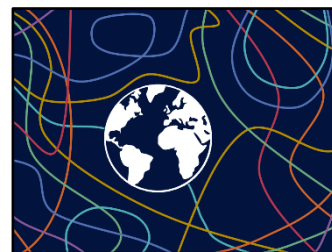


NASA CELEBRATES EARTH SCIENCE APPLICATIONS WEEK 2022

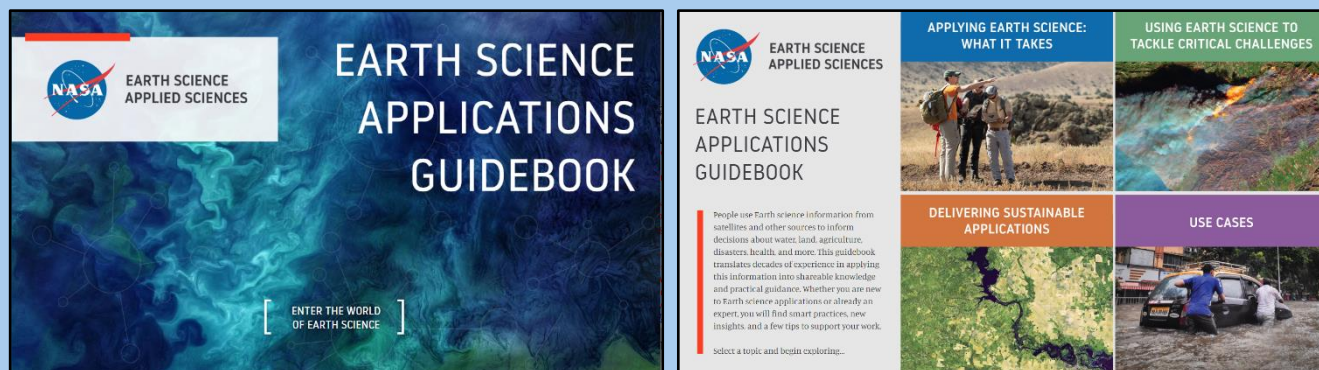
In August 2022, the NASA Applied Sciences Program hosted [Earth Science Applications Week 2022](#), a three-day virtual event to learn the practical applications of NASA Earth science data by sharing highlights from researchers and partners and interacting with early-career professionals. Daily sessions provided insight into NASA's Applied Sciences projects, followed by flash talk sessions and opportunities to network and engage. For the HAQ session, **John Haynes (NASA HQ)** presented an overview of HAQ activities and achievements. **Ben Zaitchik (Johns Hopkins U.)** shared updates on his [research](#) that aims to inform understanding, monitoring, and prediction of gastrointestinal disease burden estimates and distribution of health resources in South America, Africa, and Asia. Then, **Pawan Gupta (U. of Alabama in Huntsville)** provided an overview of recent [ARSET HAQ trainings](#), and **Aaron Naeger (U. of Alabama in Huntsville)** described the [TEMPO mission](#) and relevant updates leading to the upcoming launch. Finally, HAQAST Coordinator **Jenny Bratburd (U. of Wisconsin-Madison)** provided an update on the NASA Health and Air Quality Applied Sciences Team ([HAQAST](#)) (2021-2025) and the next NASA HAQAST Wisconsin meeting in October 2022.



Credit: NASA/U.Group

NASA EARTH SCIENCE APPLICATIONS GUIDEBOOK

In July 2022, the NASA Applied Sciences Program launched the [Earth Science Applications Guidebook](#), which translates decades of scientific experience in applying this information into shareable knowledge and practical guidance. Learn more about how Earth science information from satellites, sensors, and other sources can help inform decisions about water, land, agriculture, disasters, and health applications!



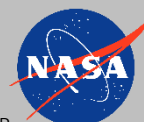
Credits: NASA

HEALTH AND AIR QUALITY APPLICATIONS APPLIED SCIENCES PROGRAM

JOHN HAYNES
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HEALTH AND AIR QUALITY APPLIED SCIENCES TEAM (HAQAST) UPDATE

In Summer 2022, HAQAST launched the [HAQAST Ambassadors program](#), as a group that represents a wide range of partner organizations and interests across the health and air quality community. A total of 14 Ambassadors were selected for this program. The program provides a venue for feedback, discussion, and regular communication for deeper, more sustained involvement with HAQAST activities. Members are liaisons between NASA and the user community, who engage in activities to promote the use of NASA Earth observations, and share stakeholder needs and questions with HAQAST applied researchers.



