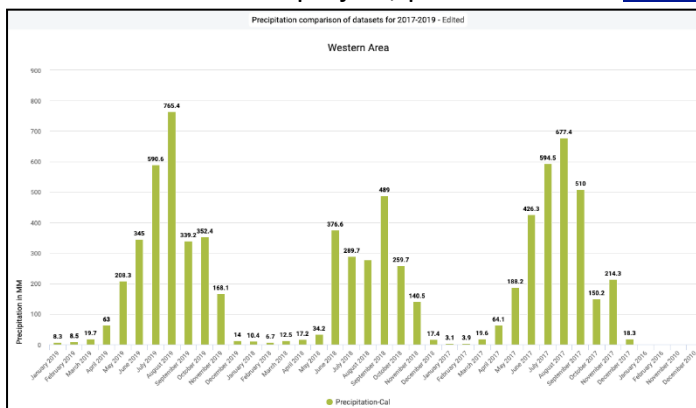
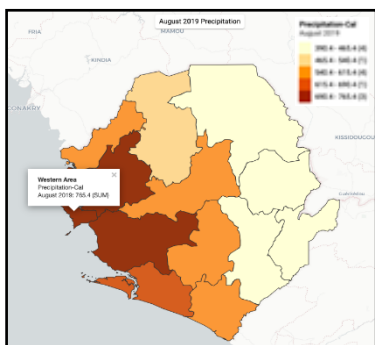


QUARTERLY HAQ PROJECT HIGHLIGHT: ENHANCING MALARIA CONTROL DECISION MAKING IN AFRICA

Supported through a 2017 HAQ grant, John Beck (**U. of Alabama in Huntsville**) and his team have released a web-based prototype application in the global health management platform District Health Information Software 2 ([DHIS2](#)). NASA Earth Observations for Health Information Systems (NEOH) is a cloud-based analytical processing application that can retrieve, process, and disseminate NASA Earth Observations. Using Sierra Leone as a case study, this tool integrates surface temperature, precipitation, and vegetation health data from IMERG, MODIS, VIIRS, and Landsat into DHIS2. Working closely with project partners at CDC, WHO, NASA MSFC, and country stakeholders, the team has enhanced this geo-referenced disease surveillance platform to improve malaria control decision-making in sub-Saharan Africa. To learn more about this project, please read the [NASA One Health Day web feature](#).



NASA GPM IMERG monthly precipitation data for August 2019 aggregated into health districts (map) and for months spanning 2017-2019 for the Western Region (chart) (Sierra Leone). Credits: John Beck

NASA CELEBRATES ONE HEALTH DAY 2021

[One Health Day](#) is celebrated every November to promote the development of transdisciplinary projects that address health threats to humans, animals, and the environment. On One Health Day 2021, the NASA HAQ and Communications Teams posted a feature on the NASA Applied Sciences Program [webpage](#) to share two health projects that demonstrate multidisciplinary collaborations with scientists and community stakeholders. This marks the [fifth annual participation](#) of Applied Sciences in One Health Day, highlighting NASA's role in connecting human, animal, and environmental health.



Credits: NASA

HEALTH AND AIR QUALITY APPLICATIONS APPLIED SCIENCES PROGRAM

JOHN HAYNES
PROGRAM MANAGER
HEADQUARTERS

HELENA CHAPMAN
ASSOCIATE
HEADQUARTERS/BAH

LAURA JUDD
ASSOCIATE
LANGLEY RESEARCH CENTER



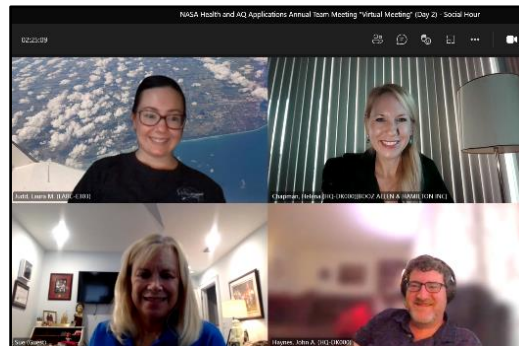
NASA HAQ TEAM CONDUCTS ANNUAL PROGRAM REVIEW

In October, the NASA HAQ Team, led by **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)**, coordinated and moderated the annual HAQ Applications Program Review 2021 with approximately 40 attendees. In this two-day virtual format, [presentations](#) were shared by NASA-funded researchers (ROSES, GEO EO4HEALTH, Rapid Response), HAQAST (**Jenny Bratburd**, **Tracey Holloway**), Communications (**Aries Keck**), and CDC partners (**Nicholas Skaff**, **Angela Werner**, **Fuyuen Yip**). **John Haynes (NASA HQ)** facilitated the Town Hall discussion on future goals, partnerships, and opportunities. This open platform offered an opportunity for researchers to describe priorities, concerns, and specific challenges faced during the COVID-19 pandemic.

