



**GEORGIA**

DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

# Characteristics of Ozone in the Metro Atlanta Area



**Byeong-Uk Kim, Ph.D**

**Asher Mouat, Ph.D**

**Xiangyu Jiang, Ph.D**

**Data & Modeling Unit, Planning and Support Program**

**Georgia EPD - Air Protection Branch**

**Session 6B: Characterizing Ozone Production**

**Regimes with Satellite Data**

**May 14, 2026**

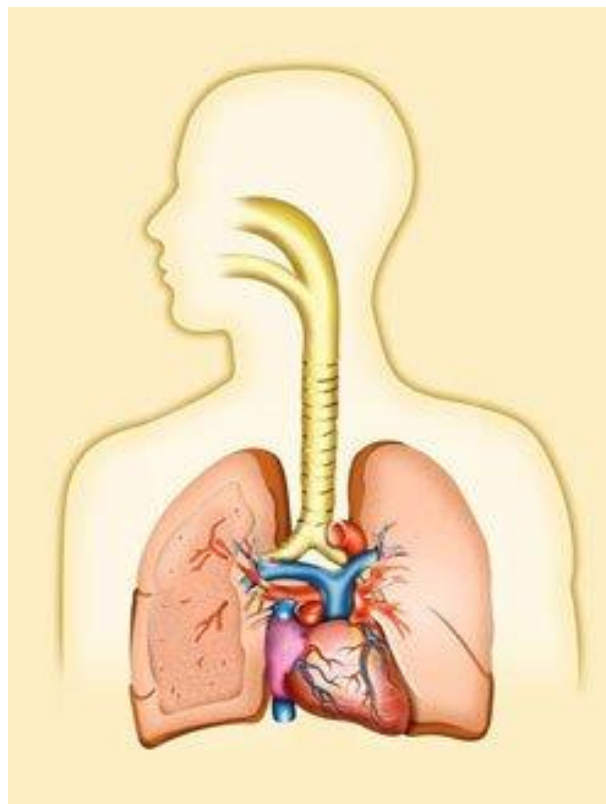


# Ground Level Ozone: The Bad One

First recorded photo of smog in Los Angeles, 1943



<https://www.aqmd.gov/home/research/publications/50-years-of-progress>



Ozone is a powerful oxidant that can irritate the airways.

<https://www.epa.gov/ground-level-ozone-pollution/health-effects-ozone-pollution>



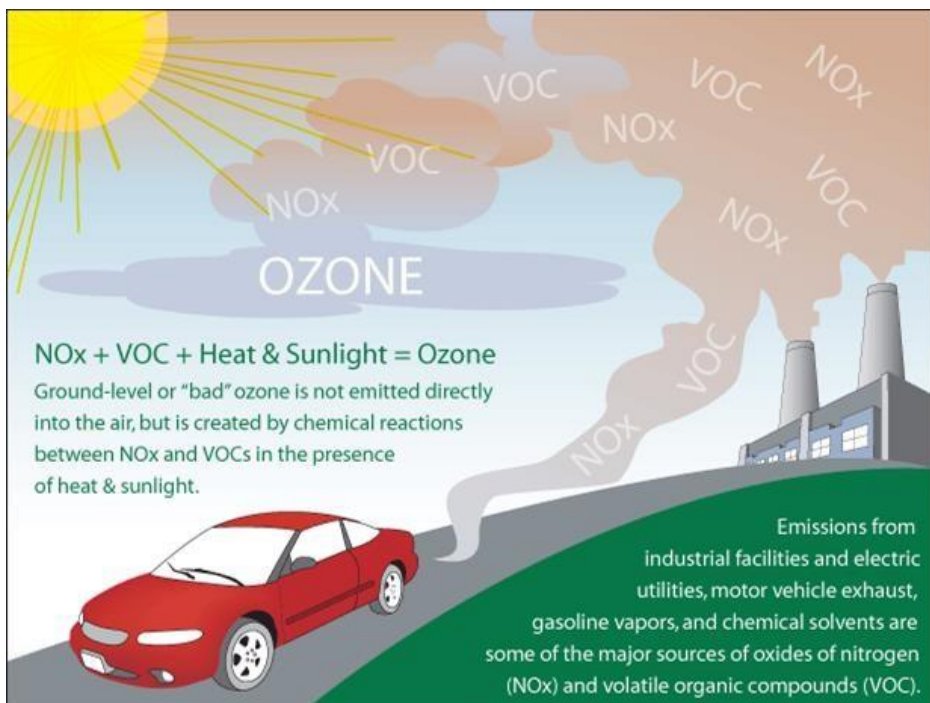
[https://www.epa.gov/sites/default/files/2015-06/documents/ozone\\_good\\_up\\_high\\_bad\\_nearby.pdf](https://www.epa.gov/sites/default/files/2015-06/documents/ozone_good_up_high_bad_nearby.pdf)

**“1943: In the middle of World War II, Los Angeles residents believe the Japanese are attacking them with chemical warfare.”**

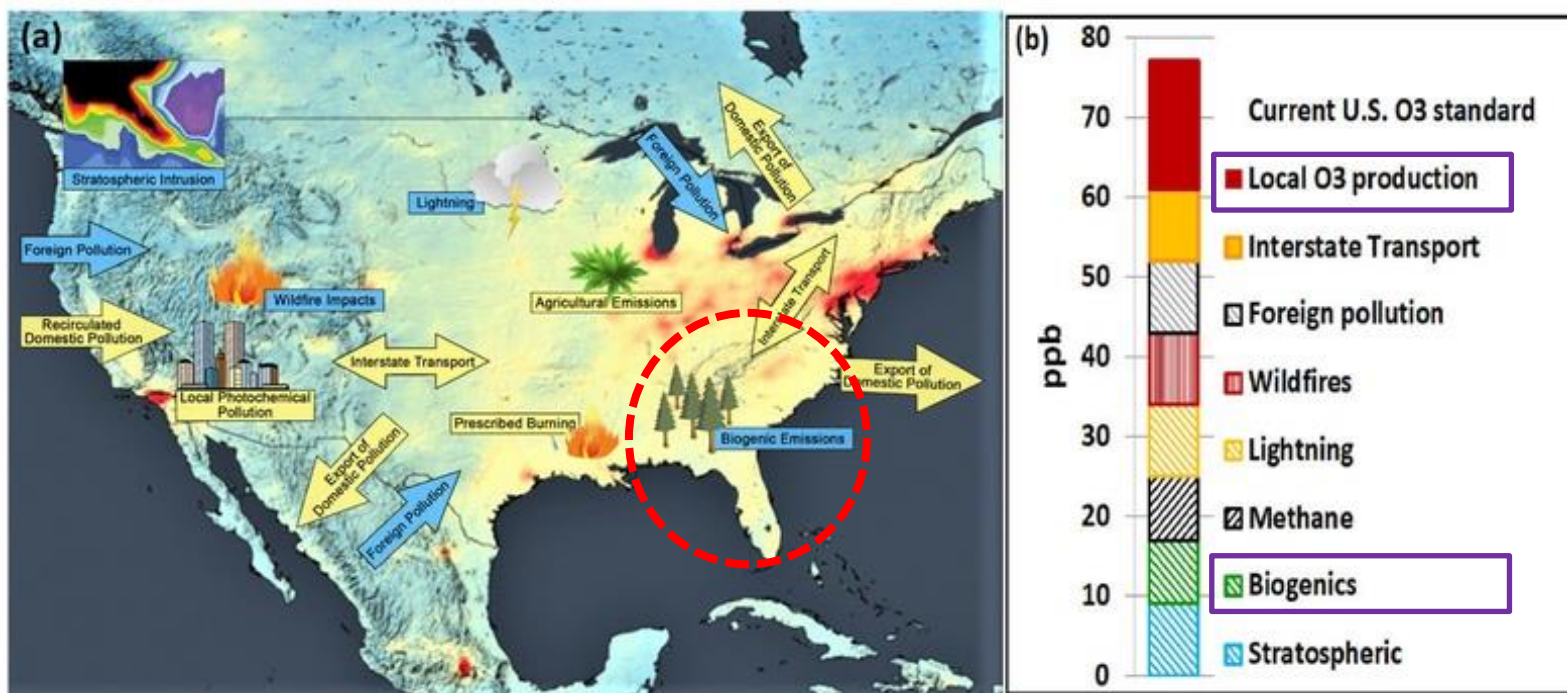
<https://www.wired.com/2010/07/0726la-first-big-smog/>