Credit: NASA HAQAST

NASA HAQ TEAM CONDUCTS ANNUAL PROGRAM REVIEW

In September 2022, 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 (ROSES2016, ROSES2017, ROSES2021, Rapid Response), Applied Sciences (**Emily Sylak-Glassman**), HAQAST (**Jenny Bratburd**, **Tracey Holloway**), TEMPO (**Aaron Naeger**), MAIA (**Abigail Nastan**), Communications (**Aries Keck**), and CDC partner (**Angela Werner**). Also, **John Haynes (NASA HQ)** facilitated the Town Hall discussion on future goals, partnerships, and opportunities.

NASA HAQ INVESTIGATOR UPDATES

- ❑ **Susan Anenberg (George Washington U.):** Her research was highlighted in the *GW Magazine's* [Air Equality for All](#) in July 2022. She was a panelist at the International Day of Clean Air for Blue Skies Celebration: Sharing the Air in North America, hosted by UNEP North America Office, World Resources Institute, and Commission for Environmental Cooperation, in September 2022.
- ❑ **Assaf Anyamba (ORNL):** He served on the NOAA/CPC and AGU's *Global Climate-Based Chikungunya Risk Mapping and Early Actions* [panel](#), as part of the Climate and Health Early Warning Systems Community of Practice event in August 2022.
- ❑ **John Haynes (NASA HQ):** He was a panelist on the [Climate-driven Zoonotic Risk](#) workshop session, hosted by Sandia National Laboratories, in July 2022.
- ❑ **Tracey Holloway (U. of Wisconsin-Madison):** She was a guest on the Wisconsin Energy Institute's [Propelling Women in Power](#) podcast and [Well Wisconsin Radio](#) in August 2022.
- ❑ **Christopher Uejio (Florida State U.):** He was a guest on the Science Friday podcast, [Higher Temperatures Are Bad for the Body](#), in July 2022.
- ❑ **Jun Wang (U. of Iowa):** His research was highlighted in the *Eos* article, [Community Scientists Help to Beat the Heat](#), in July 2022. He received the [2022 Atmospheric Sciences Ascent Award](#) in September 2022.
- ❑ **Ben Zaitchik (Johns Hopkins U.) and Josh Colston (U. of Virginia):** Their research was highlighted in the *Eos* article, [Climate Change Has Already Aggravated 58% of Infectious Diseases](#), in August 2022.

MAIA-TEMPO ENVIRONMENTAL JUSTICE WORKSHOP

In August 2022, the NASA Multi-Angle Imager for Aerosols ([MAIA](#)) and Tropospheric Emissions: Monitoring of POLLution ([TEMPO](#)) Applications Programs hosted a joint [Environmental Justice \(EJ\) Workshop](#). A total of 192 participants attended the workshop, including representatives from 20 EJ advocacy organizations, epidemiologists, environmental health researchers, and air quality managers. Presenters described NASA's HAQ program, current initiatives in equity and EJ, updates on MAIA and TEMPO projects, and MAIA and TEMPO data products and capabilities in the EJ context. The event featured a panel session where CleanAIRE NC, Ute Mountain Ute Tribe, and California Communities Against Toxics described their organization's EJ activities and use of air quality data. The final panel and group discussion sessions focused on the benefits and needs of MAIA and TEMPO data. Participants provided positive feedback about the panel, data product demonstrations, discussions of needs and benefits, and diverse perspectives. Overall, the workshop was effective at increasing participants' level of knowledge about the MAIA and TEMPO missions and stressed the importance of continued engagement in using satellite data for EJ community applications.



TEMPO. Source: [TEMPO website](#)

AGES WORKSHOP

To promote collaboration during air quality field studies in Summer 2023, 264 participants engaged in the **[AEROMMA](#), [GOTHAAM](#), [ECAPE](#), and [STAQS](#) (AGES) Workshop** on September 27-29 in Boulder, Colorado and online. AGES, which represents federally funded studies focused on improved understanding of atmospheric composition, has seeded growth to numerous efforts led by other governmental agencies and academic researchers. NASA's component to next summer's activities includes the Synergistic TEMPO Air Quality Science ([STAQS](#)) study, which aims to accelerate TEMPO air quality science in the instruments first summer of measurements. Organized by NOAA and NASA, the workshop goals were to foster collaboration in campaign science and logistics by providing a platform where researchers share their contributions to field studies and stakeholders voice their needs in these measurements. The three-day event included four sessions that reviewed airborne and ground-based studies and measurement networks, eight sessions that focused on measurements and modeling, and three sessions that examined air quality stakeholder needs, measurement strategies, and logistics. Session presentations are available on the [AGES2022 Workshop](#) webpage, and bi-monthly continued conversations will continue to Summer 2023.