Following this event, the NASA HAQ Team held a virtual social hour, *In Recognition of Sue Estes' Distinguished Career with NASA Applied Sciences*, with the NASA Applied Sciences Team, HAQ PIs, and colleagues. **Sue Estes (U. of Alabama in Huntsville)** first joined the NASA Applied Sciences Program in 2006, where she contributed 15 years of experience working in public health. To learn more about Sue's contributions to NASA Applied Sciences, please read the [Celebrating Sue: Health and Air Quality Colleague Retires from Applied Sciences](#) web feature. We celebrate Sue's leadership!

“What can I say to encapsulate Sue's stellar 15-year career at NASA? The Health and Air Quality program would not have achieved its tremendous success without Sue's incredible service and leadership. Through personal interactions with our principal investigators and partner organizations, she helped bring NASA to the forefront as a leading agency within the public health community. She made the impossible seem easy.”

— John Haynes (NASA HQ)



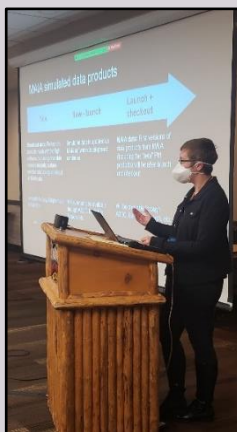
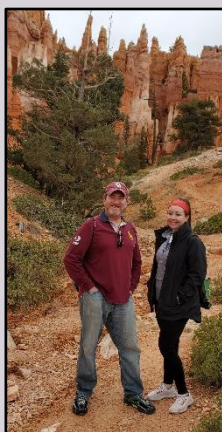
L. Judd (top left) , H. Chapman (top right), S. Estes (bottom left), and J. Haynes (bottom right). Credits: NASA

NASA HAQ INVESTIGATOR UPDATES

- ❑ **Susan Anenberg (George Washington U.):** She presented the talk, *Inconsistent Nitrogen Dioxide (NO₂) Drops during COVID-19 Lockdowns*, for the CDC Zoonoses & One Health Updates in [December 2021](#).
- ❑ **Susan Anenberg and Dan Goldberg (George Washington U.):** They presented invited talks, *Estimating NO_x Emissions from Cities using Satellite Data* and *Satellite Data for Environmental Justice*, at the Western States Air Resources (WESTAR) Council Annual Meeting in December 2021.
- ❑ **Assaf Anyamba (NASA GSFC/USRA):** He gave the talk, *Anomaly Detection in Climate Data to Drive Rift Valley Fever Modeling*, at the 8th International Meeting on Emerging Diseases and Surveillance in November 2021.
- ❑ **Assaf Anyamba (NASA GSFC/USRA) and Amber Soja (NASA LaRC):** They presented the NASA Hyperwall Talks, [Climate Variability and Disease Outbreaks](#) and [Connections Between Fire, Weather, and Climate](#), respectively, at the U.S. Center Glasgow 2021 UN Climate Conference (COP26) in November 2021.
- ❑ **Pablo Mendez-Lazaro (U. of Puerto Rico Medical Sciences Campus):** He was an invited speaker for the [6th Annual Forum on Alliances for Climate Action](#), supported by Resilient Nation Partnership Network, FEMA, and NASA, in October 2021.
- ❑ **Daniel Tong (George Mason U.):** He was elected the new Global Chair of the Steering Committee of the WMO Sand and Dust Storm Warning Advisory and Assessment System Program in October 2021. His team coordinated the [Southern New Mexico and Western U.S. Dust Symposium](#) with over 185 participants in October 2021.
- ❑ **Michael Wimberly (U. of Oklahoma):** His Arbovirus Mapping and Prediction ([ArboMAP](#)) project team held a virtual workshop with public health partners in November 2021, to review results of West Nile Virus forecasting in summer 2021 and discuss plans to release a new version of ArboMAP in 2022.

