

weather.msfc.nasa.gov/tempo/



Tropospheric Emissions:
Monitoring of Pollution
Hourly Measurement of Pollution



Smithsonian Astrophysical
Observatory



<http://tempo.si.edu/>



Health & AQ Applications of TEMPO

HAQAST Massachusetts
Cambridge, MA
June 4, 2024

Aaron Naeger
& TEMPO Team

TEMPO Mission Applications Lead
NASA Marshall Space Flight Center

U.S. Government sponsorship acknowledged.



SPORT

UAH
THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE



Panelists



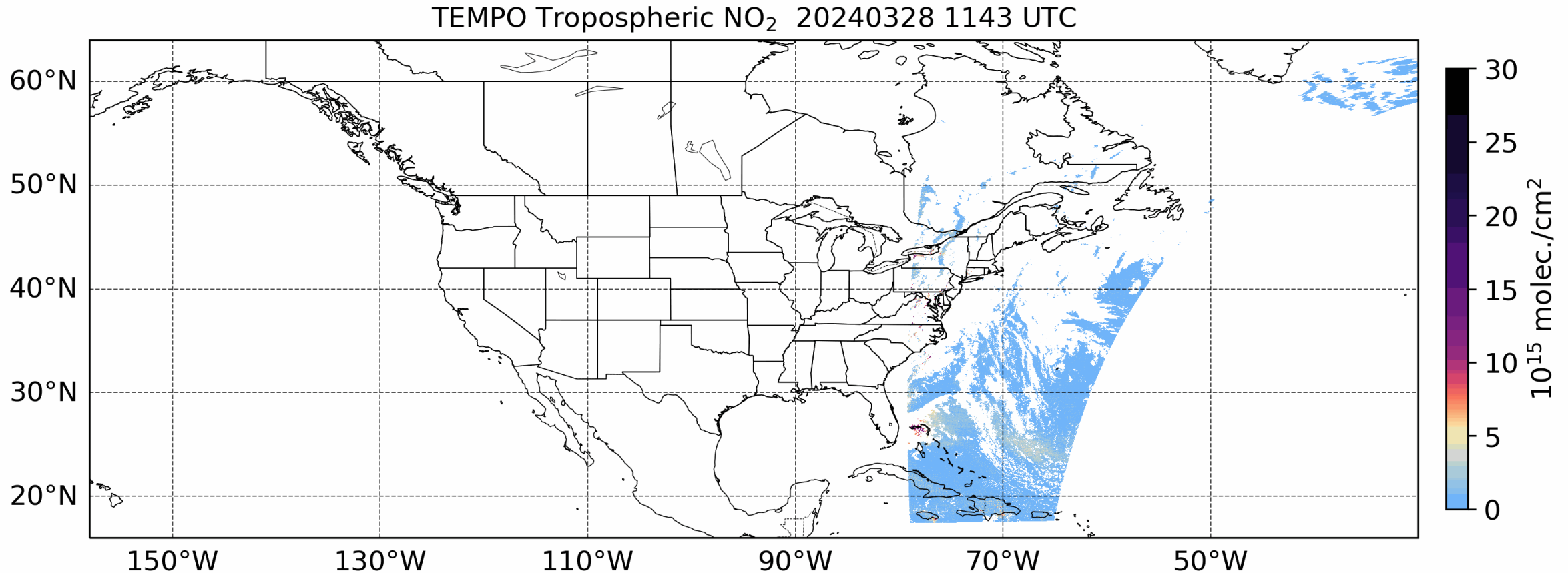
- ☐ Doug Boyer and Chola Regmi – Texas Commission on Environmental Air Quality
- ☐ Arlene Fiore – HAQAST member and Tiger Team Lead, Massachusetts Institute of Technology
- ☐ Tracey Holloway – HAQAST Team Lead, University of Wisconsin-Madison
- ☐ Caroline Nowlan – Harvard Smithsonian Astrophysical Observatory



