

NASA HAQ TEAM CONDUCTS ANNUAL PROGRAM REVIEW

In March 2023, the NASA HAQ Team coordinated and moderated the annual [HAQ Applications Program Review 2023](#), in Asheville, NC. A total of 35 people attended this two-day meeting. Presentations were shared by NASA-funded researchers (ROSES2016, ROSES2017, ROSES2021), Local and State Representatives (**Ashley Featherstone, Asheville-Buncombe Air Quality Agency**; **Evan Couzo, University of North Carolina-Asheville**), HAQAST (**Jenny Bratburd, Univ. of Wisconsin-**

Madison), Atmospheric Sciences Data Center (**Matt Tisdale, NASA LaRC**), Capacity Building (**Kathryn Caruso, DEVELOP**), TEMPO (**Aaron Naeger, Univ. of Alabama in Huntsville**), MAIA (**Abigail Nastan, JPL**), Communications (**Aries Keck, NASA HQ**), Prizes/Challenges and Environmental Justice (**Shobhana Gupta, NASA HQ**), and CDC partners (**Fuyuen Yip, John Painter**). Also, **John Haynes (NASA HQ)** facilitated the Town Hall discussion on future goals, partnerships, and opportunities.



HAQ Applications Program Review 2023 in Asheville, NC. Credit: NASA

HAQ TEAM MEMBER SELECTED FOR PRESTIGIOUS NASA AWARD

In March 2023, the selections of the [NASA Agency Honor awards](#) were announced. **Laura Judd (NASA LaRC)** was awarded the **2022 NASA Early Career Achievement Medal**. This award recognized her for outstanding early career service to NASA, in advancing innovative and practical uses of Earth Science observations for improving air quality research and decision-making. Laura has been part of the NASA family since 2012, through NASA's Student Airborne Research Program (SARP), and later came to NASA Langley Research Center in 2016, for her postdoctoral fellowship. Currently, she serves as Associate Program Manager for Health and Air Quality Applications and Research Physical Scientist. She has participated and led in multiple air quality field studies to better understand air quality challenges from the top-down perspective at high resolution. This summer, she is leading the airborne component to the Synergistic TEMPO Air Quality Science ([STAQS](#)) campaign, which aims to accelerate the use of TEMPO data for science and applications.



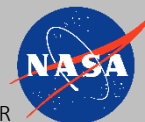
Credit: L. Judd

HEALTH AND AIR QUALITY APPLICATIONS APPLIED SCIENCES PROGRAM

JOHN HAYNES
PROGRAM MANAGER
HEADQUARTERS

HELENA CHAPMAN
ASSOCIATE
HEADQUARTERS/BAH

LAURA JUDD
ASSOCIATE
LANGLEY RESEARCH CENTER



NASA HAQ TEAM HOSTS SCIENTIFIC SESSIONS AT AMS 2023

At the American Meteorological Society (AMS) 2023, the NASA HAQ team coordinated two scientific sessions under the topic, *Air Quality and Public Health Decisions with NASA Earth Observations*, at the 14th Conference on Environment and Health. Moderated by **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)**, these sessions included 10 oral topics and had over 80 attendees each. **John Haynes (NASA HQ)** served as an exciting Core Science Keynote for the AMS Environment and Health Conference. Also, **J. Haynes** and **H. Chapman** presented NASA Hyperwall talks at the exhibit hall.

- ❑ Decision Support for Environmental Risk Assessments: Contributions from the NASA Health and Air Quality Program (**John Haynes, NASA HQ**)
- ❑ NASA's Next Generation of Atmospheric Data Science (**Elisabeth Huffer, NASA LaRC**)
- ❑ Using Earth Observations to Strengthen Anticipatory Decision Making Processes for Waterborne Diseases: A Case of Cholera (**Moiz Usmani, Univ. of Florida**)
- ❑ Multi-Decadal Nitrogen Dioxide and Derived Products from Satellites (MINDS) Datasets Released by NASA GES DISC and their Applications for Air Quality (**Feng Ding, NASA/GES DISC**)
- ❑ Impacts of Biomass Burning on the Satellite Retrievals of Formaldehyde: Implication for TEMPO's Applications in the Western U.S. (**Sree Chaliyakunnel, Univ. of Montana**)
- ❑ NASA Airathon: Crowdsourcing towards Actionable Air Quality Information from Satellite Data (**Abigail Nastan, JPL**)
- ❑ Resolving and Predicting Neighborhood Vulnerability to Urban Heat and Air Pollution: What can we Learn from a Community Science Project for Decision Making? (**Jun Wang, Univ. of Iowa**)
- ❑ Dust in the Air: Utilizing Meteorological, Particulate Matter, and Remote Sensing Data to Assess Dust Transport in Western USA (**Maura Hahnenberger & Shane Schmidt, Salt Lake Community College**)
- ❑ Enhancing Air Quality Decision-Making Activity in Indian Megacities through Assimilation of NASA Earth Observations (**Rajesh Kumar, NCAR**)
- ❑ Mapping the Thermal Potential for Urban Malaria Transmission with Satellite Earth Observations (**Nikhil Poudyal, Univ. of Oklahoma**)