A&WMA VISIBILITY CONFERENCE 2021

At the Air & Waste Management Association (A&WMA)'s Visibility Conference 2021, the NASA HAQ team coordinated a panel, *NASA Earth Science Capabilities for Investigating Aerosol Impacts*, in Bryce Canyon City, UT. With an estimated 30 attendees, **Laura Judd (NASA LaRC)** and **Helena Chapman (NASA HQ/BAH)** moderated the session with five panelists – **John Haynes (NASA HQ)**, **Sean Raffuse (U. of California, Davis)**, **Michael Cheeseman (Colorado State U.)**, **Ali Omar (NASA LaRC)**, and **Abigail Nastan (Jet Propulsion Laboratory)** – who described using NASA Earth observations to better understand aerosol impacts in relation to wildfires, air quality, and health. Specific topics included the investigation of smoke plume injection heights through MODIS MAIAC, as well as overviews of Atmosphere Observing System ([AOS](#)) and Multi-Angle Imager for Aerosols ([MAIA](#)) missions.



A. Nastan, A. Omar, and J. Haynes (left) and J. Haynes and L. Judd (center) in Bryce Canyon. A. Nastan (center) and conference panel (right) at the A&WMA Visibility Conference 2021. Credits: NASA

NASA HAQ TEAM PRESENTS AT APHA 2021

In October, at the American Public Health Association (APHA) Annual Meeting & Expo 2021, **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)** convened the *Using NASA Satellite Data to Enhance Global Health Surveillance and Decision-Making: A One Health Approach* symposium in the International Health section. Presentations included: *Applying NASA Earth Observations to Strengthen Global Collaborations and Research Networks (John Haynes, NASA HQ)*; *Use of Satellite Observations to Assess Multiple Airborne Exposures Experienced by Military Personnel Deployed in Southwest Asia (Meredith Franklin, U. of Southern California)*; *Study of Imminent Interaction between SARS-CoV-2, Air Quality due to Saharan Dust and Urban Aerosol, and Social-Environmental Factors in Puerto Rico (Pablo Méndez-Lázaro, U. of Puerto Rico Medical Sciences Campus)*; *Harnessing NASA Data for Vectorborne Disease Studies (Assaf Anyamba, NASA GSFC/USRA)*; and *Predictive Decision-making Framework for Trigger and Transmission of Cholera (Antar Jutla, U. of Florida)*. Also, **H. Chapman** presented the talk, *Key Community Collaborations to Examine the Health Impacts of Changing Global Ecosystems*, in the One Health SPIG session.

NASA AIR-ATHON DATA CHALLENGE

A public crowdsourcing challenge, in collaboration with NASA, the U.S. Department of State, and the U.S. Environmental Protection Agency (EPA), is asking participants to submit algorithms to help advance the science of predicting surface-level PM_{2.5} and NO₂ concentrations using satellite data. Offered by crowdsourcing platform DrivenData, the challenge will award cash prizes to the top three performing submitted algorithms in the PM_{2.5} and NO₂ categories. This challenge was developed by a team, including personnel from the MAIA and TEMPO projects, U.S. Department of State, and EPA under an award from the [NASA@WORK](#) program. The challenge is open to submissions until March 21, 2022, and submissions will be ranked on a real-time leaderboard. Refining submissions is allowed and encouraged. For more [information](#), please review the details for the [PM_{2.5}](#) and [NO₂](#) challenges, form a team, and send your submission!



