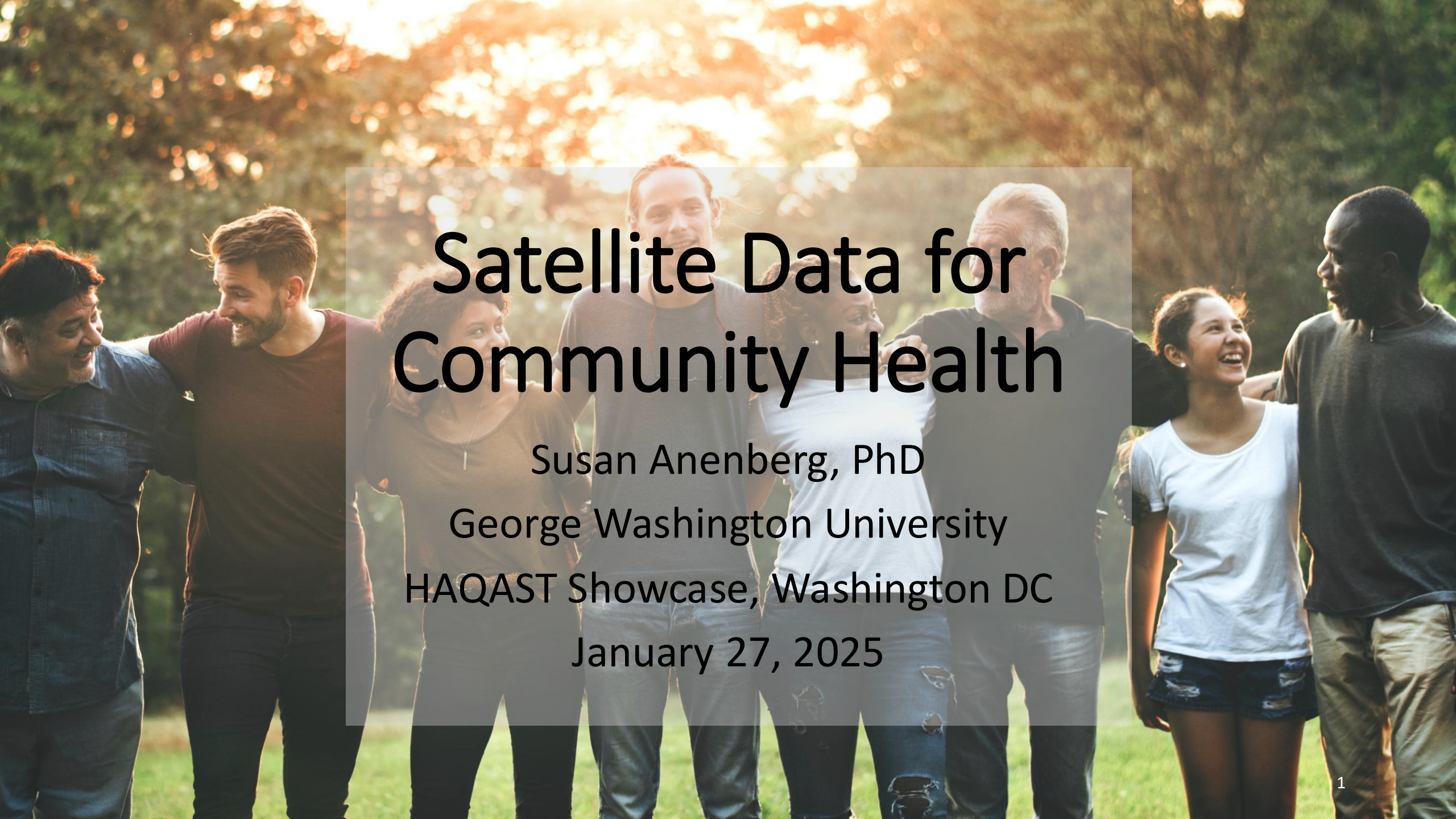


Satellite Data for Community Health

