



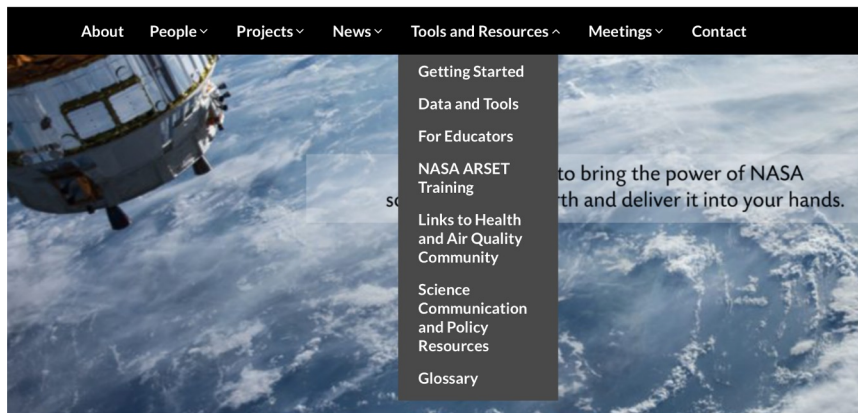
Session 1B: Facilitating the Use of Satellite Data by the Novice User

Moderator: Jenny Bratburd

Featuring HAQAST PIs and Tiger Team Leads

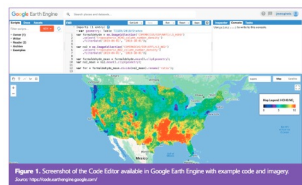


NASA HEALTH AND AIR QUALITY
APPLIED SCIENCES TEAM
Connecting NASA Data and Tools with Health and Air Quality Stakeholders

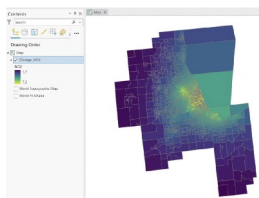


Resources for Users to Learn How to Use Datasets

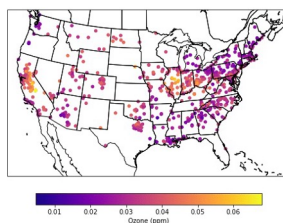
Tutorials designed for formats users work with, including Google Earth Engine, ArcGIS, Python