TEMPO Scan Operations – March 28, 2024



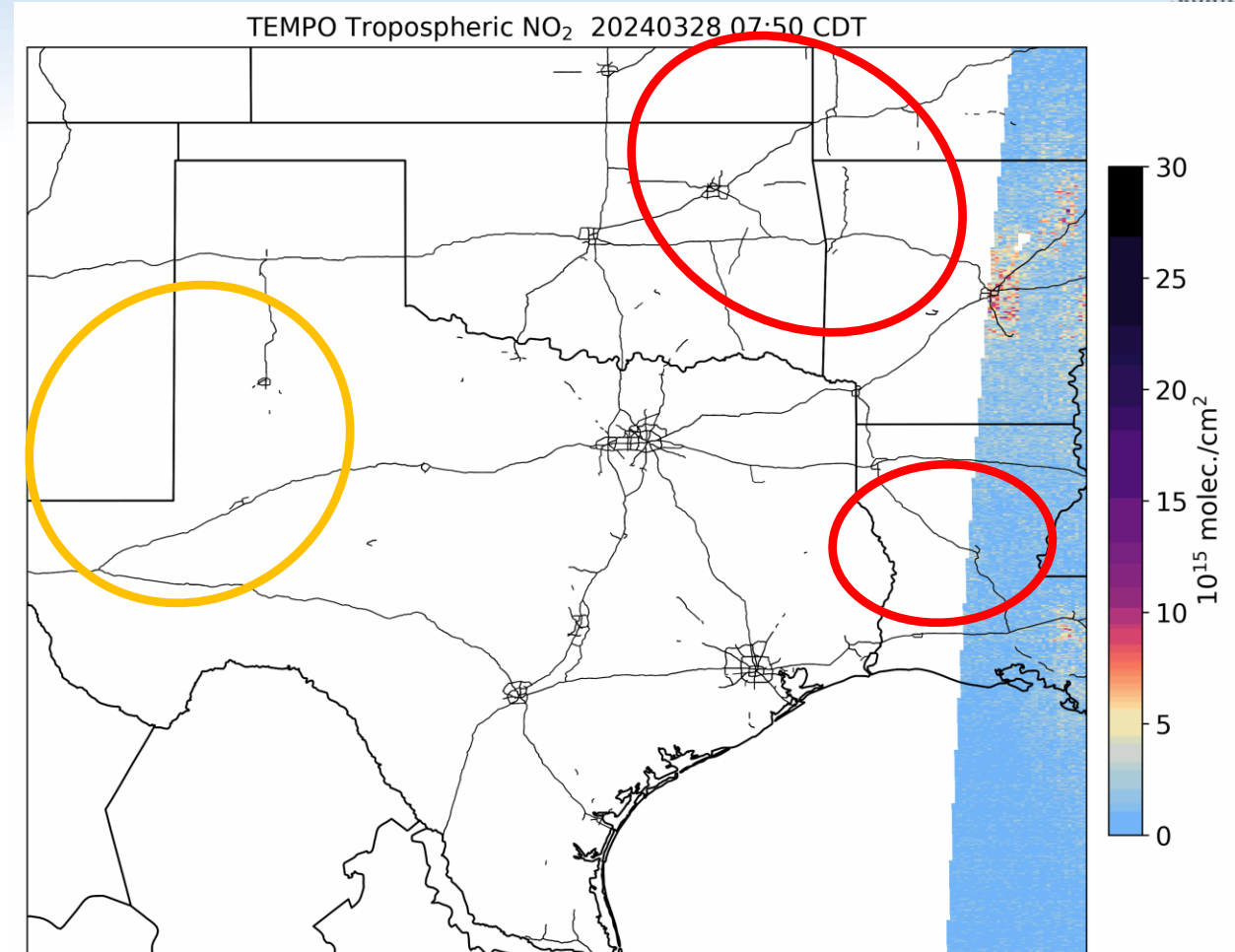
