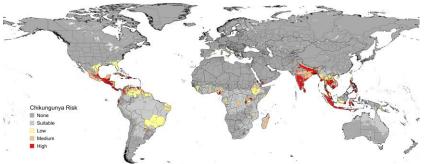## QUARTERLY HAQ PROJECT HIGHLIGHT:
MONITORING AND FORECASTING THE CLIMATE-SENSITIVE DISEASE, CHIKUNGUNYA

Supported through a supplemental HAQ grant, **Assaf Anyamba (NASA Goddard/Universities Space Research Association)**, is developing the **CHIKRisk app**, which focuses on how climate variability impacts the global emergence of the infectious disease chikungunya. This project integrates a variety of NASA Earth Observations and model data including IMERG, GLDAS, MODIS, and population data from the Socioeconomic Data and Applications Center in a machine learning framework to forecast areas at risk for chikungunya up to three months in advance. This tool is operational for project partners – DOD Armed Forces Health Surveillance Branch/Global Emerging Infections Surveillance (GEIS) Division, Pan American Health Organization, and World Health Organization – supporting the DOD Data-to-Decision Initiative for Force Health Protection and monthly public health advisories for other stakeholders.

Forecast Chikungunya Risk, July 2021

Chikungunya Risk
- None
- Suitable
- Low
- Medium
- High

CHIKRisk map of chikungunya risk forecasted for July 2021. Updated forecast maps are available to the public on the **CHIKRisk platform**. Credits: NASA/A. Anyamba

NASA CELEBRATES EARTH DAY 2021: CONNECTED BY EARTH

On April 22, 2021, the world commemorated the 51st anniversary of **Earth Day**. NASA reflected on how the fleet of Earth-observing satellites continue to examine our dynamic natural systems and effect of human activity on the planet's climate, atmosphere, land, polar regions, and oceans. Looking back on past scientific discoveries, NASA invited the public to celebrate Earth Day by sharing connections to Earth through the social media campaign **(#ConnectedByEarth)**. NASA also disseminated the **Earth Day 2021 Toolkit** and **#EarthDayAtHome resources** with activities, videos, special programs, and other materials in English and Spanish.

EARTH
FROM BIG TO SMALL DAY WE'RE ALL CONNECTED

Credit: NASA

Earth Day 2021: Connected by Earth

HEALTH AND AIR QUALITY APPLICATIONS
APPLIED SCIENCES PROGRAM

JOHN HAYNES
PROGRAM MANAGER
HEADQUARTERS

SUE ESTES
SENIOR ASSOCIATE
U. OF ALABAMA-
HUNTSVILLE

HELENA CHAPMAN
ASSOCIATE
HEADQUARTERS/BAH

LAURA JUDD
ASSOCIATE
LANGLEY RESEARCH CENTER

NATIONAL PUBLIC HEALTH WEEK 2021

In April 2021, **National Public Health Week (NPHW)**, which is supported by the American Public Health Association (APHA), highlighted key health priorities related to the *Building Bridges to Better Health* theme. The NASA HAQ and Communications Teams (**Aries Keck, McRae Lenahan, Lia Poteet**) prepared a web feature, **Building Connections for National Public Health Week**, highlighting the role of community engagement and partnerships to bridge scientific expertise in environmental health research. Project highlights included tracking Saharan dust impacts on health in the Caribbean (**Pablo Méndez-Lázaro, U. of Puerto Rico Medical Sciences Campus**), monitoring dust storms' impact on air quality, highway safety, and Valley fever surveillance (**Daniel Tong, George Mason U**.), and improving air quality modeling of surface-level ozone within the Great Lakes Region **(Jason Otkin and Brad Pierce, U. of Wisconsin-Madison)**.