# Anatomy of Ozone Air Pollution



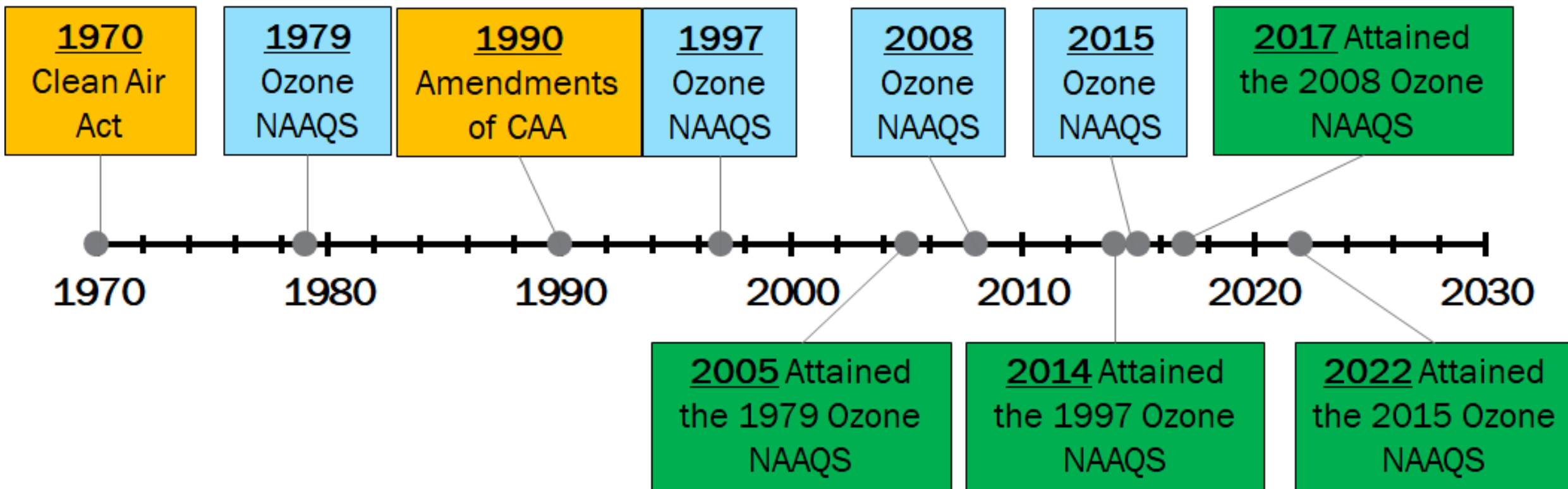
<https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics#formation>



Jaffe, Daniel A., Owen R. Cooper, Arlene M. Fiore, Barron H. Henderson, Gail S. Tonnesen, Armistead G. Russell, Daven K. Henze, Andrew O. Langford, Meiyun Lin, and Tom Moore. "Scientific assessment of background ozone over the US: Implications for air quality management." *Elem Sci Anth* 6 (2018): 56.



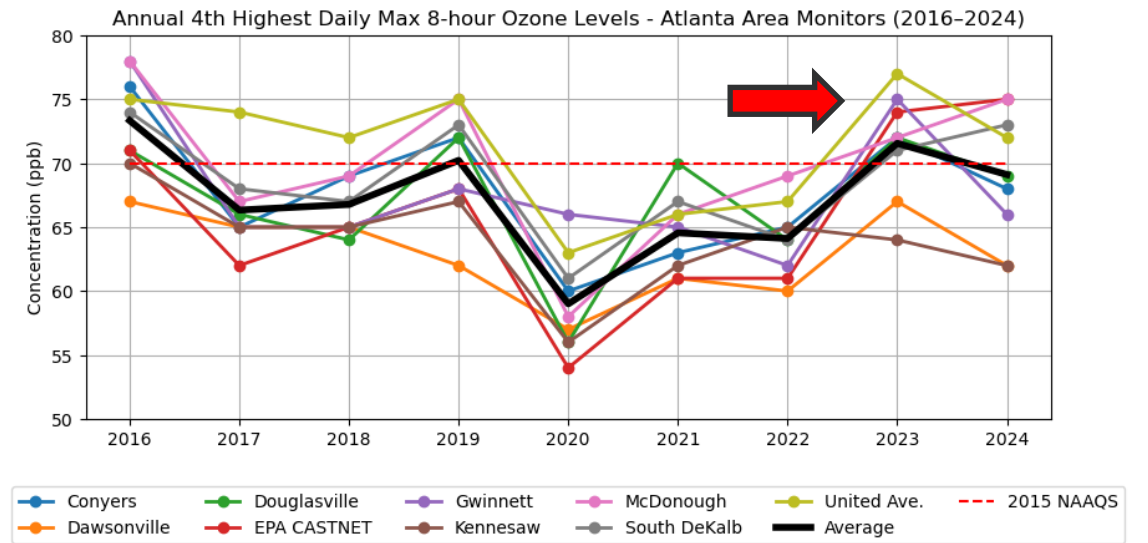
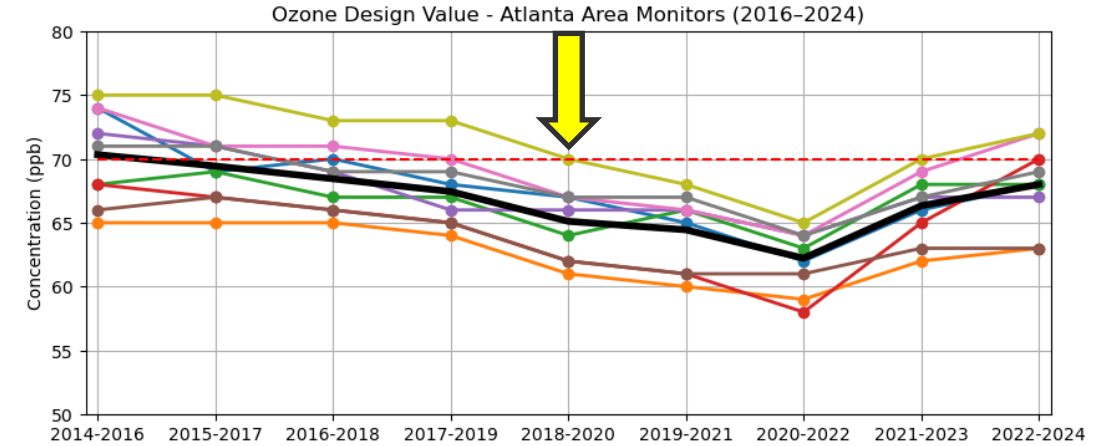
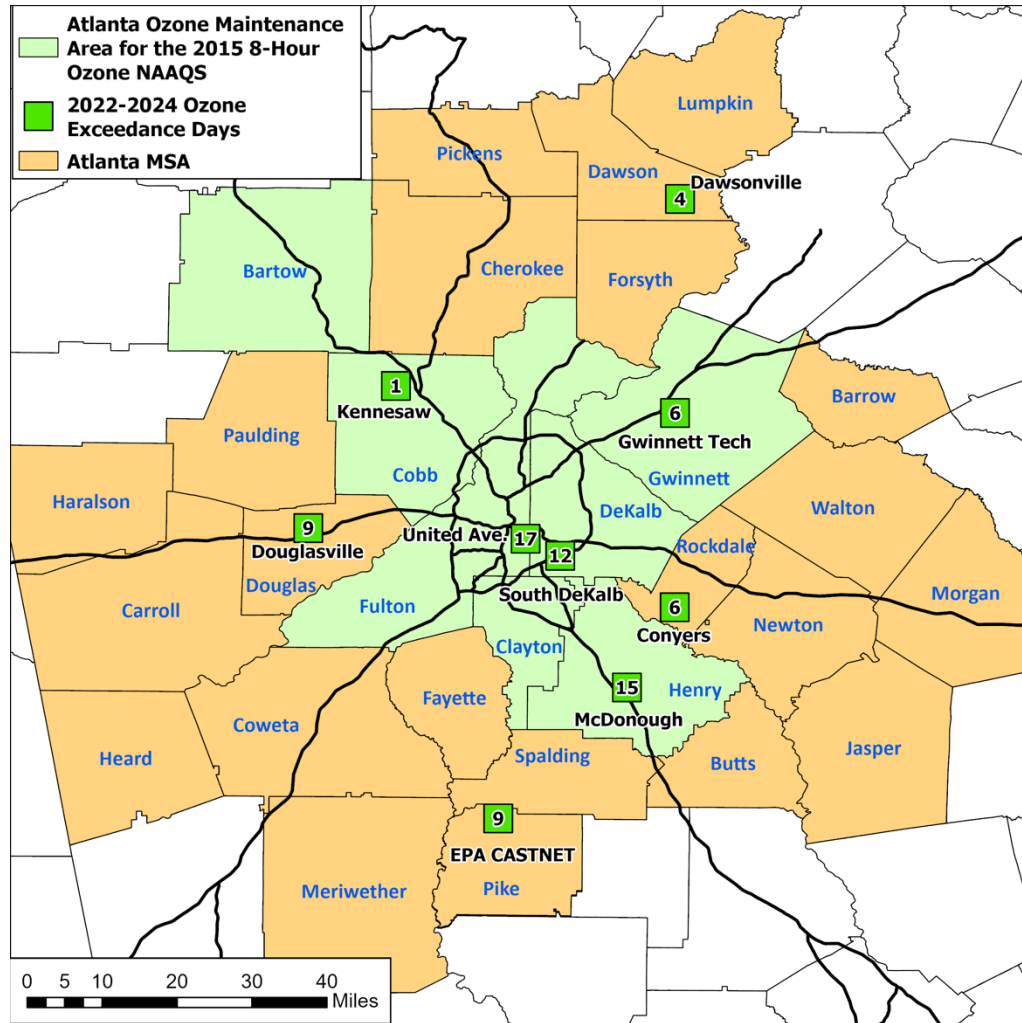
# Attainment of Ozone NAAQS: Atlanta



