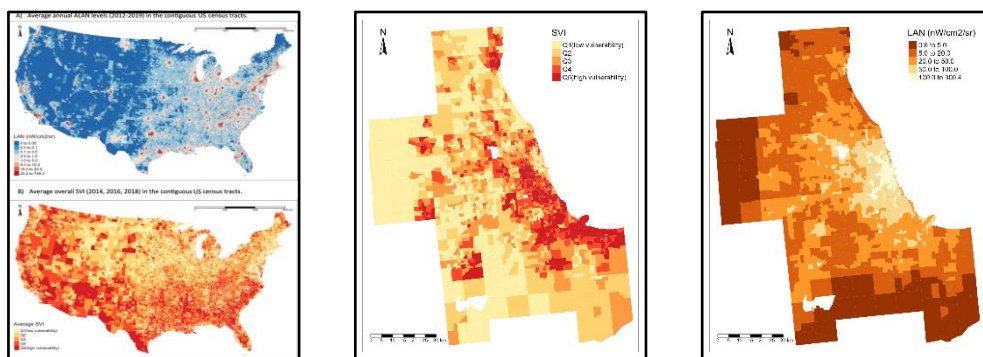


QUARTERLY HAQ PROJECT HIGHLIGHT: MAPPING ARTIFICIAL LIGHTS AT NIGHT FOR PUBLIC HEALTH SURVEILLANCE

Supported through a 2020 HAQ grant, **Qian Xiao (Univ. of Texas Health Science Center at Houston)** and her team have characterized the spatiotemporal patterns of **Artificial Light At Night (ALAN)** using NASA's Black Marble data suite (based on VIIRS day/night band data). They have studied ALAN in relation to health outcomes and social vulnerability, highlighting that light pollution is an emerging public health hazard and environmental justice issue. As findings demonstrate that both the spatial distribution and temporal trend of ALAN varied vastly across the United States, the team noted that certain rural counties in Texas have experienced a dramatic increase in ALAN levels over the past decade, likely due to oil and gas drilling activities. They also reported that more socially vulnerable neighborhoods (e.g. more concentrated racial/ethnic minority groups, lower socioeconomic status) have higher ALAN levels. Using large cohort studies, they have linked [higher ALAN levels with increased risk of obesity and cancer](#).



Average annual ALAN (2012-2019) and SVI (2014, 2016, 2018) levels in contiguous U.S. census tracts (left), with average annual SVI (middle) and LAN (right) in Chicago, 2020. Credits: Q. Xiao

NASA CELEBRATES ONE HEALTH DAY 2023

On November 3, 2023, NASA Earth [Facebook](#) highlighted the Earth science applications of [TEMPO and STAQS](#), [HAQAST expertise to solve real-world health challenges](#) including HAQAST Utah, and contributions of the [GEO Health Community of Practice](#). These initiatives demonstrate that multidisciplinary collaborations with scientists and community stakeholders are fundamental to inform health and air quality decision-making. This marks the seventh annual participation of Earth Action Program in One Health Day, highlighting NASA's role in connecting human, animal, and environmental health. Learn more about the [HAQ](#), [HAQAST](#), and [GEO Health CoP](#) events on the One Health Day global map!



Credits: NASA

HEALTH AND AIR QUALITY APPLICATIONS APPLIED SCIENCES PROGRAM

JOHN HAYNES
PROGRAM MANAGER
HEADQUARTERS

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LANGLEY RESEARCH CENTER



NASA HAQAST UTAH MEETING

In October 2023, the NASA Health and Air Quality Applied Sciences Team ([HAQAST](#)) meeting engaged stakeholders on uses of Earth science information for environmental health and air quality. Held at the Utah Department of Environmental Quality in Salt Lake City, this event helped attendees learn about new applications using satellite data (including TEMPO) as they relate to air pollution and health. Specifically, topics addressed included climate risks, urban and rural air quality, dust and wildfire smoke emissions, health impacts of artificial lights at night and heat, and community partnerships and environmental justice topics. Overall, this HAQAST meeting engaged 355 people – 120 in-person and 235 virtually – with 15 poster presentations. To learn more, please view the [HAQAST Utah proceedings](#).



