

# Satellite data for operational air quality decisions

---

HAQAST-Madison

May 14, 2026

*Presented by: Samuel Kay, PhD  
Chief, Air Quality Planning Branch*



GOVERNMENT OF THE  
DISTRICT OF COLUMBIA  
MURIEL BOWSER, MAYOR

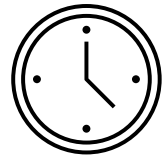
TAG THIS PRESENTATION @DOEE\_DC

# Balancing scope, scale, and relevance

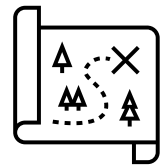
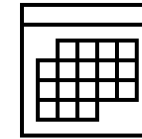
---



Scope: Research and screening (including safety and education) vs. Regulation, compliance, and enforcement



Scale: Temporal



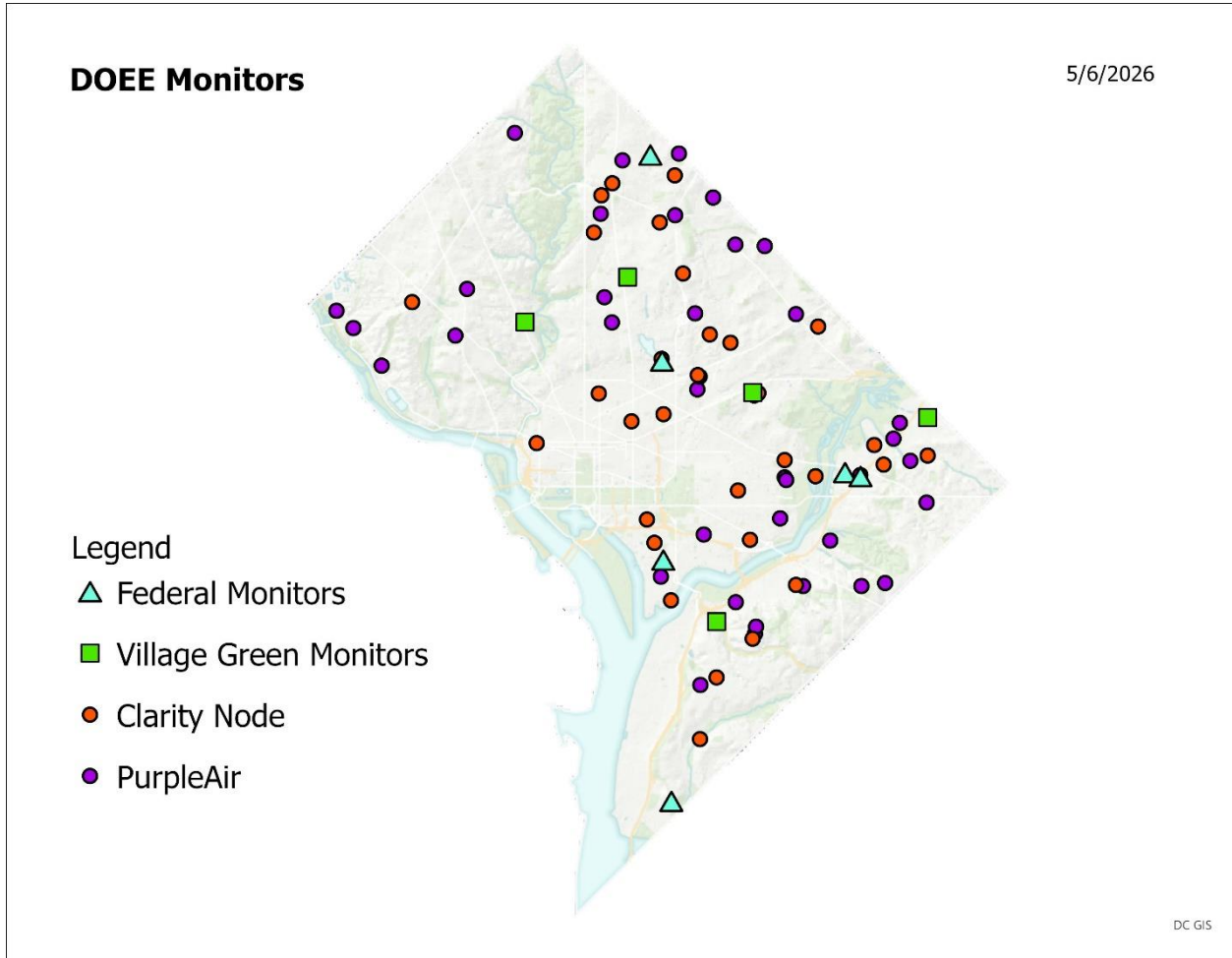
Scale: Spatial



Relevance: Policy actionable vs. Community actionable



# Understanding Air Quality at the Neighborhood Level



- Clarity and PurpleAir sensors are being deployed across the District at host sites including charter schools, libraries, and other businesses and institutions.
- DOEE will use collected data to identify pollution sources and pinpoint pollution hotspots.
- The network also provides near real-time, hyper-local air quality data to the public.

# Low-cost Sensors around the District



Bench monitor installed at Barry Farm Recreation Center in spring 2026; data now available

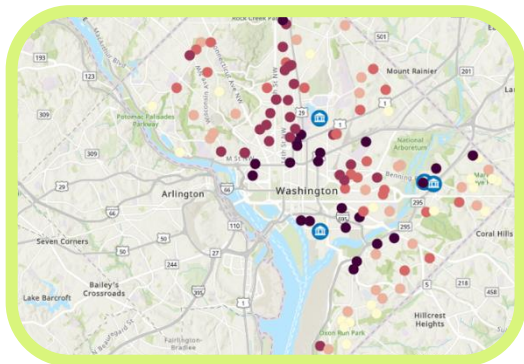


Clarity Node sensor measures Particulate Matter, Nitrogen Dioxide, Ozone, and meteorological data



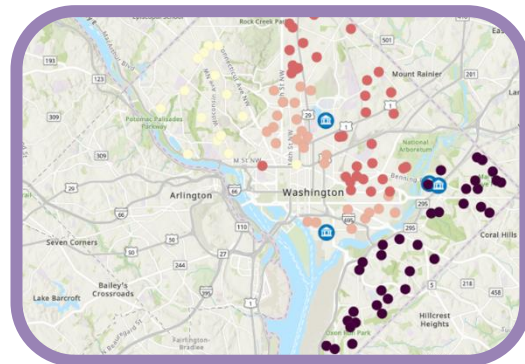
Purple Air Sensor measures Particulate matter, temperature, and humidity