26 years for the 1979 Ozone NAAQS, 17 years for the 1997 Ozone NAAQS, 9 years for the 2008 Ozone NAAQS, and 7 years for the 2015 Ozone NAAQS

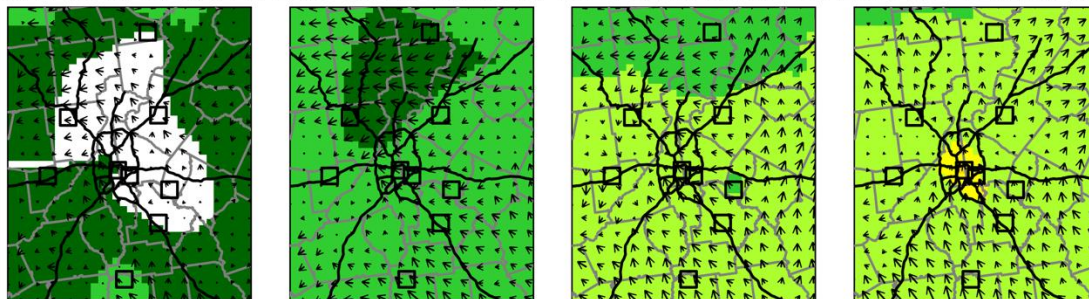


# Recent Ozone Exceedances and Trends

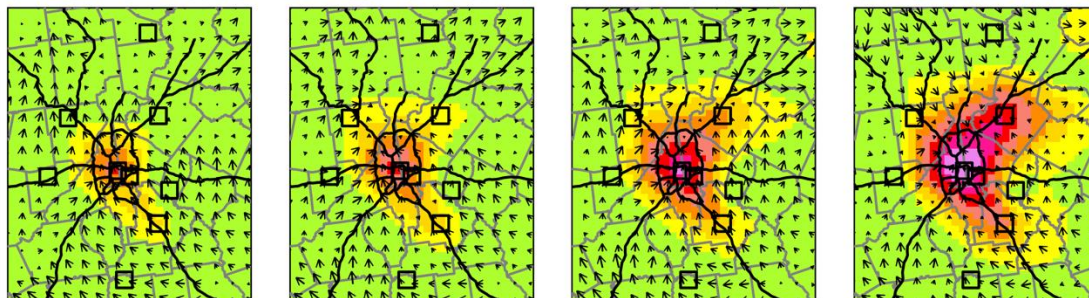


On October 17, 2022, the 7-county Atlanta area was redesignated as attainment. However, the area is currently violating the 2015 ozone NAAQS. We noted that many ozone monitors including the United Ave. monitor were heavily affected by the Canadian wildfires in 2023.

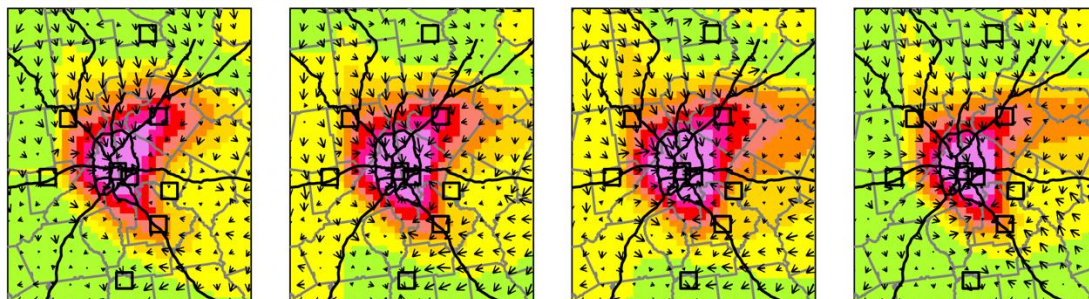
2022-06-20 07:00 EST 2022-06-20 08:00 EST 2022-06-20 09:00 EST 2022-06-20 10:00 EST



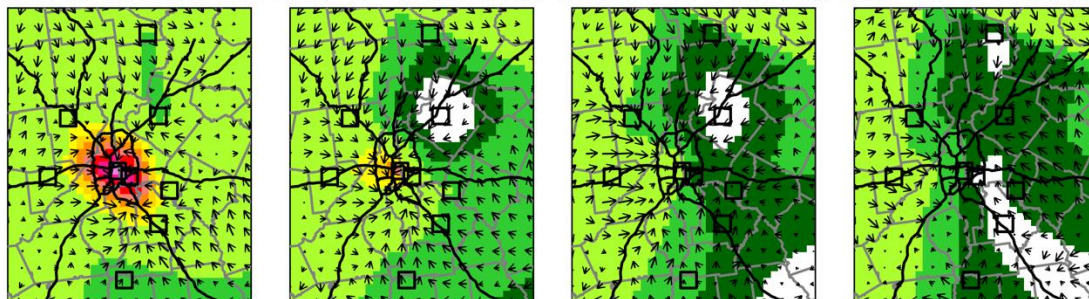
2022-06-20 11:00 EST 2022-06-20 12:00 EST 2022-06-20 13:00 EST 2022-06-20 14:00 EST



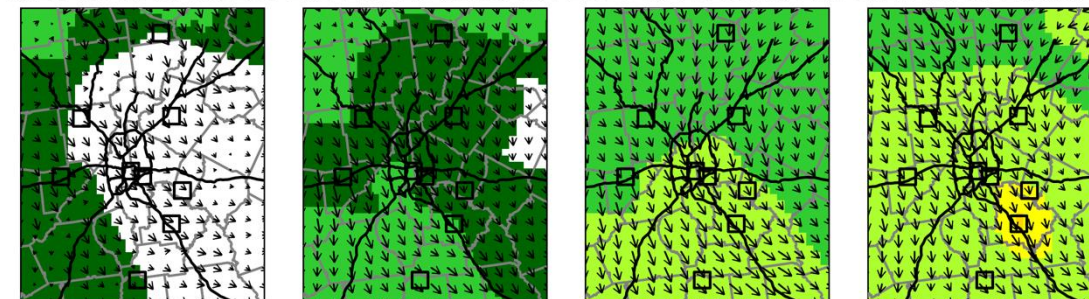
2022-06-20 15:00 EST 2022-06-20 16:00 EST 2022-06-20 17:00 EST 2022-06-20 18:00 EST



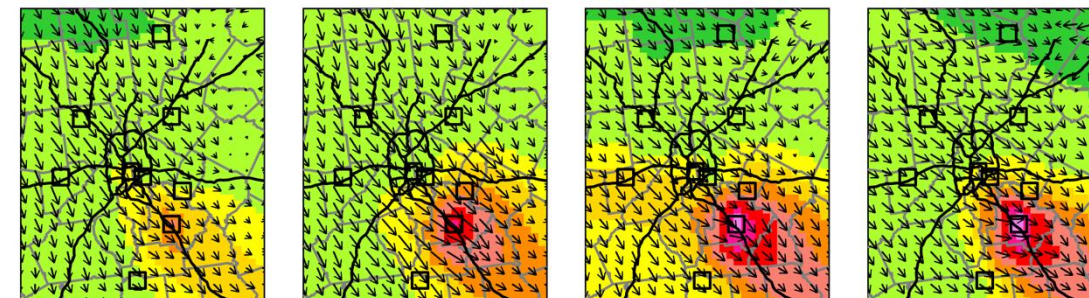
2022-06-20 19:00 EST 2022-06-20 20:00 EST 2022-06-20 21:00 EST 2022-06-20 22:00 EST



