



Data Down to Earth: HAQAST 2018 Review

Prepared by

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September 18, 2018

haqast.org

Connecting NASA Data and Tools With Health and Air Quality Stakeholders

WWW.HAQAST.ORG

TWITTER.COM/NASA_HAQAST



The Team



• Tracey Holloway (Team Lead, UW-Madison)



• Bryan Duncan (NASA GSFC)

• Arlene Fiore (Columbia University)



• Frank Freedman (San Jose State University)



• Daven Henze (University of Colorado, Boulder)



• Jeremy Hess (University of Washington, Seattle)



• Yang Liu (Emory University)



• Jessica Neu (NASA Jet Propulsion Laboratory)



• Susan O'Neill (USDA Forest Service)



• Ted Russell (Georgia Tech)



• Daniel Tong (George Mason University)



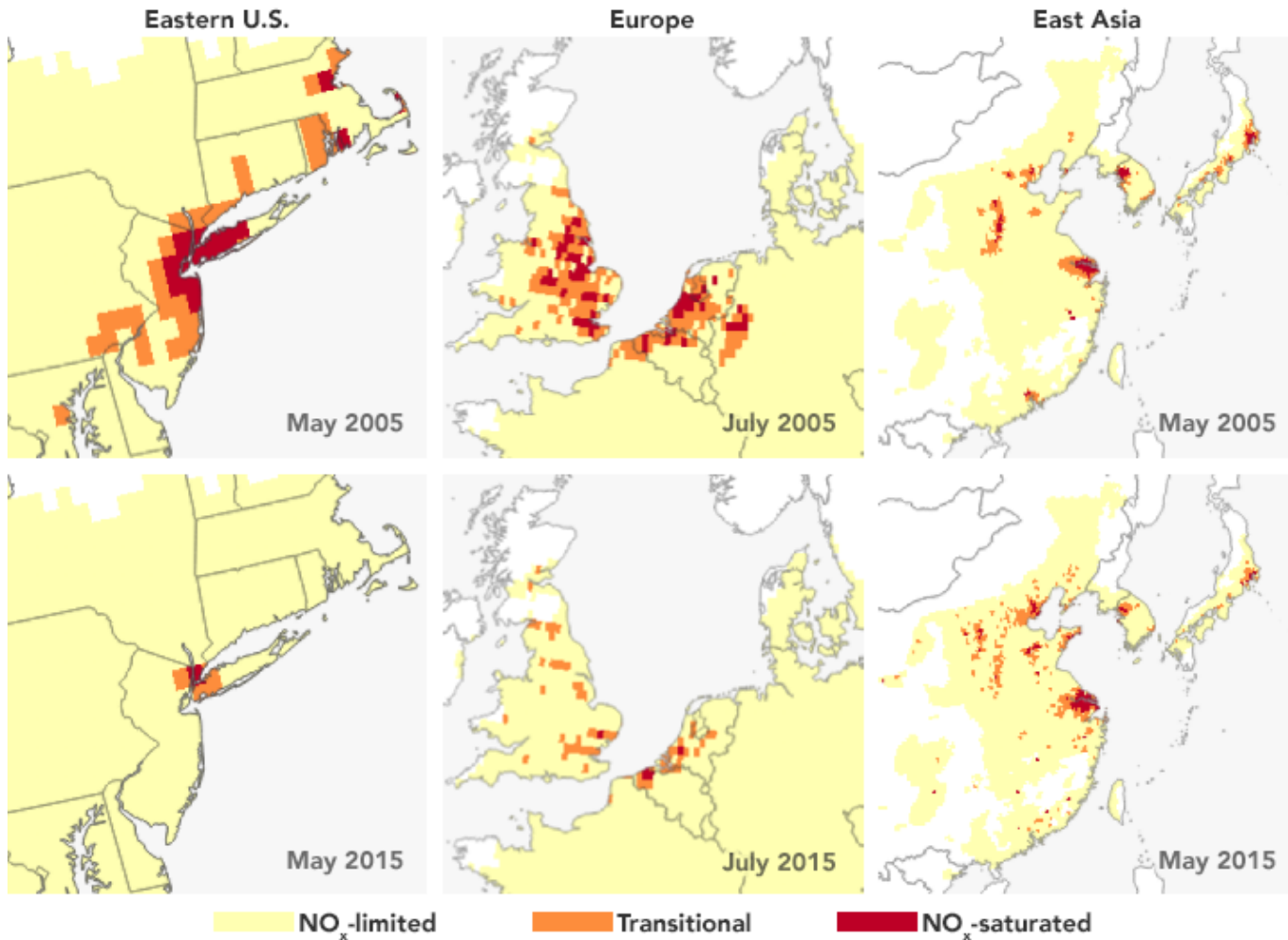
• Jason West (UNC-Chapel Hill)



