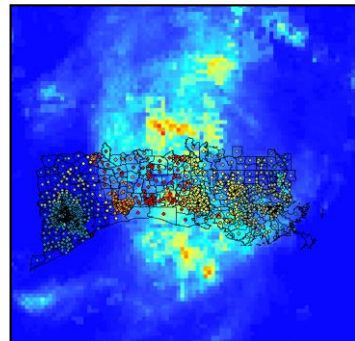


QUARTERLY HAQ PROJECT HIGHLIGHT:

FROM SPACE TO FRONT PORCH: CONNECTING EARTH OBSERVATIONS TO HEALTH OUTCOMES WITH AN ENVIRONMENTAL EXPOSURE MODELING SYSTEM

Supported through a 2017 HAQ grant, **Julia Gohlke (Virginia Tech)**, **Samarth Swarup (U. of Virginia)**, and **Ben Zaitchik (Johns Hopkins U.)**, are developing a prototype system to enhance the CDC's Social Vulnerability Index, which identifies at-risk communities following disasters to improve health hazard mitigation planning. This system incorporates estimates of rainfall, temperature, power outages, and flood water derived from GPM, MODIS, VIIRS, and the European Space Agency's Sentinel-1 satellite, while utilizing health outcomes in greater Houston from pre- and post- Hurricane Harvey as a case study. A synthetic population constructed from multiple data sources is used to model the effects of mobility and time-varying exposures. Working with project partners at CDC and the Houston Health Department, the team will integrate results from their work onto CDC's website to demonstrate the utility of Earth observation data and population modeling for emergency management decisions.



Gridded GPM observations and 48hr NAM_NMM precipitation forecast for each census tract as colored dots (August 27, 2020). Redder colors indicate more intense precipitation in both GPM and forecasts. Credit: B. Zaitchik

NASA INVESTIGATOR UPDATES

- ❑ **Susan Anenberg (George Washington U.)**, **Pablo Mendez-Lazaro (U. of Puerto Rico Medical Sciences Campus)**, and **Michael Wimberly (U. of Oklahoma)**: Their research was highlighted in Proto's (Massachusetts General Hospital) [Eyes in the Sky](#) in March 2021.
- ❑ **Assaf Anyamba (USRA/NASA GSFC)**: As part of the GPM and GLOBE Mission Mosquito Outreach efforts, he presented the talk, *Global Mapping, Monitoring and Forecasting of Chikungunya Risk*, to [Project AEDES](#) in February 2021. Project AEDES was one of the six Global Awardees in the 2019 NASA International Space Apps Challenge, winning the Best Use of Data category among 36 Global Finalists.
- ❑ **Tracey Holloway (U. of Wisconsin-Madison)**: Her leadership was highlighted in the UW-Madison article, [UW Atmospheric Scientist Bridges Science, Policy, Public Health to Bring Space-based Data to the World](#), in March 2021.
- ❑ **Laura Judd (NASA LaRC)**: Her career path was highlighted on WTRK news (CBS, Norfolk), [To Mars and Back: Meet the Women Helping NASA Langley Break Barriers in Science](#), in March 2021.
- ❑ **William Pan (Duke U.)** and **Ben Zaitchik (Johns Hopkins U.)**: They presented the talk, *Development of a Malaria Early Warning System in the Amazon: Successes and Challenges*, for the AGU GeoHealth Early Career Researcher webinar in March 2021.

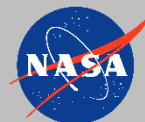
HEALTH AND AIR QUALITY APPLICATIONS APPLIED SCIENCES PROGRAM

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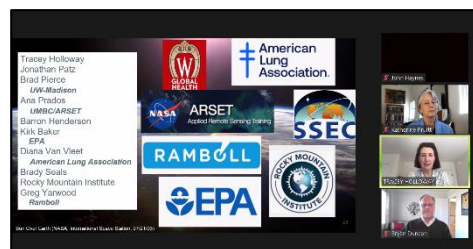


NASA HEALTH AND AIR QUALITY APPLIED SCIENCES TEAM

In February 2021, the [NASA Health and Air Quality Applied Sciences Team](#) (HAQAST) (2021-2025), led by **Tracey Holloway (U. of Wisconsin, Madison)**, which was selected in December 2020, held the first HAQAST team meeting with **14 Principal Investigators**. The team is charged with engaging managers, officials, and others in the air quality and health communities to identify emerging, near-term opportunities to apply NASA Earth Science data in collaborative Tiger Team applications projects.