AGES Workshop 2022. Source: [AGES Workshop website](#)

GEO HEALTH COMMUNITY OF PRACTICE HOLDS BIWEEKLY TELECONS



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 each meeting.

- **July 2022:** **Michael Wimberly** and **Dawn Nekorchuk (U. of Oklahoma)** presented an update on the Arbovirus Mapping and Prediction ([ArboMAP](#)) to Forecast Mosquito-Borne Disease Outbreaks. **Thilanka Munasinghe** and **Jon Harris (Rensselaer Polytechnic Institute)** and **Assaf Anyamba (NASA Goddard/USRA)** described the RPI-NASA Student Engagement collaboration ([Predicting Crimean Congo Hemorrhagic Fever Outbreaks using Temporal Climate Data](#)).
- **August 2022:** The EO4Health team moderated an open discussion about AmeriGEO Week 2022.
- **September 2022:** The [Special Edition: The Americas telecon](#) offered 13 flash talks on environmental health, infectious diseases, and data integration applications.

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) – facilitated discussions with CoP members to provide technical knowledge on health-related project tasks. In July 2022, CoP members published the GEO blog article, [Managing health risks with Earth observations](#).

AMERIGEO WEEK 2022

In August 2022, the NASA HAQ Team participated in [AmeriGEO Week 2022](#), hosted by the Paraguayan Space Agency in Asuncion, Paraguay. Notably, this event was the first in-person public engagement of the AmeriGEO Health thematic community, and it showcased how Earth observations are contributing to AmeriGEO's five thematic priorities. The ***Bridging Earth and Health Science Communities in Environmental Health: Focus on Vector-borne Diseases, Extreme Heat, and Air Quality*** session – facilitated by **John Haynes (NASA HQ)**, **Juli Trtanj (NOAA)**, and **Helena Chapman (NASA HQ/BAH)** – focused on the emerging global health challenges of malaria control, wildfires, urban heat, and climate change as leading priorities for the upcoming decade. Panelists included **William Pan (Duke U.)**; **Liana Anderson (CEMADEN, Brazil)**, **Iryna Dronova (U. California-Berkeley)**, **Ana Stewart-Ibarra (IAI)**; and **J. Trtanj**. As an AmeriGEO side event, the GEO CoP (**H. Chapman**) and Disasters (**Ricardo Quiroqa, NASA**) teams

provided formal presentations (in Spanish) on using Earth observations for disaster preparedness and public health applications to more than 100 students and faculty at the Universidad del Pacífico (UP) and the Universidad de la Integración de las Américas (UNIDA). Finally, a total of 8 posters by GEO Health CoP members were presented during the break-out poster session. We invite everyone to view the [Health session](#) and other [recorded sessions](#)!



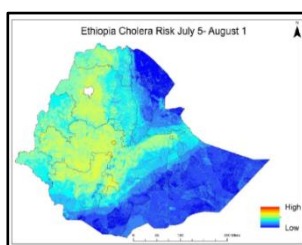
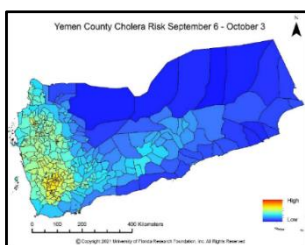
Credit: AmeriGEO

EARTH OBSERVATIONS FOR HEALTH (EO4HEALTH) PROJECTS

As part of the GEO Work Programme, four EO4Health projects were announced at the “New US Projects Supporting the GEO Work Programme” side event at the GEO XIV Plenary, held in October 2017, in Washington D.C. Updates on these four projects are presented below.

PREDICTIVE ASSESSMENT OF TRANSMISSION CONDITIONS OF CHOLERA

Antarpreet Jutla (U. of Florida) released the [Vibrio Prediction Hub](#), which includes interactive maps to explore risk of cholera disease in Yemen, Ukraine, Ghana and Ethiopia. This project integrates precipitation and air and ocean temperature data from MODIS, GPM, MERRA-2, and ORNL LandScan population data. Weekly forecasts are produced (four weeks in advance) for epidemic modes of cholera. This tool is beta operational to project partners – UNICEF, Red Cross Climate Center, and UN Office for the Coordination of Humanitarian Affairs – to inform cholera risk at pixel and county levels. The team will continue to work with project partners through their ROSES2021 project, by developing capacity building activities to engage end-users for sustained use of the web-based application as well as confirming an anticipatory decision-making framework for potential interventions. To learn more about this project, please read the [NASA web feature](#) and [EO4Health feature](#).