NATIONAL MOSQUITO CONTROL AWARENESS WEEK 2021

In June 2021, the NASA HAQ and Communications **(Lia Poteet, Aries Keck, U.Group)** Teams prepared a web feature, **Tracking Mosquitoes from Space? NASA Does That**, to support the American Mosquito Control Association's National Mosquito Awareness Week 2021. Project highlights included monitoring and forecasting chikungunya with the CHIKRisk App **(Assaf Anyamba; NASA Goddard)**, improving malaria decision support with DHIS2 **(John Beck, U. of Alabama in Huntsville)**, and a collaborative publication on malaria research **(Tatiana Loboda, U. of Maryland, College Park; William Pan, Duke U.; Michael Wimberly, U. of Oklahoma)**.

Credit: CDC

NASA HAQ INVESTIGATOR UPDATES

- ❑ **Susan Anenberg (George Washington U.):** She served as chair of a National Academies of Sciences, Engineering, and Medicine's **Leveraging Advances in Remote Geospatial Technologies to Inform Precision Environmental Health Decisions** workshop in April 2021.
- ❑ **Susan Anenberg (George Washington U.)** and **Ben Zaitchik (Johns Hopkins U.):** They served as panelists on the **Global Health and Equity on a Changing Planet: A GEH Earth Day Chat** in April 2021.
- ❑ **Susan Anenberg (George Washington U.)** and **Laura Judd (NASA LaRC)**: Their research was highlighted in the **A Local Look at Air Pollution Highlights Inequalities within Cities** article in the *Chemical & Engineering News* in June 2021.
- ❑ **Helena Chapman (NASA HQ/BAH):** She received the 40 Gators Under 40 Award by the U. of Florida in April 2021.
- ❑ **John Haynes (NASA HQ):** He presented at the **NIEHS Workshop** on Integrating Multiscale Geospatial Environmental Data Into Large Population Health Studies in June 2021.
- ❑ **Daniel Tong (George Mason U.):** His research was highlighted on **Dust Storms, Valley Fever... and Cake Pans** (NASA Applied Sciences Program) and **Dust Storms and Valley Fever in the American West** (Phys.org) in May 2021.

NASA HAQ TEAM HOSTS SCIENTIFIC SESSION AT ATS 2021

At the American Thoracic Society (ATS) International Conference 2021, the NASA HAQ team coordinated a scientific session, ***Using NASA's Earth Observation Data for Applications in Respiratory Health,*** moderated by **Helena Chapman (NASA HQ/BAH)** and **Laura Judd (NASA LaRC**). This session highlighted the NASA HAQ program and three NASA projects incorporating satellite data to examine health effects of urban ambient pollution and dust storms for community health assessments and public health surveillance.

- ❑ Earth Observations Applied to the Dynamic Ecosystem: NASA Health and Air Quality Applications **(John Haynes, NASA HQ)**
- ❑ Co-developing Solutions and Creating a Public Health Early Warning System for Hazardous Conditions to Improve Quality of Life on our Home Planet **(Pablo Méndez-Lázaro, U. of Puerto Rico Medical Sciences Campus)**
- ❑ Using NASA Earth Observations to Manage Health Risks in the Urban Heat Island **(Patrick Kinney, Boston U.)**
- ❑ Using Satellite Remote Sensing to Estimate the Health Impacts of Air Pollution in Cities Worldwide **(Susan Anenberg, George Washington U.)**

TEMPO Pre-Launch Data User Tutorial and Science Team Meeting

In April 2021, the **TEMPO** Deputy Applications Lead **Aaron Naeger (U. of Alabama in Huntsville)**, hosted the first **Pre-Launch TEMPO Data User Tutorial**, in preparation for the NASA TEMPO launch in November 2022. Over 160 registered participants attended the virtual event, which provided an overview of the first major release of pre-launch proxy TEMPO data products for the early adopter community. Participants visualized nitrogen dioxide (NO_2), formaldehyde (HCHO), and aerosol proxy products using Panoply and learned the file structure and variables as planned for the operational TEMPO products after launch. Location and coverage of granules across the TEMPO Field of Regard were also demonstrated in Google Earth. Python code for processing proxy TEMPO products and generating images were shared with tutorial participants, which included a Jupyter notebook demonstration on Google Collaboratory.