- Susan Anenberg (George Washington U.)
- Bryan Duncan (NASA Goddard Space Flight Center)
- Arlene Fiore (Columbia U.)
- Pawan Gupta (Universities Space Research Association)
- Tracey Holloway (U. of Wisconsin, Madison)
- Yang Liu (Emory U.)
- Jingqiu Mao (U. of Alaska, Fairbanks)
- Randall Martin (Washington U. in St. Louis)
- Jeffrey Pierce (Colorado State U.)
- Armistead Russell (Georgia Institute of Technology)
- Amber Soja (National Institute of Aerospace Associates)
- Daniel Tong (George Mason U.)
- Christopher Uejio (Florida State U.)
- Qian Xiao (U. of Texas Health Science Center at Houston)

In March 2021, the HAQAST team supported the [HAQAST Launch '21 Public Meeting](#) to provide an opportunity for end-users and stakeholders to learn about the work of the 14 HAQAST PIs, make connections, and get ready for the upcoming Tiger Teams. In March and April 2021, the HAQAST team coordinated the [Spring '21 Discussion Groups](#) as informal discussion groups to build two-way dialogue with stakeholder partners in health and air quality. These project leads – along with their applied research partners, end users, and stakeholders – will work to connect NASA Earth Science data and tools to the environmental health and air quality communities.



HAQAST Spring '21 Discussion Group with J. Haynes, K. Pruitt, T. Holloway, and B. Duncan. Credit: H. Chapman

March 2021 Discussion Groups

- Improving air quality forecast and analysis under smoke conditions (**Jingqiu Mao, Jun Wang**)
- How can NASA Earth observations support environmental justice? (**Susan Anenberg, Qian Xiao**)
- Expanding community involvement in the design of satellite-derived PM2.5 (**Randall Martin**)
- What is the best way to combine NASA data and low-cost monitors to quantify air pollution? (**Jeff Pierce**)
- Improving emission inventories for nitrogen oxides (NOx) (**Daniel Tong, Daniel Goldberg**)
- Differentiated health impacts of persistent and/or extreme smoke events (**Amber Soja**)

April 2021 Discussion Groups

- How can NASA data support analysis of high-pollution Events? (**Arlene Fiore**)
- How can NASA field campaign data support stakeholder information needs? (**Brad Pierce**)
- What are the main needs for improved communication, data visualization, and ease-of-access for satellite data products? (**Bryan Duncan**)
- Relationship between indoor and outdoor air quality and role of NASA data (**Pawan Gupta**)
- PM composition and health impacts (**Yang Liu, Sundar Christopher**)

NASA HAQ TEAM HOSTS SCIENTIFIC SESSION AT AMS 2021

At the American Meteorological Society (AMS) 2021, the NASA HAQ team coordinated a scientific session, [**Integrating NASA Satellite Data to Strengthen Environmental Health Applications: Approaches to Informing Health Decision-Making and Enhancing Public Engagement**](#), in the 12th Conference on Environment and Health. Moderated by **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)**, this session included nine oral session topics and had over 40 attendees in the live session.



Credit: AMS

- ❑ Using NASA Earth Observation Satellites to Enhance Health and Air Quality Applications (**John Haynes, NASA HQ**)
- ❑ The NASA TEMPO Mission: Revolutionary Air Pollution Observations for Environmental Health Applications (**Aaron Naeger, U. of Alabama in Huntsville**)
- ❑ Using CrIS Ammonia Observations to Improve Decision-Making on PM2.5 Control Policies (**Nicholas Heath, AER**)
- ❑ Using Satellite Data to Support Regional Dust Event Detection and Forecasting in the Southwestern United States—Application to Valley Fever Surveillance, Highway Safety, and Air Quality Management (**Thomas Gill, U. of Texas at El Paso**)
- ❑ Plankton, Aerosol, Cloud, Ocean Ecosystem (PACE) Mission: Advanced Oceanic and Atmospheric Satellite Observations for Science-Driven Environmental Health Applications (**Erin Urquhart, SSI/NASA Goddard Space Flight Center**)
- ❑ Endemicity of a Water-Borne Disease in Human Population (**Antar Jutla, U. of Florida**)
- ❑ Associations between Eight Earth Observation-Derived Climate Variables and Pathogen-Specific Enteric Infections in Multiple Large Surveillance Studies (**Josh Colston, U. of Virginia**)
- ❑ Development of a Health Management Information System Web Application for Using NASA Satellite-Based Earth Observations (**John Beck, U. of Alabama in Huntsville**)
- ❑ Evaluating West Nile Virus Forecasts in an Endemic Region of North America: A Retrospective Model Comparison and Validation (**Michael Wimberly, U. of Oklahoma**)