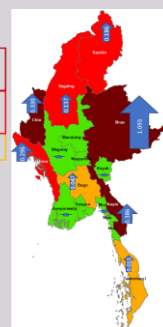


Predicted trigger risk of cholera in Yemen (September 2021) (left) and Ethiopia (July 2021) (center). The prototype smartphone capable web-hub aims to enhance cholera risk communication with decision-makers (right). Credits: NASA/A. Jutla

MYANMAR MALARIA EARLY WARNING SYSTEM (MMEWS)

Tatiana Loboda (U. of Maryland-College Park) has developed a web-based system delivery platform (Myanmar Malaria Early Warning System), which supports the 8-day dynamic spatially explicit (resolved to village level) assessment of malaria burden potential in Myanmar. The platform integrates Landsat (e.g. surface water fraction, settlement mapping, global forest loss, land surface temperature) and MODIS (land surface temperature, vegetation greenness) data. The full-scale model was assembled and executed retrospectively for

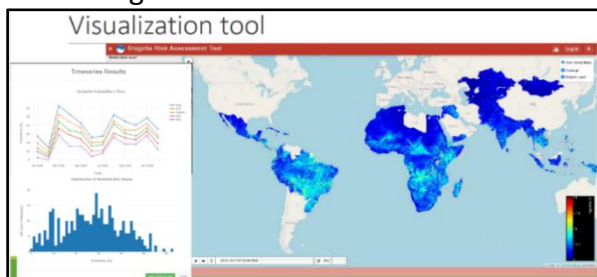
five consecutive years (2016-2020) at the specified spatial (240m country wide with localized zoom in at 30m) and temporal (8-day) resolutions. The multidisciplinary team of experts in satellite remote sensing, geospatial modeling, and malariology guided the analysis and offered support for medical intervention and other decision-making activities in the Yangon office of the Institute for Global Health and to regional partners and stakeholders. To learn more about this project, please read the [NASA web feature](#).



Analysis of historical runs has shown the Malaria Burden Potential (MBP) variable with a notable positive 5-year trend (blue arrows) across Myanmar. The greatest increase is observed within the areas of highest malaria burden (Shan, Kayah, and Chin States). Regions of the lowest malaria burden (Mandalay, Naypyitaw, and Yangon) show no discernable increase in malaria risk over the past five years. The model does not account for changes in access to care and social vulnerability associated with the COVID-19 pandemic and military coup. Credit: NASA/T. Loboda

ENVIRONMENTAL DETERMINANTS OF ENTERIC INFECTIOUS DISEASE

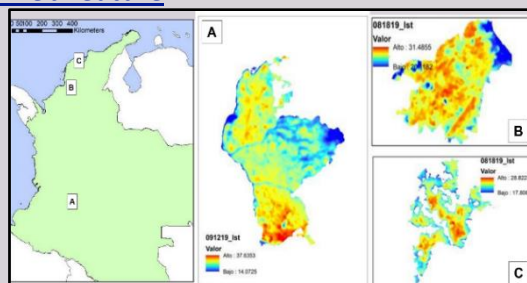
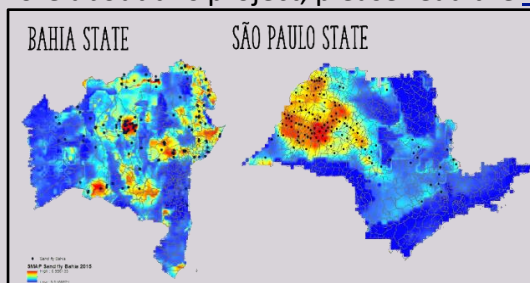
Ben Zaitchik (Johns Hopkins U.) developed a harmonized database of data from multiple enteric infectious disease studies, predictive modeling framework for transmission risk, and the Shigella Risk Assessment Tool. This project integrates satellite-derived precipitation estimates, SST, and flood estimates, MERRA-2 reanalysis, LDAS, MODIS land cover and NDVI, and commercial optical remote sensing imagery. This risk analysis resource provides interactive visualizations on enteric pathogen estimates that can help guide end-users in their health interventions, specifically by the sites of the Malnutrition and Enteric Disease (MAL-ED) study of childhood enteric infectious diseases in South America, Africa, and Asia. With supplementary RRNES funding through ROSES 2020, the team refined the COVID-19 risk analysis related to meteorological sensitivities from the first period of the pandemic for Brazil, the United States, and selected South and Central American counties. This analysis offered a framework for best practices for research on relationships between COVID-19 transmission and meteorological variables. To learn more about this project, please read the [NASA web feature](#).