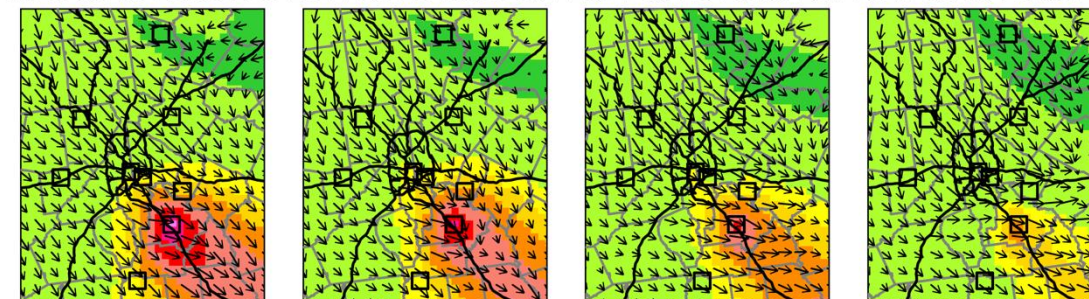
2024-08-13 07:00 EST 2024-08-13 08:00 EST 2024-08-13 09:00 EST 2024-08-13 10:00 EST



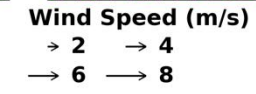
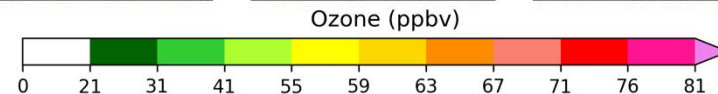
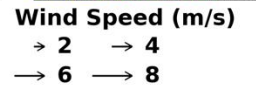
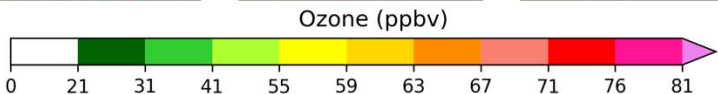
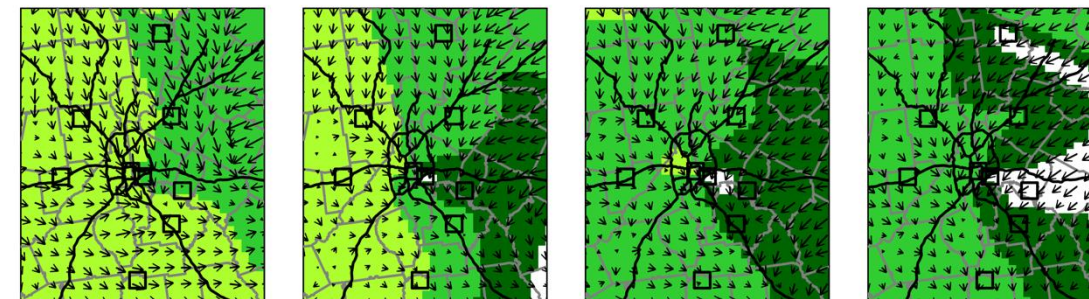
2024-08-13 11:00 EST 2024-08-13 12:00 EST 2024-08-13 13:00 EST 2024-08-13 14:00 EST



2024-08-13 15:00 EST 2024-08-13 16:00 EST 2024-08-13 17:00 EST 2024-08-13 18:00 EST



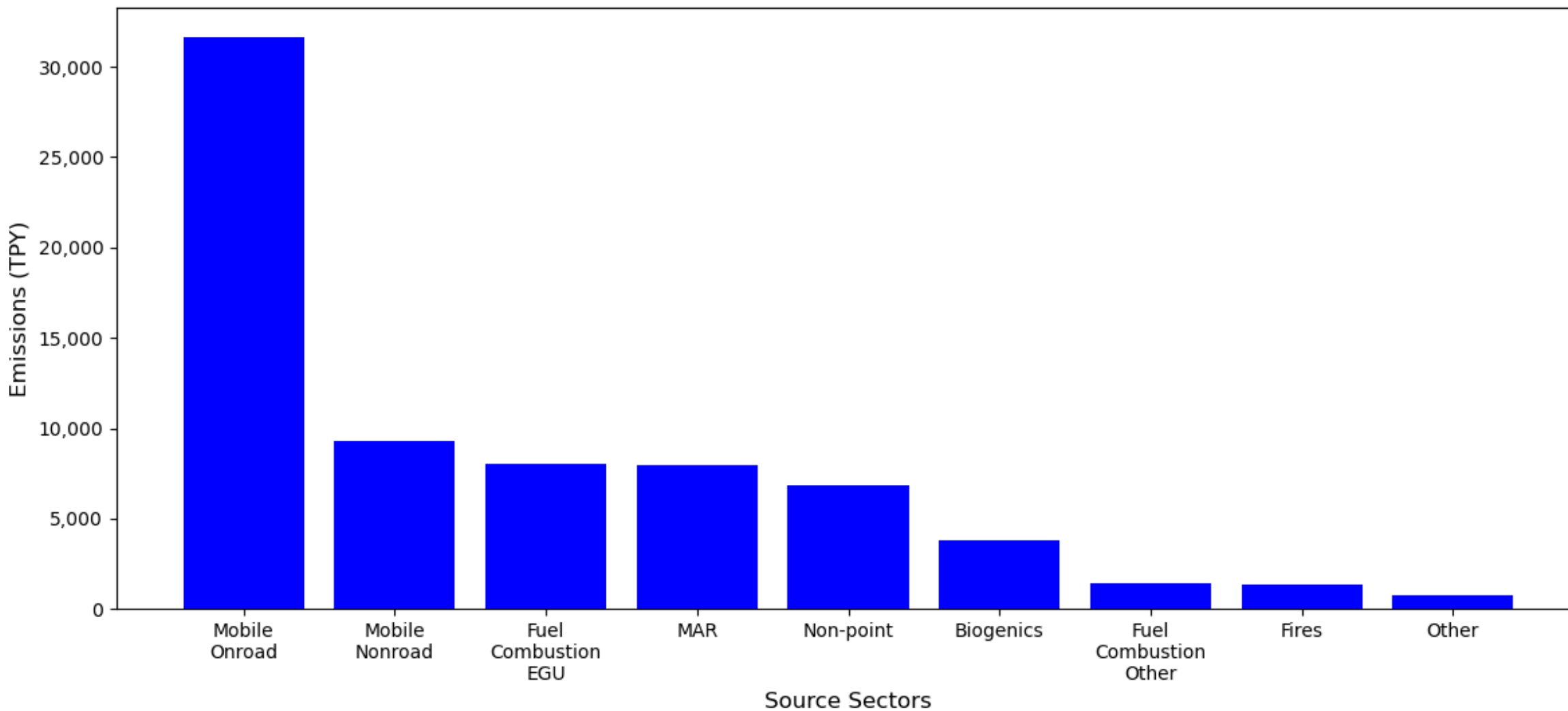
2024-08-13 19:00 EST 2024-08-13 20:00 EST 2024-08-13 21:00 EST 2024-08-13 22:00 EST





# Emissions by Sector

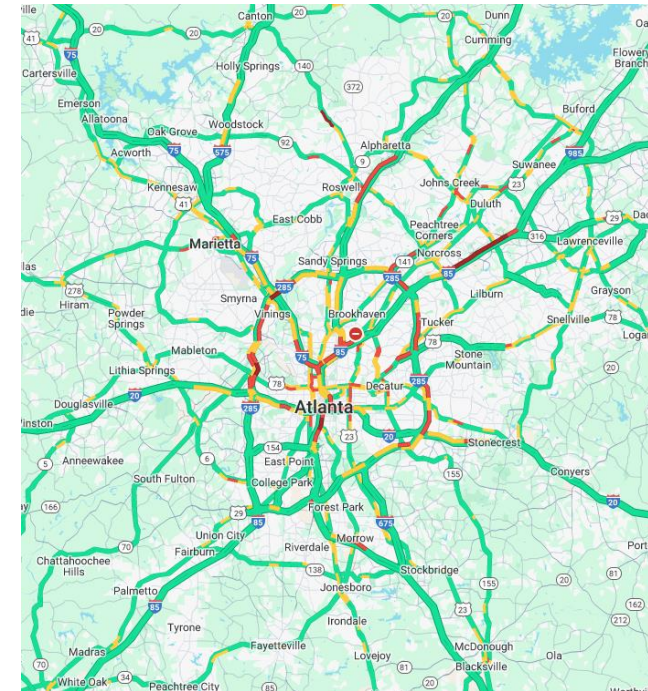
Total Annual NOX Emissions by Sector in the Metro Atlanta area  
EMP 2022v2