# Site Prioritization for Sensor Placement



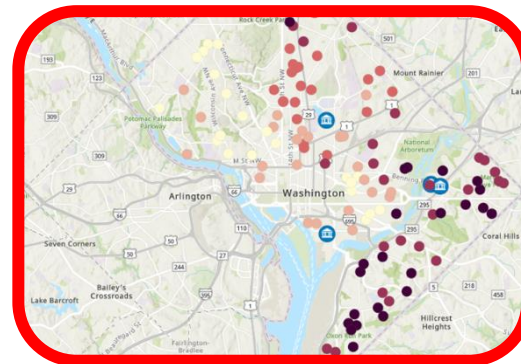
## Exposure

- Modeled emissions of traffic-related pollutants within 500m of school (PM2.5, NOx, NO2)<sup>1</sup>
- Mobile measurements of PM2.5, Black Carbon, and NO2 within 500m<sup>2</sup>



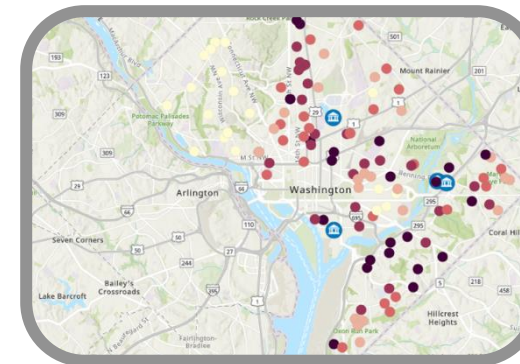
## Health

- Pediatric asthma ED visit rate<sup>3</sup>
- Low birth weight rate<sup>3</sup>
- Preterm birth rate<sup>3</sup>



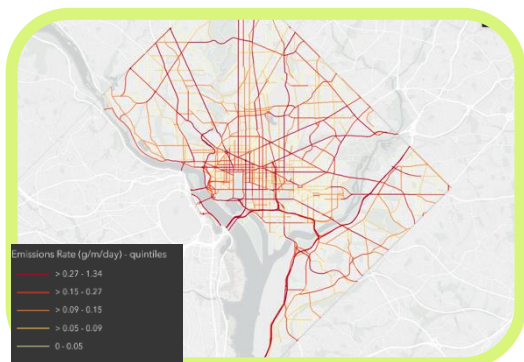
## Vulnerability<sup>4</sup>

- % Low income (Below 200% of federal poverty line)
- % People of color

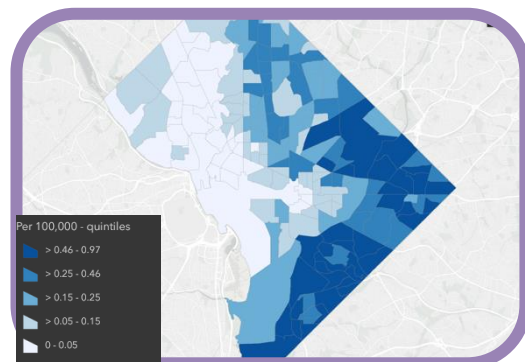


## Combined Weighted Score:

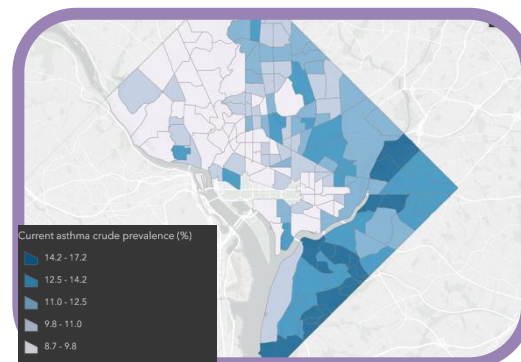
- Exposure Score (50%)
- Health Score (25%)
- Vulnerability Score (25%)



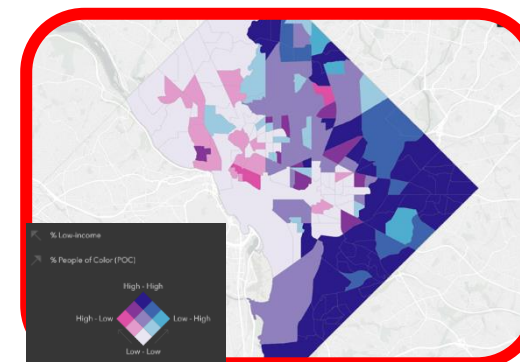
Traffic-related PM<sub>2.5</sub> Emissions<sup>1</sup>



PM<sub>2.5</sub>-attributable ER visits due to asthma concerns (ages 0-18)<sup>3</sup>