Online visualization tool for shigella infection (Shigella Risk Assessment Tool) (left). Since March 2020, the GEO Health CoP telecons allowed the team to expand professional networks (right). Credits: NASA/B. Zaitchik

A GEOSPATIAL SURVEILLANCE AND RESPONSE SYSTEM RESOURCE FOR VECTOR-BORNE DISEASE IN THE AMERICAS

John Malone (Louisiana State U. and A&M College) has characterized the environmental suitability and potential for spread of visceral leishmaniasis in Brazil and Aedes-borne arbovirus in Colombia. The team integrated VIIRS/MODIS, LANDSAT, Worldview 2 and 3, GPM, GOES-16, SRTM, SMAP, ECOSTRESS, and GEDI data to develop risk maps to illustrate visceral leishmaniasis and Aedes-borne arbovirus potential spread to guide control program interventions in the Americas. The team continues working with project partners to investigate the impact of temperature and potential evapotranspiration in disease transmission, and finalize the one-week course module content of a second manual to train and implement operational results on visceral leishmaniasis and Aedes-borne diseases at the state level (1km) and municipality health unit level (70m/30m). To learn more about this project, please read the [NASA web feature](#).



SMAP soil moisture measurements can be used in lieu of models calculated from classical thermal and precipitation climate station data to assess visceral leishmaniasis disease risk and to guide control program interventions in Bahia and Sao Paulo states, Brazil (left). LST maps developed for Colombia using Landsat 8 imagery are compared to local temperature data logger readings (right). Credits: NASA/J. Malone

NASA CELEBRATES INTERNATIONAL DAY OF CLEAN AIR FOR BLUE SKIES

Each September, the International Day of Clean Air, recognized by the United Nations, aims to increase awareness about air quality. On the [International Day of Clean Air for blue skies 2022](#), the NASA HAQ and Communications Teams supported a social media campaign on NASA Earth ([Facebook](#) and [Twitter](#)) as well as NASA Atmosphere ([Facebook](#) and [Twitter](#)). These social media posts shared information about the upcoming TEMPO and MAIA missions and the joint [MAIA-TEMPO Environmental Justice Workshop](#), which was held in August 2022.

LOOKING AHEAD

ARSET Trainings:

[Accessing and Analyzing Air Quality Data from Geostationary Satellites](#)

October 11-25, 2022

Virtual and Hybrid Meetings:

[HAQAST Wisconsin Meeting](#)

October 20-21, 2022 / Madison, WI

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

November 6-8, 2022 / Boston, MA

FDA CVM One Health Day

November 15, 2022

[American Geophysical Union Fall Meeting](#)

December 12-16, 2022 / Chicago, IL

HAQ COMMUNITY ENGAGEMENT

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

- ❑ **Texas Southern University:** H. Chapman presented the talk, *Using Earth Observations to Enhance Public Health Surveillance*, including student internship opportunities, as part of TSU's Leadership, Education, and Advancements in Undergraduate Research Pathways (TSU-LEAP) STEM Grand Rounds (40 students).
- ❑ **Georgetown University:** J. Haynes and H. Chapman gave lectures on *Spatialization and Dynamics of Vector-borne Diseases: Advances in Remote Sensing*, as part of the Interdisciplinary Seminars in Global Infectious Diseases course (10 students).
- ❑ **Uniformed Services University of Health Sciences:** J. Haynes presented *An Overview of NASA's Health and Air Quality Applications Program*, and H. Chapman spoke on *Using Earth Observations to Enhance Public Health Surveillance*, for the Journal Club of Occupational and Environmental Medicine and Preventive Medicine residency programs (20 physicians).
- ❑ **American Mosquito Control Association:** H. Chapman, William Pan (Duke U.) and Anna Stewart-Ibarra (IAI), participated in the *Satellite Data Applications and Advancements in Vector Control Initiatives* webinar (62 attendees from 6 countries).
- ❑ **Universidad Católica del Cibao (Dominican Republic):** H. Chapman presented the talk, *Applied Earth and Health Sciences: Focus on One Health*, as an invited seminar (60 medical/dental students and faculty).