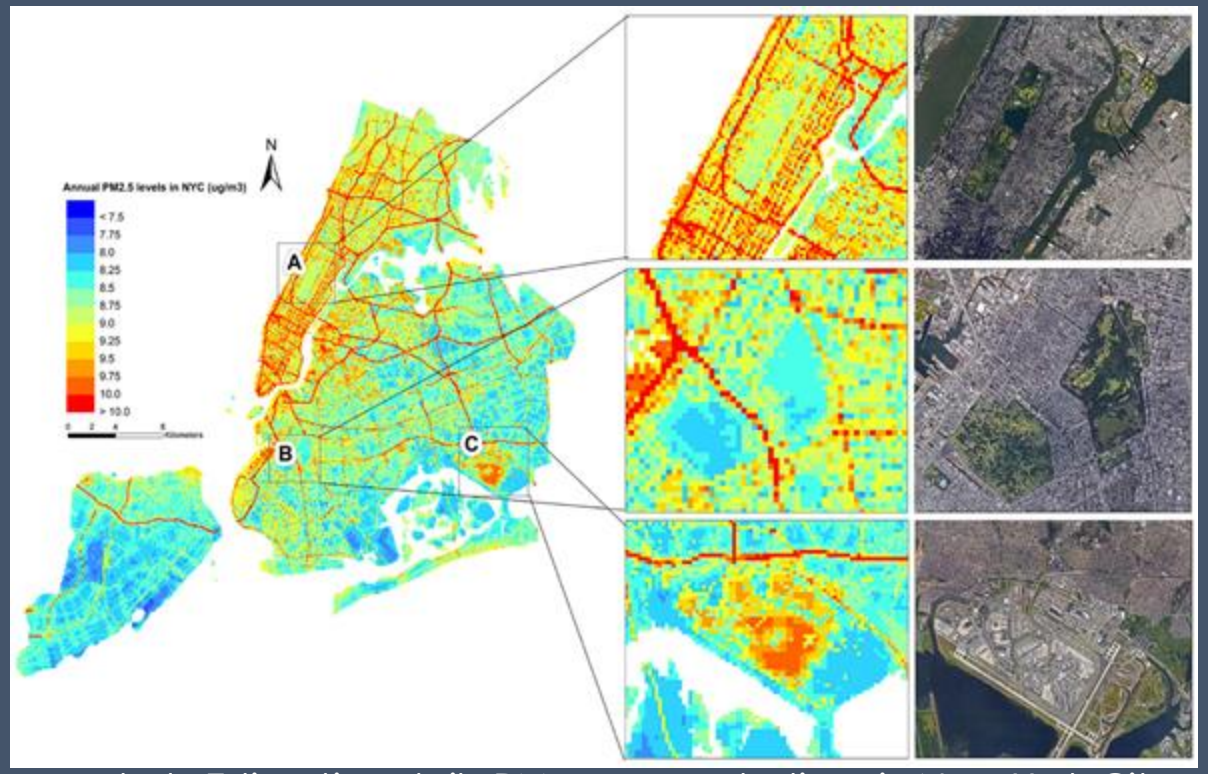
Susan Anenberg, PhD
George Washington University