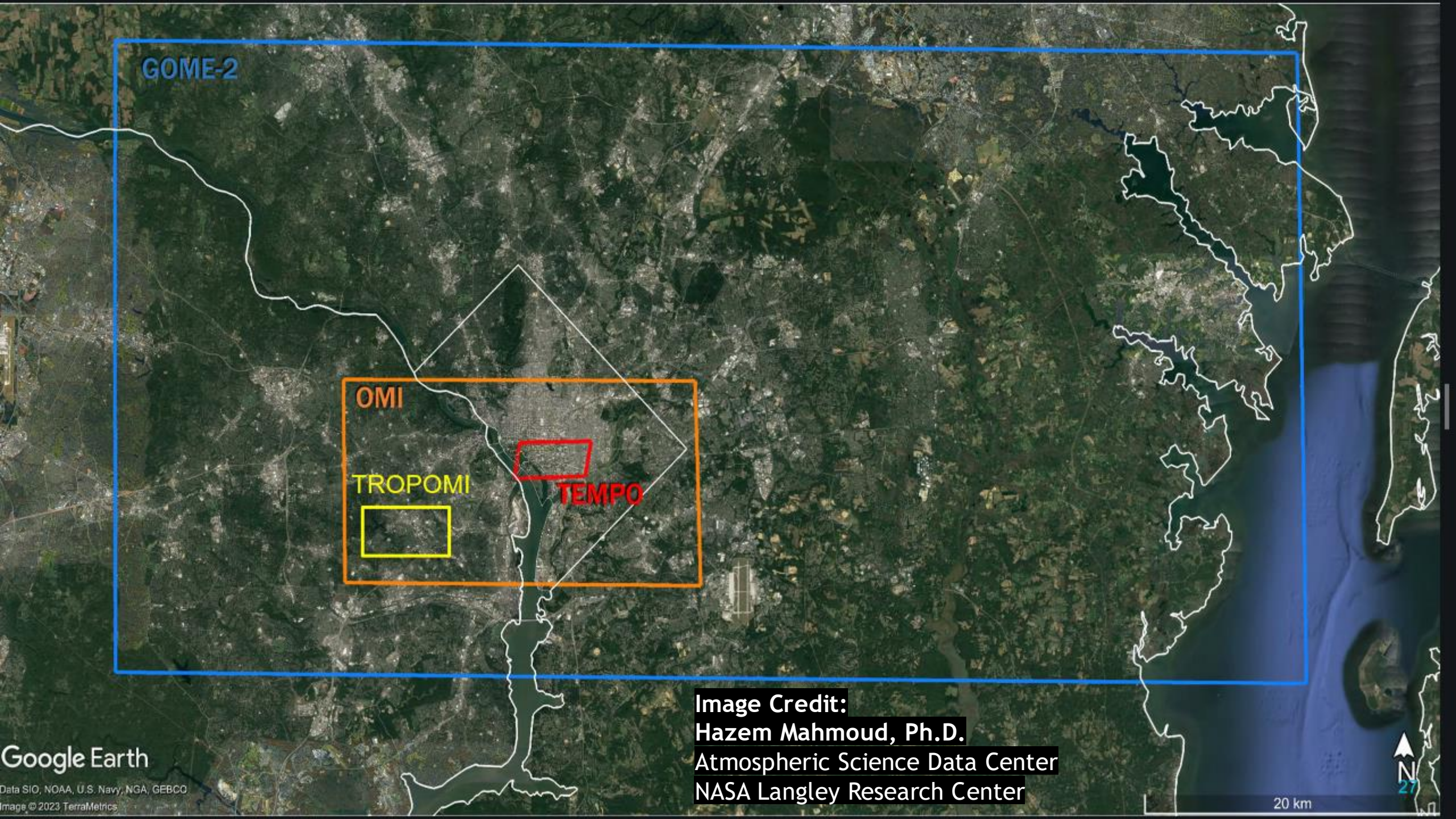


Asthma prevalence<sup>3</sup>



US EPA EJScreen % Low Income & % People of Color

Data Sources: 1) University of Vermont traffic emissions study 2) Aclima mobile monitoring study---selected parts of DC 3) CDC PLACES and DC Department of Health 4) US Census Bureau



GOME-2

OMI

TROPOMI

TEMPO

Google Earth

Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image © 2023 TerraMetrics

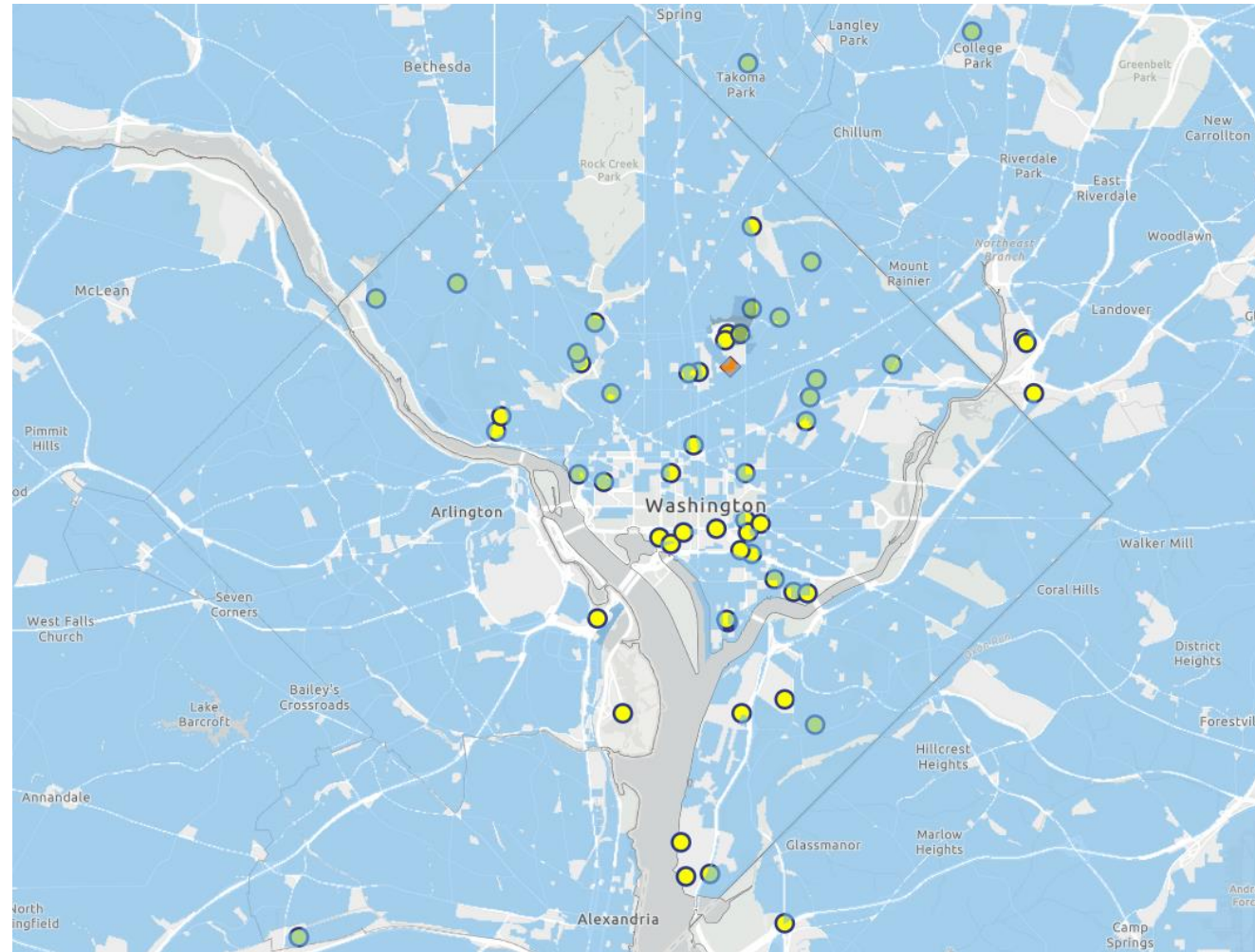
Image Credit:  
Hazem Mahmoud, Ph.D.  
Atmospheric Science Data Center  
NASA Langley Research Center