A Practical Methodology Using Google Earth Engine



Mapping Gridded TROPOMI NO₂ with ArcGIS

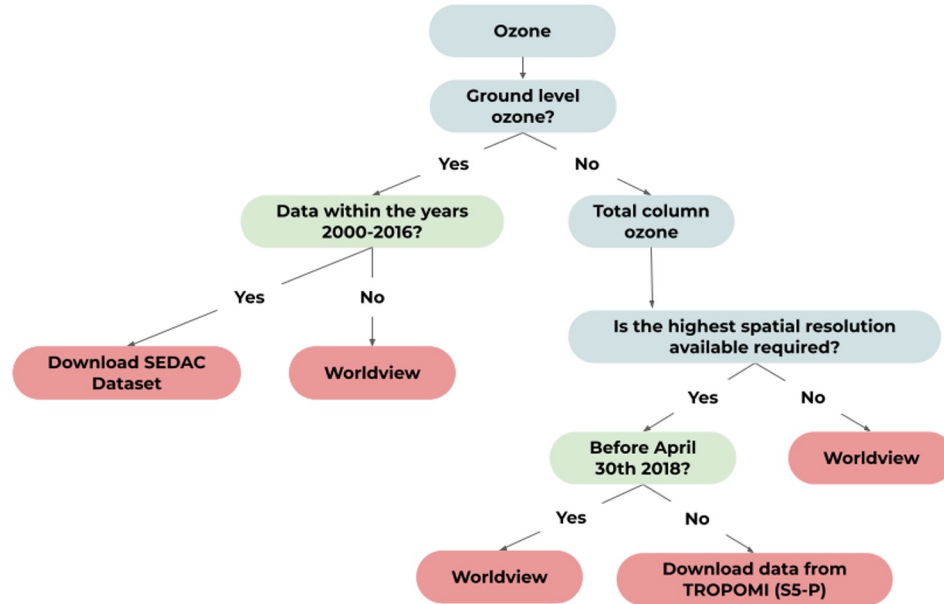


Python Tutorials for Atmospheric and Geophysical Sciences

Find more at <https://haqast.org/data-and-tools/>



Resources for Users to Find Datasets

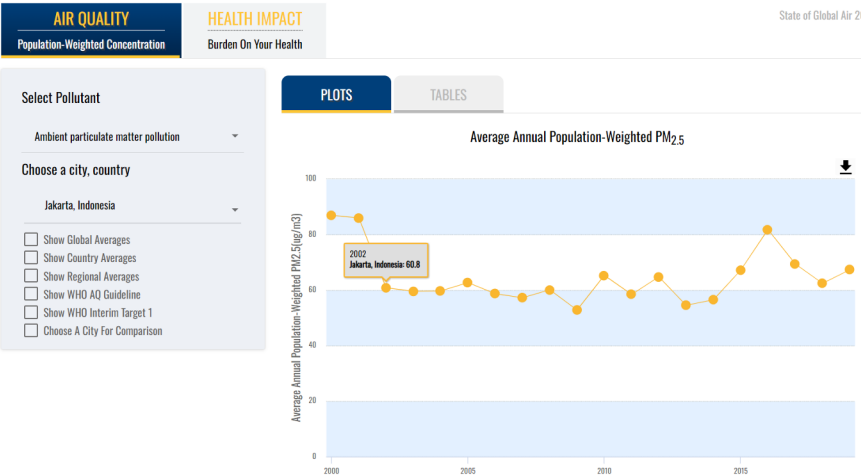


HAQAST Satellite Data Flowchart guides users to 30+ different tools and tutorials based on their interests.

Find more at <https://haqast.org/data-and-tools/>

Excerpt from HAQAST Flowchart





Air pollution and health in cities globally

NO₂, ozone, and PM_{2.5} concentrations and disease burdens in all urban areas globally, from 2000 to 2019

urbanairquality.online
<https://www.stateofglobalair.org/resources/health-in-cities>

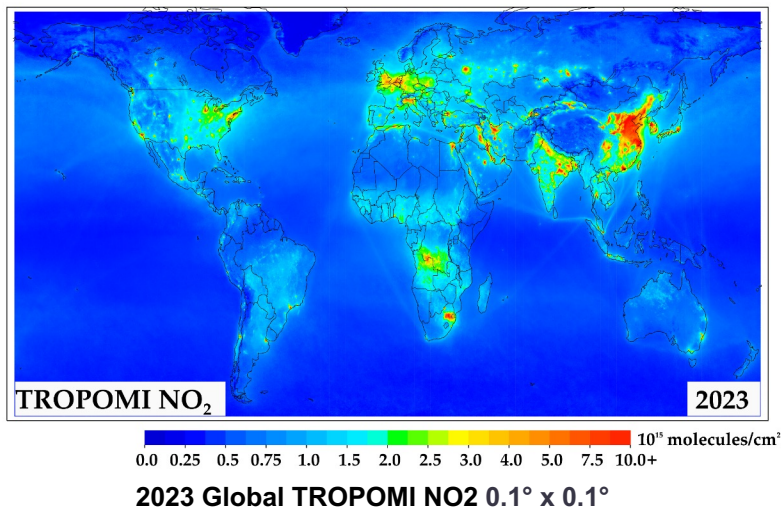
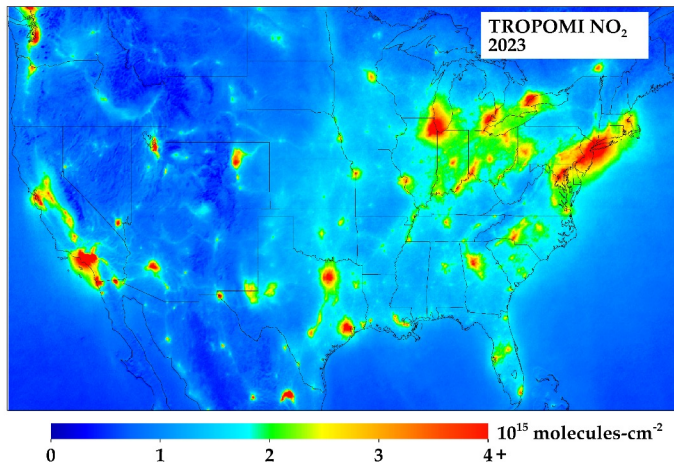


IHME



Interactive websites enable users to display maps, generate charts, compare cities, and download data

