

Our mission is to bring the power of NASA
science down to earth and deliver it into your hands.

Overview of NASA HAQAST

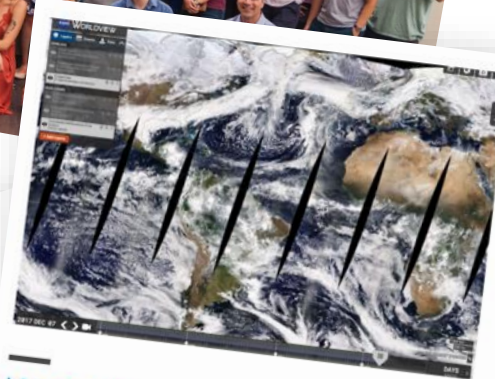
The NASA Health and Air Quality Applied Sciences Team (HAQAST)

3rd Generation; 2021-2025

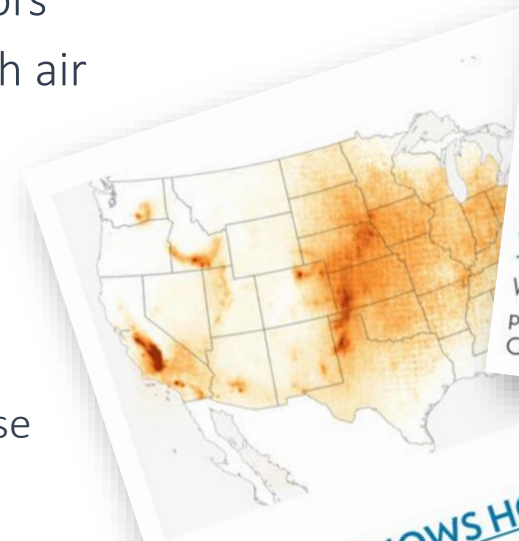
Jenny Bratburd, Outreach Program Manager, University of Wisconsin—Madison

What is “hay-kast”?

- Health and Air Quality Applied Sciences Team
- 4 year initiative through 2025
- 14 Members and 70+ co-investigators
- Mission: Connect NASA science with air quality and health applications
- ~ \$12+ Million Total Cost
- Three types of work:
 - Member projects
 - Tiger team projects (collaborative)
 - Outreach, engagement, rapid response



NASA WORLDVIEW VIDEO TUTORIAL NOW AVAILABLE
Watch HAQAST's NASA Worldview video tutorial, produced by the NASA HAQAST Communications Team



HOW SHOWS HOW BREATHES
... of NH₃



HAQAST1:
2011-2016



HAQAST2: 2016-2020
HAQAST3: 2021-2025

The team structure fundamentally changes outcomes.

- Increased visibility of work and resources to end-users
- Culture to support and promote collaborations and synergies
- Growth of two-way dialogue
- Increased collaborations to meet stakeholder needs
- Rapid spin-up of high-value activities

14 NASA Health and Air Quality Applied Sciences Team Members (HAQAST)

Tracey Holloway (Team Lead, UW-Madison)

Susan Anenberg (George Washington University)

Bryan Duncan (NASA GSFC)

Arlene Fiore (Massachusetts Institute of Technology)

Pawan Gupta (NASA GSFC)

Yang Liu (Emory University)

Jingqiu Mao (University of Alaska, Fairbanks)

Randall Martin (Washington University)

Ted Russell (Georgia Tech)

Jeffrey Pierce (Colorado State University)

Amber Soja (National Institute of Aerospace)

Daniel Tong (George Mason University)

Christopher Uejio (Florida State University)

Qian Xiao (University of Texas Health Science Center at Houston)





HAQAST Ambassadors

NASA HAQAST continues to advance applied research and partnerships, with over 70 investigators, 100s of meeting attendees, and over 1000 email subscribers.

New “Ambassadors” program engages a high-level partners committed to advancing NASA data for societal benefit, and willing to serve as liaisons to their communities.

“NASA satellite data and training has allowed for collaboration and partnerships that ... build a community of practice using satellite data for EJ applications

We are currently part of a HAQAST project that will ... look at health effects of ... air quality and extreme heat in the context of climate policy initiatives in the state.”

“NASA’s MODIS imagery is fundamental in both the analysis and forecasts processes [for wildfires across Alaska].”