20 km



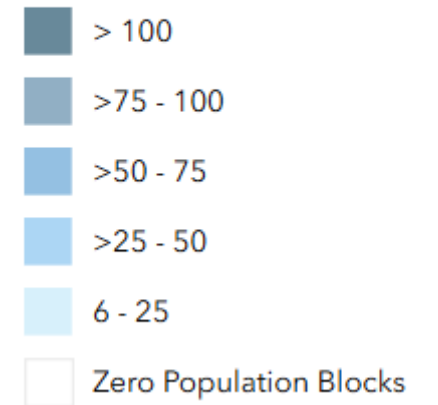
27

# HAP Sources and Risk from AirToxScreen



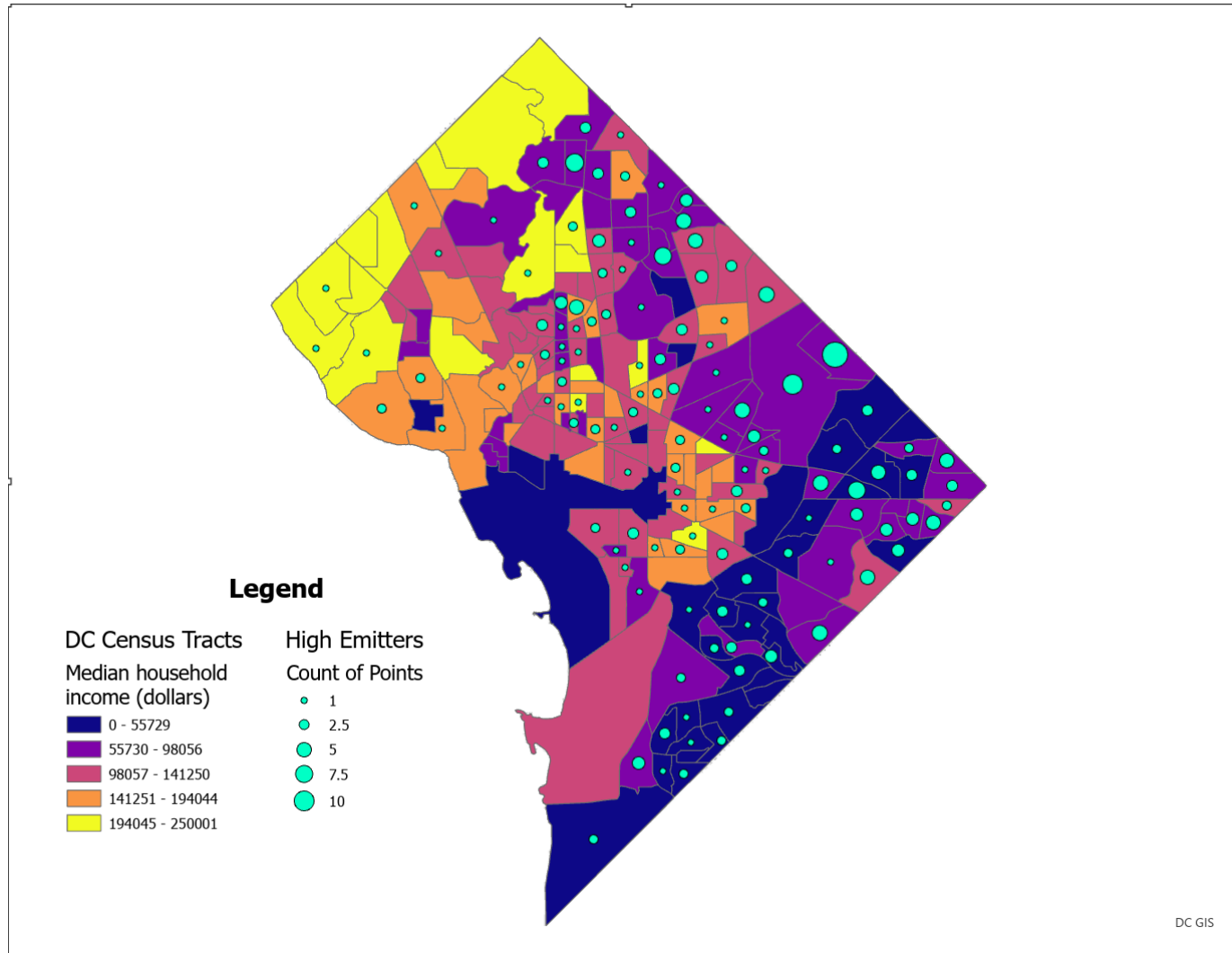
## Cancer Risk (2020)

CR Total Risk (in a million)