K. Cromar (top left) and J. Haynes (top middle) present talks in Session 1. Panelists participate in the Session 3 discussion (top right). HAQAST attendees (bottom). Credits: NASA HAQAST



NASA HAQ INVESTIGATOR AND TEAM UPDATE

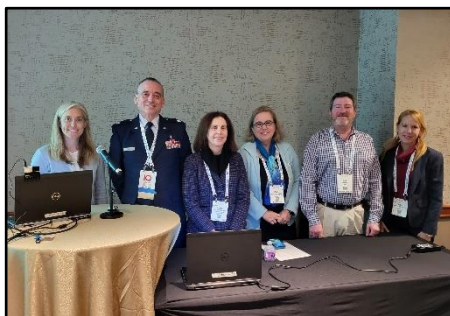
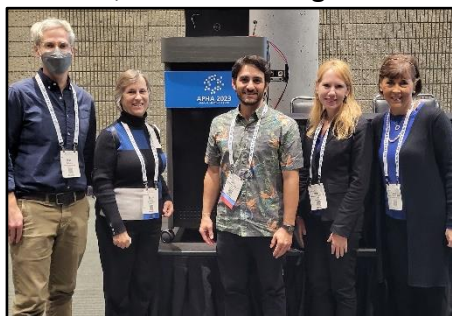
- ❑ **Assaf Anyamba (Oak Ridge National Laboratory):** He was interviewed for the Global Institute for Disease Elimination ([GLIDE](#))’s Global Health Channel, where he described the use of satellite data in disease early warning systems ([Instagram short video](#)), in November 2023.
- ❑ **Helena Chapman (NASA HQ/BAH):** She was interviewed for AGU TV ([Promoting Earth Observation for Health Decision-making](#)), as part of [Episode 5: Wide. Open. Learning.](#), in December 2023.
- ❑ **David Diner and Amber Jenkins (NASA JPL):** They gave an invited talk on MAIA Research and Applications Opportunities at the Association of Southeast Asian Nations (ASEAN) workshop on Transdisciplinary Climate/Health Collaborations, sponsored by the National Science Foundation, U.S. Department of State, Japan Science and Technology Agency, and Thailand Science Research and Innovation agency in October 2023.
- ❑ **Antar Jutla (Univ. of Florida):** He was awarded the [Charles S. Falkenberg Award](#), sponsored by the American Geophysical Union and Earth Science Information Partners, in December 2023.
- ❑ **Jun Wang (Univ. of Iowa):** His research was highlighted on the Univ. of Iowa webpage, [Wildfires have Erased Two Decades’ Worth of Air Quality Gains in Western US](#), in December 2023.

NASA HAQ TEAM PRESENTS AT APHA 2023

In November 2023, **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)** convened the *Use of Innovative Methods for Detecting Environmental Health Risks from Infectious Diseases and Air Quality Exposures* symposium at the American Public Health Association (APHA) Annual Meeting & Expo 2023 in Atlanta, GA. Over 50 people heard **John Haynes (NASA HQ)**, **Angela Werner (CDC)**, and **PIs (Armistead Russell, Georgia Tech; Yang Liu, Emory Univ.; Antarpreet Jutla, Univ. of Florida)** describe the integration of satellite-and ground-based data into the CDC Environmental Public Health Tracking Network; the development of early warning systems for cholera in Africa; an assessment of air quality impacts of one Georgia airport and two California seaports; and the potential applications of next generation environmental remote sensing instruments (TEMPO, MAIA, GOES-R) in air quality observations addressing health and air pollution inequities. Additionally, **J. Haynes** shared his talk, *Applying NASA Satellite Data for Environmental Health Applications*, for the One Health section, and **H. Chapman** also highlighted the topic, *Applying NASA Visualizations to Support Nursing Leader*, for the Nursing section.