The Greening Diplomacy Initiative (GDI) ... aims to leverage and integrate satellite data in Department products to provide accurate forecasting capabilities for our personnel overseas.”



17 HAQAST Ambassadors so far represent 6 states/regions (CT, GA, NY, Western states), 3 federal agencies (EPA, Dept. of State, National Park Service); 4 non-profits (American Cancer Society, Health Effects Institute, Earth Stewards); 2 private companies (Breezometer & IQAir)

Getting Started Is Easy



NASA HEALTH AND AIR QUALITY APPLIED SCIENCES TEAM

Connecting NASA Data and Tools with Health and Air Quality Stakeholders

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[People](#) ▾

[Projects](#) ▾

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[Tools and Resources](#) ^

[Meetings](#) ▾

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Getting Started

Data and Tools

For Educators

NASA ARSET
Training

Links to Health
and Air Quality
Community

Science
Communication
and Policy
Resources

Glossary

to bring the power of NASA
with and deliver it into your hands.



Smoke replaces ice at Lake Winnipeg.

True color image Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite, from the NASA Earth Observatory, May 2021 over Winnipeg, Canada.
Source: <https://Earthobservatory.nasa.gov/images/148340/smoke-replaces-ice-at-lake-winnipeg>.

The Four Things to Know about Satellite Data for Air Quality Management

by Tracey Holloway and Jennifer Bratburd

Making Open Science Work for Science and Society

Published: 29 July 2019 | CID: 075002

The open science movement encompasses a number of initiatives [including to] **promote successful communication between experts and decision makers** so they can make effective use of scientific information (Holloway et al. 2018; Royal Society 2012).

Government agencies have also been involved in innovative efforts to help decision makers make more effective use of data and influence research projects to make them as socially relevant as possible.... **NASA has supported a Health and Air Quality Applied Sciences Team (HAQAST), which helps stakeholders make use of NASA data** to answer stakeholders' environmental health questions (Holloway et al. 2018).



HAQAST Supports Two Types of Projects: Individual & Tiger Team

March. 2021

2022

2024

2024

2025

14 HAQAST Members'
Proposed Initiatives
with stakeholders & Co-I
collaborators

YOU
ARE
HERE

Year 1 "Tiger Teams"
larger collaborations
Focused, stakeholder-
based, short-term

Year 2 "Tiger
Teams"

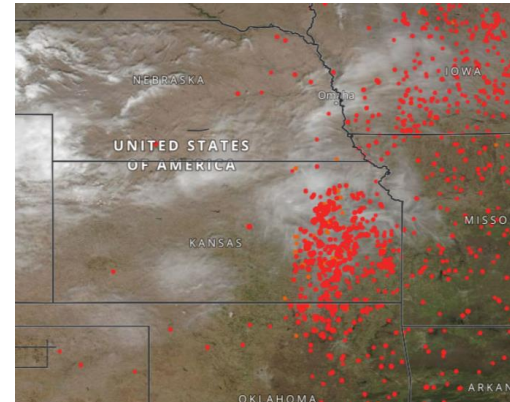
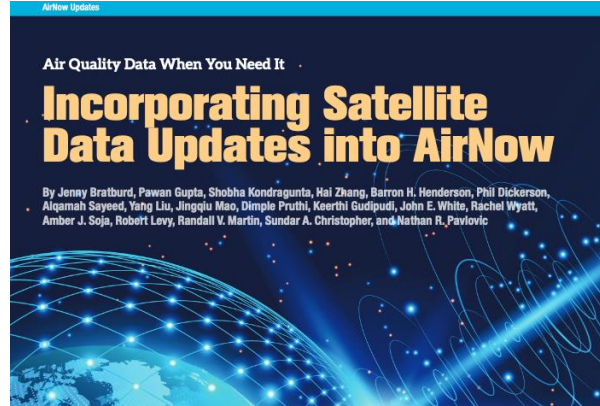
TBD



2021 Tiger Teams

- Satellite Data for Environmental Justice
- Enabling Stakeholder Access and Utilization of Data Products for Health and AQ Applications (First Steps)
- Communicating the Uncertainties of Satellite-based NO_x Emissions for Urban Planning
- Enabling USEPA to Ingest High-frequency Satellite Air Quality Data into the AirNow System
- Fused Earth Observations to Quantify Health Impacts from Agricultural Fires