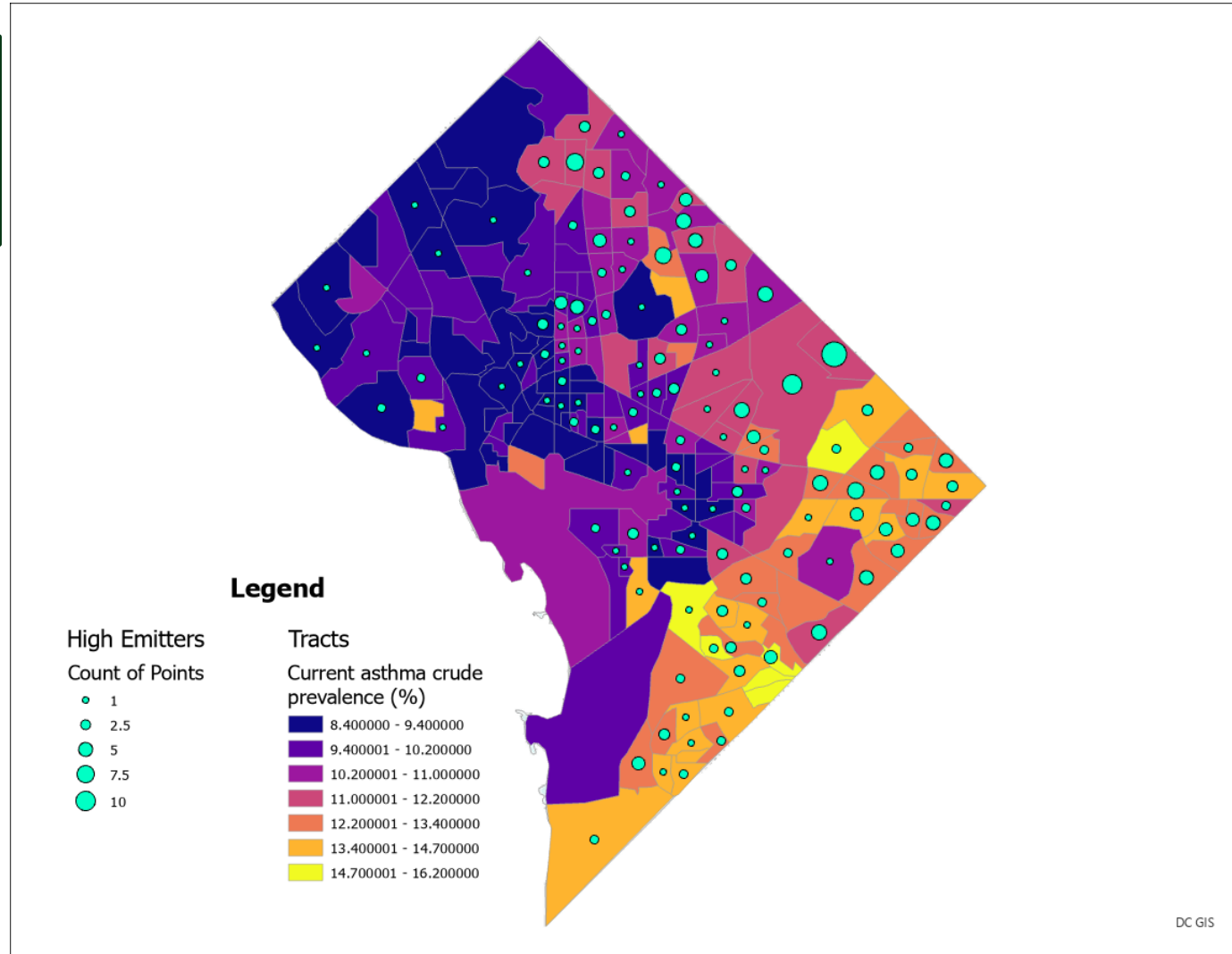
# Vehicle Emissions Differential Burden: Income