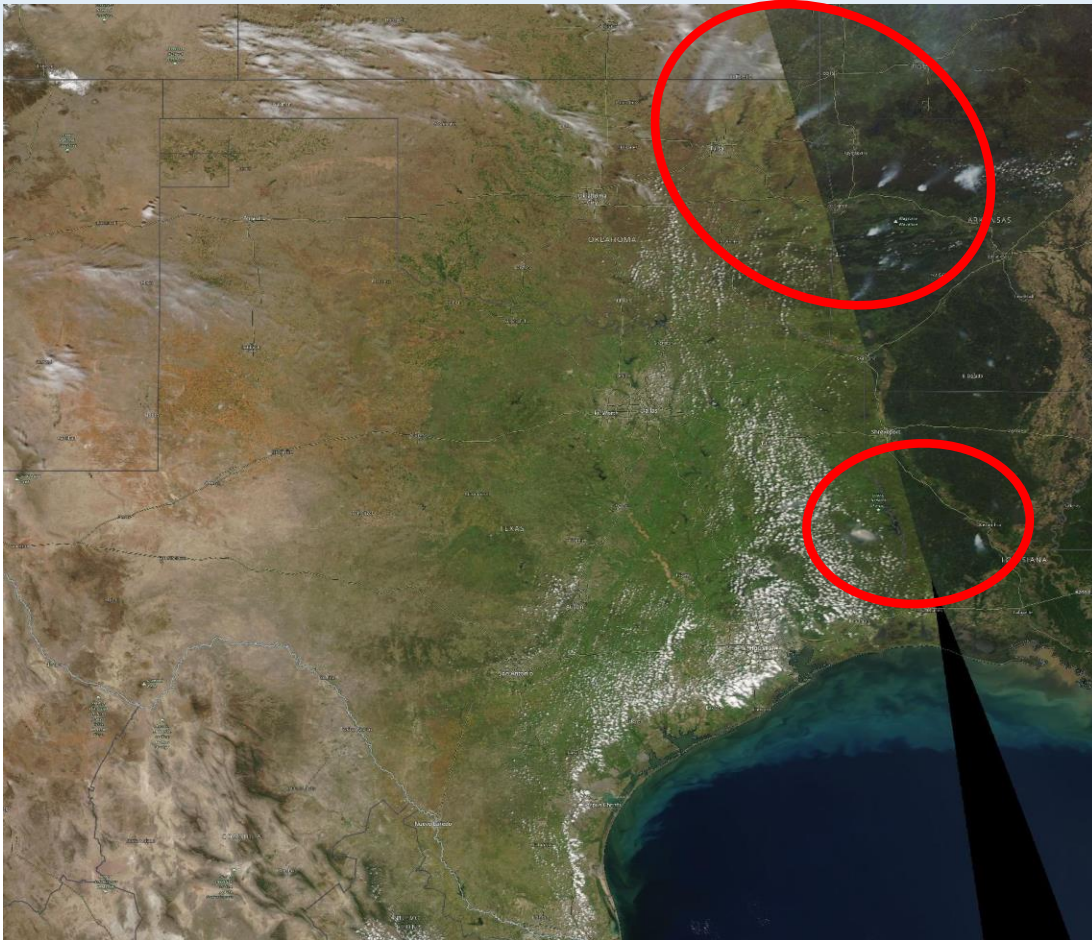
Beta Version 2 Data!