The HAQ team also presented the poster, [**Using NASA Satellite Data to Expand Environmental Health Networks: Emphasis on the One Health Concept**](#), in the 12th Conference on Environment and Health.

CDC ZONOSSES & ONE HEALTH UPDATES

In February 2021, **John Haynes (NASA HQ)** and **Juli Trtanj (NOAA)** were invited presenters to the monthly CDC Zoonoses & One Health Updates ([ZOHU](#)) webinar, which offers timely updates on zoonotic and infectious disease topics. Their talk, [**NASA and NOAA Earth Observations for Health and Air Quality Applications**](#), highlighted the use of Earth observations to improve health and air quality management and public health surveillance, focusing on applications of satellite data in relation to the COVID-19 pandemic. Over 500 people participated in the webinar. This speaking engagement was a result of NASA's continued participation on the One Health Federal Interagency COVID-19 Coordination Group, led by the CDC One Health Office.



Credit: CDC

GEO HEALTH COMMUNITY OF PRACTICE HOLDS MONTHLY TELECONS



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 60 participants, new GEO Health CoP members have joined and presented their research applications to the wider community.

- ❑ **January 2021:** **Bryan Duncan (NASA GSFC)** presented on [CityAQ](#), a pilot project that provides optimized air quality forecasts to city health and air quality managers.
- ❑ **February 2021:** The **Central American Technological University (UNITEC)** team shared the COVID-19 and Dengue Observatory, and **William Pan (Duke U.)** described [malaria risk maps](#) in the Amazon.
- ❑ **March 2021:** **Vineet Khanna (Veterans Affairs Medical Center)** discussed lung cancer screening with pollution as a factor, **Pawan Gupta (USRA/NASA MSFC)** described air quality forecasting with [NASA SERVIR in Thailand](#), and **Pablo Méndez-Lázaro (U. of Puerto Rico Medical Sciences Campus)** shared an [air quality forecasting tool](#) on seasonal Saharan dust storm events in the Caribbean.
- ❑ **March 2021:** **Marjan Van Meerloo (European Commission)** discussed the Early Warning for Epidemics Prize, **Antar Jutla (U. of Florida)** shared findings from his COVID-19 research, and **Ben Zaitchik (Johns Hopkins U.)** presented harmonized Earth observation datasets with COVID-19 cases.

The [Small Work Groups](#) leads – Heat (**Ben Zaitchik, Johns Hopkins U.**); Infectious Diseases (**Antar Jutla, U. of Florida**); Food Security and Safety (**Dorian Janney, NASA GSFC/GPM**); and Health Care Infrastructure (**John Balbus, NIEHS; Andreas Skouloudis, iSteep.org**) – leveraged expertise with CoP members to provide scientific and technical knowledge on selected health-related topics for specific project tasks. We look forward to strengthening these scientific networks over the following months!

UPCOMING TRAINING ON NASA TEMPO DATA PRODUCTS

In preparation for the NASA TEMPO launch set for October 2022, the Early Adopters Program has been coordinating with the TEMPO Science Team in designing pre-launch data products that represent the planned operational products after launch. On April 28, 2021, the [Pre-Launch TEMPO Data User Tutorial](#) will provide an overview and specifications of the first major release of pre-launch proxy TEMPO data products for the early adopter community. Current and new early adopters are encouraged to attend the tutorial session.