2023 Continental TROPOMI NO₂ 0.01° x 0.01°



Satellite NO₂: TROPOMI Monthly and Annual Averages

Continental US: 0.01° x 0.01°

Global: 0.1° x 0.1°

2019 - 2023 available

NetCDF4 file format

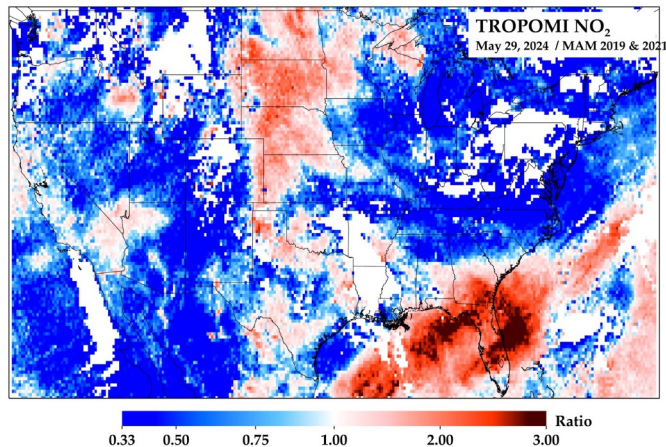
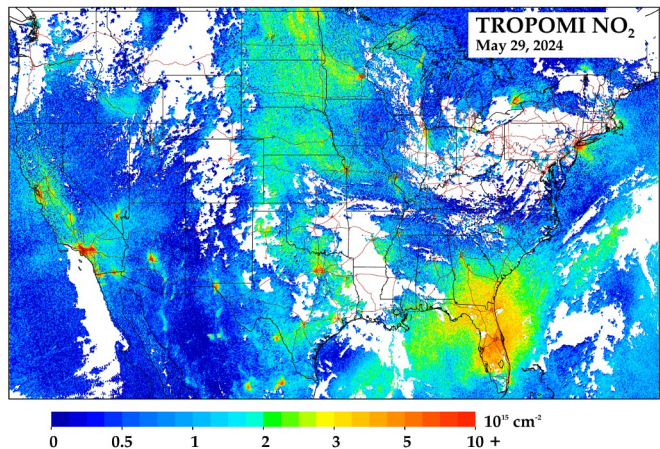
https://search.earthdata.nasa.gov/search?q=HAQ_TROPOMI_NO2

Continental US data available now

Global data available soon, temporary link:

<https://gwu.box.com/s/eq255z7gzl7q2jsjwa8h9oov10089eo1>





Ratio between May 29, 2024 and a
Spring 2019/2021 climatology

Daily Satellite NO₂ maps

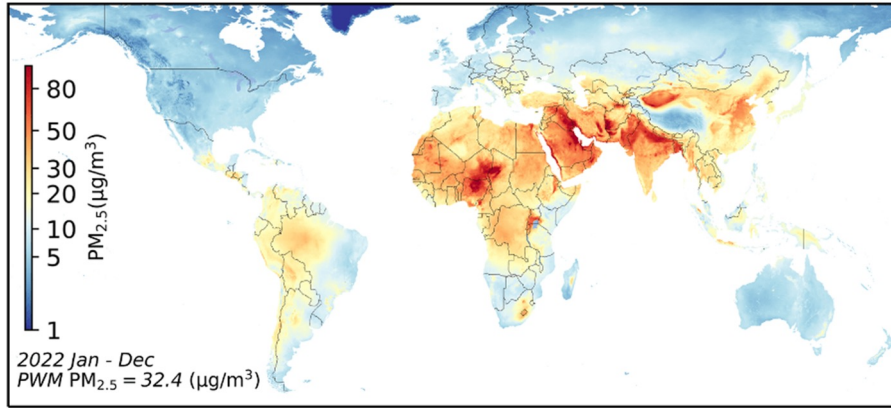
PNG plots of daily TROPOMI NO₂,
comparison to climatology, and pre-
generated zoom-in's