TEMPO started **nominal (normal) East-West scan operations on Oct. 19, 2023**, consisting of **standard (hourly daytime) scans** over full FoR (Field of Regard) and **optimized (~40 minute) scans** over daylight portions of the FoR during the morning and afternoon

South U.S. Zoom – NO₂

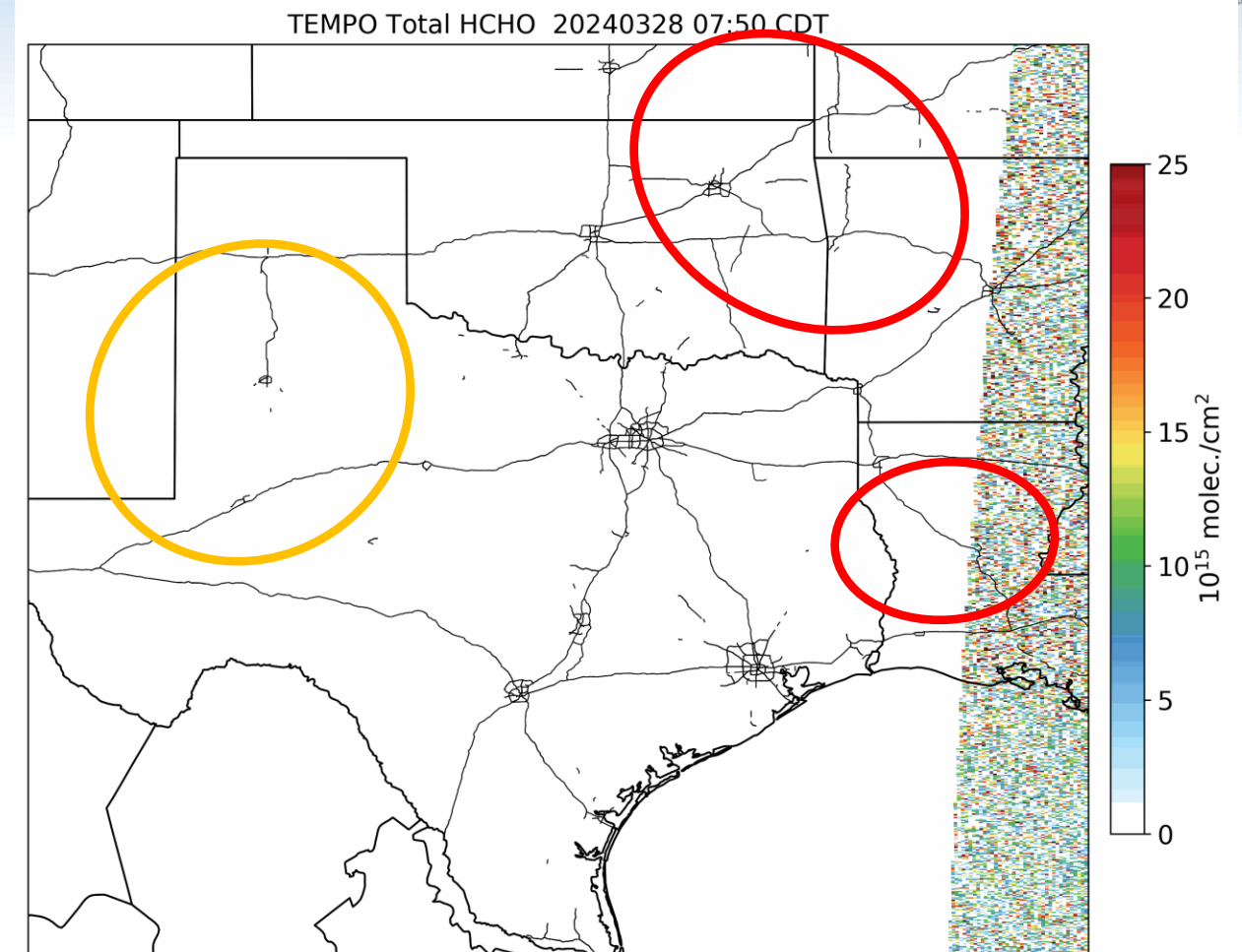
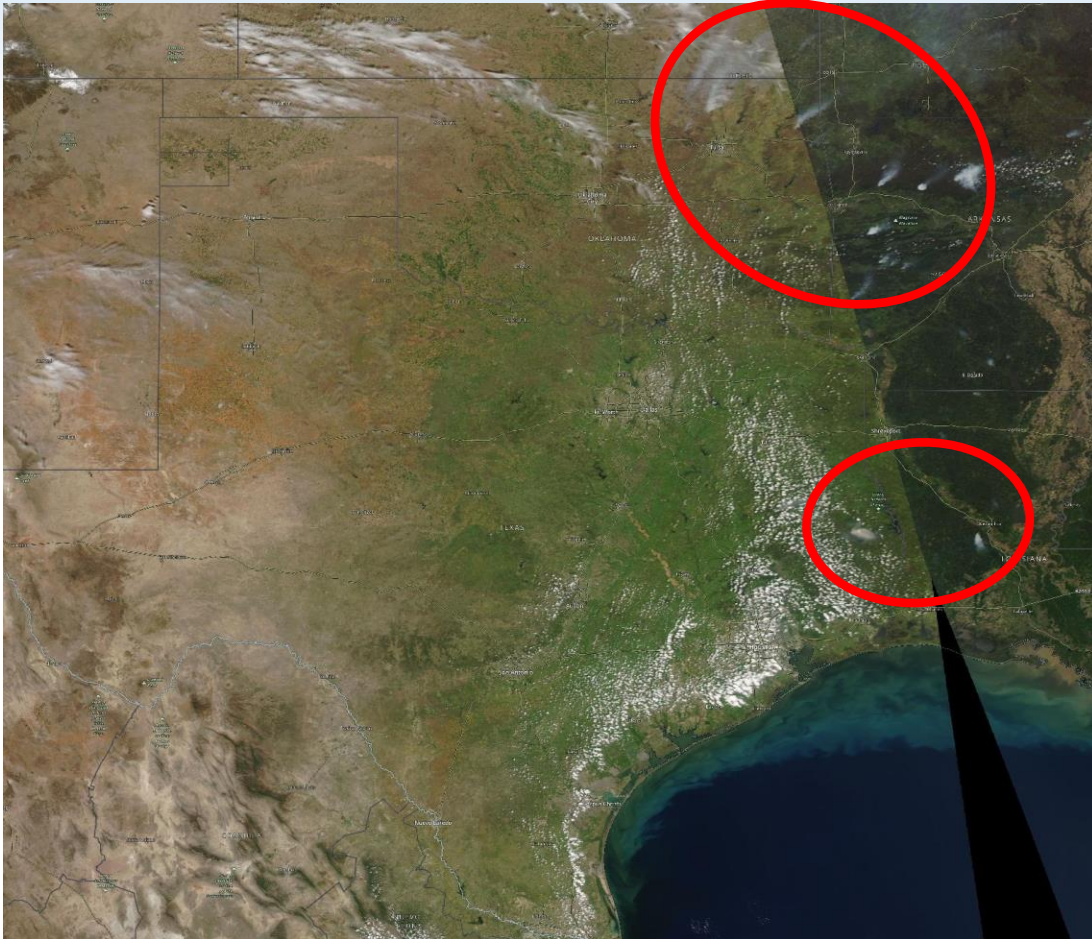
Beta Version 2 Data!