In June 2021, **K. Chance,** along with members of the TEMPO team, led the two-day **TEMPO Science Team Meeting.** The meeting consisted of 1-hour sessions focused on algorithm status, validation plans, early adopters, modeling, and aerosols and clouds. **A. Naeger** led a session highlighting applications of TEMPO data for understanding wildfire smoke impacts on air quality, emission sources and influence on ozone, and acute health effects from short-term exposure to pollutant concentrations. The interactive poster session included a wide range of topics, such as machine learning, model assimilation, field campaigns, and synergistic opportunities with TEMPO. Presentations from this meeting are **publicly available**.

TEMPO. Source: TEMPO website

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)** – continues to coordinate community teleconferences to leverage expertise across sectors and geographies and share Earth observation data and tools to support health decision-making. On average, 60 attendees participate in each telecon. Below is a synopsis of each meeting.

❑ April 2021: Aaron Naeger (U. of Alabama in Huntsville) described the TEMPO Mission and Early Adopters Program, and Abigail Nastan (Jet Propulsion Laboratory) and J. Haynes highlighted the MAIA Mission and Early Adopters Program.

❑ May 2021: Tabassum Insaf (NY Department of Health) discussed **heat mitigation efforts in New York**, Christian Braneon (Goddard Institute for Space Studies) described **mapping urban heat islands** and using global climate models and remote sensing datasets in resiliency planning, Hunter Jones (NOAA) highlighted **NOAA's NIHHIS community-led summer campaigns**, and Assaf Anyamba (USRA/NASA Goddard) described global risk maps of chikungunya with **CHIKRisk App**.

❑ June 2021: Haris Kontoes (National Observatory of Athens) presented the EuroGEO Action Group's Early Warning System for Mosquito-borne Diseases (**EYWA**), Victoria Gammino (MITRE) described vector habitat detection efforts to combat onchocerciasis, Anna Stewart-Ibarra (IAI) described **IAI** and selected projects, and Liana Anderson (CEMADEN, Brazil) discussed wildfire early warning systems in the Amazon region (**MAP-FIRE**).

In April 2021, in addition to monthly telecons, **J. Haynes** and **J. Trtanj** presented an overview of the GEO Health CoP and EO4Health at the US GEO Briefing to US Embassies in the Americas Region, with 85 total participants from 64 embassies in 15 countries. Also, **Helena Chapman (NASA HQ/BAH)** introduced the GEO Health CoP and EO4Health at the Panama Forum on Earth Observation for Social Benefit.

GEO VIRTUAL SYMPOSIUM 2021

In June 2021, the NASA HAQ Team participated in the **GEO Virtual Symposium 2021**, which aimed to share successful practices and identify ways to accelerate the delivery of products and solutions to address environmental and societal challenges. The ***Sustainable Partnerships for Health Decision-making and One Health Collaborations*** *ses*sion – facilitated by **John Haynes (NASA HQ)**, **Juli Trtanj (NOAA)**, and **Helena Chapman (NASA HQ/BAH)** – showcased three sustainable partnerships that have leveraged scientific expertise by incorporating innovative data and technology to understand impacts and support preparedness and response related to pressing global health issues, including the ongoing COVID-19 pandemic. Presentations included: *COVID-19 and Influence of Seasonality* **(Ben Zaitchik, Johns Hopkins U.)**, *Impact of the COVID-19 Pandemic on Health Care Infrastructure* **(Andreas Skouloudis, iSteep.org)**, and *Dengue MOdel forecasting Satellite-based System* **(Gina Tsarouchi, HR Wallingford)**. Also**, J. Haynes** presented on EO4Health in the *Generalizing the Concept of the Essential Variables* session. This virtual symposium encouraged multidisciplinary collaborations to leverage expertise, integrate innovative approaches, and align agendas to meet global objectives. We invite everyone to view the **recorded sessions**!