Also have seasonal comparisons too

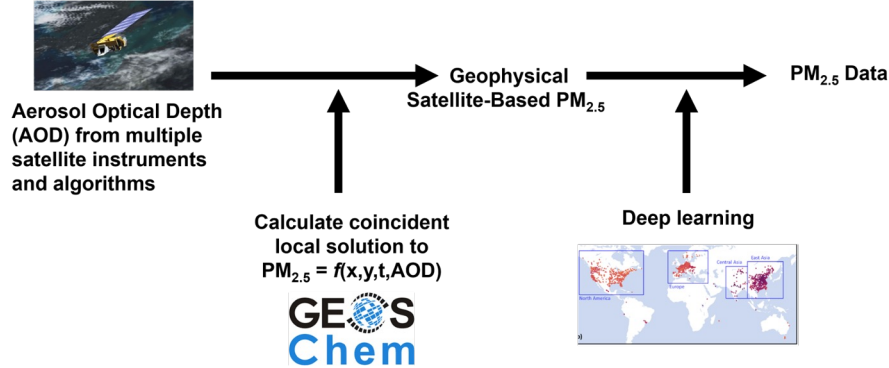
<https://tropomino2.us/>



Satellite-derived PM_{2.5} Data



Monthly global PM_{2.5} data (V6.GL.02)
for 1998-2022 gridded at 1x1 km²

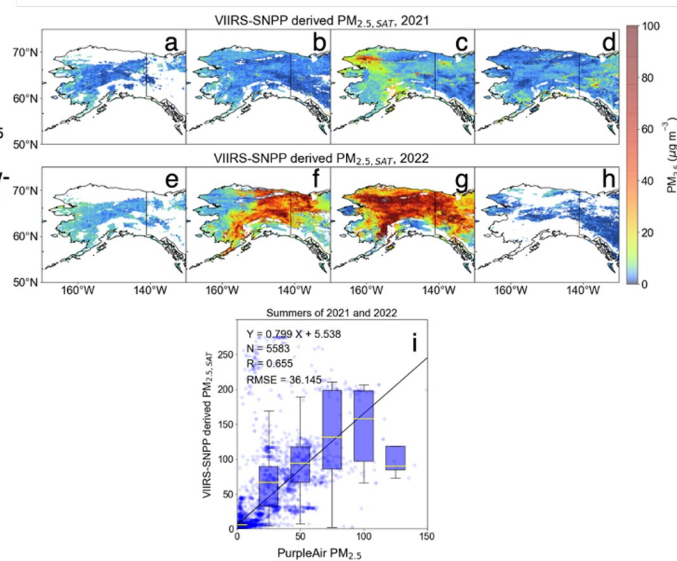
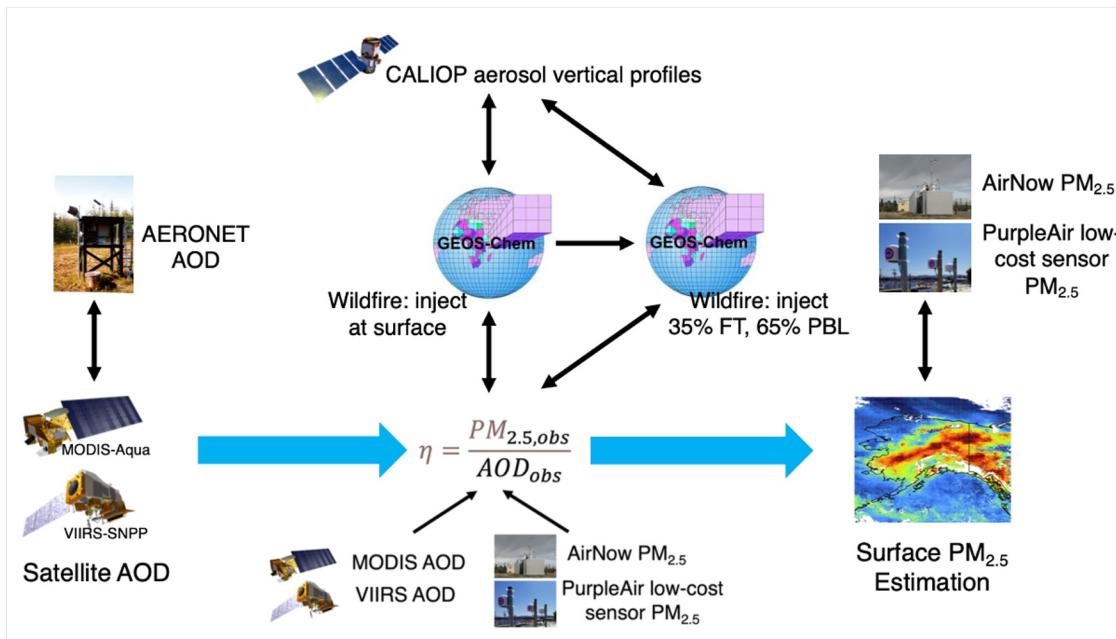