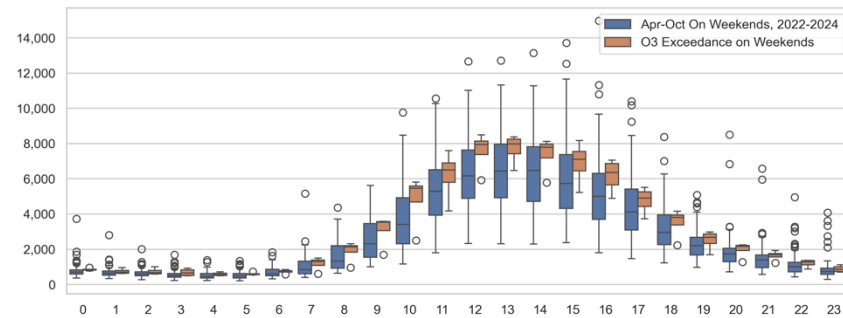
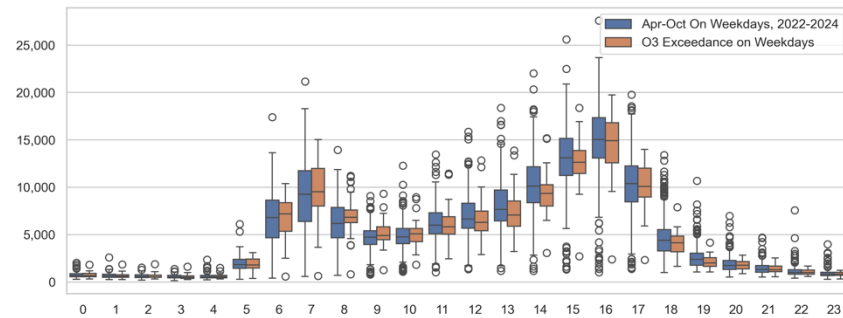
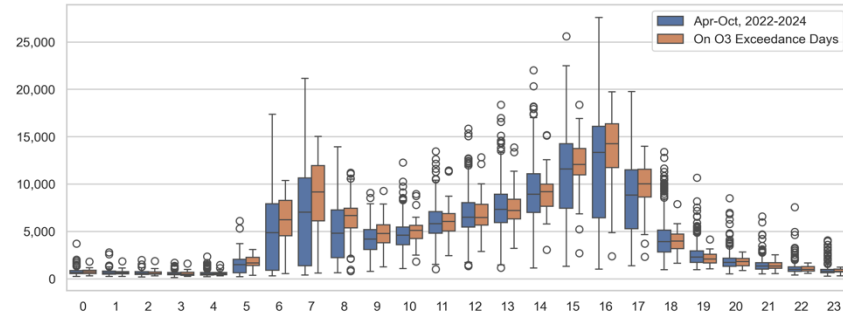


# Traffic and NOx Emissions

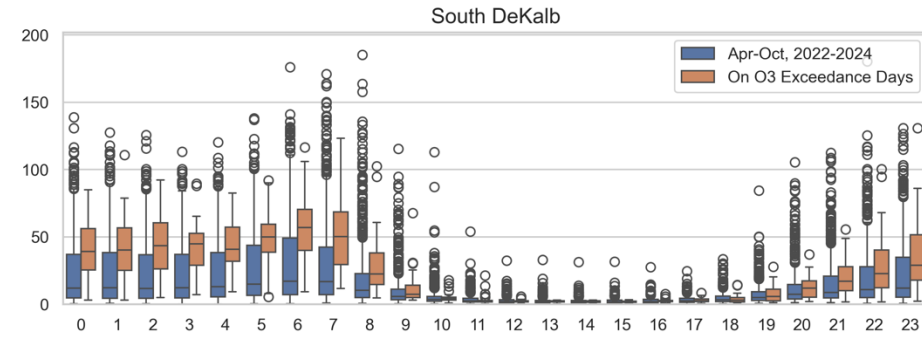
8:00 AM EST July 11, 2024



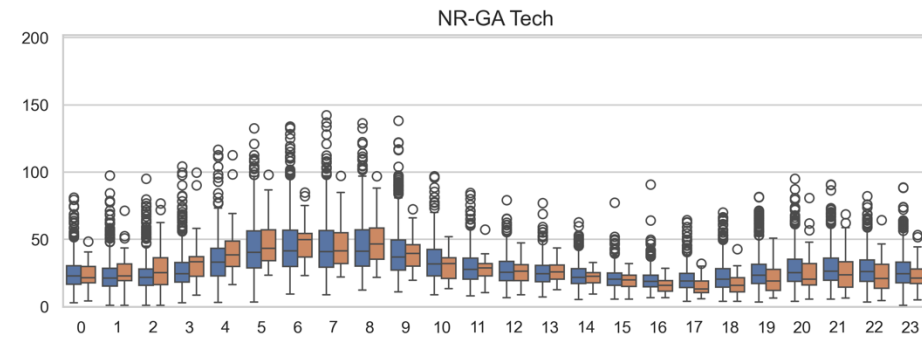
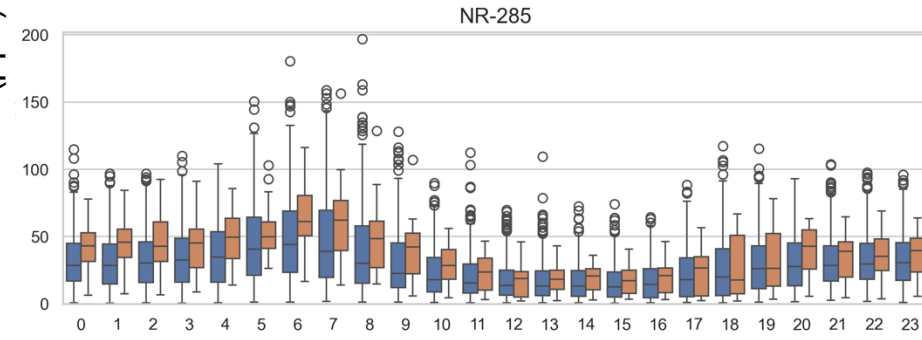
# of DRO Pixels



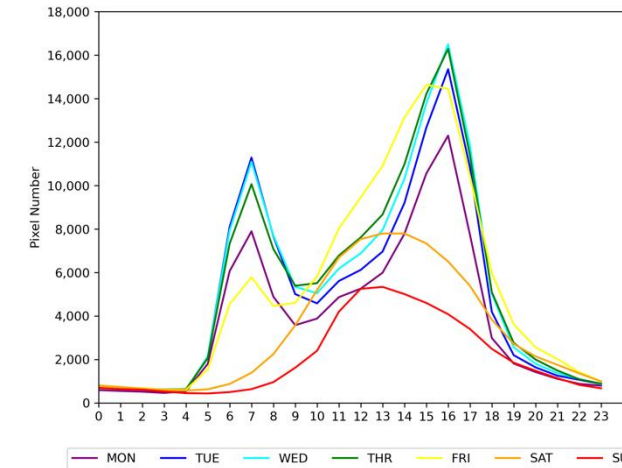
Time of Day



Concentrations (ppb)



