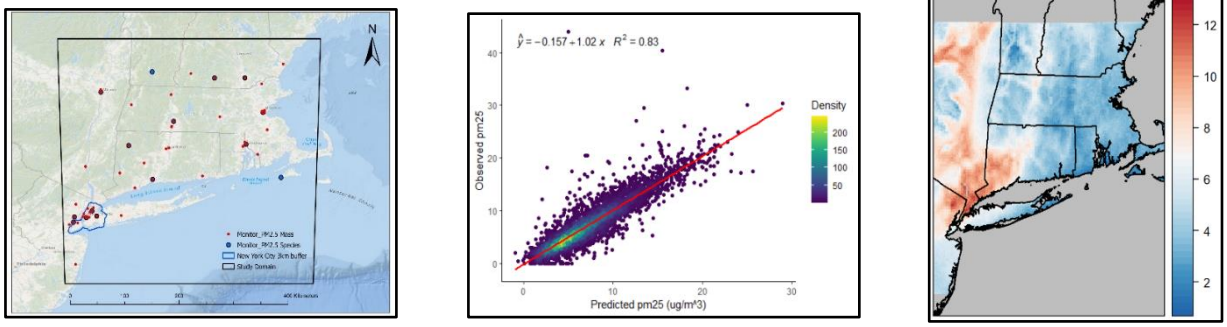
NASA Health and Air Quality
remote sensing for public health

Volume 30
January – March 2022

QUARTERLY HAQ PROJECT HIGHLIGHT:

ENHANCING ENVIRONMENTAL HEALTH SURVEILLANCE IN NEW YORK CITY

Supported through a 2017 HAQ grant, **Yang Liu (Emory Univ.)** and his team have applied a Bayesian modeling framework to estimate daily total $PM_{2.5}$ mass and speciation concentrations in the Northeastern US with full spatial coverage at 1km^2 resolution in 2018. The modeling strategy is based on the pre-launch operational algorithm for the $PM_{2.5}$ products of the Multi-Angle Imager for Aerosols (MAIA) instrument, an upcoming NASA EVI-3 mission focusing on evaluating the adverse health impacts of various $PM_{2.5}$ types in urban centers around the world. This modeling framework integrates GOES-16 AOD product, various MAIA Ancillary Geographic Products, ground air quality measurements and the WRF-Chem simulations. Working closely with project partners at the Univ. of Iowa and NYC Department of Health and Mental Hygiene, this project aims to demonstrate the value of NASA Earth Observations in supporting local environmental health surveillance and community air quality monitoring systems and preparing stakeholders to integrate emerging satellite data products into their decision support processes.



Left: Spatial distribution of $PM_{2.5}$ mass and speciation monitoring sites in the MAIA Northeastern US primary target area. Middle: Linear regression between ground $PM_{2.5}$ mass observations and matched model predictions at the daily level as a measure of model prediction accuracy. Right: Spatial distribution of predicted daily mean $PM_{2.5}$ mass concentration on January 27, 2018. Credits: Y. Liu

AIR QUALITY HIGHLIGHTS ON PEDIATRIC ASTHMA BURDEN

In January 2022, **Susan Anenberg (George Washington Univ.), Dan Goldberg (George Washington Univ.),** and team published two companion papers in the *Lancet Planetary Health*. Findings highlighted trends in NO_2 and $PM_{2.5}$ pollution and attributed them to pediatric asthma and broader disease burdens, respectively, from 2000-2019 in over 13,000 cities around the globe. These studies benefitted from satellite data of NO_2 from OMI as well as aerosol data from MODIS, SeaWIFS, and MISR. This work was published on the George Washington Univ., *Chicago Sun Times*, and Applied Sciences webpages.

HEALTH AND AIR QUALITY APPLICATIONS
APPLIED SCIENCES PROGRAM

JOHN HAYNES
PROGRAM MANAGER
HEADQUARTERS

HELENA CHAPMAN
ASSOCIATE
HEADQUARTERS/BAH

LAURA JUDD
ASSOCIATE
LANGLEY RESEARCH CENTER

Created by Helena Chapman, MD, PhD; please direct correspondence to helena.chapman@nasa.gov

NASA Health and Air Quality
remote sensing for public health

Volume 30
January – March 2022

NASA HAQAST UPDATE 22 MEETING

In January 2022, the **NASA Health and Air Quality Applied Sciences Team** (HAQAST) (2021-2025), led by **Tracey Holloway (Univ. of Wisconsin, Madison)**, held the HAQAST Update 2022 with the **14 HAQAST Principal Investigators**. The team is charged with engaging decision makers in the air quality and health communities to identify emerging, near-term opportunities where NASA Earth Science data can assist. With over 120 participants, the meeting highlighted how satellite data are now ingrained in the work of leading organizations and provide new opportunities for city and neighborhood scale analyses. Attendees agreed that environmental justice applications as well as identifying new emissions sources are possible with higher spatial resolution data. Familiarity with emerging data products arose as an ongoing theme, as stakeholders noted the need for consistent training and product communication. Several HAQAST projects are addressing this need through future webinars and workshops. Meeting recordings are available on the HAQAST webpage.