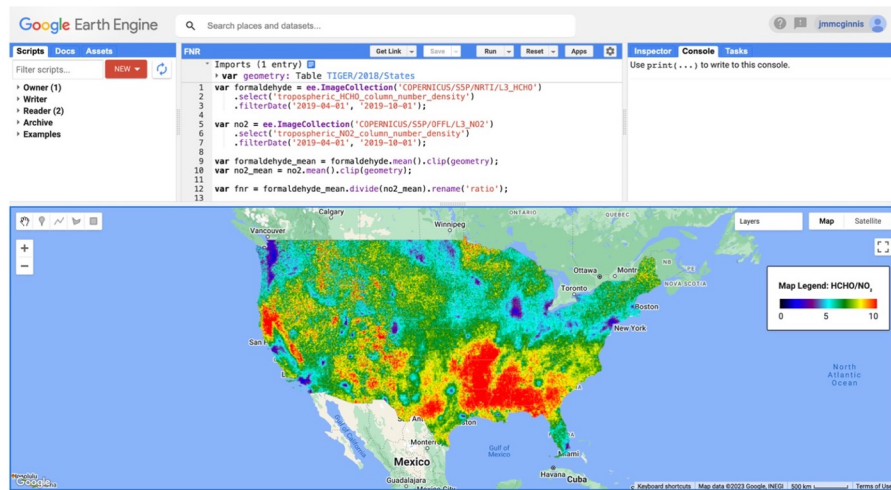
<https://sites.wustl.edu/acag/datasets/surface-pm2-5/>

Example data for 2022 and algorithmic overview



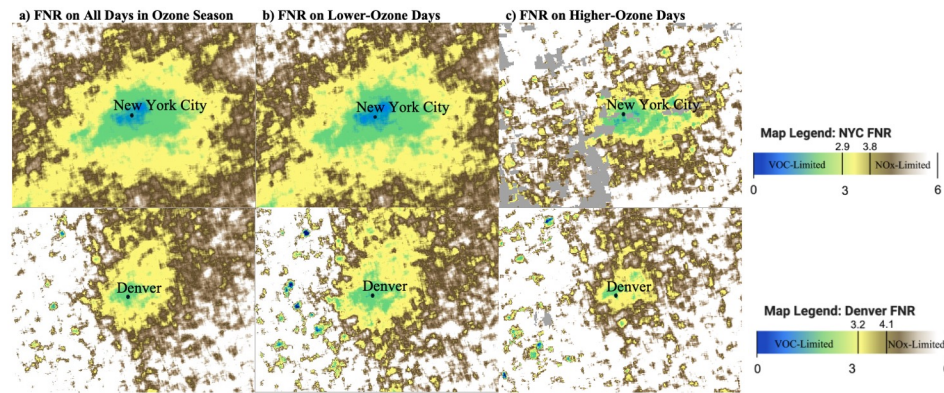
A quick and direct method to estimate surface PM_{2.5} in Alaska during wildfire season





Google Earth Engine for Health and Air Quality

Satellite data from MODIS, Sentinel, and Landsat available for data manipulation and plotting without data download.



Jennifer McGinnis, Tracey Holloway, Jenny Bratburd, Madankui Tao, and Arlene Fiore (2023) "Satellite Data to Inform Ozone Sensitivity: A Practical Methodology Using Google Earth Engine". Air & Waste Management Association EM Magazine.

Article: Air and Waste Management Association EM Magazine (December 2023 Ozone Issue)

Tutorials: <https://hollowaygroup.org/tutorials>



COLORADO STATE
UNIVERSITY



WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON



INPUT EXPOSURE DATASETS

Daily PM_{2.5}

Bi et. al 2019



Di et. al 2021



EQUATES
(EPA Air
QUALITY Time
Series)



FAQSD
(Fused Air
Quality Surface
Using
Downscaling)



WRF-CMAQ
with AOD, CO
(R. Kumar et. al
2021)