Presenters at the NASA HAQ sessions at AMS 2023. Credits: NASA

NASA INVESTIGATOR UPDATES

- ❑ **Susan Anenberg (George Washington Univ.):** She was named Chair of the Department of Environmental and Occupational Health in January 2023. She was appointed to the National Academies committee, "[Utilizing Advanced Environmental Health and Geospatial Data and Technologies to Inform Community Investment](#)", which will advise the Council on Environmental Quality's implementation of the Justice40 initiative. Also, she provided a briefing at Congressional Climate Camp, organized by the Environment and Energy Study Institute, in February 2023, focused on non-CO2 climate pollutants.
- ❑ **Assaf Anyamba (Oak Ridge National Laboratory):** He presented the talk, *Chikungunya – Forecasting and Risk Mapping*, as part of the International Society for Infectious Diseases (ISID) webinar on Chikungunya Forecasting, Risk Mapping, and Clinical Trials in March 2023.
- ❑ **Amber Soja (NASA LaRC):** She participated in the [Innovation Now podcast](#) in March 2023.

HAQAST TIGER TEAM PROJECTS

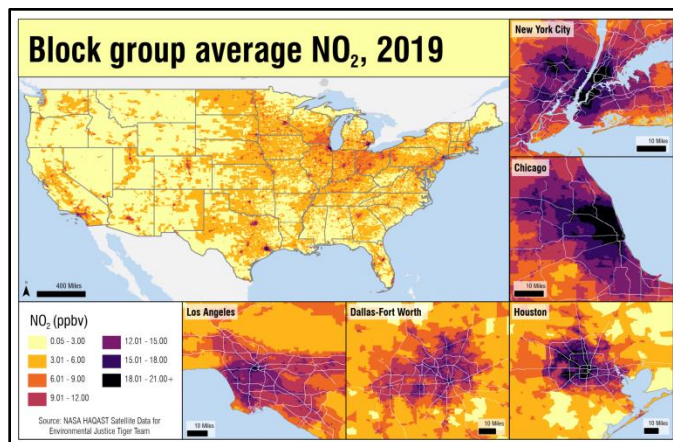
As part of the NASA Health and Air Quality Applied Sciences Team (HAQAST), five [Tiger Team projects](#) that began in 2021, have recently completed activities. The five Tiger Teams addressed a range of topics, engaged a wide variety of stakeholders, and developed many valuable resources for partners and stakeholders. Updates on these five projects are presented below.



Credits: HAQAST

SATELLITE DATA FOR ENVIRONMENTAL JUSTICE (SD4EJ)

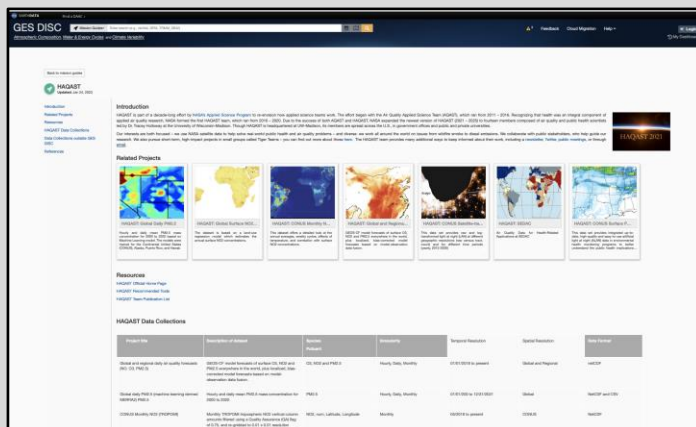
Susan Anenberg (George Washington Univ.) and **Qian Xiao (Univ. of Texas Health Science Center at Houston)** led the Satellite Data for Environmental Justice (SD4EJ) Tiger Team. This project built relationships among scientists and stakeholders and generated future partnerships to address EJ using satellite and other Earth observing data. The team developed a central warehouse for long-term satellite data on multiple environmental exposures. The team also developed algorithms for data mapping and easy linkage with health outcomes and ethnoracial and socioeconomic characteristics at various geographic scales. To learn more about this project, visit the [resource page](#).