• Mark Zondlo (Princeton University)



Results and Milestones—Selected PI Projects



PI Fiore's work featured as Earth Observatory's Image of the Day,
11/7/2017

AQ over Gulf Of Mexico—PI Duncan

- Bryan N. Duncan and Anne M. Thompson partnering with BOEM to evaluate the current capabilities of satellite data for air quality monitoring and emissions validation over the Gulf of Mexico.
- This project is a feasibility study to identify NASA resources for BOEM to aid in monitoring the impact of offshore pollution on inland communities.
- Two main project parts:
 - 1) Evaluation of NASA datasets for monitoring offshore air pollutants.
 - 2) Field campaign coordinated to measure surface to validate the satellite data.

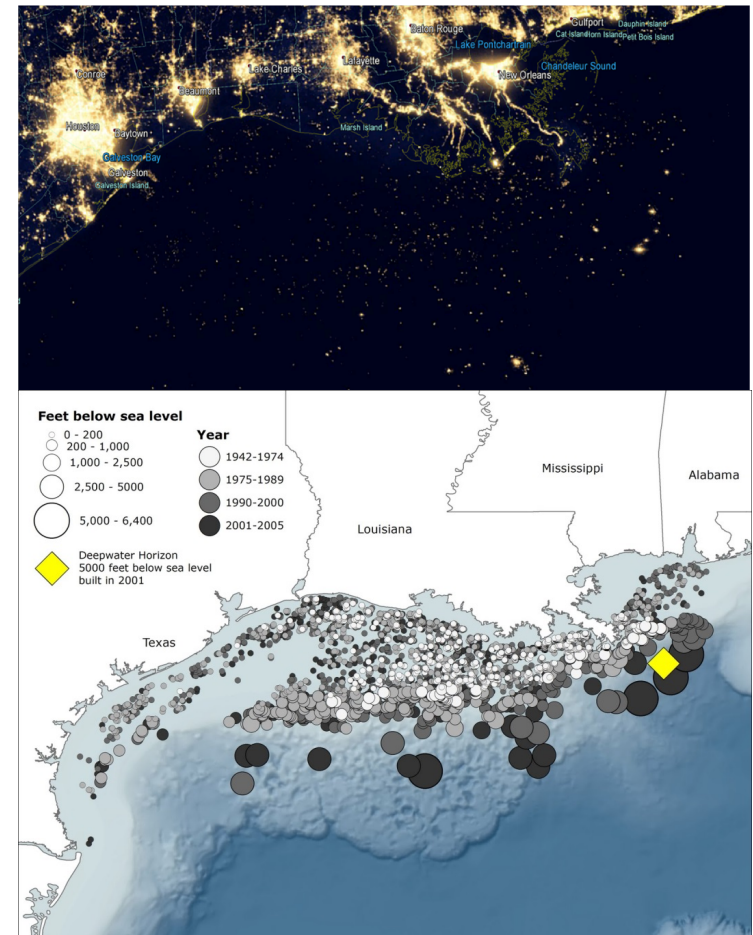


Figure. Suomi VIIRS “Lights at Night” data clearly show the locations of oil rigs and platforms