APHA2023 panelists at the HAQ panel session.
Credits: NASA



APHA2023 panelists of the Nursing (left) and One Health (middle) sections. J. Haynes presents his talk in the One Health section (right).
Credits: NASA

NASA HAQ TEAM PRESENTS AT WMA GENERAL ASSEMBLY

In October 2023, **Helena Chapman (NASA HQ/BAH)** was an invited panelist at the World Medical Association’s [74th General Assembly](#) in Kigali, Rwanda. As part of the Global Health Security session, she presented the talk, *One Health Joint Plan of Action (2022-2026): Relevance in this Era of Emerging and Reemerging Health Threats*, where she described the [One Health Joint Plan of Action](#) and emerging One Health risks as well as highlighted specific examples of integrating satellite-and ground-based data to develop operational tools that can strengthen public health surveillance and global security. Representatives of 50 national medical associations participated in this biannual event, coordinated by the Rwanda Medical Association.



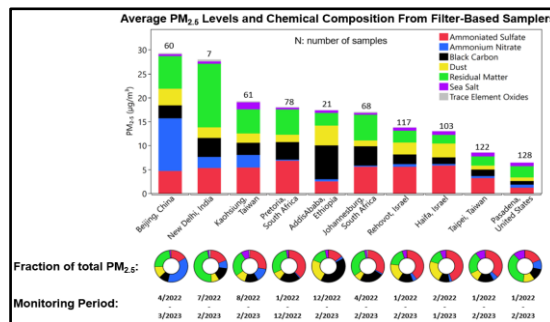
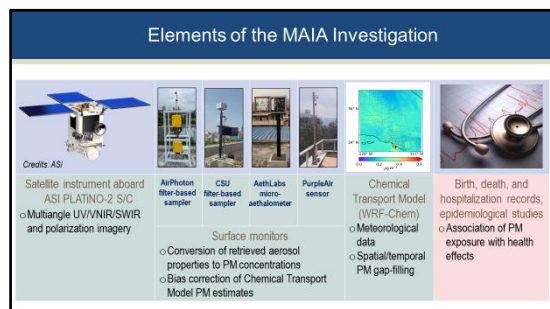
Panelists of the Global Health Security session at the WMA 74th General Assembly in Kigali, Rwanda. Credits: WMA

MAIA'S SURFACE AIR-QUALITY MONITORS BREAK NEW GROUND

Over the past two years, [NASA's MAIA mission](#) has been working hard to deploy air quality monitors that can measure the concentration and chemical composition of outdoor PM in several large metropolitan regions within MAIA's [Primary Target Areas](#). The team reports that the deployment of all monitors is nearly complete and that the surface PM monitoring network is now fully operational.

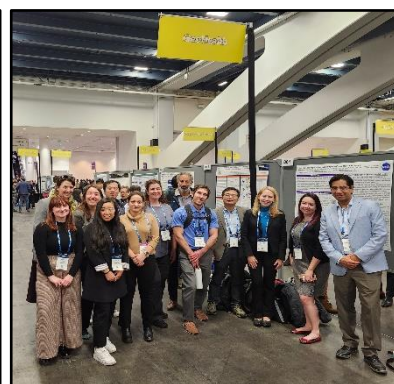
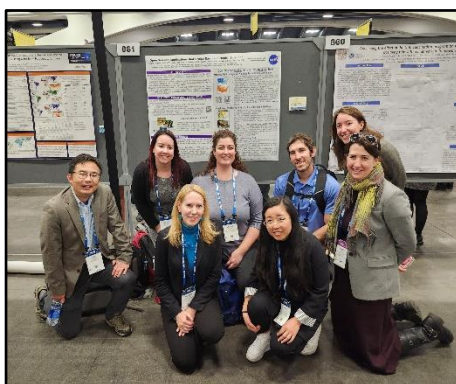
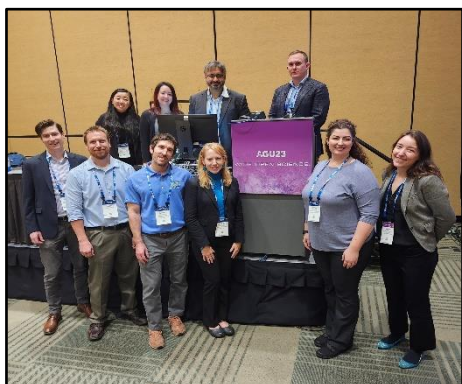
Ground-level PM measurements are a key part of the MAIA satellite mission, which has a planned launch in 2025. They are used to transform satellite-retrieved aerosol properties into estimates of PM mass concentrations near the ground. MAIA's network of sensors complements existing monitoring capabilities while also offering the first-ever assessment of PM_{2.5} and its chemical composition in several countries where significant data gaps previously existed, such as Ethiopia.