TEMPO. Source: [TEMPO website](#)

NASA HAQ TEAM HOSTS SYMPOSIUM AT AMCA 2021

In March 2021, the HAQ team supported the *NASA Earth Observations for Improved Vector-borne Disease Surveillance* symposium at the American Mosquito Control Association Annual Conference, with over 130 attendees. Moderated by **Helena Chapman (NASA HQ/BAH)**, researchers described examples of integrating satellite (LDAS, GPM, MODIS) with ground-based data to enhance mosquito-borne disease surveillance and risk characterization (ArboMAP, DHIS2, VectorSurv).

- ❑ Earth Observations Applied to a Changing World: NASA Health and Air Quality Applications (**John Haynes, NASA HQ**)
- ❑ A Thermodynamic Paradigm for Studying Disease Vector's Habitats and Life Cycles Using NASA's NextGen Remote Sensing Instruments (**Jeffrey Luvall, NASA Marshall Space Flight Center**)
- ❑ Malaria Early Warning System Tools to Understand the Re-emergence of Malaria in Ecuador (**William Pan, Duke U.**)
- ❑ VectorSurv Gateway Tools for Tracking the Spread of Invasive Aedes and Risk for Aedes-borne Viruses (**Chris Barker, U. of California, Davis**)
- ❑ Multiregion Modeling and Prediction of Human Arboviral Disease: West Nile Virus in South Dakota, Louisiana, and Elsewhere (**Justin Davis, U. of Oklahoma**)

Also, **H. Chapman** presented the talk, *Using Satellite Data to Enhance One Health Networks in Vector Control*, in the Disease and Vector Studies session.

2021 NASA ACCP AQ WORKSHOP

In March 2021, the [2021 NASA Aerosol, Cloud, Convection and Precipitation \(ACCP\) Air Quality Workshop](#) focused on current applications and future opportunities of ACCP observations to support air quality and disaster applications. This three half-day virtual meeting provided an opportunity for representatives from federal and state operational agencies, private companies, and boundary organizations to discuss how NASA ACCP aerosol products could be better leveraged to inform decision-making activities. On the agenda, Day 1 offered an overview of the Decadal Survey and the ACCP Study and Applications. Day 2 included panel sessions on air quality forecasting and monitoring, followed by an open discussion with current and emerging end-users. Day 3 focused on the needs of the public health, wildfire smoke, dust storms, and aviation hazard communities. This workshop had more than 160 participants.

NASA HAQ TEAM PRESENTS AT ASPPH 2021

In March 2021, at the Association of Schools and Programs of Public Health (ASPPH) Annual Meeting 2021, **Helena Chapman (NASA HQ/BAH)** represented the HAQ Team and presented an e-poster presentation, *Promoting Innovative Scientific Approaches to Build One Health Networks*. In this presentation, she encouraged multidisciplinary collaborations that integrate diverse scientific data and approaches that can foster community partnerships, strengthen public education, and ultimately protect population health. She described the GEO Health Community of Practice as a timely example of Earth and health scientists collaborating throughout the COVID-19 pandemic to advance scientific knowledge on environmental health indicators.

RECENT WEBINARS BY HAQ TEAM

The NASA HAQ team (John Haynes, NASA HQ; Helena Chapman, NASA HQ/BAH) conducted webinars on Earth observations for public health applications and on potential career paths.

January 2021

- ❑ **NIH's Foundation for Advanced Education in the Sciences:** J. Haynes and H. Chapman provided invited lectures for the [Global Health and Infectious Diseases](#) course.

February 2021

- ❑ **U. of Oklahoma's Student Chapter of AMS and National Weather Association:** J. Haynes presented the talk, [A Day in the Life of a Program Manager for Health and Air Quality at NASA](#) (30 students).

March 2021

- ❑ **Women Power Week (U. Chile, U. Concepción, U. Santiago de Chile):** H. Chapman presented the talk, *Exploring an Innovative Health Career: From Mosquitoes to Satellites* (40 students).