HAQAST

Credits: HAQAST

NASA INVESTIGATOR UPDATES

- **Susan Anenberg (George Washington Univ.):** Her team presented the talk, *Satellite Data for Environmental Justice: Advancing EJ Mapping Tools and Building a New Community of Practice*, at the National Environmental Justice Conference in March 2022.
- **Laura Judd (NASA LaRC)**: She co-authored, *A Succession of Cloud, Precipitation, Aerosol, and Air Quality Field Experiments in the Coastal Urban Environment*, published in the *Bulletin of the American Meteorological Society* in February 2022.
- **Pablo Méndez-Lázaro (Univ. of Puerto Rico Medical Sciences Campus):** He gave the talk, *Dust Storms, Socio-environmental factors, and COVID-19 in Puerto Rico*, at the Yale Center on Climate Change and Health in January 2022. He also presented the topic, *Can Saharan Dust Intrusion be Considered a Co-factor on Risk of Morbidity and Mortality in Puerto Rico?*, for the InDust Webinar of the WMO/Barcelona Dust Regional Center in February 2022.
- **Sheryl Magzamen** and **Jeffrey Pierce (Colorado State Univ.):** Their team and collaborators received funding for the project, *Smoke-ready Communities: Creating and Sustaining Air Quality Information using Targeted Communication Interventions to Improve Human and Animal Health*, from the Colorado State Univ's One Health Institute and the US Environmental Protection Agency in March 2022.
- **Abigail Nastan (Jet Propulsion Laboratory):** Her profile was highlighted on the EOSDIS User Profile in March 2022.
- **Daniel Tong (George Mason Univ.):** His research was featured by the NOAA Air Resources Laboratory article, New Dust Forecast Model Excels in Predicting Recent Dust Storms, in late December 2021.
- **Ben Zaitchik (Johns Hopkins Univ.):** He co-authored, *Planning for Compound Hazards during the COVID-19 Pandemic: The Role of Climate Information Systems*, published in the *Bulletin of the American Meteorological Society* in March 2022.

NASA Health and Air Quality
remote sensing for public health

Volume 30
January – March 2022

NASA HAQ TEAM HOSTS SCIENTIFIC SESSIONS AT AMS 2022

At the American Meteorological Society (AMS) 2022, the NASA HAQ team coordinated two scientific sessions under the topic, *Advancing Awareness of Environmental Threats to Human Health through the Integration of NASA Earth Observations,* at the 13th 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 50 attendees participating virtually.

Credit: AMS

Presidential Session on Health Security

- ❑ Examining the Impact of Environmental Risks on Human Health within the NASA Health and Air Quality Program (**John Haynes, NASA HQ**)
- ❑ Healthcare Visits during and following Flooding Events using Satellite-derived Inundation Data to Estimate Exposure (**Julia Gohlke, Virginia Tech**)
- ❑ Anticipatory Decision-making Framework for Preventing Cholera Outbreaks (**Antarpreet Jutla, Univ. of Florida**)
- ❑ Advancing Awareness of Environmental Threats to Human Health through the Integration of NASA Earth Observations (**John Beck, Univ. of Alabama in Huntsville**)
- ❑ Forecasting West Nile Virus with Arbovirus Monitoring and Prediction (ArboMAP) in Multiple US States: A Comparison of Environmental Data Sources (**Dawn Nekorchuk, Univ. of Oklahoma**)
- ❑ Unprecedented Death Toll of the 2020 Western United States Wildfires (**Daniel Tong, George Mason Univ.**)