Credits: NASA

2021 EARLY ADOPTERS WORKSHOP: DATA TUTORIAL

In November, NASA Applied Sciences hosted the [2021 Early Adopters Workshop: 2nd Data Tutorial](#) for the TEMPO (Tropospheric Emissions: Monitoring of Pollution) mission. Led by **Aaron Naeger (TEMPO Deputy Program Applications Lead, U. of Alabama in Huntsville)**, there were more than 170 workshop participants from U.S. state and local air quality agencies, federal agencies, academic institutions, and international organizations. Participants learned details on the TEMPO pre-launch proxy data (nitrogen dioxide, formaldehyde, ozone, aerosol products), application examples, and intended data uses. Through hands-on tutorials, participants downloaded proxy products from NASA Earthdata, browsed data file contents, and analyzed visualizations using Panoply, ArcGIS, and an interactive notebook. Main workshop outcomes included: (1) data access through NASA Earthdata to broaden the use of TEMPO proxy products; (2) enhanced understanding of TEMPO proxy products to facilitate effective processing and application of pre-launch data for operational data after launch; and (3) development of a plan to execute designated TEMPO experiments after launch, with special attention on applied science experiments from the Early Adopter community. To learn more about a previous, but similar, workshop, please review the [Revolutionary Air-Pollution Applications from Future TEMPO Observations](#) article in the *Bulletin of the American Meteorological Society (BAMS)* magazine.

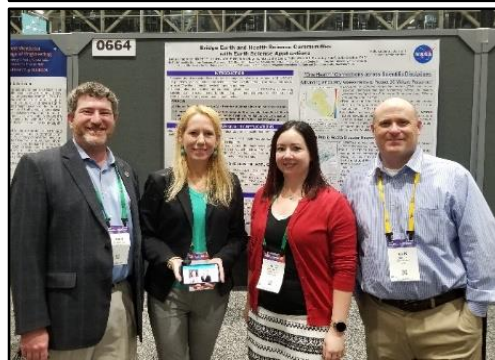


TEMPO. Source: [TEMPO website](#)

NASA HAQ TEAM HOSTS SCIENTIFIC SESSIONS AT AGU 2021

At the American Geophysical Union (AGU) Fall Meeting 2021, the NASA HAQ team coordinated an oral and poster session, *Connecting Global Ecosystems to Human Health: Enhanced Decision Support Applications Using NASA Satellite Data*, in New Orleans, LA. With a total of 70 attendees in the live session, moderated by **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC)**, eight oral session topics included:

- ❑ Monitoring Environmental Risks Using NASA Data within the NASA Health and Air Quality Applications Program (**John Haynes, NASA HQ**)
- ❑ Examining Historic Limitations, Improvements, and Potential Applications of Remote Sensing to Study Water-, Air-, and Vector-Borne Infectious Diseases (**Emma Goldberg, U. of Florida**)
- ❑ Earth Observation Inspired Environmental Equity and Decision-making Framework for Prediction of Water-borne Diseases (**Antar Jutla, U. of Florida**)
- ❑ Use of Satellite Remote Sensing to Enable Seasonal Malaria Chemoprevention Decisions (**Udaysankar Nair, U. of Alabama in Huntsville**)
- ❑ Spatiotemporal Variation in Childhood Risk of Enteric Shigella Infection: Using Earth Observation-derived Climate Data for Risk Mapping and Decision Making (**Josh Colston, U. of Virginia**)
- ❑ Development and Evaluation of North America Wildfire Ensemble Forecast (**Peewara Makkaron, George Mason U.**)
- ❑ Enhanced Air Quality Modeling to Support Environmental Decision-Making (**Arastoo Pour Biazar, U. of Alabama in Huntsville**)



AGU2021 panelists for the HAQ session (top), HAQ poster presenters (center), and the TRACER-AQ session moderated by L. Judd (bottom). Credits: NASA

The HAQ poster session had five posters, including the topic, *Bridge Earth and Health Science Communities with Earth Science Applications*. **L. Judd** also co-organized 3 oral sessions and 1 poster session, highlighting research about *Advances in a Global Observing System for Air Quality*. **Rita Colwell (U. of Maryland, College Park)** presented the talk, *Future of Infectious Diseases: How Earth Observations can Help Predict Next Pandemics* (NASA ESD's Virtual Hyperwall). **H. Chapman** and **Lauren Childs-Gleason (NASA LaRC)** also served as invited panelists on the *Science and Society Student Career Panel*, sharing career trajectories and advice for interdisciplinary research and practice in the geosciences.

GEO HEALTH COMMUNITY OF PRACTICE HOLDS BIWEEKLY TELECONS AND ANNUAL MEETING AT AGU 2021



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. On average, 40 attendees participate in each telecon. Below is a synopsis of these meetings.

