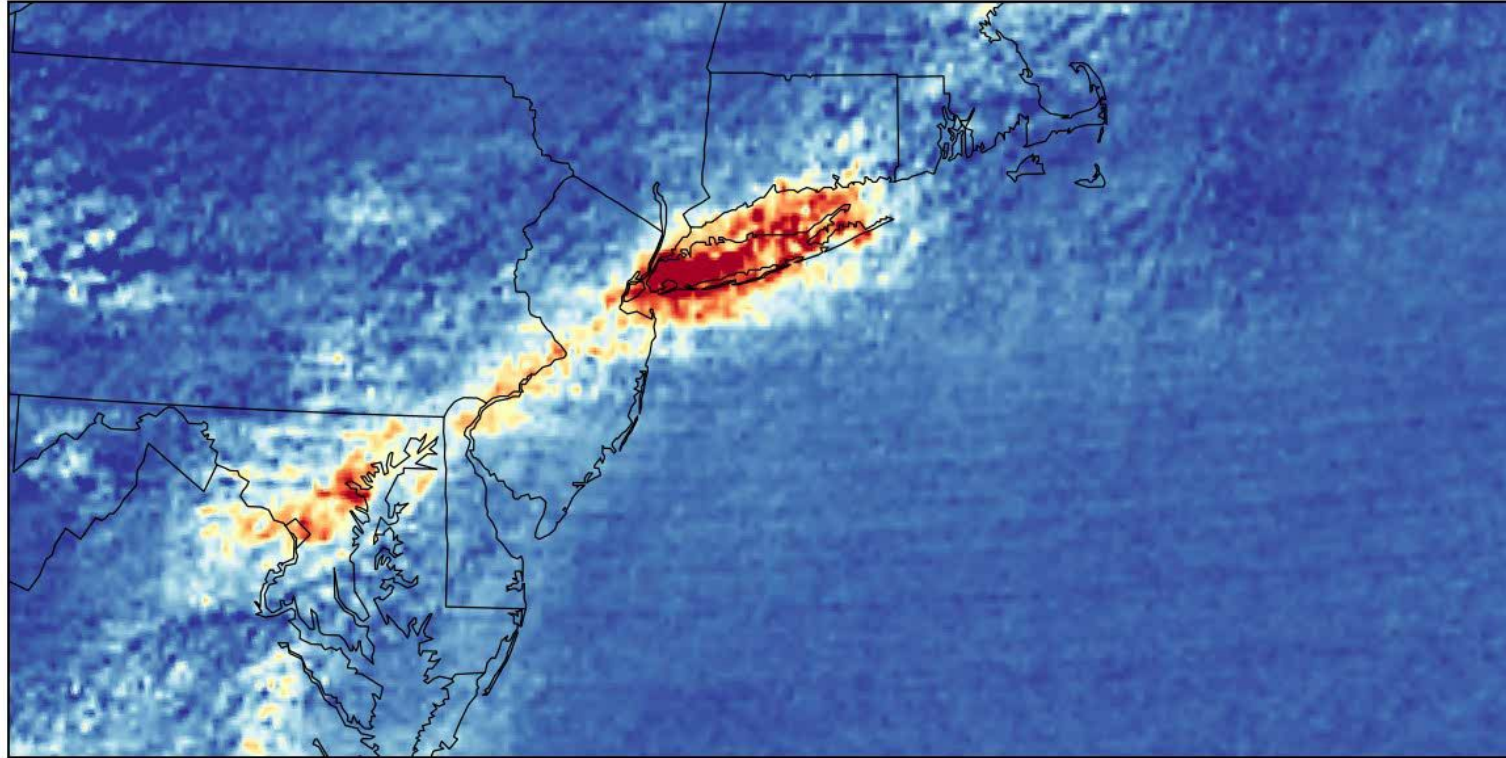
2018-2023 Summer NO2 Animation

2018-2023 TROPOMI NO2 Summer Animation

2018 TROPOMI Summer NO2

Esri, GEBCO, Garmin, NaturalVue
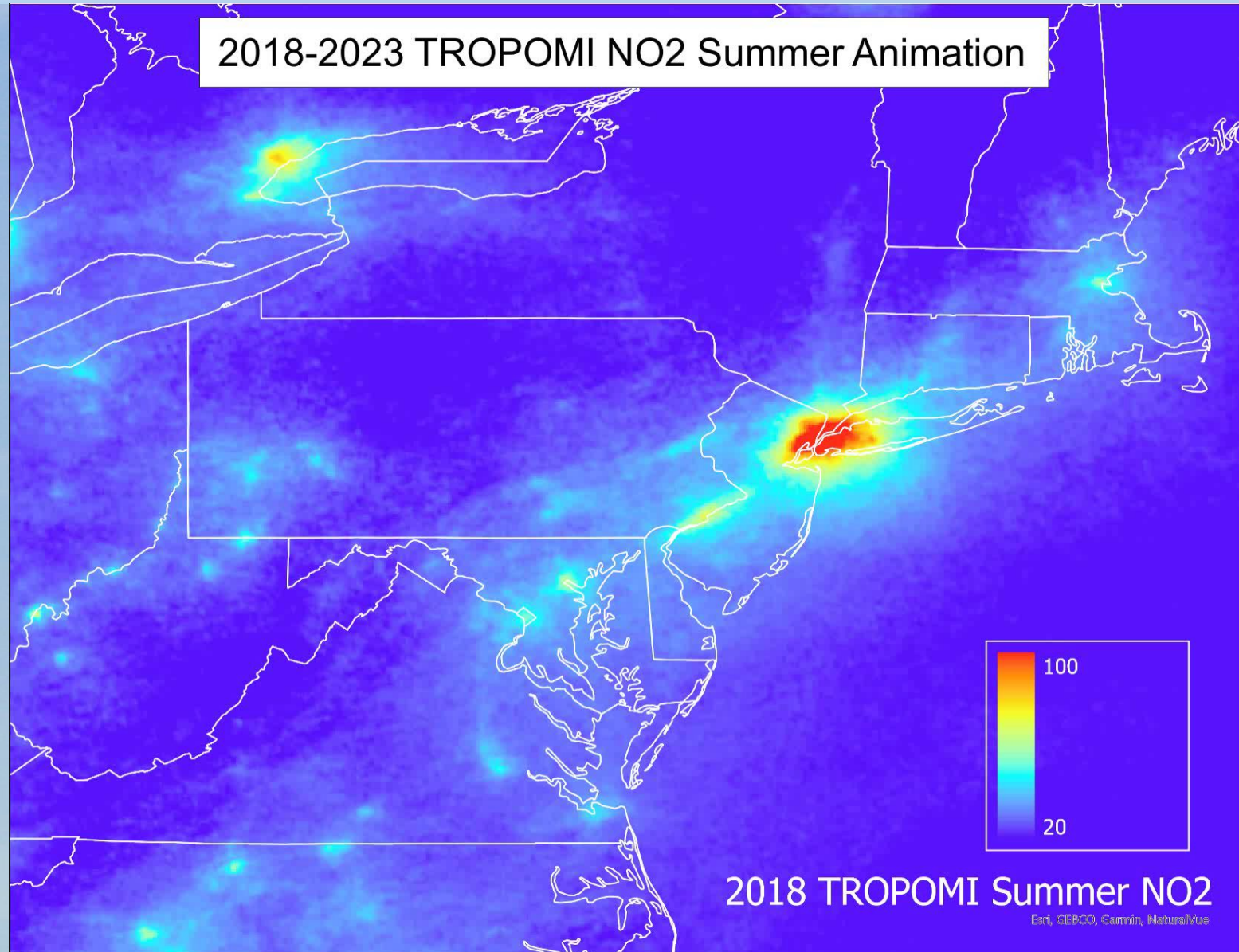
TEMPO NO2 Animation (unvalidated data)

troposphere nitrogen dioxide vertical column
TEMPO August 21, 2023 Hourly NO2 1146-1945z

troposphere nitrogen dioxide vertical column (molecules/cm^2)

1.0×10^{14} 1.1×10^{15} 2.1×10^{15} 3.1×10^{15} 4.1×10^{15} 5.1×10^{15} 6.0×10^{15} 7.0×10^{15} 8.0×10^{15} 9.0×10^{15} 1.0×10^{16}

Data Min = -5.5×10^{15}, Max = 1.9×10^{16}

TEMPO hourly and sub-hourly scans over NYC (and other urban areas and events) are a major advancement in tracking and understanding emission sources. Although unvalidated, this animation is the first time we have seen