BNE



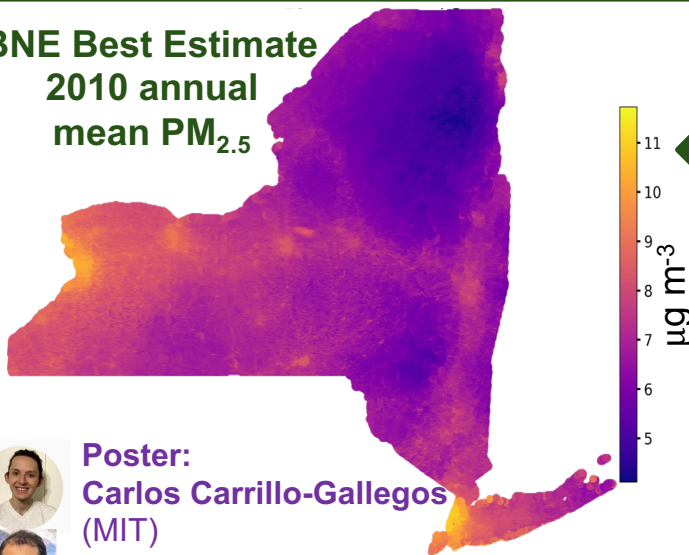
Jaime
Benavides
(Columbia)
Flash
Talk

Characterizing Pollutant Exposure and Uncertainty for Health Analyses

Novel **B**ayesian **N**onparametric
Ensembling (**BNE**) method
incorporates several exposure
datasets and provides a best estimate
with uncertainty

J. Paisley, S. Rowland, J. Zhe Liu, B. Coull and **M. -A. Kioumourtzoglou** (2022) Bayesian Nonparametric Model Averaging Using Scalable Gaussian Process Representations, 2022 IEEE International Conference on Big Data.

BNE Best Estimate
2010 annual
mean PM_{2.5}



µg m⁻³

daily PM_{2.5}
2010-2016 available

□ epi studies

Co-I Kioumourtzoglou (Session 5B tomorrow)
(MSPH/Columbia) & NYS DOH (T. Adeyeye & T. Insaf)

□ CIESIN/SEDAC

Co-I S. Adamo
CIESIN/Columbia
Flash Talk



MAILMAN SCHOOL
OF PUBLIC HEALTH



DEPARTMENT OF
EARTH, ATMOSPHERIC
AND PLANETARY SCIENCES



Poster:
Carlos Carrillo-Gallegos
(MIT)
Vijay Kumar
(Columbia)



STRESS Platform

System for the Triage of Risks from Environmental and Socio-economic Stressors



Combinatory Metrics Water Land Climate Economy Energy Climate Opinions

Demographics Health Biodiversity

Region
USA

Exposure to airborne particulate matter

2015

Deaths, ages 0 to 5

Deaths, ages 5 to 25

Deaths, ages 25+

Circulatory Deaths, ages 25+

Respiratory Deaths, ages 25+

Death Rate, ages 0 to 5

Estimated Death Rate, ages 0 to 5

Death Rate, ages 5 to 25

Estimated Death Rate, ages 5 to 25

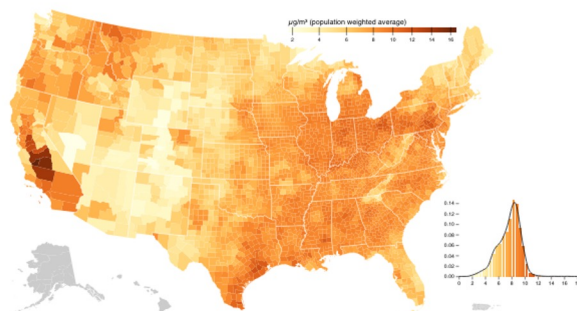
Death Rate, ages 25+

Estimated Death Rate, ages 25+

Circulatory Death Rate, ages 25+

Estimated Circulatory Death Rate, ages 25+

Exposure to airborne particulate matter



☐ Highways ☐ Major railroads ☐ Transmission lines
☐ Marine highways ☐ Critical water habitats ☐ Endangered species

DOWNLOAD DATA

DOWNLOAD IMAGE (SVG)

DOWNLOAD IMAGE (PNG)

About the Exposure to airborne particulate matter data

Gridded concentrations of fine particulate matter (PM2.5) (Di et al, 2021) are combined with gridded population data (US Census Bureau, 2018) to provide an estimate of exposure to airborne particulate matter.