HAQAST Showcase, Washington DC

January 27, 2025

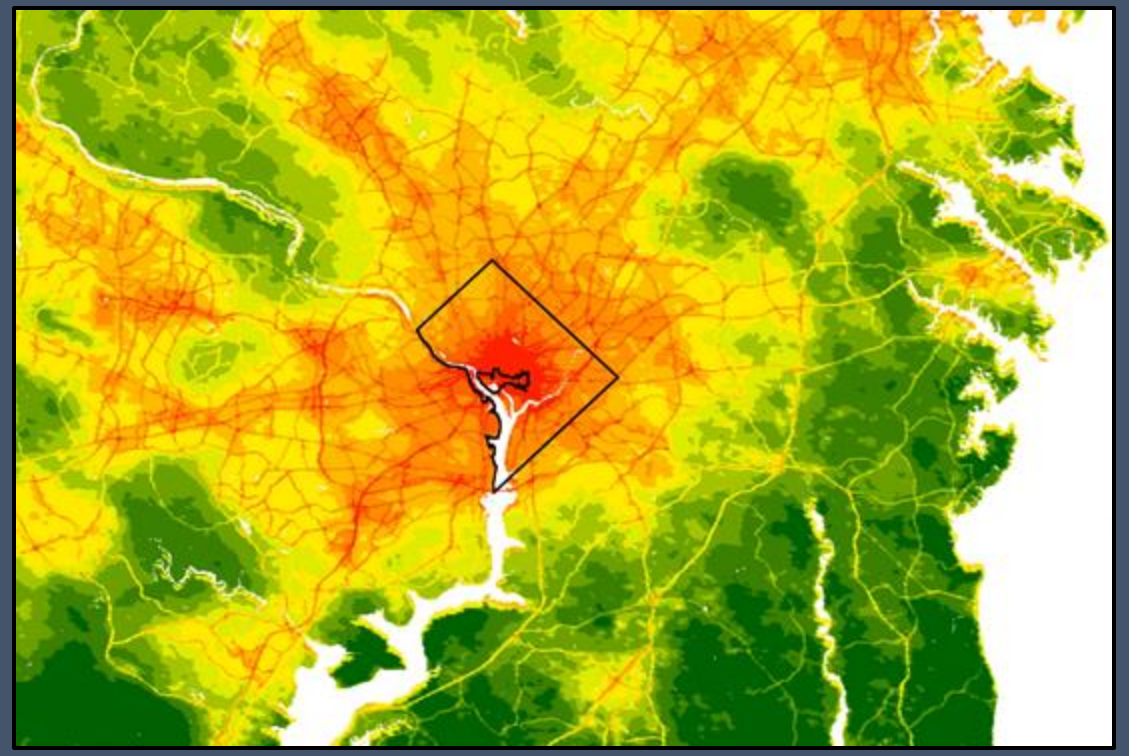
Satellite datasets provide information at scales relevant for community health

$PM_{2.5}$ in New York City



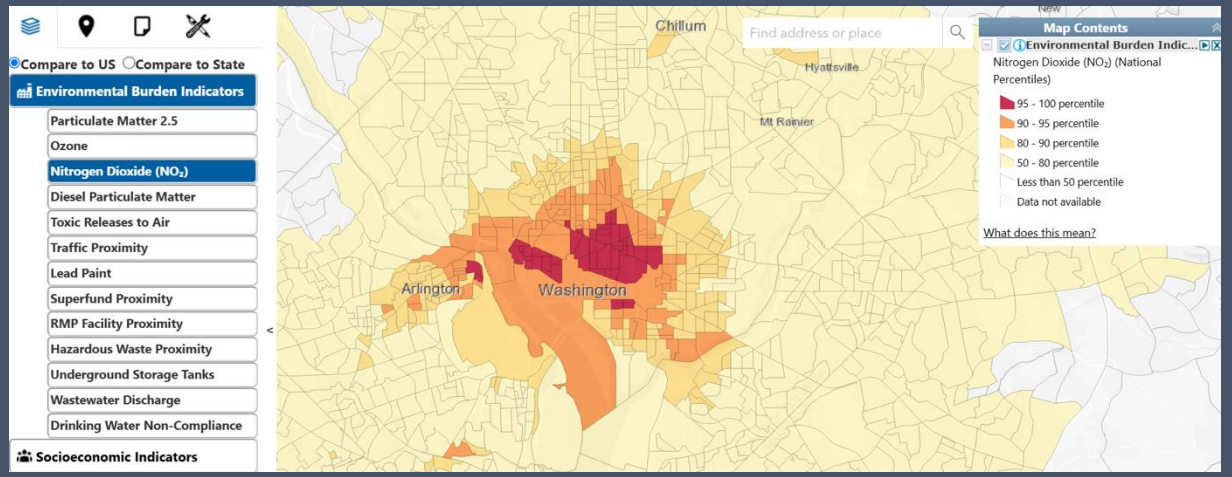
Huang et al., Estimating daily $PM_{2.5}$ concentrations in New York City at the neighborhood-scale: Implications for integrating non-regulatory measurements, Science of the Total Environment, 2019