Example of surface level NO₂ dataset at the census block level over CONUS, with several major metropolitan areas highlighted, created for use with EJSscreen. Credits: NASA HAQAST

ENABLING STAKEHOLDER ACCESS AND UTILIZATION OF DATA PRODUCTS FOR HEALTH AND AQ APPLICATIONS (FIRST STEPS)

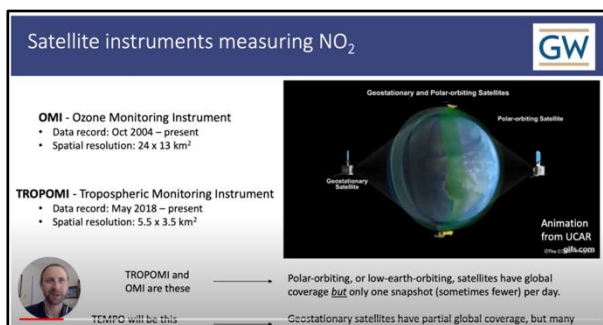
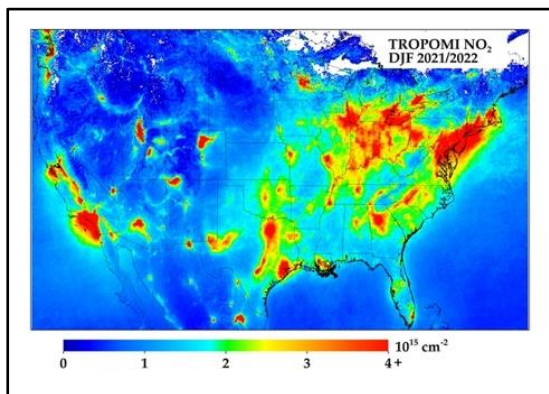
Kevin Cromar (New York Univ.) led the Enabling Stakeholder Access and Utilization of Data Products for Health and AQ Applications Tiger Team. This project started a collaboration between HAQAST members and stakeholders to identify ways to “scale up” the potential impact of satellite data with data products that are mapped onto uniform latitude/longitude grid or with other geophysical variables to all interested stakeholders. This project delivered a thorough documentation of products and a [homepage](#) to serve as a one-stop shop for all these resources.



Screenshot of data product homepage. Credits: NASA HAQAST

COMMUNICATING THE UNCERTAINTIES OF SATELLITE-BASED NO_x EMISSIONS FOR URBAN PLANNING

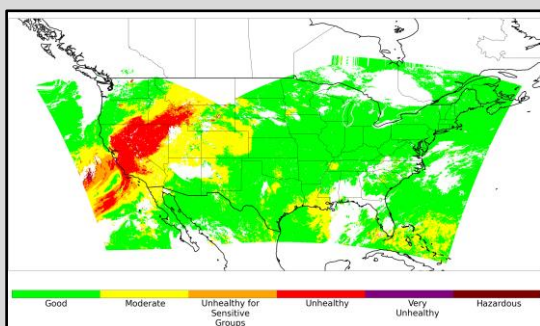
Dan Goldberg (George Washington Univ.) led a team to develop satellite-based NO_x emissions resources. New satellite instruments (e.g. TROPOMI, TEMPO) and algorithms (NASA OMI NO₂ SP v4, TROPOMI NO₂ v2) can provide insight on anthropogenic NO_x. This project used two methods: (1) comparing satellite data to high resolution (<12 km²) model simulations, and (2) comparing bottom-up emission inventory estimates to satellite-derived estimates from urban areas and power plants. To learn more, find a [tutorial](#) on how to download and use TROPOMI data, [resources](#) on TROPOMI NO₂ filtered for quality assurance and re-gridded, and [presentation](#) on the team's activities.