Feedback

STRESS: A Data-Visualization Platform

- Growing collection of >100 variables
- Combinatory metrics allow user-inspired, interactive aggregation of variables
- Downloadable data & maps
- County-level report cards
- In progress: global mapping; future scenarios; including HAQAST datasets

STRESS platform: <https://mst.mit.edu/>

Schlosser, C.A., et al. (2023): Assessing Compounding Risks Across Multiple Systems and Sectors: A Socio-Environmental Systems Risk-Triage Approach. Front. Clim., 24 April 2023 Sec. Climate Risk Management Volume 5 - 2023
| <https://doi.org/10.3389/fclim.2023.1>



Wildfire Exposure Linked to Higher Risk of Death after Lung Cancer Surgery

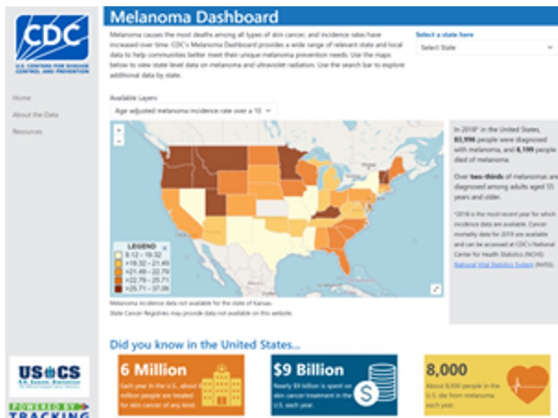
Study of 400,000+ individuals suggest need to prioritize of cancer patients and other medically high-risk populations in climate adaptation efforts.



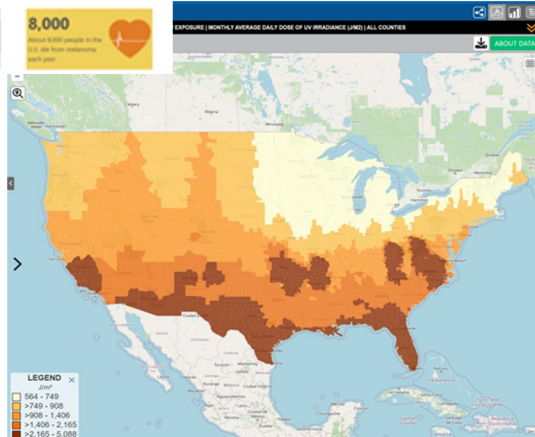
EMORY
UNIVERSITY



Zhang et al. (2023) JAMA
Oncology



Example: Monthly average daily dose of UV radiance (J/m^2) in Jan 2020. County level data estimated using OMI L2 Surface UV Irradiance Product



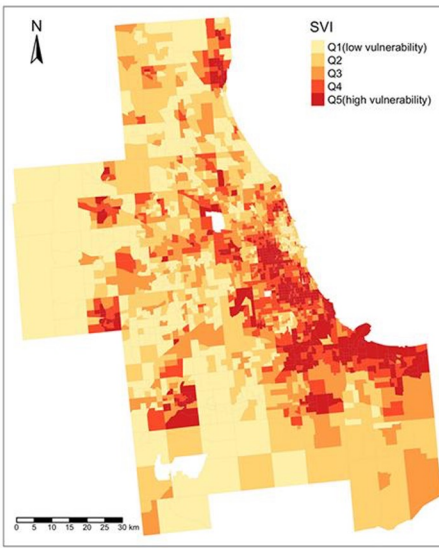
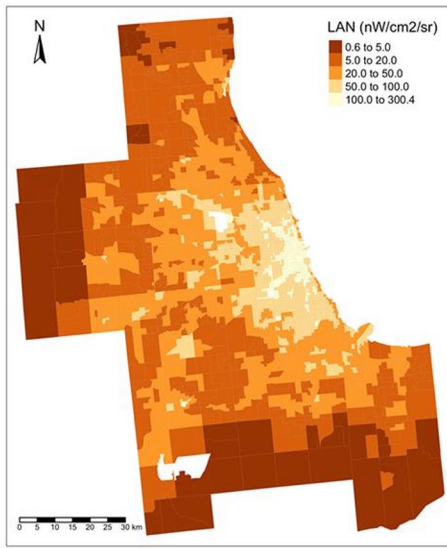
Satellite-based UV Radiation Data Integrated into CDC Melanoma Dashboard

Over 8,000 people died of melanoma in the US in 2018. Melanoma causes the most deaths among all types of skin cancer, and incidence rates have increased over time. CDC's Melanoma Dashboard provides a wide range of relevant state and local data to help communities better meet their unique melanoma prevention needs.