- ❑ **October 2021:** The *Special Edition: The Americas* telecons offered flash talks on public health applications, and Myles Harris (U. College London) described the UCL Institute for Risk and Disaster Reduction Space Health Risks Research Group.
- ❑ **November 2021:** Thilanka Munasinghe and Ethan Joseph (Rensselaer Polytechnic Institute) and Assaf Anyamba (NASA GSFC/USRA) described the RPI-NASA Student Engagement collaboration. Amin Dezfuli (NASA GSFC) introduced his research on examining large-scale climatic phenomena affecting migratory birds to North America. Sophia Liu (USGS) discussed operationalizing open science and innovation through crowdsourcing, citizen science, and prize competitions.

The **Small Work Groups** leads – Heat (Ben Zaitchik, Johns Hopkins U.; Cascade Tuholske, Columbia U.'s Earth Institute); Infectious Diseases (Antar Jutla, U. of Florida); Food Security and Safety (Dorian Janney, NASA GSFC/GPM); Air Quality (Eric Klos, DailyBreath; Pawan Gupta, USRA/NASA MSFC); and Health Care Infrastructure (John Balbus, NIEHS; Andreas Skouloudis, iSteep.org) – continue to leverage expertise with CoP members to provide scientific and technical knowledge on selected health-related topics for specific project tasks.

In December 2021, the GEO Health CoP and the American Geophysical Union (AGU) partnered to hold the GEO Health CoP Meeting as a GeoHealth side event at AGU Fall Meeting 2021.

- ❑ **Leadership Updates:** GEO Secretariat Team (Steven Ramage), PAHO (Marcelo Korc), AmeriGEO (Angelica Gutierrez, NOAA), AOGEO (Xingfa Gu, Institute of Remote Sensing Applications, Chinese Academy of Sciences), and EuroGEO (Marjan van Meerloo, European Commission)
- ❑ **EO4Health Project Updates:** Gina Tsarouchi (HR Wallingford), Antar Jutla (U. of Florida), Tatiana Loboda (U. of Maryland, College Park), John Malone (Louisiana State U./A&M College), and Ben Zaitchik (John Hopkins U.)
- ❑ **Public-Private Partnership Panel:** Eric Klos (DailyBreath), Estella Geraghty (Esri), and Io Blair-Freese (Bill & Melinda Gates Foundation)
- ❑ **Small Work Group Updates and Flash Talks by CoP Members**

With over 100 attendees, this meeting provided an opportunity for Earth and health scientists to describe key international projects and updates, enhance professional networks, and discuss priority focus areas that advance GEO/AGU efforts, CoP Goals, and Work Group activities. To review the agenda and presentations, please visit the [Day 1](#) and [Day 2](#) event webpages.

UPDATES FROM THE HAQAST TEAM

In October 2021, HAQAST held internal meetings, where PIs provided research updates from member projects and Tiger Teams, shared best practices for stakeholder engagement, and proposed plans and activities for the future of HAQAST. To learn more about HAQAST news and activities, please visit the [HAQAST webpage](#).



Credits: HAQAST

HARRIS COUNTY PUBLIC HEALTH ONE HEALTH CONFERENCE 2021

In October 2021, **Helena Chapman (NASA HQ/BAH)** was an invited panelist for the Harris County Public Health's One Health Conference 2021. She presented the talk, *Building One Health Networks within the Earth and Health Science Communities*, as part of the Operationalizing One Health panel with Laura Kahn (One Health Initiative) and Gerald Parker (Texas A&M U.). This talk highlighted innovative applications of NASA Earth observations to examine ecosystem risks and build One Health collaborations like the GEO Health Community of Practice.

LOOKING AHEAD

ARSET Trainings:

[Using Earth Observations for Pre- and Post-Fire Monitoring](#)

January 18-20, 2022

Meetings:

[NASA HAQAST Update 2022](#)

January 20-21, 2022

[American Meteorological Society Annual Meeting](#)

January 23-27, 2022

[American Mosquito Control Association Annual Meeting](#)

February 28 – March 4, 2022

Jacksonville, FL

[American Thoracic Society International Conference](#)

May 13-18, 2022

San Francisco, CA

[Air & Waste Management Association's Annual Conference & Exposition 2022](#)