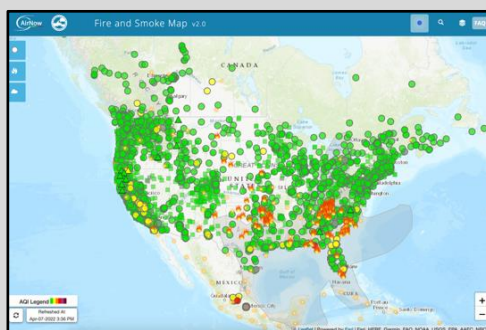
Yearly average NO₂ from TROPOMI, via tropomino2.org (left). Screenshot of tutorial on using TROPOMI data (right). Credits: NASA HAQAST

ENABLING U.S. EPA TO INGEST HIGH-FREQUENCY SATELLITE AIR QUALITY DATA INTO THE AIRNOW SYSTEM

Pawan Gupta (NASA GSFC) initiated a new collaboration between HAQAST members, NOAA, and U.S. EPA to develop a value-added hourly and daily PM_{2.5} dataset using GOES data covering CONUS region and integrate the data into the AirNow system. The new data layers at high temporal and spatial resolutions in the U.S. EPA's AirNow system will address significant monitoring gaps in many areas around the country, and create a framework for ingesting data from future NASA/NOAA missions (e.g. TEMPO, MAIA, ATMOS, GEO-XO) into a regulatory agency's monitoring system. To learn more about this team's efforts, review this [emPLUS article](#).



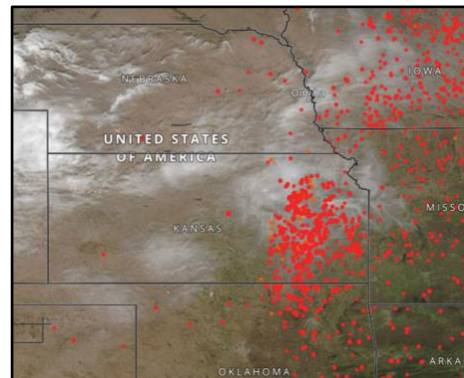
Map shows GOES (East and West combined) PM_{2.5} data on August 20, 2020, over the continental U.S., colored by the U.S. EPA AQI. Unhealthy AQI values over the western U.S. are associated with wildfires. Credits: NASA HAQAST



Screenshot of archived data from April 7, 2022, from the U.S. EPA AirNow website Fire and Smoke Map, showing PM_{2.5} monitors (circles) and estimated PM_{2.5} (contours). Colors indicate the scale on the AQI. Credits: NASA HAQAST

FUSED EARTH OBSERVATIONS TO QUANTIFY HEALTH IMPACTS FROM AGRICULTURAL FIRES

Amber Soja (NASA LaRC) and **Sheryl Magzamen (Colorado State Univ.)** led this team to use remote sensing technology, novel technology in low-cost monitoring, and high-resolution fire-detection and Aerosol Optical Depth products from MODIS, VIIRS, and GOES-16 to quantify smoke exposure to communities from agricultural burning. Two study sites included western Palm Beach County, Florida and the Flint Hills region of Kansas. To learn more about this project, review the [presentation](#) from HAQAST Wisconsin.



Smoke and active fire from the Flint Hills.
Credits: NASA HAQAST

NASA HAQ TEAM HOSTS SYMPOSIUM AT AMCA 2023

In March 2023, the HAQ team coordinated the *Using NASA Satellite Data to Complement Vector Control Practices* Symposium at the American Mosquito Control Association (AMCA) Annual Conference in Reno, NV. This in-person symposium had over 130 attendees. Moderated by **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)**, researchers highlighted projects that use satellite data to forecast risk of vector-borne disease risk in the United States and selected international sites, as well as stakeholder applications to support mosquito control at the state level. Also, **H. Chapman** presented the talk, *Satellite Applications and Advancements in Environmental Health: Focus on the One Health Concept*, in Spanish, as part of the Latin American Symposium, with 40 attendees.