Measurements to date reveal significant variations in outdoor PM pollution levels and its makeup depending on global location. In Africa, high levels of black carbon – which is among the most harmful components of PM_{2.5}, and primarily emitted from the combustion of fossil and biomass fuels – are recorded. The latest data have garnered the attention of academics, policymakers, city officials, and U.S. embassy staff, as a sign that MAIA results can impact environmental policy and research.



NASA HAQ TEAM HOSTS SCIENTIFIC SESSIONS AT AGU 2023

At the American Geophysical Union (AGU) Annual Meeting 2023, the NASA HAQ team coordinated an oral and poster session, *Connecting NASA Earth Science Applications with Community Health Stakeholders: Using Open Science to Create Innovative Solutions*, in San Francisco, CA. Moderated by **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)**, over 100 attendees participated in the oral session, which included talks on air quality modelling for wildfire and smoke conditions, drought-related health risks, cholera forecasting, and harmful algal bloom challenge. The HAQ poster session had 7 posters, including the topic, *Open Science Applications that Bridge Earth and Health Sciences*.



Panelists of the HAQ scientific session (left) and poster session with HAQ PI teams (middle) and presenters (right) at AGU2023. Credits: NASA

At the NASA exhibit booth, **Barry Lefer (NASA HQ)** presented the Hyperwall talk, *Accelerating Air Quality Solutions through Earth Observations*. Also, **H. Chapman** co-convened the oral GeoHealth (*Understanding the Linkage Between Geosciences and Biothreats for Enhancing National and Global Security*) and Global Environmental Change (*Innovative Applications of Earth Observations to Mitigate Environmental Challenges in the Americas*) sessions and contributed as the GEO Health Community of Practice representative on the USGEO Town Hall. To learn more about the HAQ program activities, view her AGU TV interview ([Promoting Earth Observation for Health Decision-making with Helena Chapman](#)).



B. Lefer presents the Hyperwall talk at the NASA exhibit (left) and panelists of the National and Global Security session (right) at AGU2023. Credits: H. Chapman

GEO HEALTH COMMUNITY OF PRACTICE HOLDS BIWEEKLY TELECONS AND ANNUAL MEETING



The Group on Earth Observations (GEO) [Health Community of Practice](#) (CoP) – led by **John Haynes (NASA HQ)** and **Juli Trtanj (NOAA)** – continues to coordinate community teleconferences that leverage expertise and share Earth observation data and tools to support health decision-making. At these Fall meetings, Work Group leads led discussions, with 40 attendees at each telecon.

- ❑ **October 2023:** **Lindsay Campbell (Florida Medical Entomology Laboratory, Univ. of Florida)** shared research on spatial ecology of medically important arthropod vectors.
- ❑ **November 2023:** **Bryan Duncan (NASA GSFC)** discussed integrating satellite data into standard operations of LMIC agencies, and **Susan Anenberg (George Washington Univ.)** presented on using satellite observations for health surveillance and environmental policy planning across all scales. **Marina Mendoza (ImageCat, Inc.)** highlighted research on predicting wildland fire health impacts, **Antonio Correas (Skymantics)** described ongoing research on heat waves and emergency health care, **Emmanouil Platanakis (Univ. of Bath, UK)** presented a decision and alert system for air pollution-related health risks, and **Paul Churchyard (HSR.health)** discussed a generative AI-based user interface to geospatial and health applications.