NASA Session on Advancing Awareness of Environmental Threats to Human Health

- ❑ Data Integration to Connect Environment and Health (**Zhong Liu, George Mason Univ.**)
- ❑ Enabling Access and Use of NASA Earth Science Data for Environmental Security and Justice with Thematic Data Pathfinders (**Cynthia Hall, NASA GSFC**)
- ❑ NASA GLOBE CLOUD GAZE: Creating Data Quality Flags for Citizen Science Cloud Observations matched to NASA Satellite Data (**Marile Colon Robles, NASA LaRC**)
- ❑ Addressing Fiery Needs: How SERVIR-Mekong Brings NASA Air Quality Data Down to Earth (**Amanda Markert, Univ. of Alabama in Huntsville**)

J. Haynes participated on the panel, *Exploring the Evolution of Frameworks in Climate Risk Tools and Applications*. **L. Judd** participated in the panel, *Clouds, Aerosol, and Air Quality in the Coastal Urban Environment: Interagency Field Campaigns in the Houston, Texas, Region during 2021–22*. The HAQ team also presented the poster, *Promoting One Health Networks to Examine Ecosystem Risks to Human Health,* in the 13th Conference on Environment and Health.

AMS WEBINAR ON HOUSTON AIR QUALITY

In February 2022, **Laura Judd (NASA LaRC)** and **Doug Boyer (Texas Commission on Environmental Quality)** served as panelists for *The Air You Breathe* webinar, supported by the AMS. Their presentations highlighted Houston air quality and TRACER-AQ, a NASA-led air quality campaign with partners from TCEQ and a number of academic institutions, which collected observations from aircraft, boats, mobile labs, and ground sites.

Credit: H. Chapman

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

- **January 2022: Ann Stapleton (USDA NIFA)** described an AI-related potential pilot project around meta-data using knowledge graphs, and **Kathryn Berger (Development Seed)** shared previous Agrimetrics work producing models to solve global agri-food challenges.
- **February 2022: Nale Mudau (South African National Space Agency)** and **Phoebe Oduor (Regional Centre for Mapping of Resources for Development)** shared current activities and priorities of the AfriGEO region. **Anna Stewart-Ibarra (Inter-American Institute for Global Change Research)** moderated the discussion to identify synergies for AfriGEO collaborations.
- **February-March 2022:** 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**); Food Security and Safety (**Dorian Janney, NASA GSFC**); and Health Care Infrastructure (**John Balbus, NIEHS**; **Andreas Skouloudis, iSteep.org**) – highlighted upcoming priorities and workstream activities.

In March and April 2022, EO4Health, GEO Health CoP, and AfriGEO coordinated the *Special Edition: AfriGEO Webinar* to showcase ongoing Earth science applications addressing emerging health challenges across Africa. With over 110 attendees, 18 flash talks highlighted air quality and heat topics (Day 1) and vector-borne diseases, water-related pathogens, and environmental health concerns (Day 2). Panelists represented institutions in Kenya, Netherlands, Puerto Rico, Spain, Uganda, United Kingdom, USA, and Zimbabwe. Moving forward, the GEO Health CoP will continue to strengthen these global research and applications networks that address climate, environment, and health priorities.

HAQ EARLY ADOPTER PROGRAM ACTIVITIES

In January 2022, the TEMPO and MAIA Early Adopters (EA) Programs co-hosted an AMS session entitled, *Air Quality Monitoring with New-Generation Satellites*, in the 13th Conference on Environment and Health. Presentations highlighted the critical role of TEMPO and MAIA data in enhancing science applications in air quality, health, and agricultural communities. In March 2022, to further engage the air quality management community on TEMPO data, a comprehensive presentation on air quality management applications using TEMPO data was given at the A&WMA's Measurements Conference. Discussion topics included the use of TEMPO data for improving exceptional event demonstrations, instrument siting analyses, and fence-line monitoring activities.

From January to March 2022, the NASA Airathon crowdsourcing competition focused on using remote sensing data and other geospatial data sources to develop models for estimating daily levels of NO_2 and $PM_{2.5}$. Over 1,300 participants submitted science algorithms to win cash awards and potentially improve capabilities to estimate NO_2 and $PM_{2.5}$ using satellite data.

TEMPO. Source: TEMPO website

NASA Health and Air Quality
remote sensing for public health

Volume 30
January – March 2022

NASA HAQ TEAM HOSTS SYMPOSIUM AT AMCA 2022

In March 2022, the HAQ team coordinated the *Enhancing US and Global Mosquito Surveillance with NASA Satellite Data* symposium at the American Mosquito Control Association Annual Conference. This in-person symposium had over 50 attendees. Moderated by **Helena Chapman (NASA HQ/BAH)**, researchers highlighted projects that use satellite data to forecast risk of West Nile virus in the United States and malaria in Peru and Myanmar as well as enhance a global health management information system to support malaria control in low- and middle-income countries.