- ❑ Improving Vector Control with NASA Data: An Overview of NASA Health and Air Quality Applications (**John Haynes, NASA HQ**)
- ❑ Blending Multi-source Data Sets to Forecast Vector-borne Disease Risk (**Assaf Anyamba, Oak Ridge National Laboratory**)
- ❑ Making Sense of Disparate Data Types using VectorSurv (**Christopher Barker, Univ. of California, Davis**)
- ❑ Mosquito Control Alchemy: Turning Data into Effective Control Strategies (**Sarah Wheeler, Sacramento-Yolo Mosquito and Vector Control District**)
- ❑ Use of Geo-spatial Data to Plan and Monitor Dengue Vector Control (**Roberto Barrera, CDC Dengue Branch, Puerto Rico**)



Presenters at the NASA HAQ session (left) and Latin American Symposium (right) at AMCA 2023. Credits: NASA

GEO HEALTH COMMUNITY OF PRACTICE & REGIONAL NETWORKS



The Group on Earth Observations (GEO) [Health Community of Practice](#) (CoP) – led by **John Haynes (NASA HQ)** and **Juli Trtanj (NOAA)** – coordinates community teleconferences to leverage expertise across sectors and geographies and share Earth observation data and tools to support health decision-making. As each teleconference has engaged about 40 participants, new GEO Health CoP members have joined and presented their research applications to the wider community.

- ❑ **January-February 2023:** The EO4Health team moderated a [Deep Dive on Human Migration and Health](#) topics, including regional perspectives (**Angelica Gutierrez, AmeriGEO**) and data science and applications perspectives (**Susana Adamo, NASA SEDAC/Columbia Univ.**).
- ❑ **March 2023:** The EO4Health team moderated a [Deep Dive on GEO Work Programme elements](#) – GEO Sustainable Development Goals (EO4SDG) with **Argyro Kavvada (NASA HQ/BAH)**, GEO Human Planet Initiative (HPI) with **Bob Chen (NASA SEDAC/Columbia Univ.)**, and GEO Global Agricultural Monitoring Initiative (GEOGLAM) with **Ian Jarvis**.

In January 2023, the EO4Health team held an informal networking reception, as part of the AMS Board on Environment & Health Social. Also, the Small Work Groups leads – Heat (**Ben Zaitchik, Johns Hopkins Univ.; Cascade Tuholske, Columbia Univ.’s Earth Institute**); Infectious Diseases (**Antar Jutla, Univ. of Florida; Tatiana Loboda, Univ. of Maryland-College Park**); Food Security and Safety (**Orhun Aydin, St. Louis Univ.; Mahesh Jampani, International Water Management Institute, Sri Lanka**); and Health Care Infrastructure (**Andreas Skouloudis, iSteep.org; Ajay Gupta, HSR.health**) – coordinated community telecons to discuss priorities and established targeted activities and timelines.

NASA’S CLIMATE STRATEGY

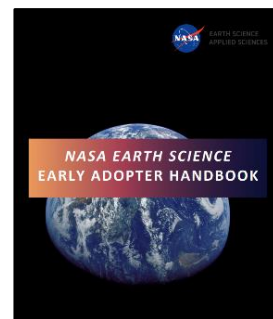
In March 2023, the NASA Office of the Chief Scientist [released](#) the *Advancing NASA’s Climate Strategy*, as a comprehensive evaluation of NASA’s climate portfolio by the cross-agency working group. This strategy highlights four key priorities – innovate, inform, inspire, and partner – to strengthen the integration of climate across NASA. Please learn more about the [Advancing NASA’s Climate Strategy](#).



Credits: NASA

NASA EARLY ADOPTER HANDBOOK

In December 2022, the NASA Earth Science Division released the Early Adopter Interactive Platform and [Handbook](#). The Early Adopters Programs provide potential users with proxy data products before launches, offer trainings to use these products, and foster interactions between the Early Adopters and Science Team members to enhance algorithms and data products for application.

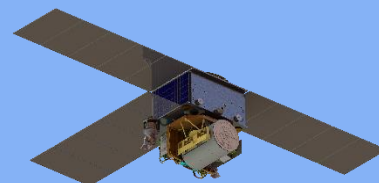


Credits: NASA

MAIA SATELLITE TEAM PARTNERS WITH ITALIAN SPACE AGENCY (ASI)

In January 2023, NASA signed a partnership agreement with the **Agenzia Spaziale Italiana (ASI)** to provide the hosting services for the upcoming Multi-Angle Imager for Aerosols ([MAIA](#)) mission. The MAIA satellite instrument, which was completed by the Jet Propulsion Laboratory in October 2022, will be installed aboard ASI's PLATiNO-2 spacecraft, with a planned launch date of late 2024. Once launched, the MAIA mission will investigate the health impacts of particulate matter air pollution in some of the world's most populous cities.