- ❑ A mostly clear day across South U.S. with smoke from prescribed burns during the afternoon
- ❑ TEMPO captured high NO₂ levels across cities, traffic corridors, power plants, **oil and gas fields**, and **prescribed burns**

South U.S. Zoom – HCHO

Beta Version 2 Data!

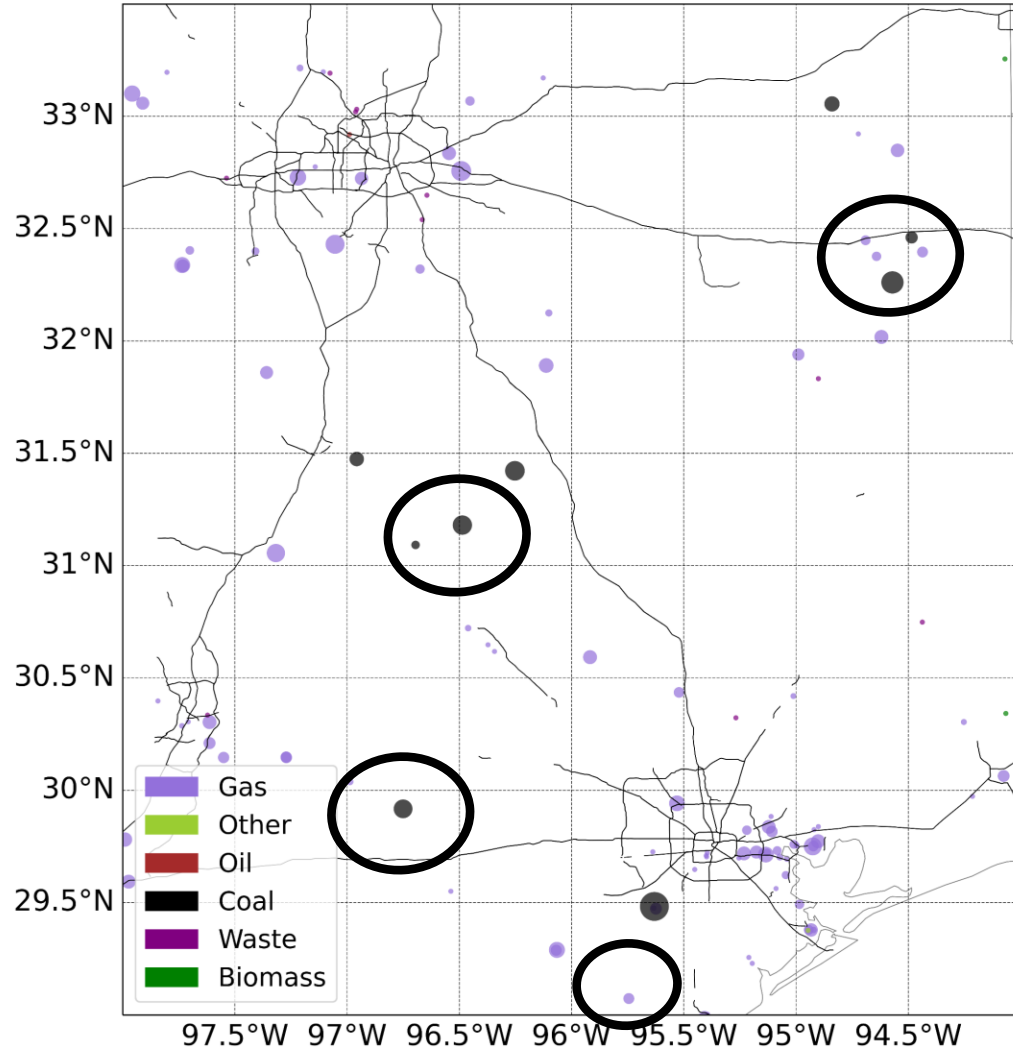


- ☐ High HCHO levels across Houston and **prescribed burns**
- ☐ Formation of secondary formaldehyde downwind of Permian basin