The **Small Work Groups** leads continued to leverage expertise with CoP members to provide technical knowledge on selected health-related topics for project tasks.

In December 2023, the GEO Health CoP held the CoP Annual Meeting 2023. [Day 1](#) (50 attendees) included international updates (**Madeeha Bajwa, GEO Secretariat; Ashutosh Limaye, NASA SERVIR; Jorge del Rio Vera, UNOOSA**), regional updates (**Naledzani Mudau, SANSa; Paschalis Tziastas, European Commission; Juli Trtanj, NOAA**), and Global Heat Resilience Service overview (**Juli Trtanj, NOAA; Martyn Clark, GEO Secretariat**). [Day 2](#) (35 attendees) included updates from the five Work Group leads.



Attendees at CoP Annual Meeting at AGU2023. Credits: H. Chapman

GEO WEEK 2023 AND MINISTERIAL SUMMIT

In November 2023, the EO4Health team supported the *Earth Observations and Smartphones: Water and Health Risk for Decision Makers and Grassroots* flash talk, by **Antar Jutla (Univ. of Florida)** and **Ali Akanda (Univ. of Rhode Island)**, at the [GEO Week 2023 and Ministerial Summit](#) in Cape Town, South Africa. The event highlighted how Earth observations can help advance understanding of ecosystem risks and accelerate nature-based solutions, through the GEO Work Programme 2023-2025 and the GEO Post-2025 Strategy. The EO4Health team promoted the [Changing Cholera's Tune](#) exhibit and pamphlets, as part the USGEO Jazz Observatory exhibit.



A. Jutla presents his work at the USGEO Jazz Observatory exhibit. Credits: A. Jutla

HAQ COMMUNITY ENGAGEMENT



HEALTH & AIR QUALITY

The NASA HAQ team (**Helena Chapman, NASA HQ/BAH** and **Laura Judd, NASA LaRC**) presented webinars that introduced the HAQ program and key examples of using Earth observations for public health applications.

- ❑ **Rollins College (Virtual)**: L. Judd and H. Chapman presented an overview of the HAQ focus area, selected projects, and training opportunities and selected projects in November 2023 (15 public health students and faculty).
- ❑ **University of Santo Tomas (Virtual for Chile)**: H. Chapman gave the virtual talk, *Incorporating Satellite Data in Public Health to Address Climate Change* (in Spanish), as part of the First International Congress on One Health in November 2023.

LOOKING AHEAD

Meetings:

American Meteorological Society Annual Meeting

January 28-February 1, 2024

AGU Chapman Conference on Remote Sensing of the Water Cycle

February 13-16, 2024
Honolulu, HI

American Mosquito Control Association Annual Meeting

March 4-8, 2024
Dallas, TX

American Thoracic Society International Conference

May 17-22, 2024
San Diego, CA

Air & Waste Management Association's Annual Conference & Exposition

June 24-27, 2024
Calgary, AB, Canada

LINKING HEALTH AND AIR QUALITY WITH ENVIRONMENTAL JUSTICE

In October 2023, the HAQ team joined the Equity and Environmental Justice (EEJ) team to support the *NASA EEJ Webinar Series*, focusing on health and air quality topics. **John Haynes (NASA HQ)** described the objectives of the HAQ program and selected projects that highlighted key community stakeholder engagements. Then, **Qian Xiao (Univ. of Texas Health Sciences Center at Houston)** provided a summary of the HAQAST Tiger Team's Satellite Data for Environmental Justice ([SD4EJ](#)). A total of 33 participants attended this webinar.