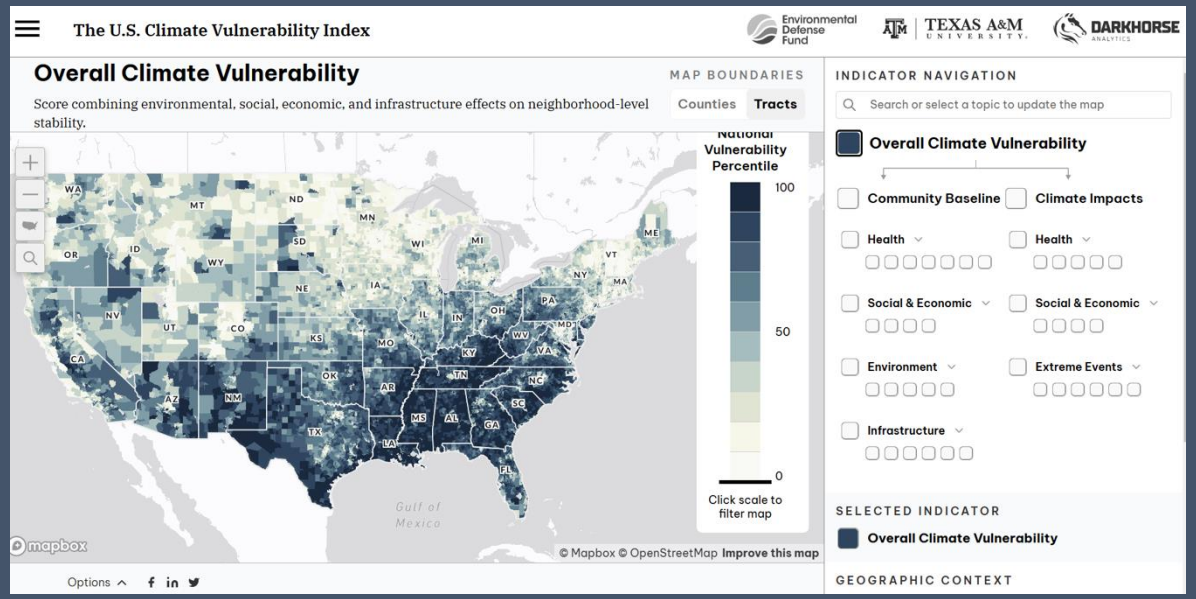
NO_2 in Washington, DC



Data from: Anenberg et al., Long-term trends in urban NO_2 concentrations and associated paediatric asthma incidence: estimates from global datasets, Lancet Planetary Health, 2022