Time of Day

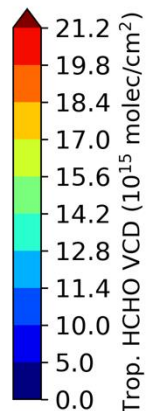
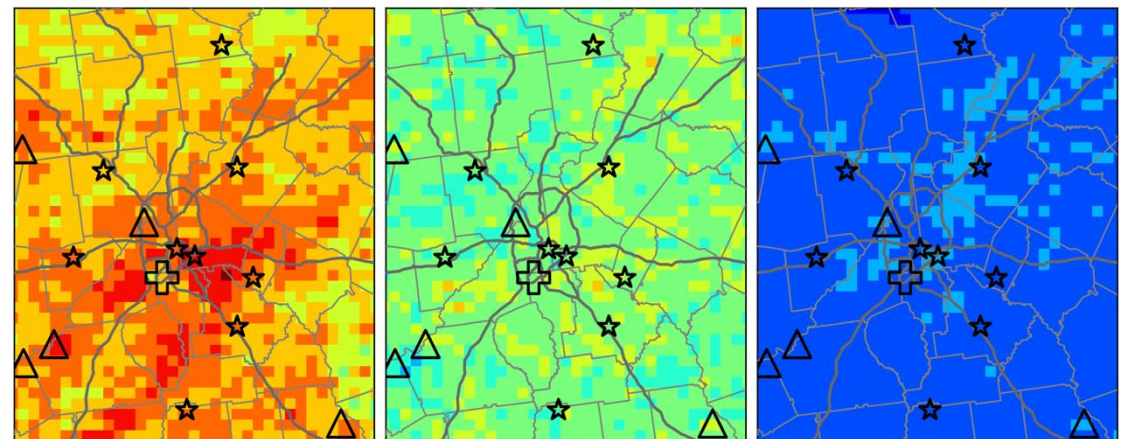
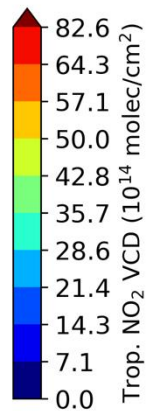
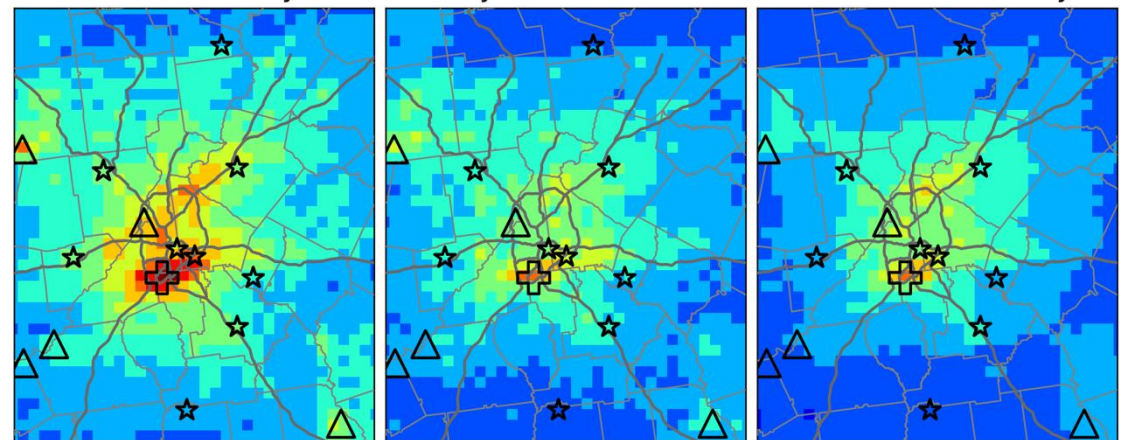




# From Space: NO<sub>2</sub> and HCHO VCDs

Mean TEMPO VCDs, 9am-5pm EST

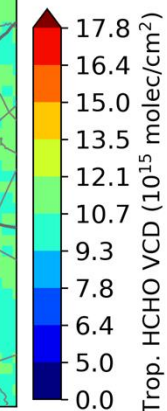
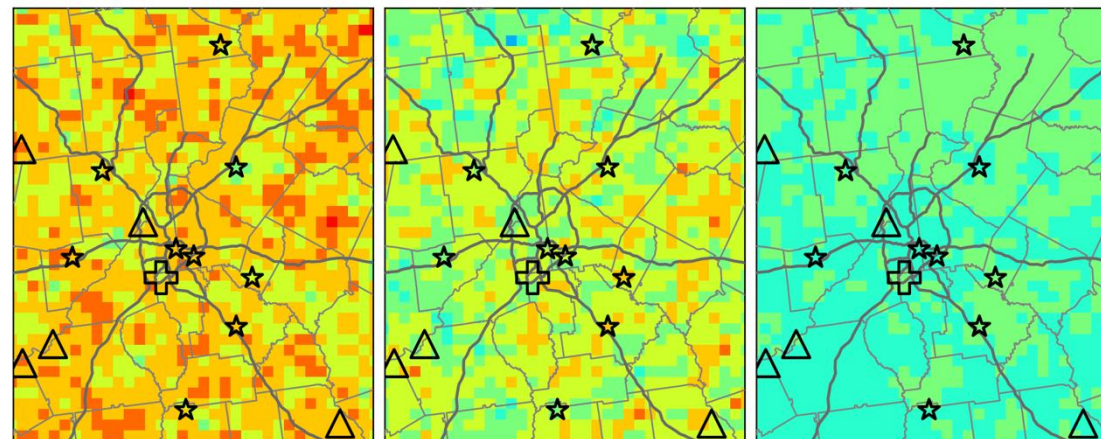
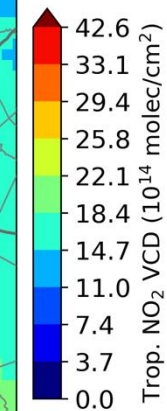
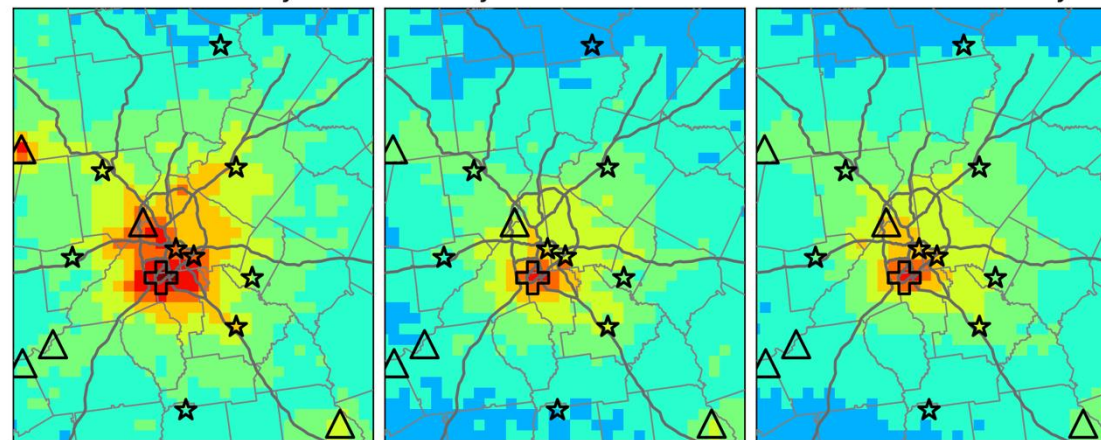
Exceedance days    +/-1 day from exceedances    Non-exceedance days



TEMPO: March - September, 2024

TROPOMI VCDs, 1:30pm EST

Exceedance days    +/-1 day from exceedances    Non-exceedance days

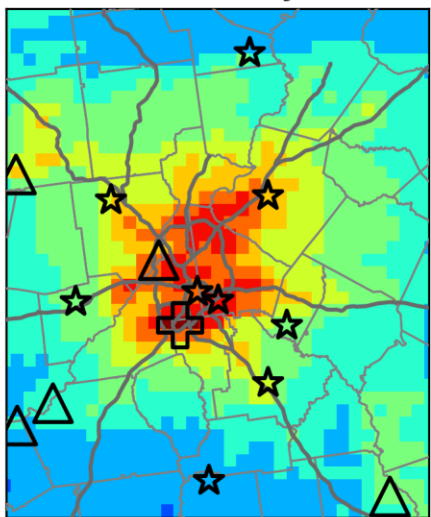


TROPOMI: March - September, 2022-2024

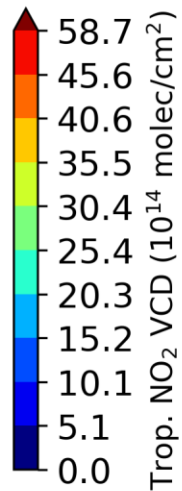
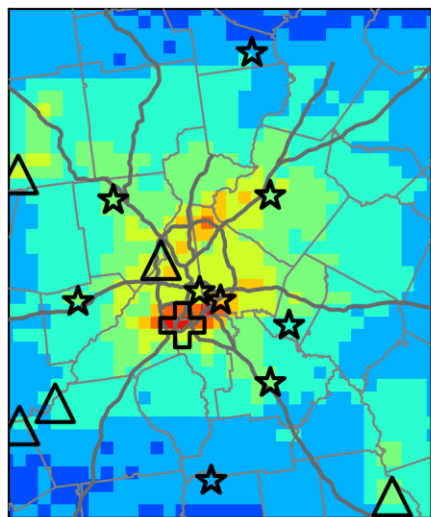