AWMA 2021 FEATURES PRESENTATIONS ON AIR QUALITY AND PUBLIC HEALTH APPLICATIONS FROM INVESTIGATORS

In June 2021, at the **Air & Waste Management Association (AWMA) Virtual Conference 2021**, the NASA HAQ Team coordinated the scientific session, *Innovative Uses of Earth Observations within NASA Health and Air Quality Applied Sciences Team (HAQAST)*, moderated by **Laura Judd (NASA Langley)** and **Helena Chapman (NASA HQ/BAH)**. In this panel, NASA HAQ Program Manager, HAQAST Team Lead, and three HAQAST members shared their research of integrating Earth observations for use in stakeholder activities. More than 80 people attended this session.

- ❑ Earth Observations Applied to a Changing World: NASA Health and Air Quality Applications **(John Haynes, NASA HQ)**
- ❑ Overview of the NASA Health and Air Quality Applied Sciences Team **(Tracey Holloway, U. of Wisconsin-Madison)**
- ❑ Quantifying Pollution from Prescribed and Smaller Fires: The Massive Conundrum in our National Emission Inventory **(Amber Soja, National Institute of Aerospace/NASA LaRC)**
- ❑ Rising Dust and Impact on American Public: How Many People Were Killed by Windblown Dust Events? **(Daniel Tong, George Mason U.)**
- ❑ Planes, Boats and Trains-and Satellites: Impact of Airport, Sea Port and Railyard Emissions on Air Quality, Exposure and Health at Local-to-Global Scales **(Talat Odman, Georgia Institute of Technology)**

H. Chapman also presented the talk, *Promoting Environmental Resiliency through One Health Collaborations during the COVID-19 Pandemic*, in the *COVID-19: Effects, Control and Management* session. The recorded sessions are available to conference attendees through December 31, 2021.

HAQ COMMUNITY ENGAGEMENT

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

- ❑ **George Washington U.:** H. Chapman provided an invited lecture for the Risk Management and Communications course (12 students). J. Haynes and H. Chapman offered invited lectures for the Public Health Biology course (35 students).
- ❑ **Tuskegee U. Public Health Program, Howard U. School of Public Health, Ohio State U. Veterinary Public Health Club, Cornell U. Veterinary One Health Association:** J. Haynes and H. Chapman presented an overview of the HAQ program and selected projects to 25 public health and 20 veterinary students.
- ❑ **U. of Florida One Health Webinar Series:** H. Chapman and L. Judd served as panelists on the *The Air We Breathe* webinar (27 attendees).
- ❑ **SKEMClub of Don Bosco Technical High School (Costa Rica):** H. Chapman shared findings of selected projects using Earth observations for public health applications and offered career advice (20 students).
- ❑ **NASA Earth Science Division:** H. Chapman presented an overview of the HAQ program and selected projects as part of the webinar series for the High School Senior Experience (10 interns).

FDA ONE HEALTH SYMPOSIUM 2021

In April 2021, the US Food and Drug Administration (FDA) coordinated the **2021 FDA One Health Virtual Symposium** to reinforce the FDA's One Health initiative and highlight FDA's partnerships with external organizations. The HAQ Team **(Helena Chapman, NASA HQ/BAH)** was invited to present on a panel with representatives from CDC, USDA, U. of California-Davis, and the Global Virome Project. Her talk, *Health and Air Quality Applications for One Health*, was well received and showcased key examples where multidisciplinary collaborations have integrated satellite- and ground-based data to mitigate risk of emerging One Health risks.

LOOKING AHEAD

Virtual Meetings:

Earth Science Applications Week
August 9-12, 2021

AmeriGEO Week
August 23-27, 2021

RECENT COMMUNICATIONS

NASA
- ❑ **New NASA Earth System Observatory to Help Address, Mitigate Climate Change** (Tylar Greene and Karen Fox, NASA HQ)
- ❑ **Dust Storms and Valley Fever in the American West** (Lia Poteet, U.Group)
- ❑ **Downstream Consequences: How NASA Satellites Track Harmful Algal Blooms** (Sofie Bates, NASA's Earth Science News Team)
- ❑ **How Scientists Are Using the International Space Station to Study Earth's Climate** (Erin Winick Anthony, International Space Station Program Research Office, NASA Johnson Space Center)
- ❑ **Earth Day Connections: NASA Study Predicts Less Saharan Dust in Future Winds** (Lara Streiff, NASA's Earth Science News Team)
- ❑ **Saharan Dust Forecasts Minimize Health Risks in the Caribbean** (Rebecca Carroll, NASA's Spinoff Publication)
- ❑ **TEMPO Air Pollution Sensor Treks Toward Satellite Integration** (Joe Atkinson)