Integrated satellite data into mapping tools



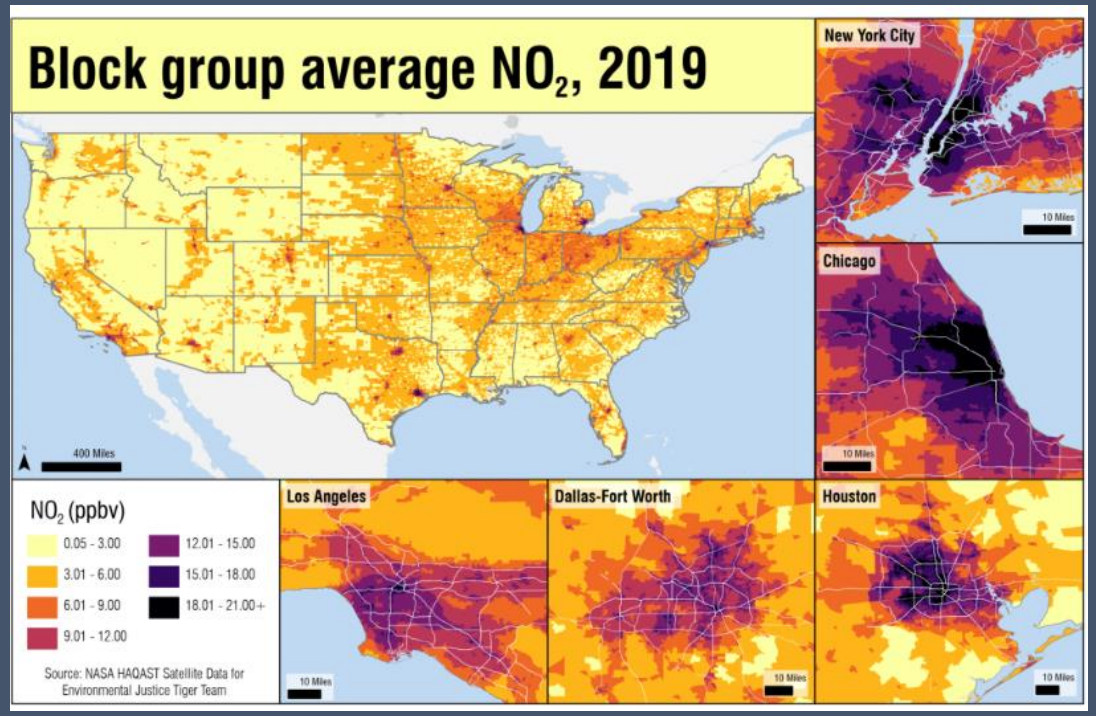


Mapping tools critical for viewing community-scale environmental risk factors:

- How much pollution is in my area?
- How does pollution in my neighborhood compare to other neighborhoods?

Increased accessibility of satellite data

Aggregating data to administrative boundaries



Produced by Gaige Kerr, GW

Reformatting datasets and made them easier to download

– TROPOMI NO2 (January 2019–)

This dataset includes daily gridded TROPOMI NO2 data, zipped into monthly files, as well as data in shapefile format. These data were generated from Level-2 satellite data (on swaths) and gridded to a 12km x 12km (daily and annual), 4km x 4km (daily and annual), and 1km x 1km (annual) horizontal resolution over the continental United States using the Wisconsin Horizontal Interpolation Program for Satellites (WHIPS) for ease of comparison with photochemical grid model output.

Download Annual Files

Gridded netCDF
- 2023 (1km)
- 2022 (12km | 4km | 1km)
- 2021 (12km | 4km | 1km)
- 2020 (12km | 4km | 1km)
- 2019 (12km | 4km | 1km)

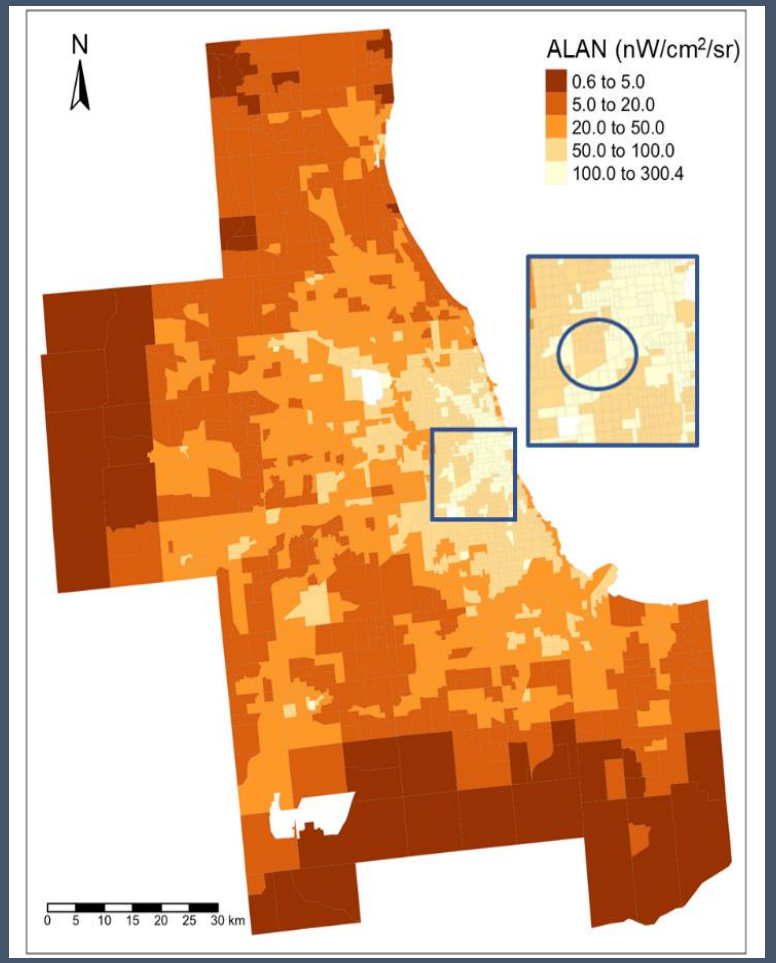
Gridded Shapefiles
- 2023 (12km | 4km)
- 2022 (12km | 4km)
- 2021 (12km | 4km)
- 2020 (12km | 4km)
- 2019 (12km | 4km)