# From Space: NO<sub>2</sub> and HCHO VCDs

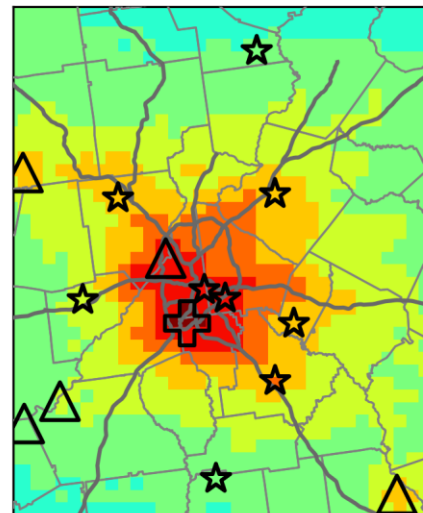
Mean TEMPO VCDs, 9am-5pm EST  
Weekday



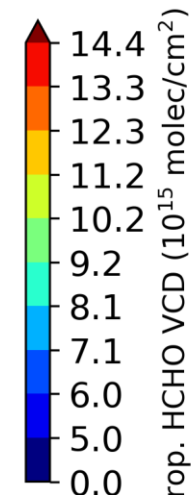
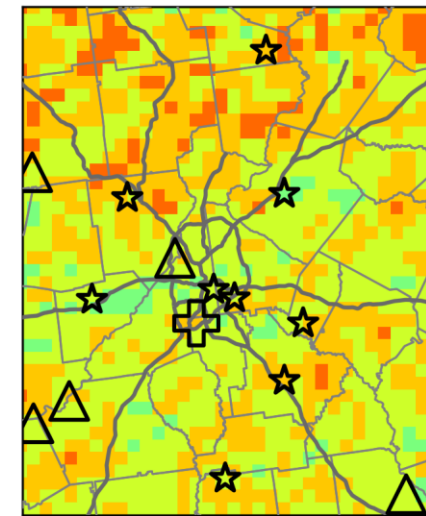
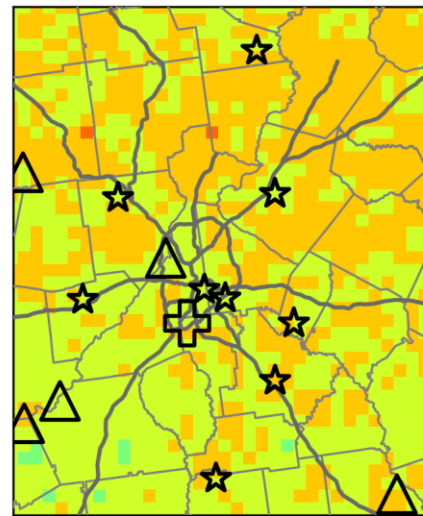
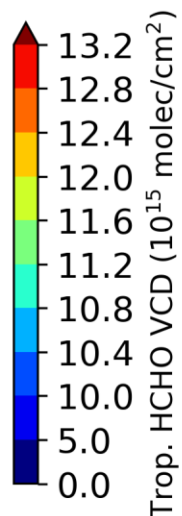
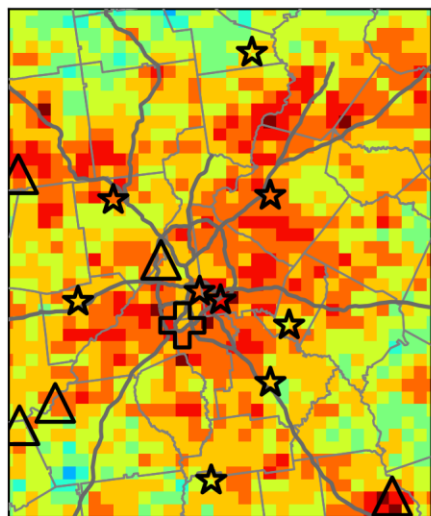
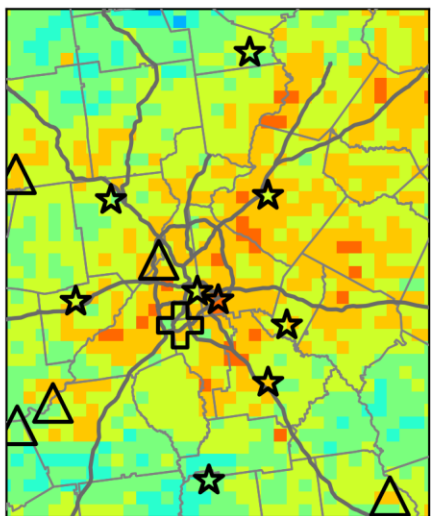
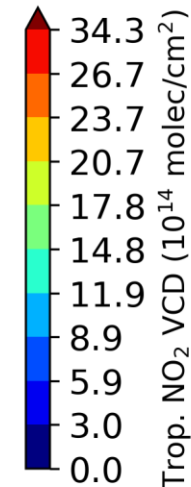
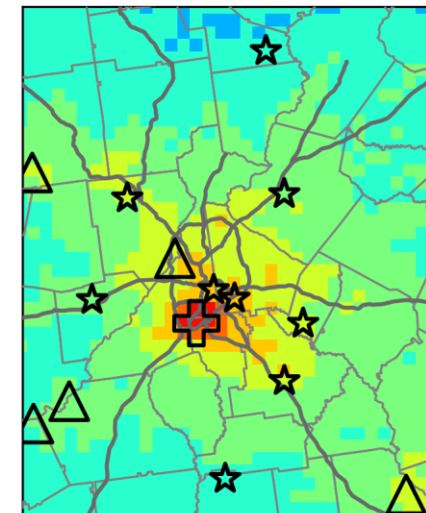
Weekend



TROPOMI VCDs, 1:30pm EST  
Weekday



Weekend

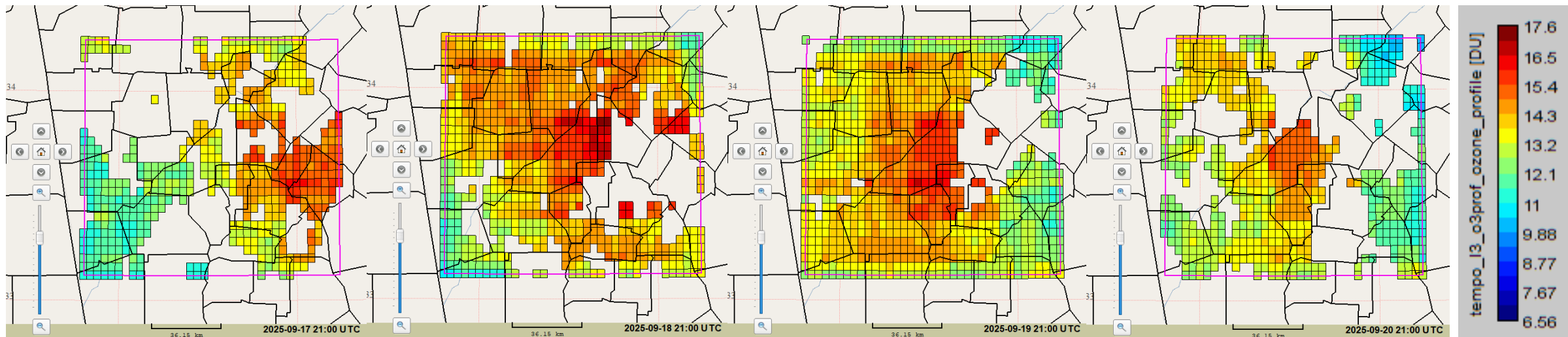




# Future Projects with Satellite Data

## ■ Understanding high ozone events

- Interpret elevated ground-level ozone using TEMPO's "ozone profile" and NO<sub>2</sub> and HCHO VCDs from TROPOMI, TEMPO, and PACE
- Diagnose the ozone formation regime (i.e., NO<sub>x</sub> vs VOC)
- Identify any missing precursor sources