In addition to providing hosting, launch, and mission operation services, ASI will solicit and select members for an ASI MAIA Science Team, who will develop their own science objectives for their work with MAIA data, complementing the activities of the NASA MAIA Science Team. ASI will also establish and maintain a version of the MAIA data archive in Italy and distribute data products for users in Italy. The MAIA investigation has established two additional secondary target areas in Italy as well as the central Primary Target area covering Rome and Bologna.



MAIA. Source: [MAIA website](#)

TEMPO MISSION & EARLY ADOPTER PROGRAM ACTIVITIES

January 2023

- ❑ **American Meteorological Society (AMS) Annual Meeting 2023 (Denver, CO):** Aaron Naeger (Univ. of Alabama in Huntsville) moderated the *New Generation Geostationary Observations and Instruments* session, which incorporated key presentations from the Geostationary Operational Environmental Satellite (GOES) instrument and science team members, a potential follow-on to the TEMPO mission (TEMPO Continuity Instrument), and NOAA's Geostationary Extended Observations (GeoXO) mission (Atmospheric Composition Spectrometer with early-2030 launch).
- ❑ **NASA Applied Sciences Program Mission Engagement Review:** A. Naeger presented a TEMPO project status update and cross-mission collaboration with MAIA, noting the focus on enhanced health and air quality applications that will be offered by the TEMPO-MAIA synergy.

March 2023

- ❑ **NASA Air Quality-Focused Remote Sensing for [EPA Applications Training](#) (Durham, NC):** Hosted by U.S. EPA in partnership with the NASA ARSET Program, numerous EPA scientists acquired new knowledge on how the hourly and sub-hourly daytime observations from TEMPO will improve their ability to monitor and diagnose emissions and transport of policy-relevant air pollutants. They also learned about the suite of tools and services that will be available for TEMPO data distribution.



TEMPO. Source: [TEMPO website](#)

RECENT PRESENTATIONS BY HAQ TEAM

The NASA HAQ team (**John Haynes, NASA HQ; Helena Chapman, NASA HQ/BAH; Laura Judd, NASA LaRC**) continues to be active in presenting talks on using Earth observations for public health applications within health and air quality communities.

February 2023

- ❑ **OGC Global Health Summit 2023 (Italy):** J. Haynes gave the virtual closing keynote speech, as part of the *Leveraging GeoAI to Advance Public Health* session.
- ❑ **6th Global Science, Technology and Innovation Conference (Brazil):** J. Haynes presented an overview of the HAQ program, GEO, and NASA-Rio partnership to over 75 attendees.
- ❑ **Univ. of Nevada-Reno's School of Public Health:** The HAQ team presented virtual talks to 80 public health students and faculty.

March 2023

- ❑ **1st International Congress on Medical Education (Dominican Republic):** H. Chapman gave a virtual [One Health talk](#) to over 70 in-person and 200 virtual attendees.
- ❑ **AGU/AMS GeoHealth Showcase:** J. Haynes gave a virtual talk, as part of this first AGU/AMS GeoHealth Showcase.
- ❑ **U.S. Department of State's U.S.-Singapore Third Country Training Program (TCTP):** H. Chapman offered a virtual talk on selected HAQ projects to 20 trainees.
- ❑ **TEMPO Press Conference (Washington, DC):** L. Judd shared information about TEMPO at the Smithsonian National Air and Space Museum.

LOOKING AHEAD

ARSET Training:

[Biodiversity Applications for Airborne Imaging Systems](#)

March 27 – April 5, 2023

Meetings:

[HAQAST Missouri](#)

April 18-19, 2023

St. Louis, MO

[Joint Science Meeting for TEMPO, GeoXO ACX, & TOLNet](#)

May 1-5, 2023

Huntsville, AL

[American Thoracic Society International Conference](#)

May 19-24, 2023

Washington, DC

[Air & Waste Management Association's Annual Conference & Exposition](#)

June 5-8, 2023

Orlando, FL

[AGU Chapman Conference on Climate and Health for Africa](#)