NASA Applied Sciences Program
- ❑ **Building Connections for National Public Health Week** (Lia Poteet, U.Group)
- ❑ **Dust Storms, Valley Fever… and Cake Pans** (Lia Poteet, U.Group)

NASA Earth Observatory
- ❑ **Records Fall in Early Summer Heatwave** (Kathryn Hansen)
- ❑ **Finding Gold Mining Hotspots in Peru** (Kasha Patel)
- ❑ **Heatwave Scorches the Middle East** (Kathryn Hansen)
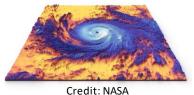- ❑ **Aerosol Optical Depth** (NASA Earth Observatory Team)

Eos
- ❑ **Using Satellite Data to Map Air Pollution and Improve Health** (Jackie Rocheleau)

NASA EARTH SYSTEM OBSERVATORY

In May 2021, the NASA Earth Science Division disseminated the **New NASA Earth System Observatory to Help Address, Mitigate Climate Change** press release, which highlighted that NASA will design a new set of Earth-focused missions to provide key information that guide efforts related to climate change, disaster mitigation, fighting forest fires, and improving real-time agricultural processes. The observatory is guided by recommendations from NASEM's 2017 Earth Science Decadal Survey. The areas of focus include aerosols; cloud, convection, and precipitation; mass change; surface biology and geology; and surface deformation and change.

Credit: NASA

GLOBAL HEALTH SECURITY

In June 2021, the U.S. Department of State Bureau of Educational and Cultural Affairs sponsored the International Visitor Leadership Program on *Global Health Security – Combating Infectious Diseases*. As part of this program, **John Haynes (NASA HQ)**, John Balbus (NIH/NIEHS), Juli Trtanj (NOAA), Shubhayu Saha (CDC), Casey Barton Behravesh (CDC), Vincent Munster (NIAID), and Camille Hopkins (USGS) provided brief presentations on the role of their agencies and the importance of partnerships between agencies and sectors.

PUBLICATIONS

Estimation of Ambient PM2.5 in Iraq and Kuwait from 2001 to 2018 using Machine Learning and Remote Sensing. *Environment International.* (J. Li, E. Garshick, J.E. Hart, L. Li, L. Shi, A. Al-Hemoud, S. Huang, P. Koutrakis)

Impacts of El Niño-Southern Oscillation on Surface Dust Levels across the World during 1982-2019. *Science of the Total Environment.* (J. Li, E. Garshick, S. Huang, P. Koutrakis)

GeoFairy2: A Cross-Institution Mobile Gateway to Location-Linked Data for In-Situ Decision Making. *ISPRS International Journal of Geo-Information.* (Z. Sun, L. Di, S. Cvetojevic, Z. Yu)

Comparison of Chemical Lateral Boundary Conditions for Air Quality Predictions over the Contiguous United States during Pollutant Intrusion Events. *Atmospheric Chemistry and Physics.* (Y. Tang, H. Bian, Z. Tao, L.D. Oman, **D. Tong**, P. Lee... I. Stajner)

Shaping the Future of Science: COVID-19 Highlighting the Importance of GeoHealth. *GeoHealth*. (M.E. Gorris, **S.C. Anenberg**, **D.L. Goldberg**, G.H. Kerr, J.D. Stowell, **D. Tong**, **B.F. Zaitchik**)

Integrating Data to Find Links Between Environment and Health. *Eos*. (Z. Liu, **D. Tong**, J. Wei, D. Meyer)