-Income data from US  
Census Bureau  
-Emissions data from  
2024 RSD study

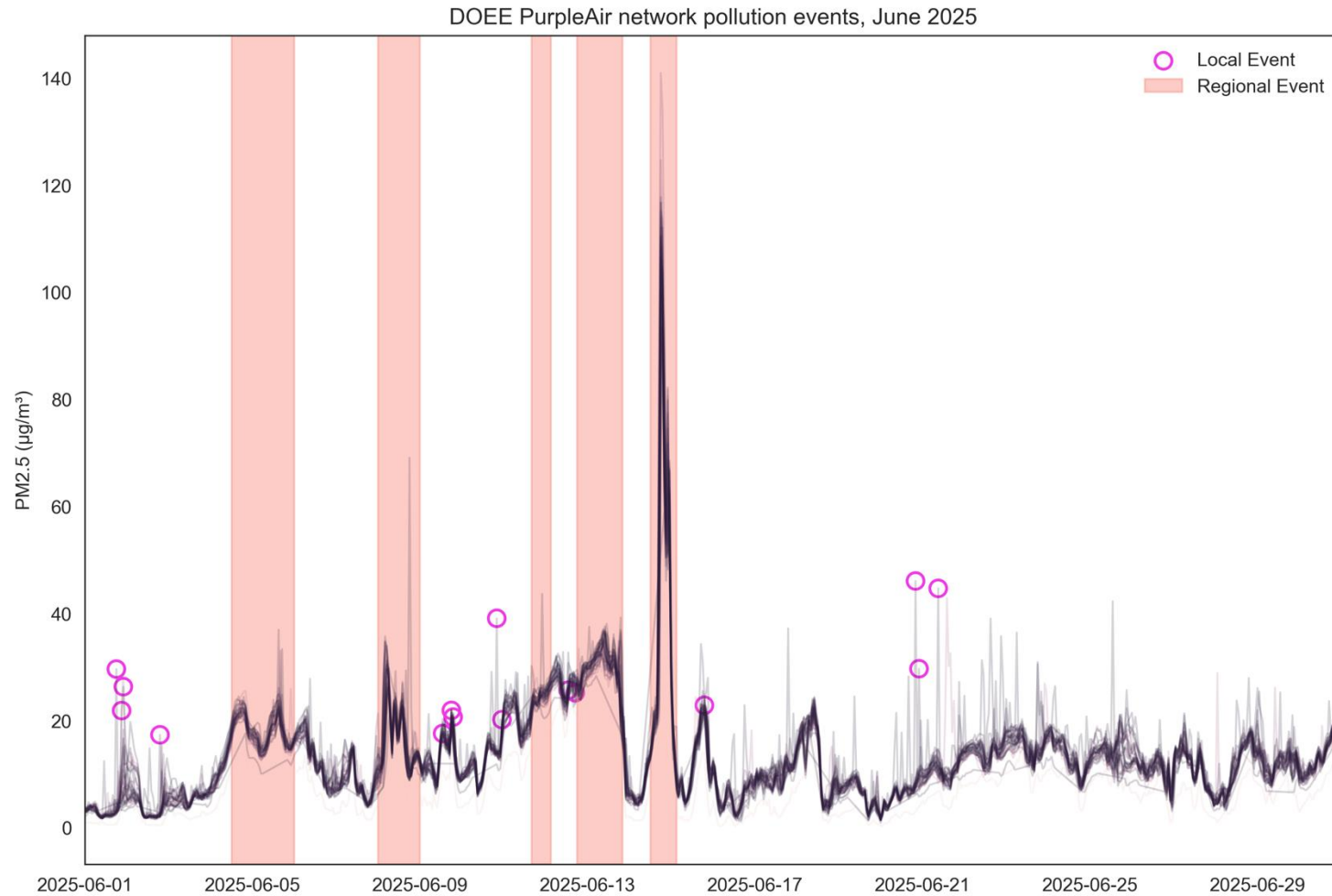


# Vehicle Emissions Differential Burden: Asthma

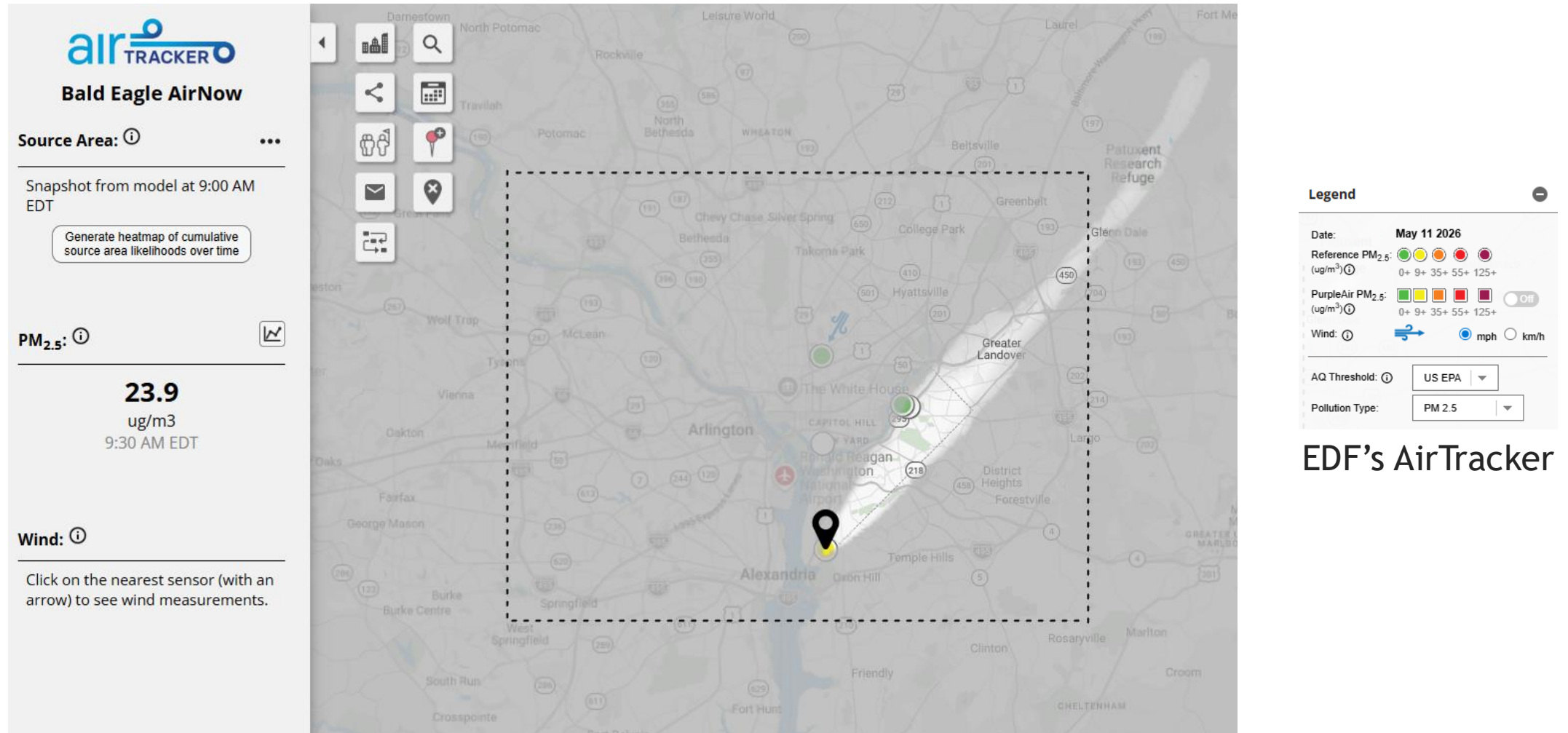
-Asthma data from  
CDC PLACES  
-Emissions data from  
2024 RSD study