Example outputs: (left) article on updates to AirNoq; (right) Smoke and active fire from the Flint Hills, from Amber Soja

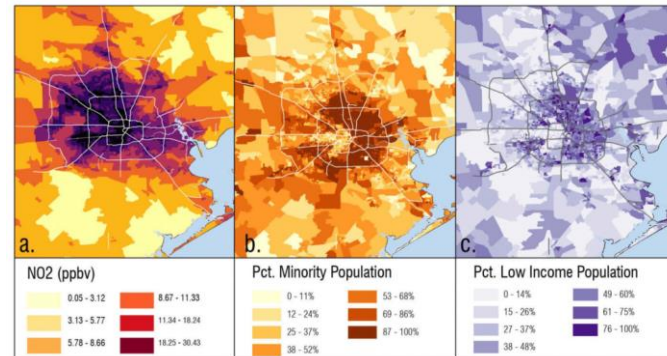
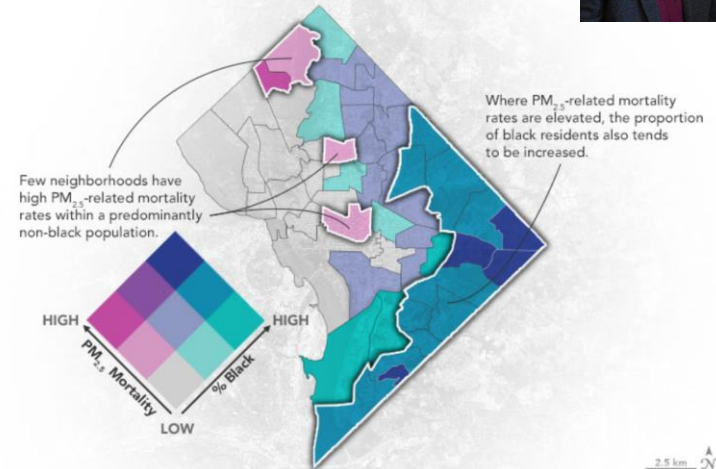




Satellite Data for Environmental Justice



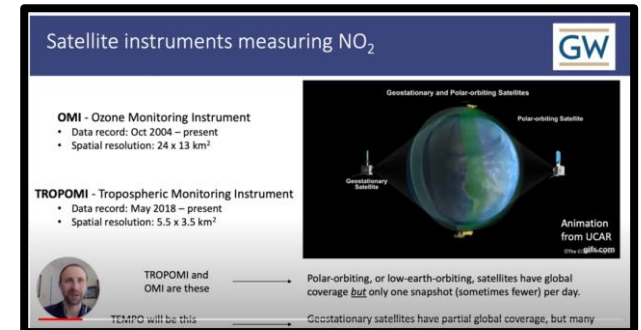
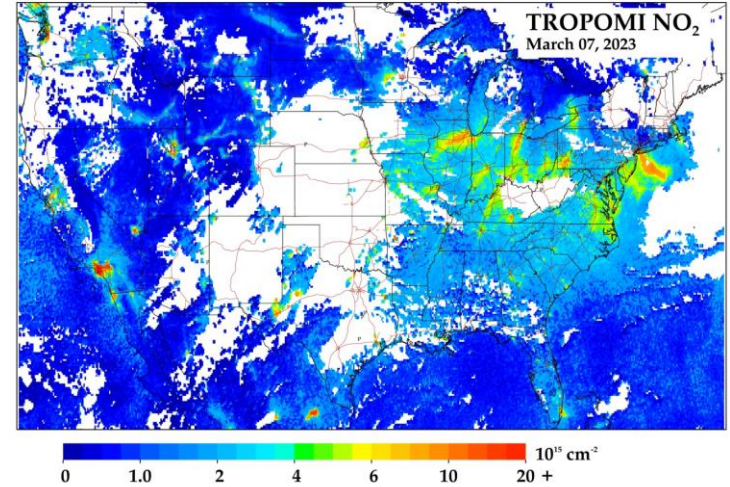
- Built collaborative partnerships
 - Data integrated into Environmental Defense Fund national Climate Vulnerability Index
 - Detailed guidance for EPA on including NO₂ datasets as an indicator on EJScreen
- Developing a training with ARSET and publishing a review
- Resource page available now: <https://haqast.org/ej/>