County Shapefiles
- 2023 (12km | 4km)
- 2022 (12km | 4km)
- 2021 (12km | 4km)
- 2020 (12km | 4km)
- 2019 (12km | 4km)

https://sage.nelson.wisc.edu/data-and-models/datasets/satellite-data-for-air-quality/

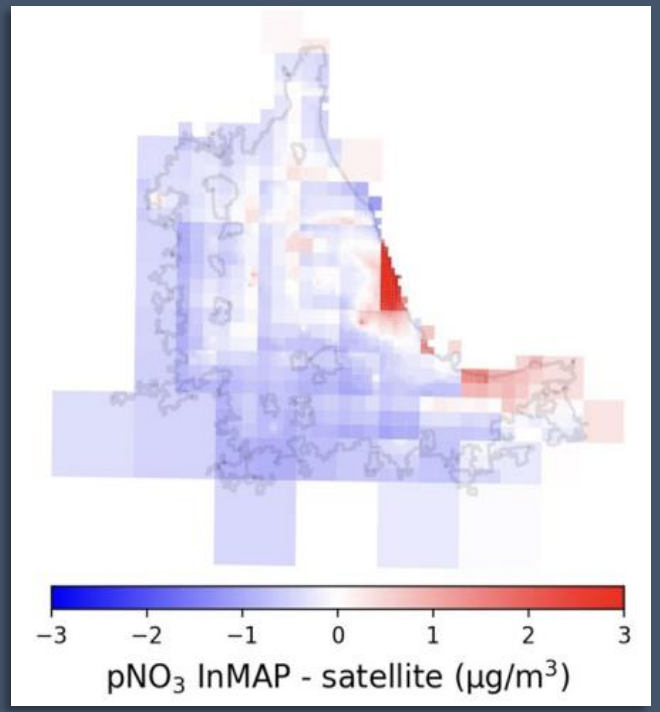
Light pollution as a community health issue

https://www.earthdata.nasa.gov/news/worldview-image-archive/floridas-night-lights



In the US, some neighborhoods experience higher levels of light pollution, an emerging environmental hazard.

Community health assessment with satellite data and reduced-form models



Difference between city-boundary scaled InMAP and satellite-derived data over Chicago, IL for pNO_3 from *Gallagher, C. L., Holloway, T., Tessum, C. W., Jackson, C. M., & Heck, C. (2023). Combining satellite-derived PM2.5 data and a reduced-form air quality model to support air quality analysis in US cities. GeoHealth, 7, e2023GH000788. https://doi.org/10.1029/2023GH000788*

- Satellite-derived $PM_{2.5}$ improves results from the Intervention Model for Air Pollution (InMAP), the only model capable of capturing **neighborhood-scale $PM_{2.5}$ across the U.S.** (Gallagher et al., 2023).
- We worked with non-profits and governments to use satellite data and models to complement monitoring.