August 21, 2023 RSIG Animation
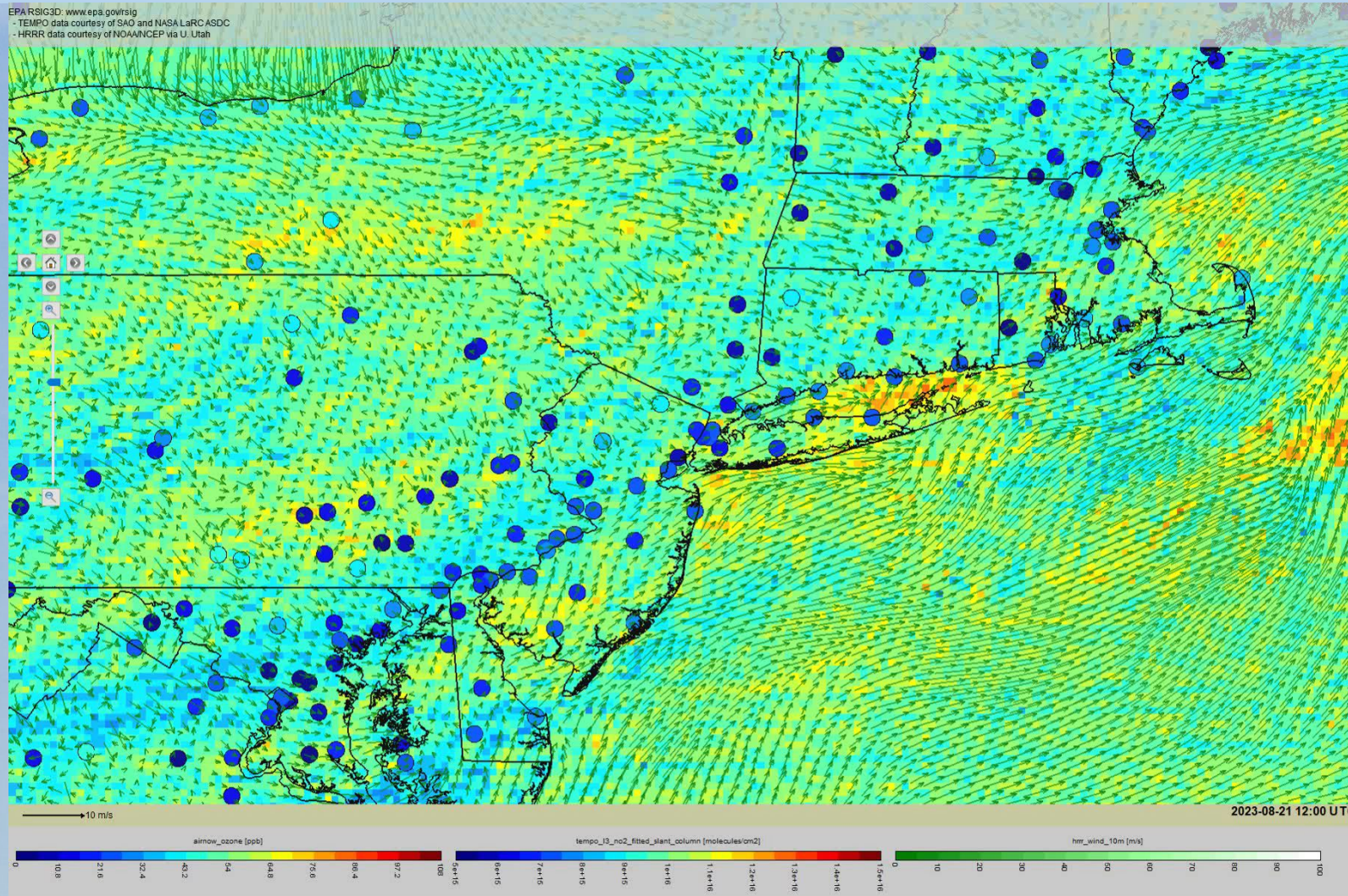