June 12-15, 2023

Washington, DC

RECENT COMMUNICATIONS

NASA

- ❑ [NASA Says 2022 Fifth Warmest Year on Record, Warming Trend Continues](#) (Tyler Green, NASA HQ; Jacob Richmond, NASA GSFC)
- ❑ [NASA in 2023: A Look Ahead](#)

NASA Applied Sciences Program

- ❑ [SERVIR's Southeast Asia Hub Expansion](#) (Jacob Ramthun)

NASA Earth Observatory

- ❑ [2022 Tied for Fifth Warmest Year on Record](#) (Joshua Stevens)

NASA Earth Data

- ❑ [NASA/Esri Agreement Enhances Use of NASA Geospatial Data](#)
- ❑ [NASA and IBM Collaborate to Apply AI to Earth Science Data](#)

PUBLICATIONS

[Combating Cholera by Building Predictive Capabilities for Pathogenic *Vibrio cholerae* in Yemen](#). *Scientific Reports*.

(M. Usmani...**R.R. Colwell**, **A. Jutla**)

[Spatiotemporal Variation in Risk of Shigella Infection in Childhood: A Global Risk Mapping and Prediction Model using Individual Participant Data](#). *Lancet Global Health*.

(H.S. Badr...**B.F. Zaitchik**, M.N. Kosek)

[Evaluation of Extreme Soil Moisture Conditions during the 2020 Sahel Floods and Implications for Disease Outbreaks](#). *Geophysical Research Letters*. (N.P. Thomas,

A. Anyamba, H. Tubbs, B. Bishnoi)

[Associations of Autism Spectrum Disorder with PM2.5 Components: A Comparative Study Using Two Different Exposure Models](#). *Environmental Science & Technology*.

(M.M. Rahman...**R.V. Martin**, et al.)

[A Culture of Fire: Identifying Community Risk Perceptions Surrounding Prescribed Burning in the Flint Hills, Kansas](#). *Journal of Applied Communications*. (Z. Rosen...**J.R. Pierce**, et al.)

[Effects of Long-term Ambient Air Pollution Exposure on Township-level Pulmonary Tuberculosis Notification Rates during 2005-2017 in Ningxia, China](#). *Environmental Pollution*. I. Popovic...**R.V. Martin**, et al.)

[Emissions, Meteorological and Climate Impacts on PM2.5 Levels in Southern California using a Generalized Additive Model: Historic Trends and Future Estimates](#). *Chemosphere*. (Z. Gao...**A.G. Russell**).

[Inequitable Exposures to U.S. Coal Power Plant-Related PM2.5: 22 Years and Counting](#). *Environmental Health Perspectives*. L.R.F. Henneman...**S.C. Anenberg**, et al.)

[Sources of Air Pollution-related Health Impacts and Benefits of Radially Applied Transportation Policies in 14 US Cities](#). *Frontiers in Sustainable Cities*. (M.O. Nawaz, D.K. Henze, **S.C. Anenberg**...**D.L. Goldberg**, et al)

[A Cross-sectional Analysis of Long-term Exposure to Ambient Air Pollution and Cognitive Development in Children aged 3–4 years living in 12 Low- and Middle-income Countries](#). *Environmental Pollution*. (D.B. Odo...**R.V. Martin**, et al.)

[Incident Dementia and Long-term Exposure to Constituents of Fine Particle Air Pollution: A National Cohort Study in the United States](#). *PNAS*. (L. Shi...**R.V. Martin**...**A.G. Russell**, et al.)

[Air Quality Impacts of Electric Vehicle Adoption in California](#). *Atmospheric Environment*. (T.N. Skipper...**A.G. Russell**)

[How Many People Were Killed by Windblown Dust Events in the United States?](#) *Bulletin of the American Meteorological Society*. (**D. Tong** et al.)

[Impacts of Estimated Plume Rise on PM2.5 Exceedance Prediction during Extreme Wildfire Events: A Comparison of Three Schemes \(Briggs, Freitas, and Sofiev\)](#). *Atmospheric Chemistry and Physics*. (Y. Li, **D. Tong**, et al.)

PAST

ARSET Training:

[Connecting Citizen Science with Remote Sensing](#)

January 24-31, 2023

Meetings:

[American Meteorological Society Annual Meeting](#)

January 8-12, 2023
Denver, CO

[American Mosquito Control Association Annual Meeting](#)

February 27 – March 3, 2023
Reno, NV