- ❑ Using Earth Observations to Enhance Public Health Surveillance: NASA Health and Air Quality Applications **(John Haynes, NASA HQ)**
- ❑ Forecasting Arbovirus Risk based with Environmental Monitoring and Mosquito Surveillance Data: Lessons Learned from Multi-state Comparisons **(Michael Wimberly, Univ. of Oklahoma)**
- ❑ Myanmar Malaria Early Warning System: Supporting the Global Malaria Elimination Agenda **(Tatiana Loboda, Univ. of Maryland, College Park)**
- ❑ Incorporating NASA Earth Science Data into a Health Information System for Supporting Malaria Control **(John Beck, Univ. of Alabama in Huntsville)**

M. Wimberly, J. Beck, H. Chapman, J. Haynes, and T. Loboda at AMCA2022. Credit: H. Chapman

Also, **H. Chapman** presented the talk, *Incorporating NASA Satellite Data in Vector Control and Public Health Activities*, in the Disease and Vector Studies I session.

HAQ TEAM MEMBERS WIN PRESTIGIOUS NASA AWARDS

In February 2022, the selections of the **NASA Agency Honor awards** were announced.

Credit: H. Chapman

- ❖ **Helena Chapman (NASA HQ/BAH)** was awarded the **2021 NASA Early Career Achievement Medal.** This award recognized her outstanding performance and significant contributions to improve the discipline area, and to support NASA projects, programs, and initiatives, during the first years of her career. Since 2017, she has contributed to HAQ program activities, first as a AAAS fellow and then as Associate Program Manager, where she promotes the use of innovative and practical uses of Earth science observations for improving public health decision-making.

Credit: J. Haynes

- ❖ **John Haynes (NASA HQ)** and **H. Chapman** formed part of the NASA team for the Rapid Response and Novel Research in Earth Science (RRNES) COVID-19 solicitation, which was selected for the **2021 NASA Group Achievement Award**.
- ❖ **H. Chapman, Shobhana Gupta (NASA HQ), and Tsengdar Lee (NASA HQ)** formed part of the 26-member NASA Advanced Supercomputing (NAS) COVID-19 HPC Consortium Support Group, under the leadership of Piyush Mehrotra (NASA ARC), which was selected for the **2021 NASA Group Achievement Award**.

NASA Health and Air Quality
remote sensing for public health

Volume 30
January – March 2022

RECENT PRESENTATIONS BY HAQ TEAM

The NASA HAQ team continues to be active in presenting within health and air quality communities.

- ❑ **Univ. of Alabama in Huntsville's Department of Atmospheric and Earth Science**: H. Chapman presented the topic, *Using NASA Earth Observations to Enhance Public Health Surveillance and Promote One Health Collaborations*, and L. Judd gave the talk, *Unveiling the Air We Breathe at New Scales: a Focus on Geostationary-like Observations during Airborne Field Campaigns*, as invited presenters for the AES departmental seminars.

- ❑ **One Health Commission's One Health Social Initiative:** H. Chapman presented the talk, *GEO Health Community of Practice: Using Earth Observation Data to Inform Health Decision-making*, as an invited panelist on *One Health Meets Social Sciences* webinar.

LOOKING AHEAD

ARSET Training:
Using the UN Biodiversity Lab to Monitor the Pulse of the Planet
April 14 – May 4, 2022

Atmospheric CO_2 and CH_4 Budgets to Support the Global Stocktake
May 11-25, 2022

American Thoracic Society International Conference
May 13-18, 2022

Air & Waste Management Association's Annual Conference & Exposition
June 27-30, 2022

RECENT COMMUNICATIONS

NASA

- ❑ Amazing Earth: Satellite Images from 2021 **(Michael Brock)**
- ❑ NASA Researcher Finding Ways to Turn Down the Heat in Cities **(Jordan Hickey, Jessica Merzdorf Evans, NASA GSFC)**
- ❑ NASA Science Enables First-of-its-Kind Detection of Reduced Human CO_2 Emissions **(Jessica Merzdorf Evans, NASA GSFC)**

NASA Applied Sciences Program

- ❑ Child Asthma and Other Health Effects of Long-Term Urban Air Pollution **(Aries Keck, U.Group)**
- ❑ Celebrating Women's History Month: Six Women in Science that Make our World Go Round **(Marissa Kunerth, Earth Applied Sciences Writer)**

NASA Earth Observatory

- ❑ No Breathing Easy for City Dwellers: Nitrogen Dioxide **(Joshua Stevens, NASA Earth Observatory)**
- ❑ No Breathing Easy for City Dwellers: Particulates **(Joshua Stevens, NASA Earth Observatory)**

PUBLICATIONS

Quantifying *Karenia brevis* Bloom Severity and Respiratory Irritation Impact along the Shoreline of Southwest Florida. *PLoS One*. (**R.P. Stumpf**, Y. Li, B. Kirkpatrick, R.W. Litaker, et al.)