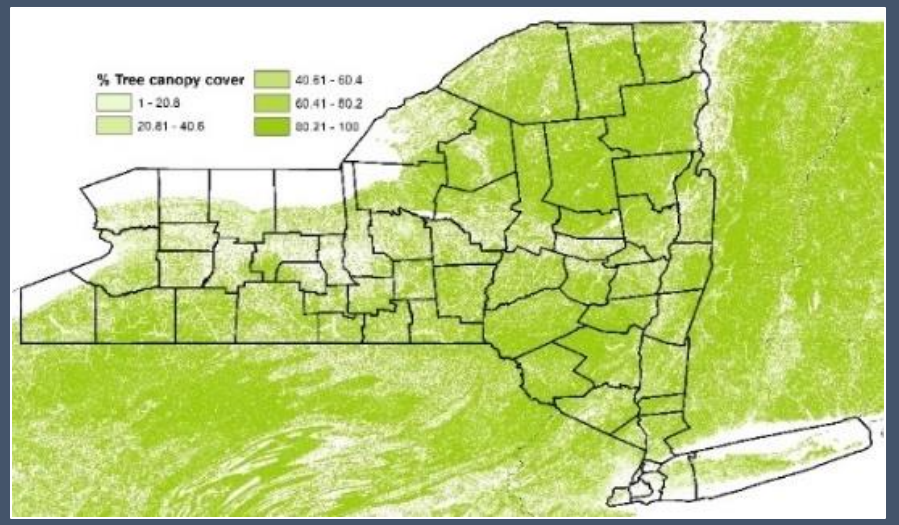
"Better information about air quality will help us know when to take action to protect our health and help our community develop strategies to reduce pollution where it is highest."
– City of Madison, Overview of Local Air Monitoring Initiative

Teaching/learning modules for community health

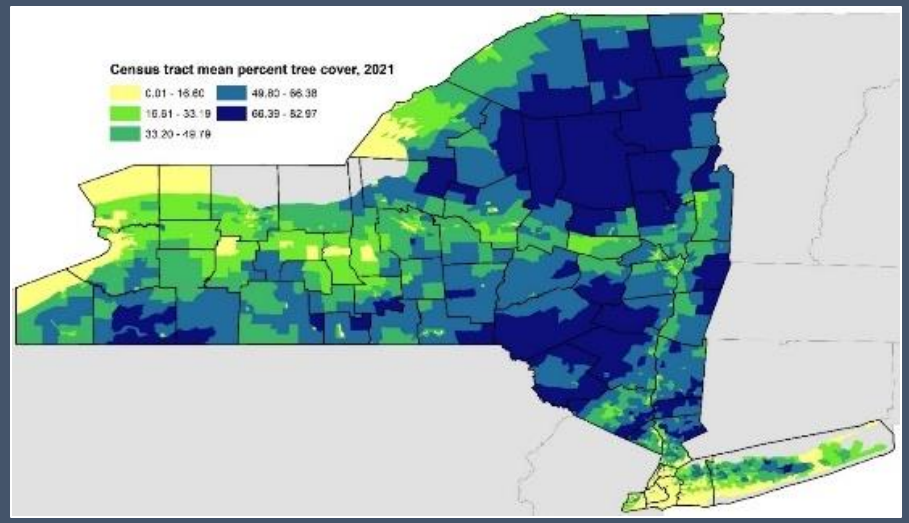
- Module on ***"Outdoor workers, heat, air pollution, and tree cover in New York: a rural-urban narrative"*** (by Susana Adamo and John Squires's, Arlene Fiore's team)

- Students compared communities:
  1. Heat, air pollution, and health
  2. Tree canopy cover and outdoor workers' exposure

USDA Forest Service 2023. National Land Cover Database Tree Canopy Cover, 2011-21