Satellite-based NO_x for Urban Planning



- Developed website for viewing near-real time TROPOMI NO₂ images (tropomino2.us) and estimates of pediatric asthma (urbanairquality.online)
- New tutorials and resources available
 - Using TROPOMI NO₂
 - Intro to Python for Air Quality
- Analysis of TROPOMI NO₂ versus Gridded emissions inventory



Satellite instruments measuring NO₂ 

OMI - Ozone Monitoring Instrument

- Data record: Oct 2004 – present
- Spatial resolution: 24 x 13 km²

TROPOMI - Tropospheric Monitoring Instrument

- Data record: May 2018 – present
- Spatial resolution: 5.5 x 3.5 km²

Geostationary and Polar-orbiting Satellites

Animation from UCAR www.gifsc.com

TROPOMI and OMI are these → Polar-orbiting, or low-earth-orbiting, satellites have global coverage but only one snapshot (sometimes fewer) per day.

TEMPO will be this → Geostationary satellites have partial global coverage, but many



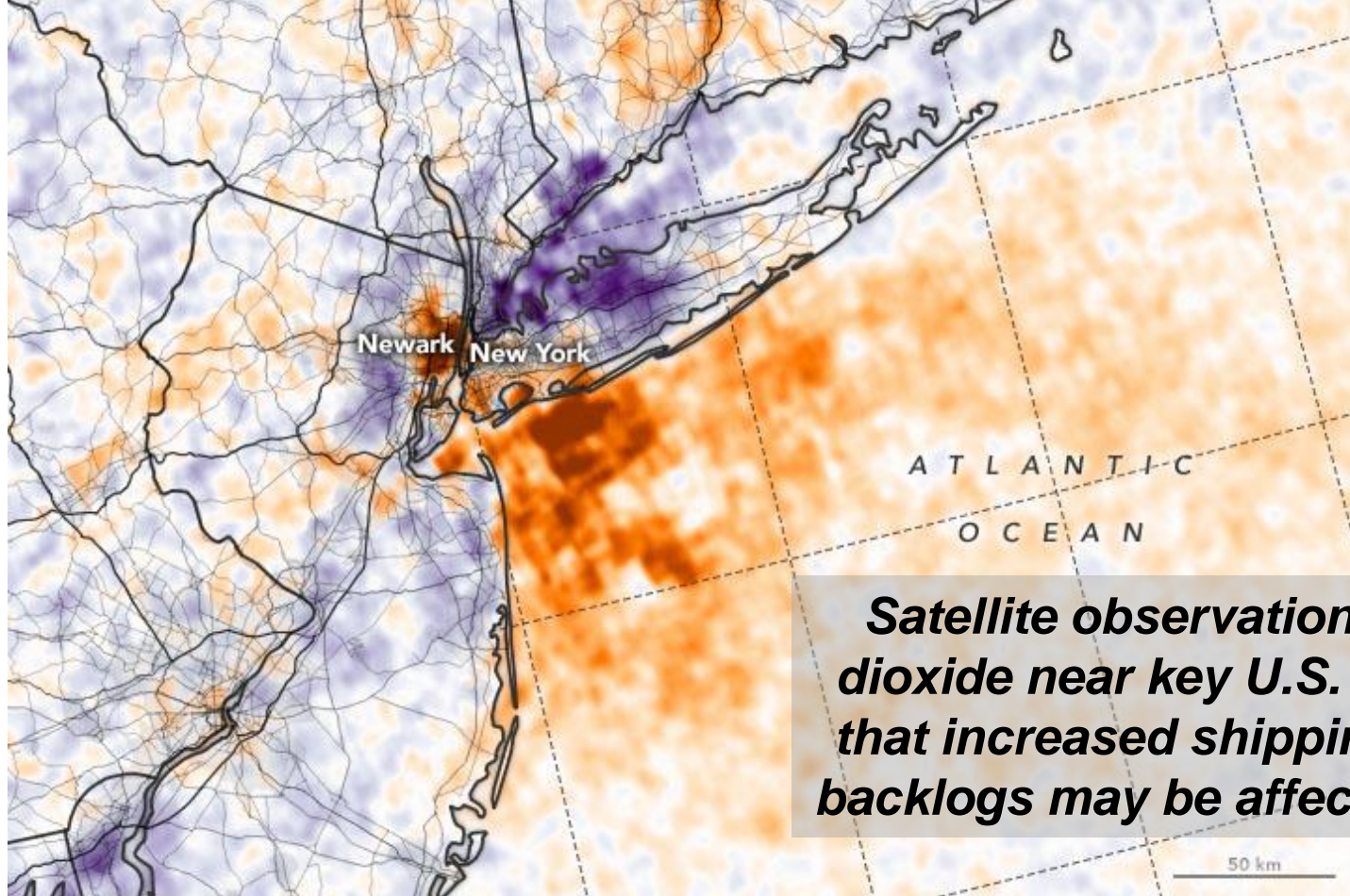
2023 Tiger Teams

- Soon to be announced!



Rapid Response Projects

- Responding to the need of smoke forecasts in Alaska: A data fusion approach with advanced deep learning algorithms
- Collaborating with the New Mexico Department of Health to Respond to Wildfires and Extreme Heat
- Distribution and pollution: Investigating the influence of warehouse-related transportation activities on NO_2 and $\text{PM}_{2.5}$ using satellites, models, and monitors
- Incorporating Remote Sensing Derived Estimates of Wildland Fires into the American Thoracic Society “Health of the Air” Annual Report
- HAQAST Ambassador Stakeholder Engagement



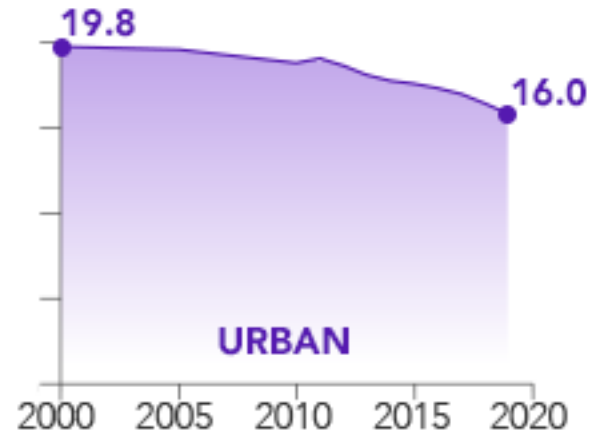
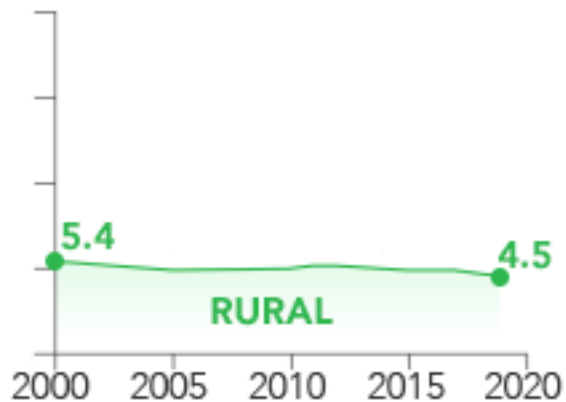
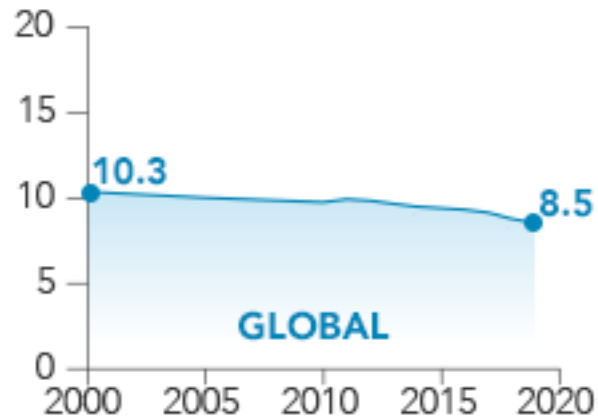
Satellite observations of nitrogen dioxide near key U.S. ports suggest that increased shipping activity and backlogs may be affecting air quality.