RECENT COMMUNICATIONS

NASA

- ❑ [NASA and Google Team up to Better Track Local Air Pollution](#) (Argyro Kavvada, NASA)
- ❑ [Great Air Quality for the Great Lakes Region](#) (Lia Poteet, U.Group)

NASA Earth Observatory

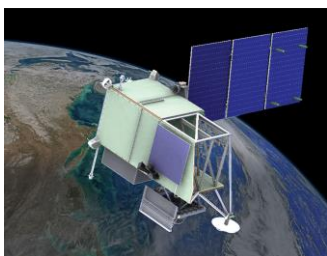
- ❑ [Clearer View of Great Lakes Air Quality](#) (Lia Poteet, U.Group; Mike Carlowicz, NASA Earth Observatory)

NASA Applied Sciences Program

- ❑ [Tracking Ozone Pollution in the Great Lakes Region](#) (Lia Poteet, U.Group)
- ❑ [NASA Airathon: Air Quality Challenge Winners Announced](#) (Marissa Kunerth, IntelliBridge)
- ❑ [AGU Publishes Book on Earth Science Applications Led by Applied Sciences Program](#) (Lia Poteet, U.Group)

2022 PACE APPLICATIONS WORKSHOP

In September 2022, Erin Urquhart Jephson (NASA GSFC/SSAI) and Natasha Sadoff (NASA GSFC/SSAI) led the [NASA PACE \(Plankton, Aerosol, Cloud, ocean Ecosystem\) Applications Workshop](#). The event focused on future uses of [PACE](#) satellite data, research, and applications to benefit society and support decision-making in the context of water resources, air quality and health, climate, disasters, and ecological forecasting. View the [session recordings](#) of the PACE Applications Workshop, and learn more about the PACE [Community of Practice](#) and [Early Adopters program](#)!



Credit: [PACE webpage](#)

PAST

ARSET Training:

[Satellite Remote Sensing for Measuring Urban Heat Islands and Constructing Heat Vulnerability Indices](#)

August 2-11, 2022

[Selecting Climate Change Projection Sets for Mitigation, Adaptation, and Risk Management Applications](#)

September 19-20, 2022

Virtual and Hybrid Meetings:

[MAIA-TEMPO Environmental Justice Workshop](#)

August 5, 2022

[Earth Science Applications Week](#)

August 9-11, 2022

[AmeriGEO Week](#)

August 15-19, 2022

Asunción, Paraguay

[HAQ Program Review 2022](#)

September 19 and 22, 2022

PUBLICATIONS

[Clean Air Policies are Key for Successfully Mitigating Arctic Warming](#). *Communications Earth & Environment*. (K. von Salzen, C. H. Whaley, **S.C. Anenberg**, et al.)

[Integrated Forecasts Based on Public Health Surveillance and Meteorological Data Predict West Nile Virus in a High-Risk Region of North America](#). *Environmental Health Perspectives*. (**M.C. Wimberly**, J.K. Davis, M.B. Hildreth, J.L. Clayton)

[Resolving and Predicting Neighborhood Vulnerability to Urban Heat and Air Pollution: Insights From a Pilot Project of Community Science](#). *GeoHealth*. (**J. Wang**, L. Castro-Garcia, G.D. Jenerette, et al.)

[Predictive Intelligence for Cholera in Ukraine?](#) *GeoHealth*. (M. Usmani, K. Brumfield, B. Magers, A. Huq, R. Barciela, T. Nguyen, **R. Colwell**, **A. Jutla**)

[The Association of Indoor Heat Exposure with Diabetes and Respiratory 9-1-1 Calls through Emergency Medical Dispatch and Services Documentation](#). *Environmental Research*. (**C.K. Uejio**, A. Patel Joiner, E. Gonsoroski, et al.)

[Impacts of Sugarcane Fires on Air Quality and Public Health in South Florida](#). *Environmental Health Perspectives*. (H.K. Nowell... **R.V. Martin**, **C.K. Uejio**, C.D. Holmes)

[Dust Storms, Valley Fever, and Public Awareness](#). *GeoHealth*. (**D.Q. Tong**, M.E. Gorris, T.E. Gill, et al.)

[Individual and Neighborhood Socioeconomic Status and Long-term Individual Trajectories of Sleep duration among Black and White Adults: The Southern Community Cohort Study](#). *Sleep*. (S.H. Nyarko, L. Luo, D.G. Schlundt, **Q. Xiao**)

[Incorporating Satellite Data Updates into AirNow](#). *EM Magazine*. (**J. Bratburd**, **P. Gupta**, S. Kondragunta, et al.)