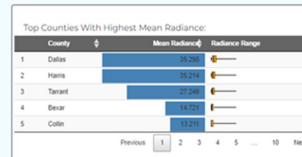
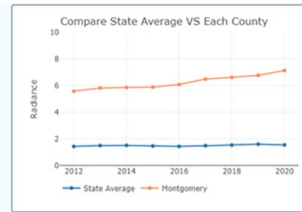
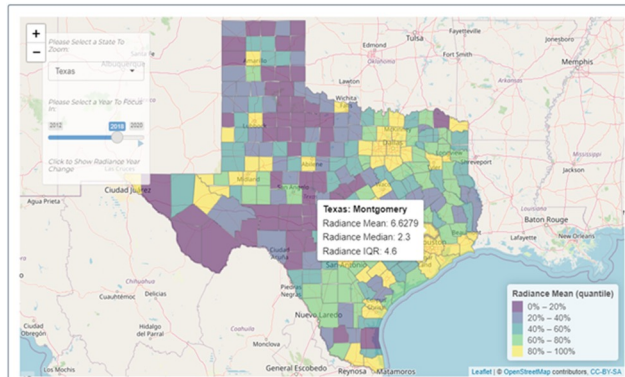
Stony Brook University





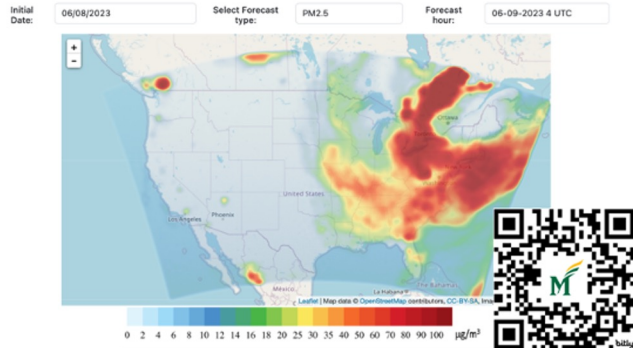
Brighter Neighborhoods Harm Human Health

- Light at night disrupts circadian rhythms, is associated with increased breast cancer risk
- Artificial light at night found to be higher in vulnerable neighborhoods
- ALAN data and dashboard published



Xiao et al. (2021) Environmental Health Perspectives
 Xiao et al. (2023) Environment International
 Xiao et al. (2023) Environmental Science and Pollution Research
 Dashboard: <https://spatiotemporal-data-science.shinyapps.io/ALAN>

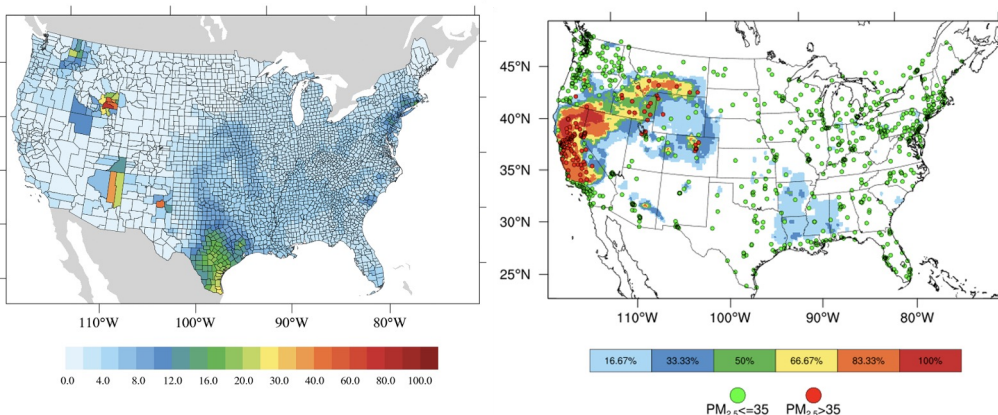




Hazardous Air Quality Ensemble forecast System (HAQES): Towards Community Consensus

- Large uncertainties exist in wildfire PM2.5 forecasts;
- New ensemble forecast consistently outperforms individual forecasts.
- Real-time ensemble products of PM2.5, BC, OC and AOD using forecasts from NOAA, NASA and Naval Research Laboratory;

County-/Census-tract-level Forecasts PM2.5 Exceedance Probability



Makkaron, P., et al., 2023. JGR-Atmospheres, 128(22), e2022JD037298.

Li, Y et al., 2024. BAMS, <https://doi.org/10.1175/BAMS-D-23-0208.1>

Project website: <http://air.csiss.gmu.edu/haqes/>

Data access: https://disc.gsfc.nasa.gov/datasets/HAQES_NA_PM25_OC_COUNTY_1/summary