A Systematic Review and Meta-analysis of the Potential Non-human Animal Reservoirs and Arthropod Vectors of the Mayaro Virus. *PLoS Neglected Tropical Diseases*. (M. Celone, B. Okech, B.A. Han, B.M. Forshey, **A. Anyamba**, et al.)

Asymmetric Relationship between Ambient Air Temperature and Incidence of COVID-19 in the Human Population. *American Journal of Tropical Medicine and Hygiene*. (M. Usmani, Y. Jamal, M. Gangwar, B. Magers, J. Chaves-Gonzalez, C.-Y. Wu, **R. Colwell**, **A. Jutla**)

Climate Conditions During a Rift Valley Fever Post-epizootic Period in Free State, South Africa, 2014–2019. *Frontiers in Veterinary Science*. (**A. Anyamba**, R. Damoah, A. Kemp, et al.)

Associations Between Eight Earth Observation-Derived Climate Variables and Enteropathogen Infection: An Independent Participant Data Meta-Analysis of Surveillance Studies With Broad Spectrum Nucleic Acid Diagnostics. *GeoHealth*. (J.M. Colston, **B.F. Zaitchik**, H.S. Badr, et al.)

Estimating Changes in Emergency Department Visits associated with Floods caused by Tropical Storm Imelda using Satellite Observations and Syndromic Surveillance. *Health Place*. (B. Ramesh, M.A. Jagger, **B.F. Zaitchik**, K.N. Kolivras, S. Swarup, B. Yang, B.G. Corpuz, **J.M. Gohlke**, et al.)

Declines and Peaks in NO_2 Pollution during the Multiple Waves of the COVID-19 Pandemic in the New York Metropolitan Area. *Atmospheric Chemistry and Physics*. (M. Tzortziou, C.F. Kwong, **D.L. Goldberg**, L. Schiferl, R. Commane, N. Abuhassan, et al.)

Influence of Conducive Weather on Ozone in the Presence of Reduced NOx Emissions: A Case Study in Chicago during the 2020 Lockdowns. *Atmospheric Pollution Research*. (P. Jing, **D.L. Goldberg**)

Every Breath We Take: Air Pollution is a Pernicious Threat Linked to Millions of Deaths Each Year. ThinkGlobalHealth. (M. Brauer, **S. Anenberg**)

Global Urban Temporal Trends in Fine Particulate Matter ($PM_{2.5}$) and Attributable Health Burdens: Estimates from Global Datasets. *Lancet Planetary Health*. (V.A. Southerland, M. Brauer,…**R.V. Martin**, J. Apte, **S.C. Anenberg**)

Long-term Trends in Urban NO_2 Concentrations and Associated Paediatric Asthma Incidence: Estimates from Global Datasets. *Lancet Planetary Health*. (**S.C. Anenberg**, A. Mohegh, **D.L. Goldberg**, et al.)

Communicating Respiratory Health Risk among Children using a Global Air Quality Index. *Environmental International*. (L.A. Gladson, **K.R. Cromar**, M. Ghazipura, **K.E. Knowland**, C.A. Keller, **B.N. Duncan**)

Global Fine-scale Changes in Ambient NO_2 during COVID-19 Lockdowns. *Nature*. (M.J. Cooper, **R.V. Martin**, M.S. Hammer, P.F. Levelt, P. Veefkind, L.N. Lamsal, N.A. Krotkov, J.R. Brook, C.A. McLinden)

Long-term Exposure to $PM_{2.5}$ Major Components and Mortality in the Southeastern United States. *Environmental International*. (Y. Wang, S. Xiao, Y. Zhang, H. Chang, **R.V. Martin**, A. Van Donkelaar, A. Gaskins, **Y. Liu**, P. Liu, L. Shi)

PAST

Meetings:

American Meteorological Society Annual Meeting
January 23-27, 2022

American Mosquito Control Association Annual Meeting
February 28 – March 4, 2022
Jacksonville, FL