Census tract mean percent tree canopy cover



HAQAST

Massachusetts Institute of Technology

Columbia University in the City of New York

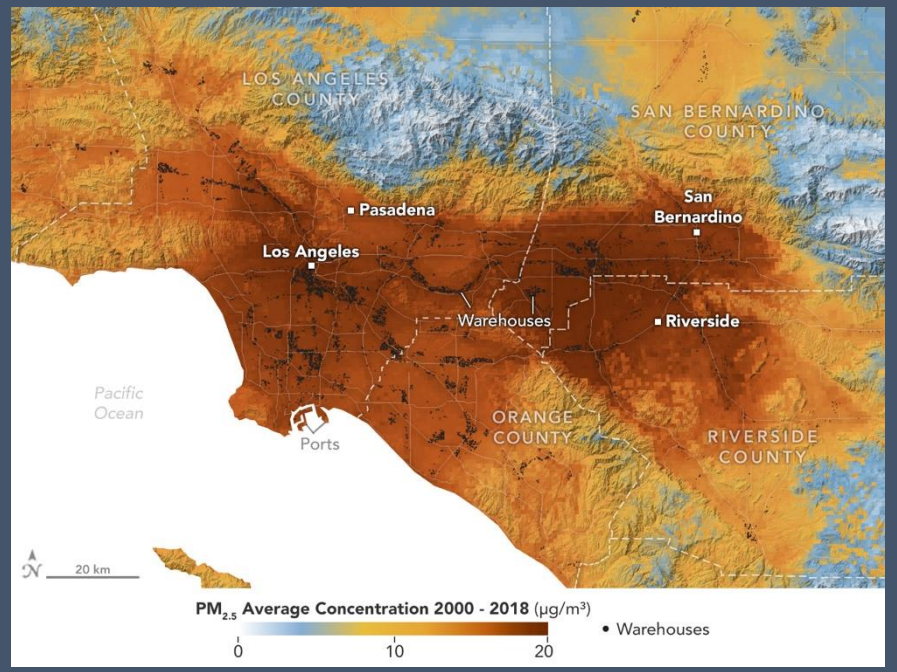
EARTH | 4 MIN READ

NASA-Funded Study Assesses Pollution Near Los Angeles-Area Warehouses

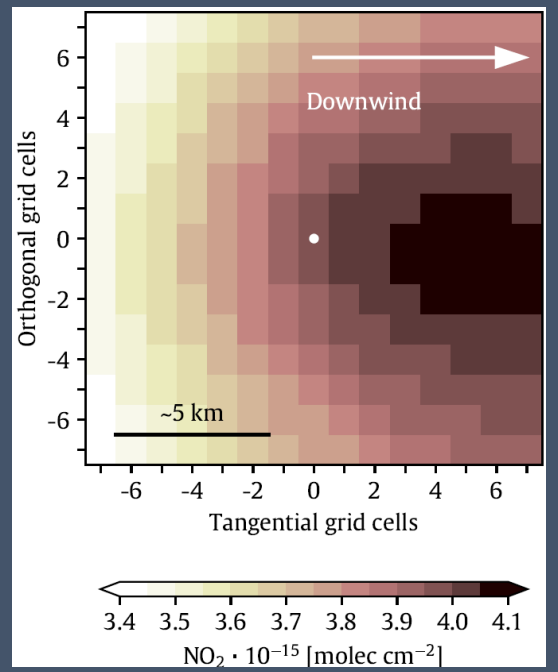
Oct. 9, 2024

Warehouses were associated with higher NO_2, $PM_{2.5}$, and elemental carbon concentrations nearby.

https://www.nytimes.com/2024/07/24/climate/e-commerce-truck-pollution.html



https://www.jpl.nasa.gov/news/nasa-funded-study-assesses-pollution-near-los-angeles-area-warehouses/



https://www.nature.com/articles/s41467-024-50000-0

NO_2 pollution:
A top risk factor for children in US cities

GBD

Global burden and strength of evidence for 88 risk factors in 204 countries and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021

oa

GBD 2021 Risk Factors Collaborators*

Lancet 2024; 403: 2162–203

See Comment page 1960

*Collaborators listed at the end of the Article

Correspondence to: Prof Simon I Hay, Institute for

Summary

Background Understanding the health consequences associated with exposure to risk factors is necessary to inform public health policy and practice. To systematically quantify the contributions of risk factor exposures to specific health outcomes, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2021 aims to provide comprehensive estimates of exposure levels, relative health risks, and attributable burden of disease for 88 risk factors in 204 countries and territories and 811 subnational locations, from 1990 to 2021.

District of Columbia
Both sexes, 5-14 years, DALYs per 100,000

2021 rank
1 Low birth weight
2 Short gestation
3 High body-mass index
4 Bullying
5 NO2 pollution
6 Iron deficiency
7 High alcohol use
8 Kidney dysfunction
9 High fasting plasma glucose
10 Child wasting

Key accomplishments for community health

Integrated satellite data into **mapping tools**

Increased **accessibility** of satellite data

Fostered **research** using satellite data for community health

Sincere THANK YOU to all HAQAST teams, partners, and NASA!