LOOKING AHEAD

[A.37 Earth Science Applications: Health and Air Quality \(ROSES2021\)](#)

NOI due: April 30, 2021

Proposal due: June 18, 2021

ARSET Training:

[Satellite Observations and Tools for Fire Risk, Detection, and Analysis](#)

May 11-27, 2021

Virtual Meetings:

2021 FDA One Health Symposium

April 13, 2021

[American Thoracic Society International Conference](#)

May 14-19, 2021

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

June 14-17, 2021

RECENT COMMUNICATIONS

NASA

- ❑ [Landsat Satellite Data Warns of Harmful Algal Blooms](#) (Kate Ramsayer, NASA GSFC)
- ❑ [Paraguay's First Satellite Deployed From the International Space Station](#) (Melissa Gaskill, NASA JSC)

NASA Applied Sciences Program

- ❑ [Applied Sciences 2020 Highlights](#)
- ❑ [It's All in the Details: Planning a Successful Conference with Laurel Fletcher](#) (Maddie Ecker, U.Group)

NASA Earth Observatory

- ❑ [Reduced Fires Lead to Some Air Quality Improvements in Africa](#) (Sofie Bates, NASA Earth Science News Team, and Mike Carlowicz)
- ❑ [Smoking Sugar Fields in South Florida](#) (Adam Voiland, NASA Earth Science News Team)

HAQ ANNUAL SUMMARY 2020

In March 2021, the NASA Applied Sciences Program disseminated the [NASA Health and Air Quality Applications Annual Summary 2020](#). This report summarized major accomplishments, project portfolio milestones, community leadership, and international activities. It highlighted the achievements of the Health and Air Quality Applied Sciences Team (HAQAST) and four ongoing Earth Observations for Health (EO4HEALTH) projects of the GEO Work Programme 2020–2022.



Credit: NASA

PAST

Virtual Meetings:

[American Meteorological Society Annual Meeting](#)

January 10-15, 2021

[American Mosquito Control Association Annual Meeting](#)

March 2-5, 2021

[2021 NASA ACCP Air Quality Workshop](#)

March 16-18, 2021

[Association of Schools and Programs of Public Health Annual Meeting](#)

March 23-25, 2021

PUBLICATIONS

[Dust Emission Source Characterization for Visibility Hazard Assessment on Lordsburg Playa in Southwestern New Mexico USA](#). *Geoenvironmental Disasters*. (R.S. Van Pelt, J. Tatarko, **T.E. Gill**, et al.)

[Understanding Dust Sources through Remote Sensing: Making a Case for CubeSats](#). *Journal of Arid Environments*. (M.C. Baddock, R.C. Bryant, M. Dominguez Acosta, **T.E. Gill**)

[Drought and Land Use/Land Cover Impact on Dust Sources in Southern Great Plains and Chihuahuan Desert of the U.S.: Inferring Anthropogenic Effect](#). *Science of the Total Environment*. (T. Kandakji, **T.E. Gill**, J.A. Lee)

[Satellite Observations and Malaria: New Opportunities for Research Applications](#). *Trends in Parasitology*. (**M.C. Wimberly**, K.M. de Beurs, **T.V. Loboda**, **W.K. Pan**)

[Applying a One Health Approach in Global Health and Medicine: Enhancing Involvement of Medical Schools and Global Health Centers](#). *Annals of Global Health*. (C. Machalaba, J. Raufman, **A. Anyamba**, et al.)

[TROPOMI NO₂ in the United States: A Detailed Look at the Annual Averages, Weekly Cycles, Effects of Temperature, and Correlation With Surface NO₂ Concentrations](#). *Earth's Future*. (**D.L. Goldberg**, **S.C. Anenberg**, G.H. Kerr, A. Mohegh, Z. Lu, D.G. Streets)

[Does Improved Risk Information Increase the Value of Cholera Prevention? An Analysis of Stated Vaccine Demand in Slum Areas of Urban Bangladesh](#). *Social Science & Medicine*. (S. Aziz, E.L. Pakhtigian, A.S. Akanda, **A. Jutla**, A. Huq, M. Alam, G.U. Ashan, **R.R. Colwell**)

[Rift Valley Fever and the Challenges of Remaining Fully Prepared for this Periodic Emergency](#). *OIE Panorama Bulletin*. (B. Dungu, **A. Anyamba**)

[Assessing the Distribution of Air Pollution Health Risks within Cities: A Neighborhood-Scale Analysis Leveraging High-Resolution Data Sets in the Bay Area, California](#). *Environmental Health Perspectives*. (V.A. Southerland, **S.C. Anenberg**, M. Harris, J. Apte, P. Hystad, A. van Donkelaar, **R.V. Martin**, M. Beyers, A. Roy)

[Advances in Satellite Data for Wildfire Smoke Forecasting](#). *Eos*. (**S. O'Neill**, **S. Raffuse**)