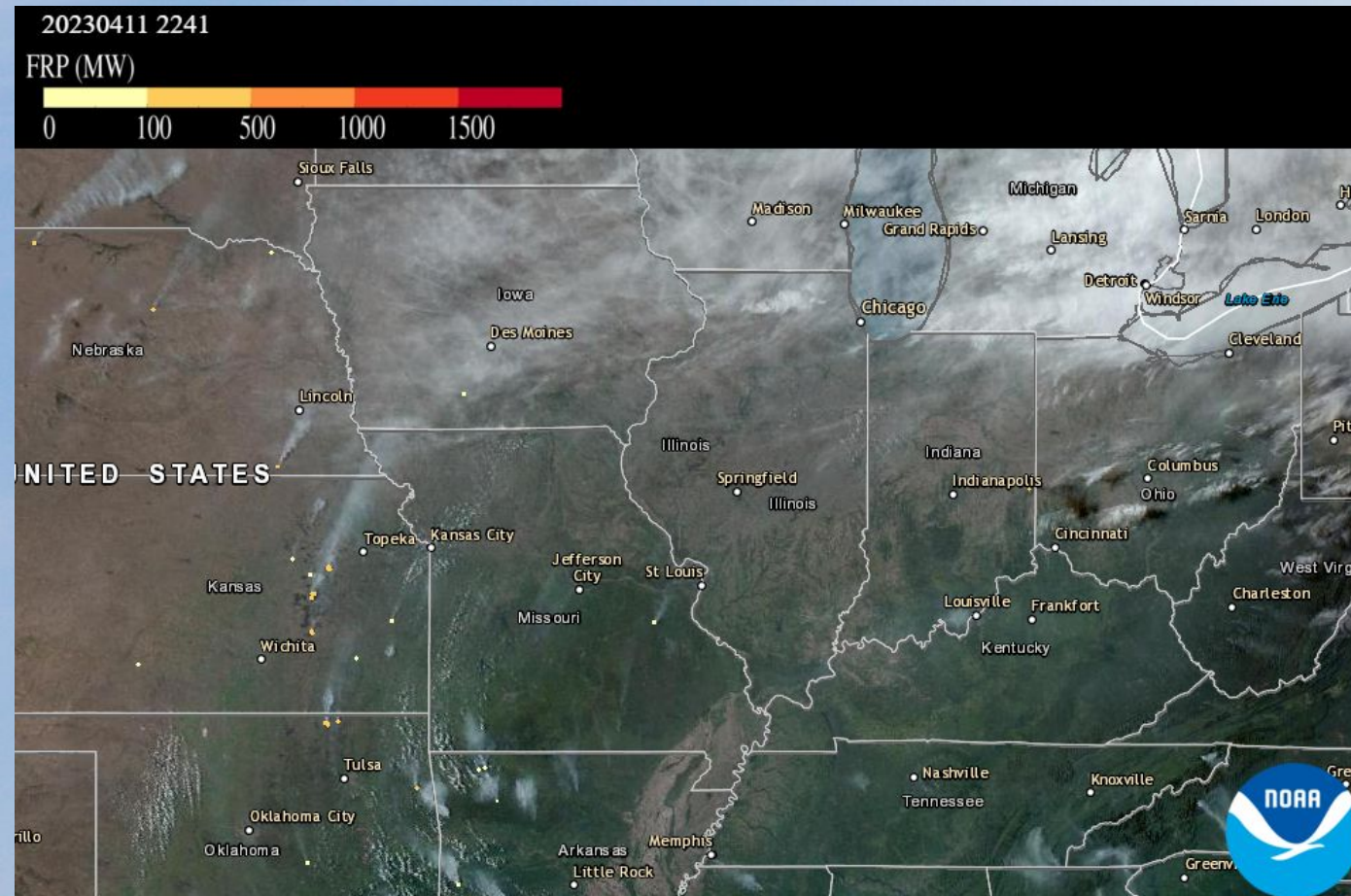