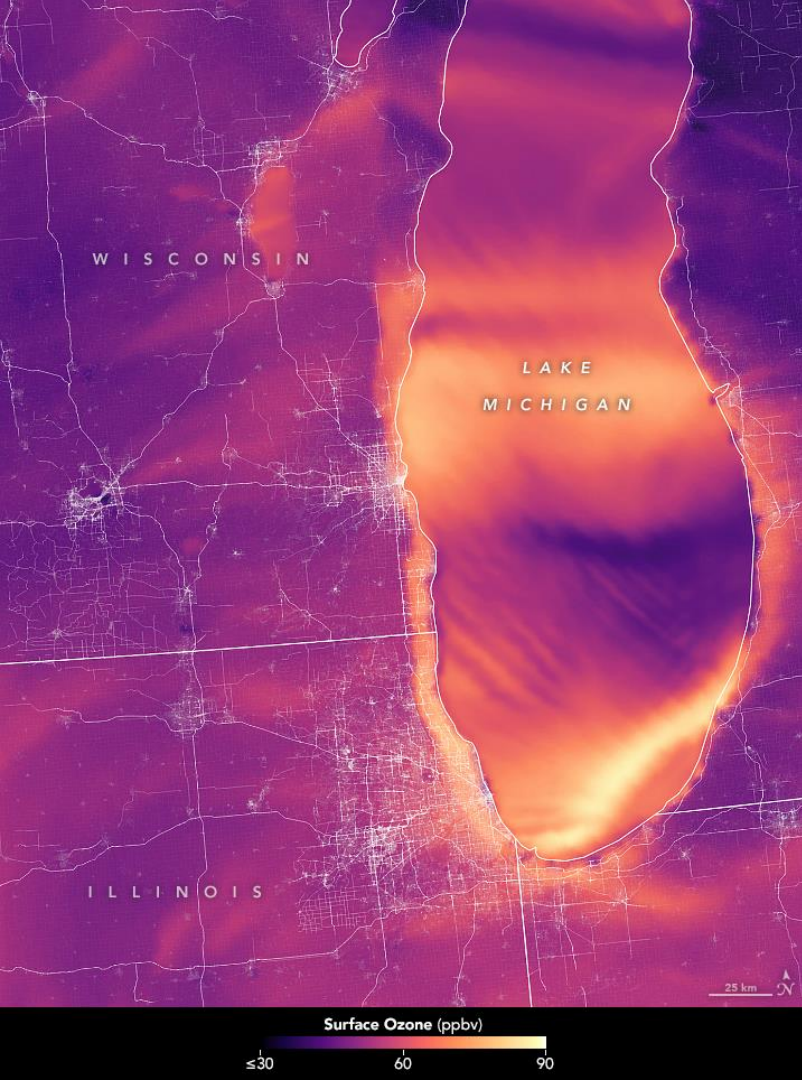
Change in Mean Tropospheric NO₂ Column Density, 2018-19 vs 2021 ($\mu\text{mol}/\text{m}^2$)



A new satellite-derived global dataset links concentrations of nitrogen dioxide with cases of pediatric asthma in urban areas around the world.

Fraction of Pediatric Asthma Attributable to NO₂ Pollution (%)





Air quality experts incorporate more satellite data and customized models from NASA to better track ozone pollution around the Great Lakes.

<https://earthobservatory.nasa.gov/images/150135/clearer-view-of-great-lakes-air-quality>

Public, hybrid meetings every ~6 months



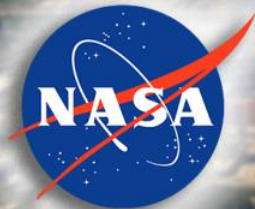


Photo by Cpt. Timothy Reinhart, USAF


HAQAST Missouri

- April 18th and 19th, 2023
- Public, hybrid meeting
- Dialogue with stakeholders & scientists



NASA HEALTH AND AIR QUALITY APPLIED SCIENCES TEAM

Connecting NASA Data and Tools with Health and Air Quality Stakeholders

A wide-angle photograph of Earth from space, showing a vast expanse of blue oceans, white clouds, and brownish-green landmasses. In the upper left corner, the metallic structure of a satellite or spacecraft is visible, partially obscuring the view of the planet.

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