MDA803: 65 ppb  
2025-09-17 4 PM EST

MDA803: 72 ppb  
2025-09-18 4 PM EST

MDA803: 74 ppb  
2025-09-19 4 PM EST

MDA803: 69 ppb  
2025-09-20 4 PM EST



# Future Projects with Satellite Data

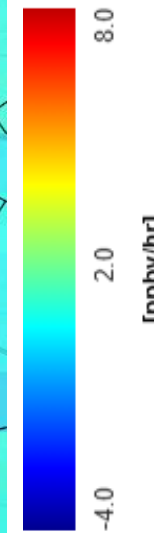
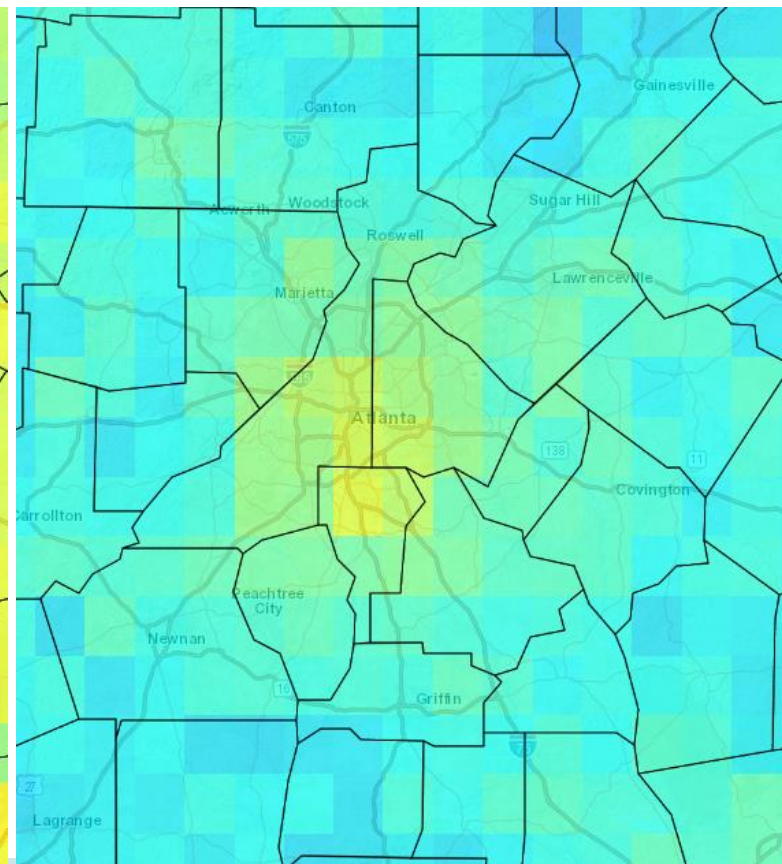
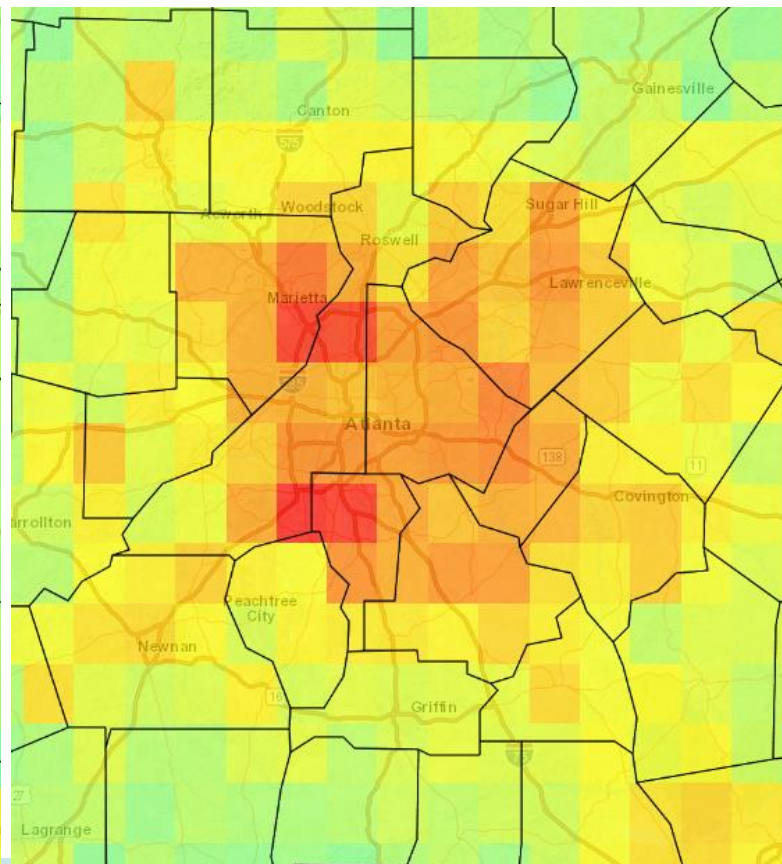
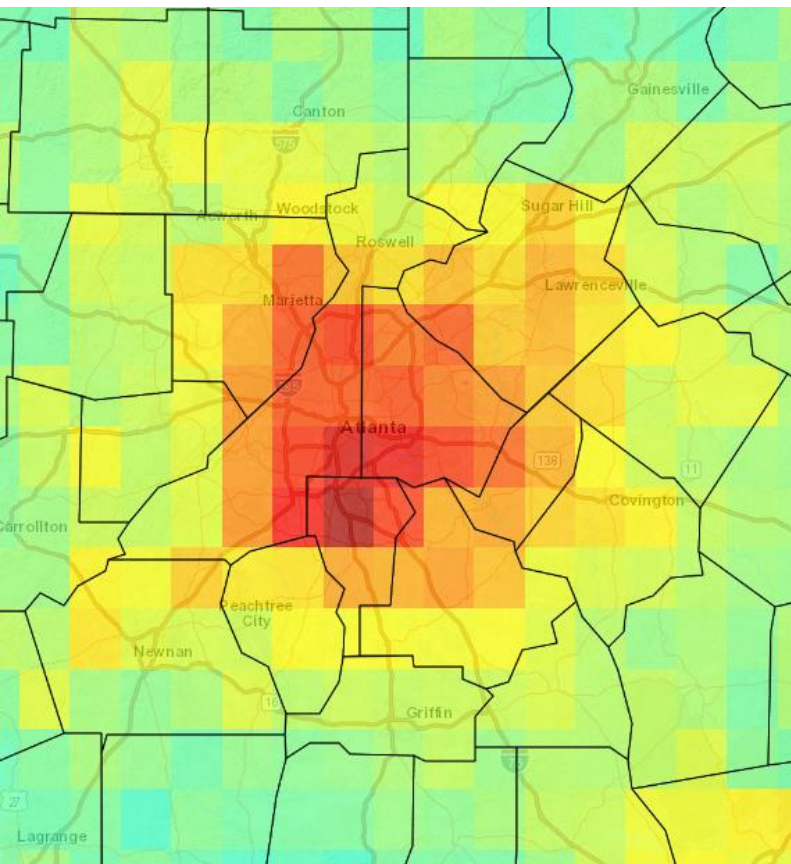
Illustrative Example: June 2023

<https://www.ozonerates.space>

P03

Sens. to NO<sub>x</sub>

Sens. to VOC



- 1) Souri, A. H., González Abad, G., Duncan, B. N., and Oman, L. D.: Beyond binary maps from HCHO<sub>2</sub>: a deep neural network approach to global daily mapping of net ozone production rates and sensitivities constrained by satellite observations (2005–2023), *Atmos. Chem. Phys.*, 26, 809–837, <https://doi.org/10.5194/acp-26-809-2026>, 2026.
- 2) Souri, A. H., González Abad, G., Wolfe, G. M., Verhoelst, T., Vigouroux, C., Pinardi, G., Compennolle, S., Langerock, B., Duncan, B. N., and Johnson, M. S.: Feasibility of robust estimates of ozone production rates using a synergy of satellite observations, ground-based remote sensing, and models, *Atmos. Chem. Phys.*, 25, 2061–2086, <https://doi.org/10.5194/acp-25-2061-2025>, 2025.



# CONTACT INFORMATION

**Xiangyu Jiang, Ph.D.**  
**Georgia Dept. of Natural Resources**  
**4244 International Parkway, Suite 120**  
**Atlanta, GA 30354**

**Xiangyu.Jiang@dnr.ga.gov**  
**470-251-2610**



# QUESTIONS?