# Outlier Detection Methodology

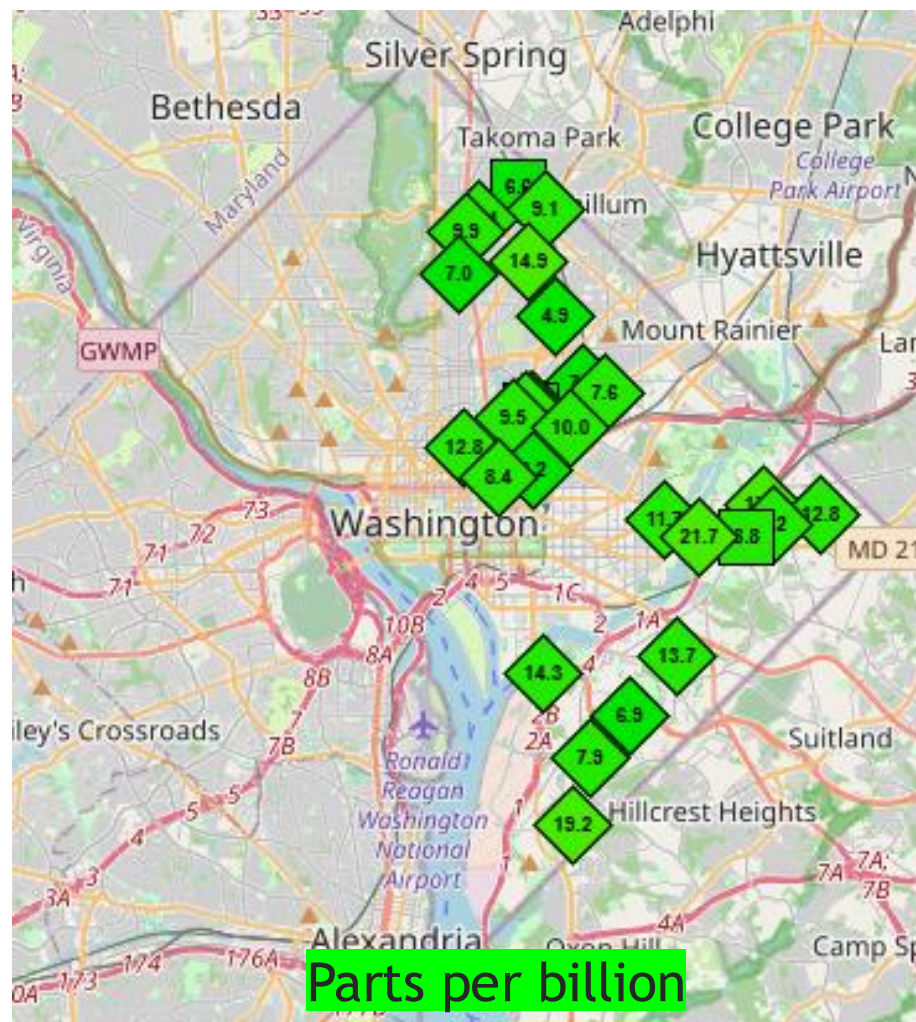
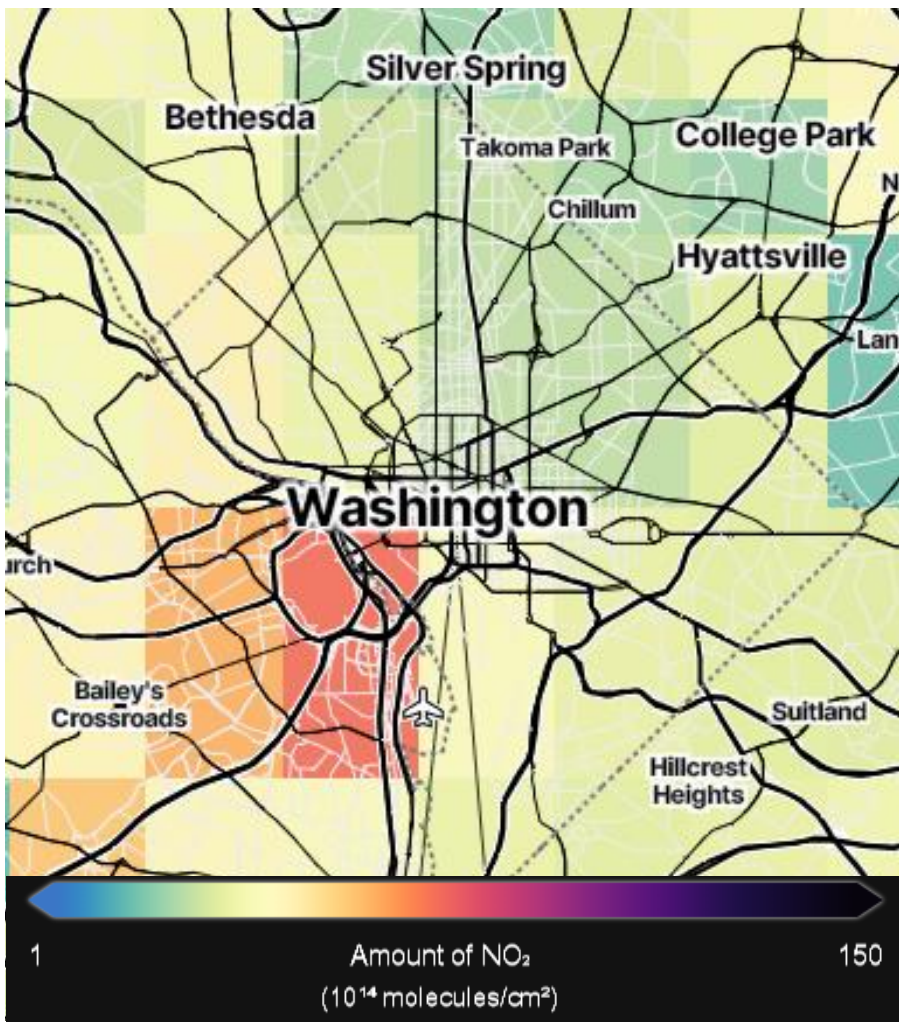