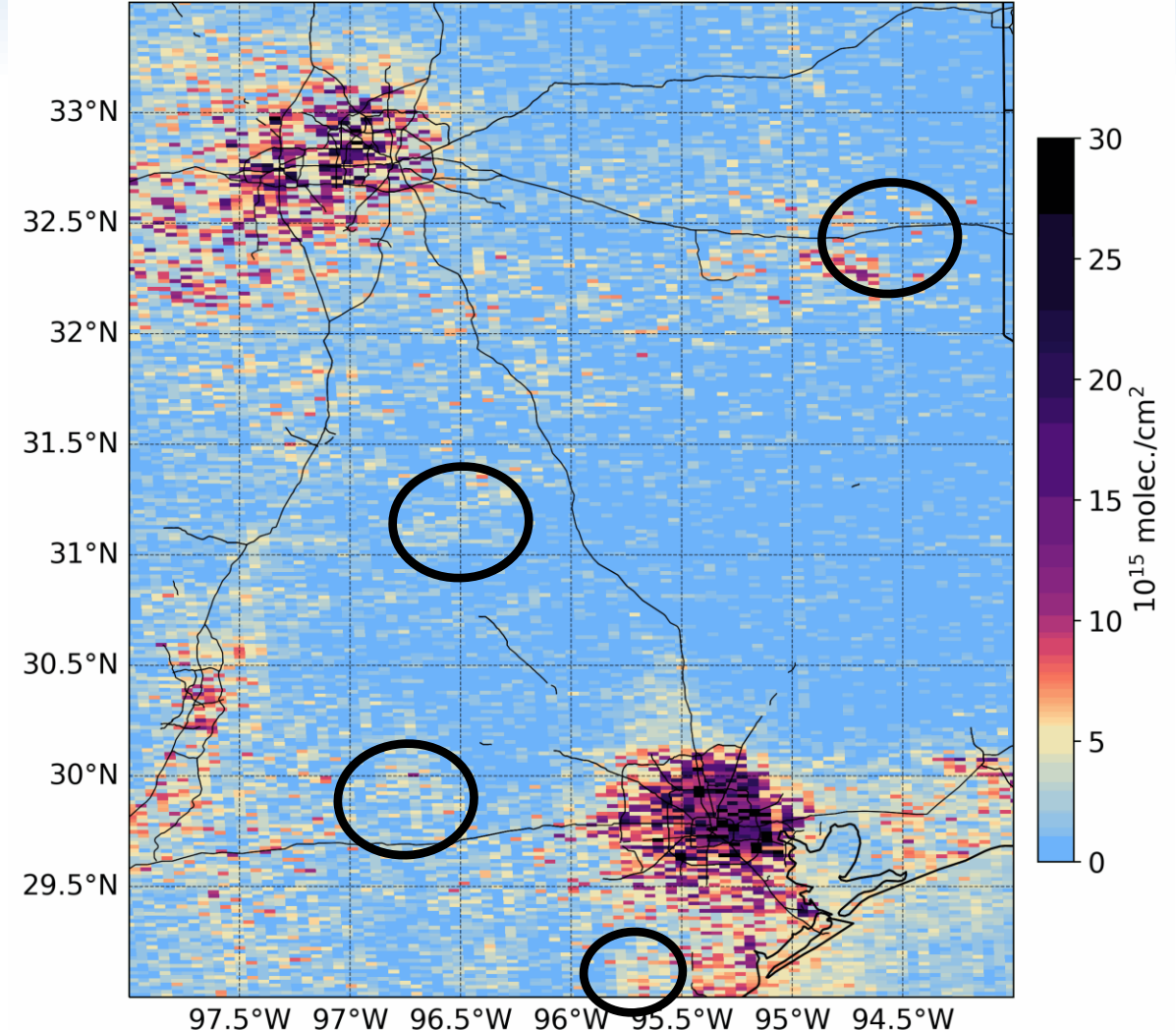
East Texas Zoom – NO₂

Beta Version 2 Data!

World Resource Institute
Global Power Plant Database



TEMPO Tropospheric NO₂ 20240328 08:30 CDT



☐ TEMPO captures NO₂ hot spots in the vicinity of coal- and gas-fired power plants



TEMPO Applications & Special Operations



- ❑ TEMPO special operations can be conducted over a slice or portion of the FoR at higher sub-hourly frequency (e.g., ≤ 10 min)
- ❑ Focus areas include **air quality hazards** (e.g., wildfires, volcanoes), **chemistry studies** (e.g., lightning NO_x), & field campaigns
- ❑ Special operations have been on hold since start of nominal operations but are now being considered

Subset of special experiments

- ❖ 2023 Coastal Texas Air Quality Observations
- ❖ Formation of ozone along Colorado Front Range
- ❖ High Resolution Scanning over the New York City area
- ❖ Sub-city scale AQ forecasting system from data fusion
- ❖ AQ Impacts from Oil & Gas Activities in West U.S.
- ❖ Monitoring volcano emissions and plume transport
- ❖ Observing wildland fires and air quality impacts
- ❖ Lightning NO_x

Green Paper!



* No published updates to Green Paper since halt of special operations in Dec 2023.