June 27-30, 2022

San Francisco, CA

RECENT COMMUNICATIONS

NASA

- [NASA To Launch 4 Earth Science Missions in 2022](#) (Alison Gold, NASA Earth Science News)
- [NASA Smoke Signals for Air Quality](#) (Lia Poteet, U.Group)

NASA Applied Sciences Program

- [Smoke Signals from Satellites](#) (Lia Poteet, U.Group)

NASA Earth Science Communications

- [NASA's Eyes on the Earth Puts the World at Your Fingertips](#) (Jet Propulsion Laboratory)

NASA Earth Observatory

- [An Extra Air Pollution Burden](#) (Adam Voiland, NASA Earth Observatory)
- [NASA To Launch Four Earth Science Missions in 2022](#) (Alison Gold, NASA Earth Science News)
- [Scientific Questions Arrive in Ports](#) (Adam Voiland, NASA Earth Observatory)

RECENT TALKS BY NASA HAQ TEAM

NASA HAQ Team (**John Haynes**, NASA HQ; **Helena Chapman**, NASA HQ/BAH; **Laura Judd**, NASA LaRC) continued to bridge Earth and health science communities through webinar presentations on using Earth observations for public health applications.

- ❑ **U.S. Center Glasgow 2021 UN Climate Conference (COP26)**: NASA Hyperwall Presentation by L. Judd on [Revealing Urban Pollution Patterns](#).
- ❑ **National Conference of Science, Technology and Innovation (CONACIETI 2021) (UNITEC, Honduras)**: Invited talk by H. Chapman on Earth Observations for Health and One Health in Spanish.

PAST

ARSET Training:

[Introduction to NASA Resources for Climate Change Applications](#)

September 29 – October 6, 2021

Meetings:

[A&WMA Visibility Conference](#)

October 5-8, 2021

[HAQ Annual Program Review](#)

October 12 and 20, 2021

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

October 24-27, 2021

[American Geophysical Union Fall Meeting](#)

December 13-17, 2021

CELEBRATING NASA'S ACTIVITIES DURING 2021

NASA reached significant milestones in 2021 – such as advancements on upcoming Earth science mission launches, making history on Mars, continued progress on its Artemis plans for the Moon, and the successful launch of the James Webb Space Telescope. To learn more about NASA's milestones, please review the [NASA's 2021 Included Mars Landing, First Flight, Artemis, More](#) web feature.



Credits: NASA

PUBLICATIONS

[Integrated Assessment of Global Climate, Air Pollution, and Dietary, Malnutrition and Obesity Health Impacts of Food Production and Consumption between 2014 and 2018](#). *Environmental Research Communications*. (C.S. Malley...**S.C. Anenberg**, B. Mantlana, T.P. Robinson)

[Junior Doctors Lead a Global Call to Action to Promote Multidisciplinary Collaborations](#). *WMA/JDN Newsletter*. (**H. Chapman**)

[Satellite Monitoring for Air Quality and Health](#). *Annual Review of Biomedical Data Science*. (**T. Holloway**, **D. Miller**, **S. Anenberg**, et al.)

[Secondary Organic Aerosols from Anthropogenic Volatile Organic Compounds Contribute Substantially to Air Pollution Mortality](#). *Atmospheric Chemistry and Physics*. (B. Nault, D. Jo, B. McDonald, et al.)

[Intensity and Frequency of Extreme Novel Epidemics](#). *Proceedings of the National Academy of Sciences of the USA*. (M. Marani, G.G. Katul, **W.K. Pan**, A.J. Parolari)

[Validation of North American Land Data Assimilation System Phase 2 \(NLDAS-2\) Air Temperature Forcing and Downscaled Data with New York State Station Observations](#). *Remote Sensing Applications: Society and Environment*. (M.G. Estes Jr, **T. Insaf**, M.Z. Al-Hamdan, T. Adeyeyeb, W. Crosson)

[Urban NOx Emissions around the World Dedined Faster than Anticipated between 2005 and 2019](#). *Environmental Research Letters*. (**D.L. Goldberg**, **S.C. Anenberg**, L.N. Lamsal, et al.)

[Estimating Intra-urban Inequities in PM2.5-attributable Health Impacts: A Case Study for Washington, DC](#). *GeoHealth*. (M.D. Castillo, **P.L. Kinney**, V. Southerland...**R.V. Martin**, **S.C. Anenberg**)