# Regional-scale back trajectories

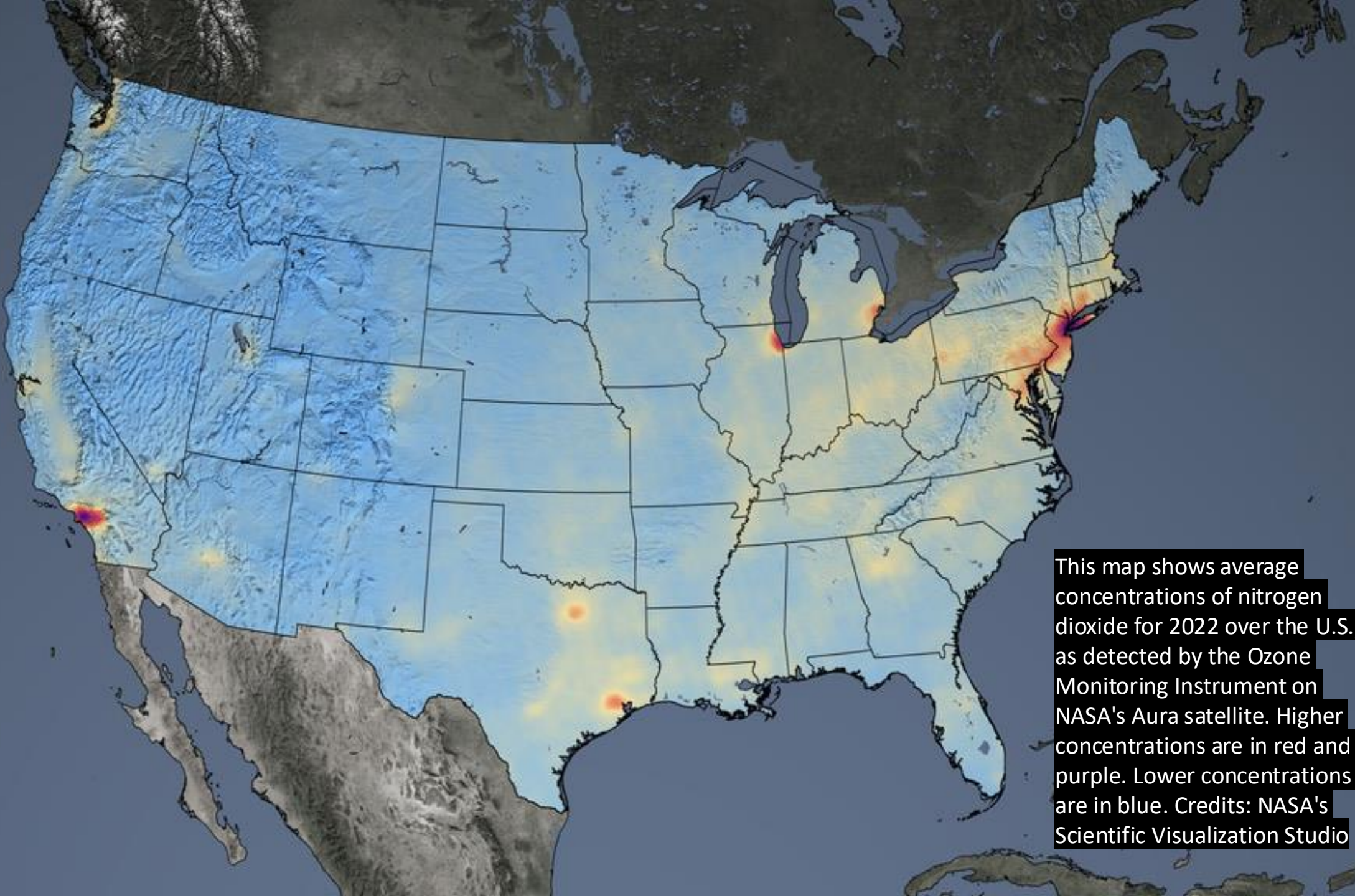


EDF's AirTracker

# Analysis of Ground-based vs. Satellite-based Measurements



NO<sub>2</sub> in the District on April 11, 2026, measured by TEMPO satellite (left) and DOEE low-cost sensor network (right)



This map shows average concentrations of nitrogen dioxide for 2022 over the U.S., as detected by the Ozone Monitoring Instrument on NASA's Aura satellite. Higher concentrations are in red and purple. Lower concentrations are in blue. Credits: NASA's Scientific Visualization Studio

# Current and possible applications for satellite data in DC

---

Current and/or achievable

Sensitivity analysis - informational complement to ground-based sensors

Regional-scale back-trajectories - regulatory and enforcement

Aspirational

Air quality forecasting

Improved forecasting and “nowcasting” for air alerts

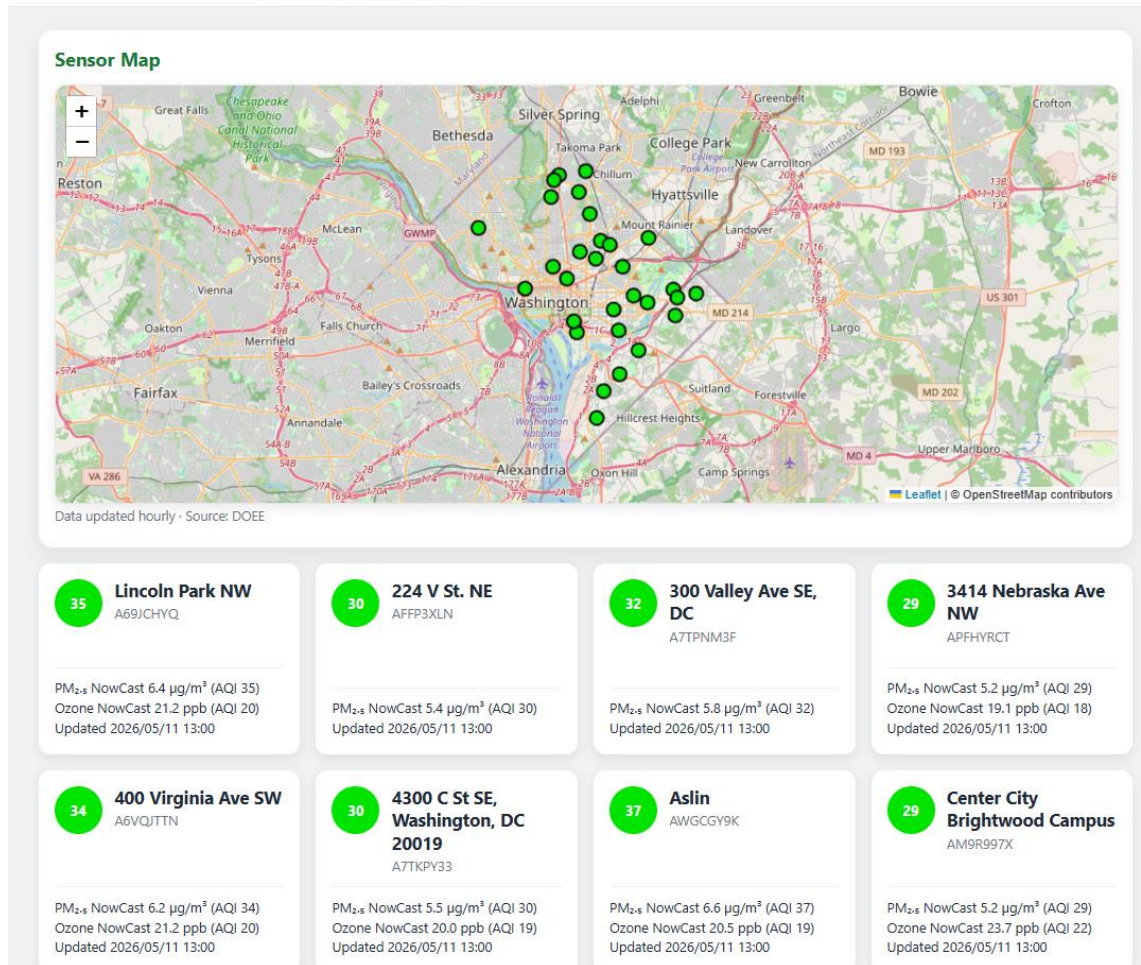
FEM-equivalent satellite data for criteria pollutants; “fill in” ground-based networks

Reliably detect and speciate fine and ultrafine PM, HAPs, and attribute to sources from space!

Regional-scale back-trajectories - informational

Deeper, actionable insights into ozone formation and smoke transportation

# Low-cost Sensors –Dashboards



- DOEE-built dashboard for real-time data from our Clarity node network
- Main intent is to provide sensor hosts with hyper-local data
- Public input will also inform design of future dashboards, potentially combining those from multiple sensors



Clarity map



PurpleAir map



VG Bench map



Thank you!

Get in touch:

[Samuel.Kay@DC.gov](mailto:Samuel.Kay@DC.gov)

[Kane.Samuel@DC.gov](mailto:Kane.Samuel@DC.gov)