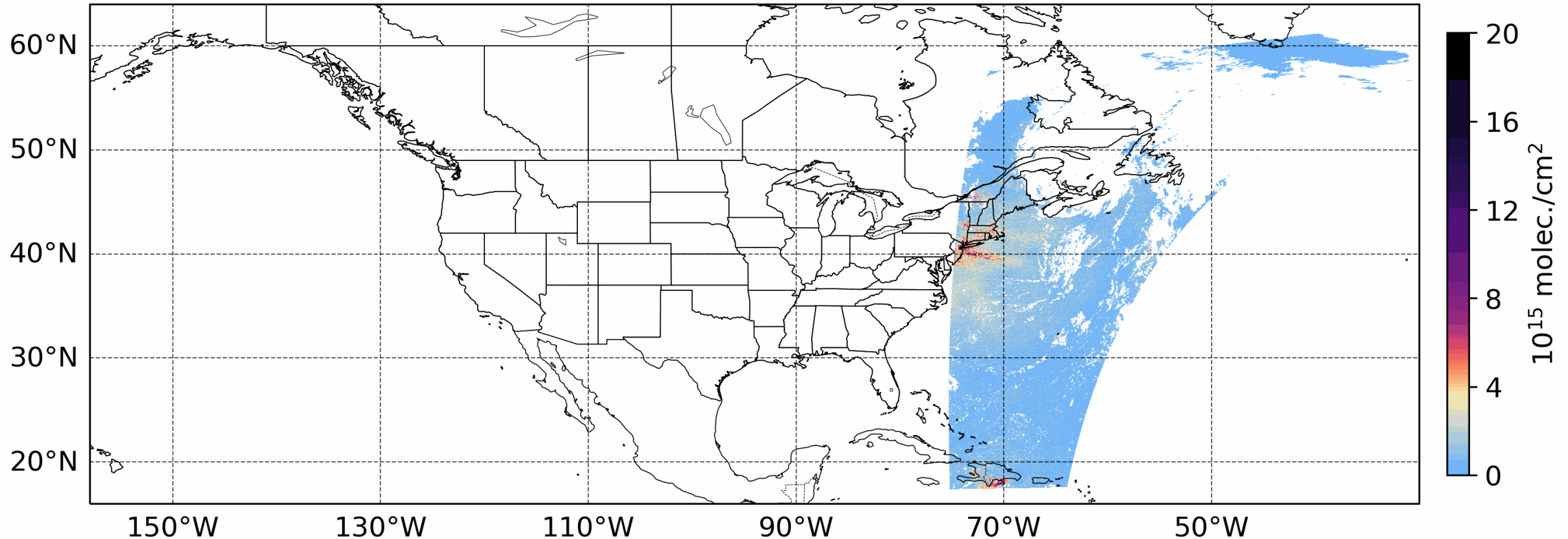


TEMPO Special Scans – Sept 17, 2023



Beta Version 2 Data!

TEMPO Tropospheric NO₂ 20230917 1122 UTC



TEMPO special scans were conducted at an 11-min frequency from ~1700 – 2000 UTC



What's on Tap?

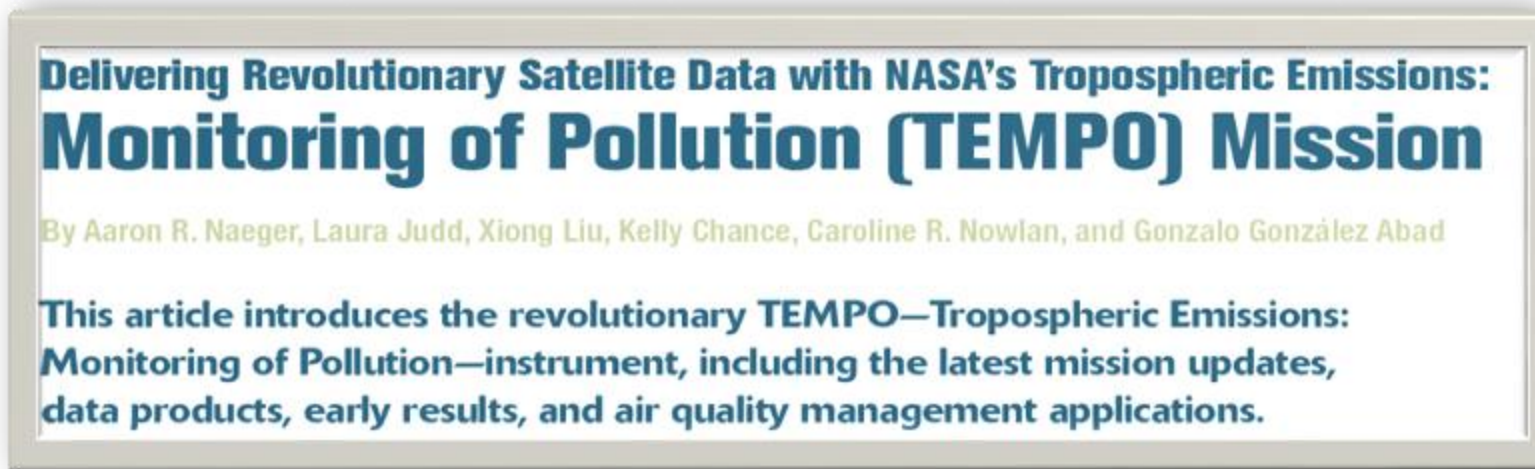


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- ☐ Planning a TEMPO Early Adopters virtual meeting before the end of June
- ☐ Training event for TEMPO data is being planned for this summer or fall
- ☐ Development of codes, tools, user guides, and training items for TEMPO
 - Build archive of use case examples
 - Work together with the NASA ARSET team
- ☐ Development of machine learning models and value-added products for TEMPO
- ☐ Evaluation and implementation of TEMPO special operation experiment requests and update Green Paper





Panel & Discussion Questions



- ☐ How do you expect TEMPO data to enhance your research or work activities?
- ☐ What are your TEMPO data needs? Products? File Formats? Tools or services?
- ☐ Are the standard data products (latency > 3 hours) sufficient? Or do you need TEMPO near real-time data (latency < 3 hours)?
- ☐ Do you have a need for TEMPO special operations?