RECENT COMMUNICATIONS

NASA

- ❑ [A Tale of Three Pollutants](#) (Sally Younger)
- ❑ [Satellite Data Can Help Limit the Dangers of Windblown Dust](#) (Nathan Marder)
- ❑ [NASA Technologies Receive Multiple Nods in TIME Inventions of 2023](#) (Roxana Bardan)
- ❑ [See SWOT Mission's Unprecedented View of Global Sea Levels](#) (Jet Propulsion Laboratory)

NASA Applied Sciences Program

- ❑ [Air Quality Forecasts Get an Upgrade](#) (Marissa Kunerth, IntelliBridge)

NASA Earth Observatory

- ❑ [An Unequal Air Pollution Burden at School](#) (Adam Voiland)

NASA EarthData

- ❑ [Living in Heat that Kills](#) (Charlie Plain)
- ❑ [Using Satellite Data to Solve Real-World Health and Air Quality Issues](#) (Charlie Plain)
- ❑ [How Open Science is Enabling Equity and Environmental Justice](#) (Josh Blumenfeld)

PUBLICATION OF THE FIFTH NATIONAL CLIMATE ASSESSMENT

Led by the US Global Change Research Program (USGCRP) and its 14 member agencies, the *Fifth National Climate Assessment (NCA5)* was published in November 2023. This report highlights a comprehensive analysis of observed and projected U.S. climate change impacts, vulnerabilities, and risks, and shares examples of local applications that build community resilience.



Credit: NCA5

PUBLICATIONS

[Anticipatory Decision-making for Cholera in Malawi.](#)

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

[PM_{2.5} Data Inputs Alter Identification of Disadvantaged Communities.](#) *Environmental Research Letters*. (T.S.

Carter, G.H. Kerr, H. Amini, R.V. Martin...S. Anenberg)

[County-Level Artificial Light at Night \(ALAN\) in the Contiguous US \(2012-2019\): Spatial Variations, Temporal Trends and Environmental Justice Analyses.](#) *Environmental Science and Pollution Research International*. (Q.

Xiao...J. Wang, C. Bauer)

[Long-term Mortality Burden Trends Attributed to Black Carbon and PM_{2.5} from Wildfire Emissions across the Continental USA from 2000 to 2020: A Deep Learning Modelling Study.](#) *Lancet Planetary Health*. (J. Wei, J.

Wang, Z. Li, S. Kondragunta, S. Anenberg, et al.)

[Evaluating the Spatial Patterns of US Urban NO_x Emissions using TROPOMI NO₂.](#) *Remote Sensing of Environment*. (D.L. Goldberg, M. Tao, G.H. Kerr, S. Ma, D.Q. Tong, A.M. Fiore...S.C. Anenberg)

[Development and Evaluation of a North America Ensemble Wildfire Air Quality Forecast: Initial Application to the 2020 Western United States "Gigafire".](#) *Journal of Geophysical Research: Atmospheres*. (P. Makkaroon, D.Q. Tong, et al.)

[Profiles of Operational and Research Forecasting of Smoke and Air Quality Around the World.](#) *Landscape Fire, Smoke, and Health: Linking Biomass Burning Emissions to Human Well-Being*. (S.M. O'Neill...D. Tong, et al.)

[Adverse Health Impacts of Outdoor Air Pollution, including from Wildland Fires, in the United States: "Health of the Air," 2018-2020.](#) *Annals of the American Thoracic Society*. (K. Cromar, L. Gladson, J. Gohlke, Y. Li, D. Tong, G. Ewart)

[Air Pollution, Weather, and Agricultural Worker Productivity.](#) *American Journal of Agricultural Economics*. (A.E. Hill...J.R. Pierce)

[Satellite Data to Inform Ozone Sensitivity: A Practical Methodology Using Google Earth Engine.](#) *EM: The Magazine for Environmental Managers*. (J. McGinnis, T. Holloway, J. Bratburd, M. Tao, A. Fiore)

PAST

ARSET Training:

[Spectral Indices for Land and Aquatic Applications](#)

October 26 – November 9, 2023

Meetings:

[World Medical Association General Assembly](#)

October 4-7, 2023

Kigali, Rwanda

HAQAST Utah

October 19-20, 2023

Salt Lake City, UT

GEO Week 2023

November 6-10, 2023

Cape Town, South Africa

[American Public Health Association Annual Meeting & Expo](#)

November 12-15, 2023

Atlanta, GA

[American Geophysical Union Annual Meeting](#)

December 11-15, 2023

San Francisco, CA