Unofficial Data: Not for Public Release

- Using the **RSIG3d application** provided by EPA, one can add layers to the TEMPO data.
- This animation shows the hourly TEMPO (unvalidated) data with the HRRR winds and observed ozone concentrations.
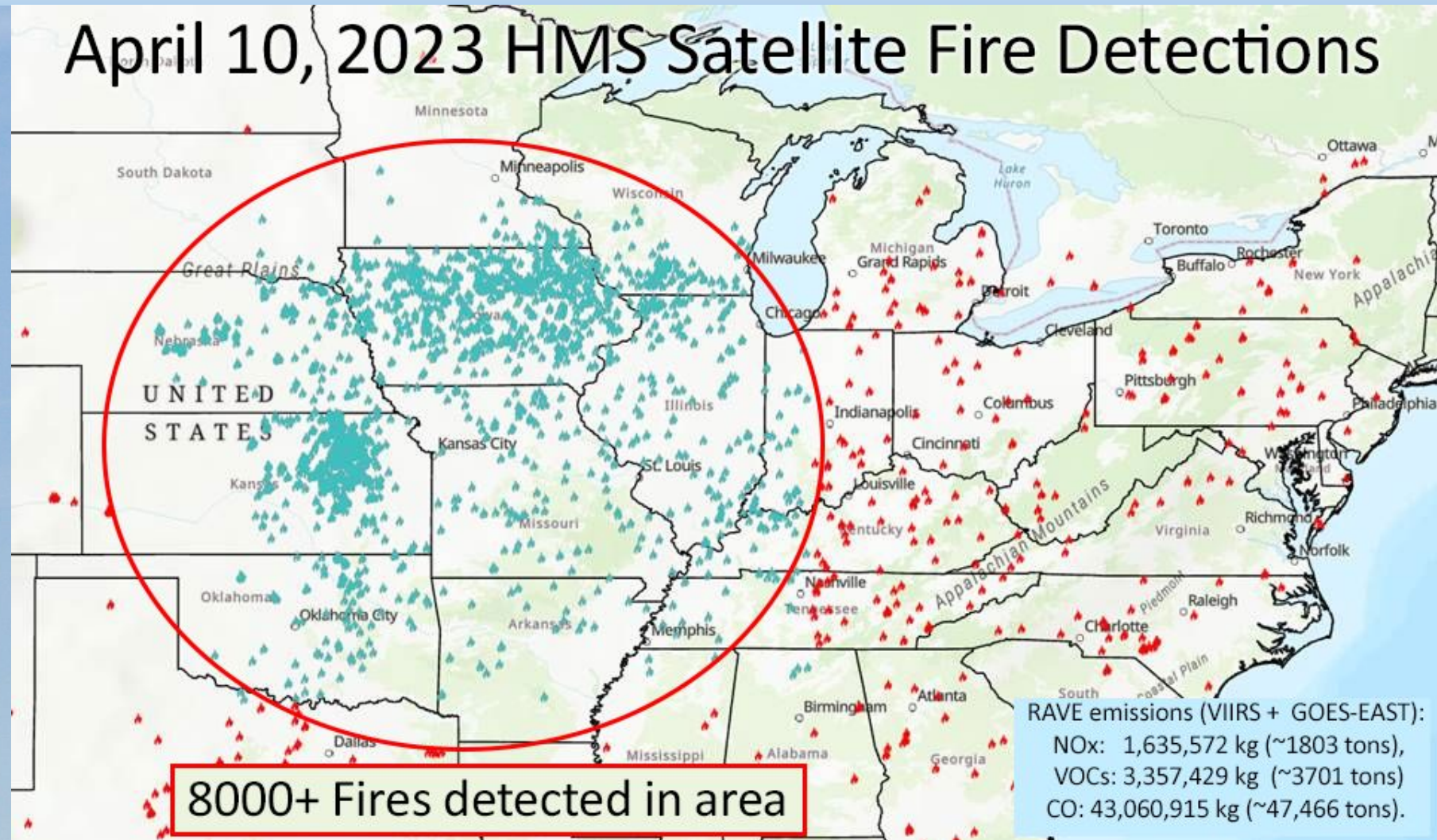
Tracking Prescribed Fire Smoke April 2023

- During April 13-14, 2023, Connecticut experienced a rare ozone exceedance event in April, the first since 2016.

- Due to the widespread nature of this event, it is likely that smoke from fires upwind of Connecticut contributed to the unusually high ozone levels.

- These fires reoccur each year and add a background level of aerosols and ozone.

April 10, 2023 Fire Detections

April 10, 2023 HMS Satellite Fire Detections

8000+ Fires detected in area

RAVE emissions (VIIRS + GOES-EAST):
NOx: 1,635,572 kg (~1803 tons),
VOCs: 3,357,429 kg (~3701 tons)
CO: 43,060,915 kg (~47,466 tons).

- The NOAA NESDIS RAVE Fire Detection algorithm was able to estimate fire emissions from selected fires inside circle. These are significant emissions for a single day. **We need to know the ozone produced from fires.**

The ACX Capabilities

- A robust space-based air quality monitoring capability from ACX will provide complementary measurements to existing surface networks and emissions monitoring operated by national, tribal, state, and local regulatory agencies. High spatial and temporal resolution ACX measurements will be sensitive to the amount and changes of gases and aerosols in the planetary boundary layer.

- ACX will capture ozone measurements, ozone and aerosol precursor data and provide an aerosol layer height.

- ACX continuous measurements will provide better forecasts for these components, with the highest priority factors for air quality monitoring:
  - Ozone (O3)
  - Particulate matter (PM)
  - Nitrogen dioxide (NO2)
  - Formaldehyde (CH2O)
  - Glyoxal (C2H2O2)
  - Sulfur dioxide (SO2)

- ACX will provide $(5 \text{ km})^2$ equivalent spatial resolution at nadir.

GeoXO ACX Stakeholder Needs

Although we have not yet experienced the full capability of the TEMPO instrumentation, it appears that GeoXO ACX will be able to match, if not exceed its capabilities.

- We need to maintain the pixel resolution, for urban-scale surveillance;

- Need to be able to better resolve surface level concentrations, which is always a challenge, especially for ozone;

- Need to be able to, through post processing and modeling, to better determine ozone production and transport from smoke;

- Need to be able to resolve smaller fire FRPs, than currently possible with GOES, to more accurately calculate fire emissions for modeling and inventory. Many fires still go undetected.

- Data output netcdf and hdf files need to be formatted to be easily displayed in GIS applications.