Seasonal NH_3 in the US—PI Zondlo

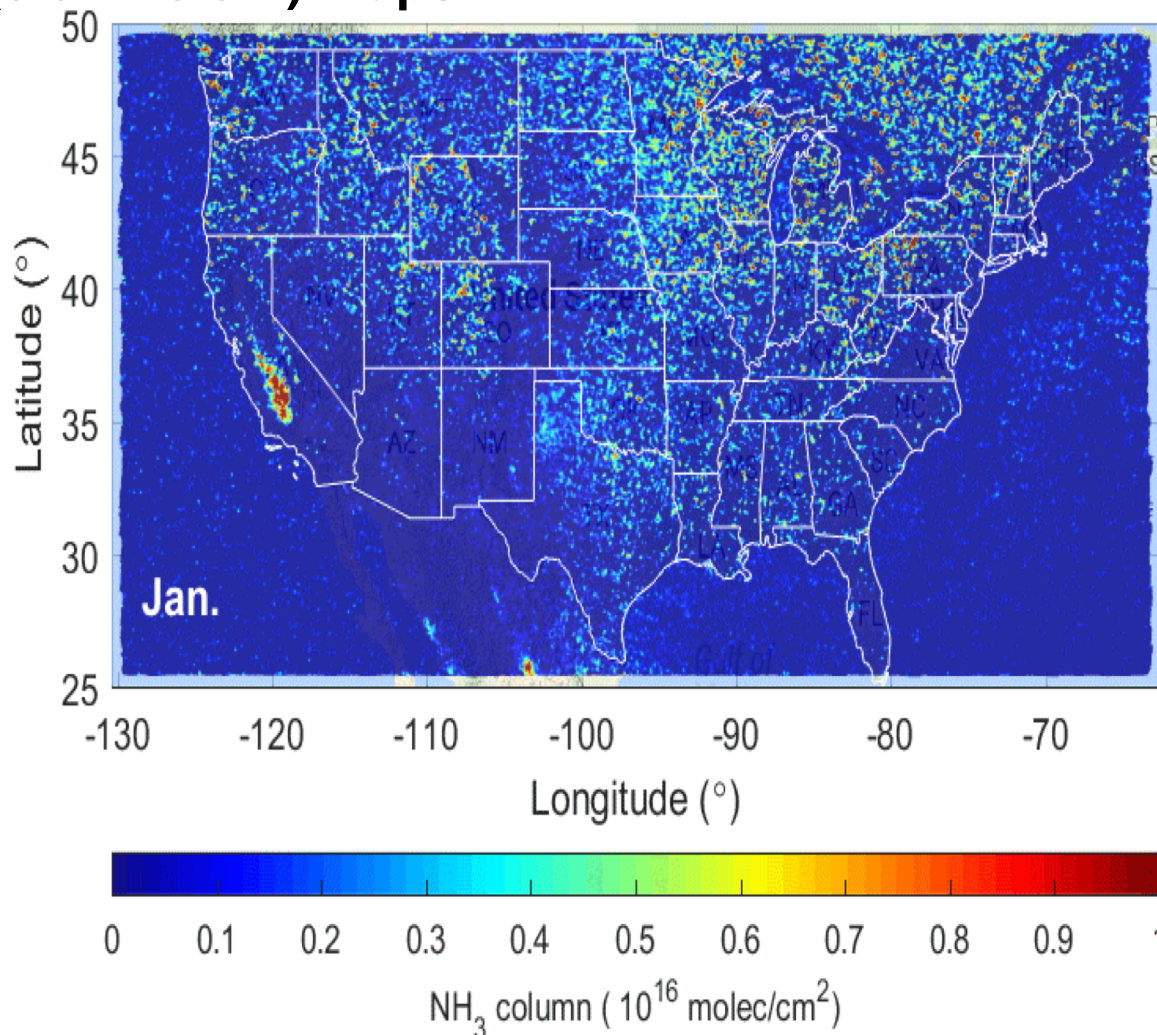
2008 – 16, Metop/A & Metop/B, oversampling high resolution
($0.02^\circ \times 0.02^\circ$) maps

Overall annual cycle:

- low in winter, peak in spring /summer

Different seasonalities across US:

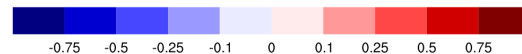
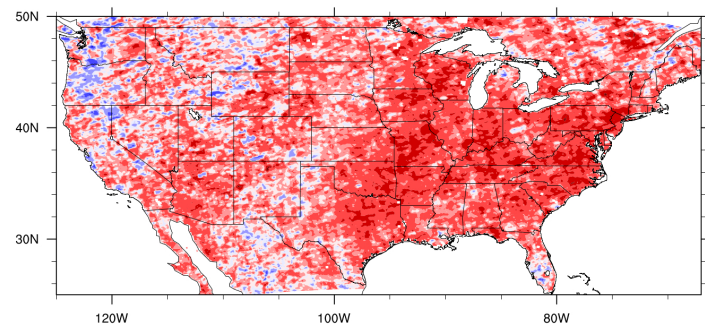
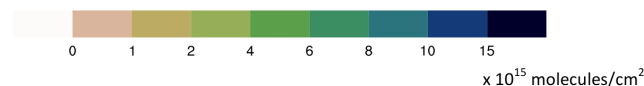
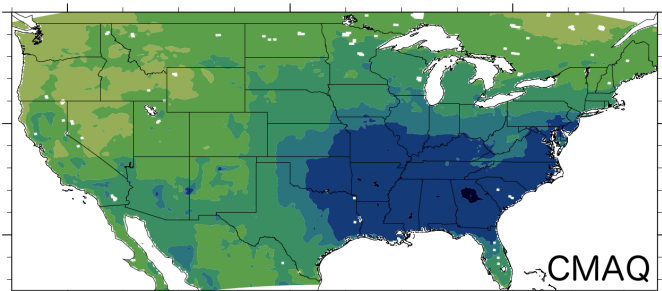
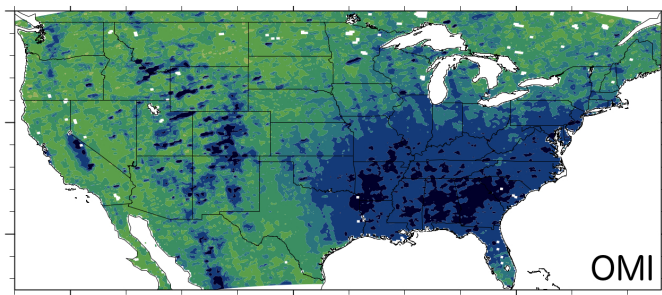
- Corn Belt (IL/IA): peaks in April to May
- San Joaquin Valley (feedlots/crops): July
- western High Plains (feedlots July-August)





New Directions for HCHO—PI Holloway

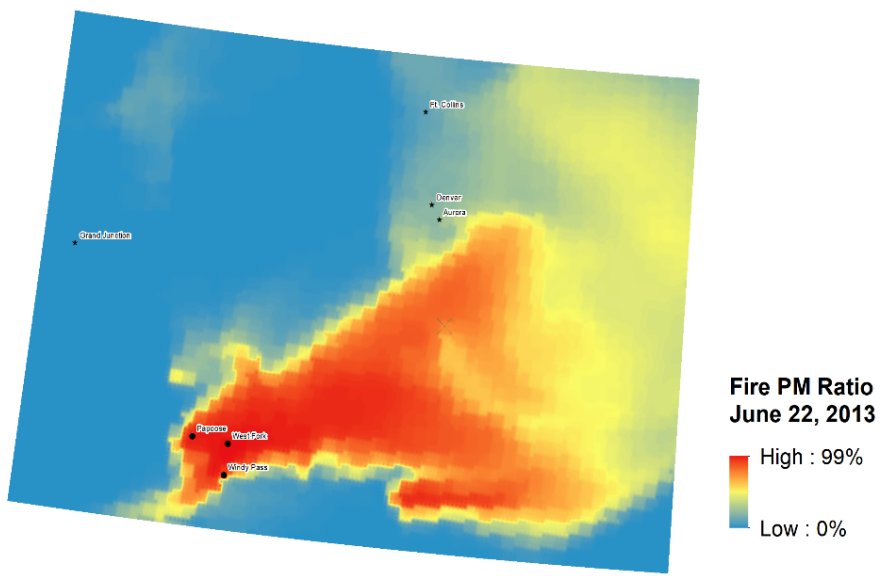
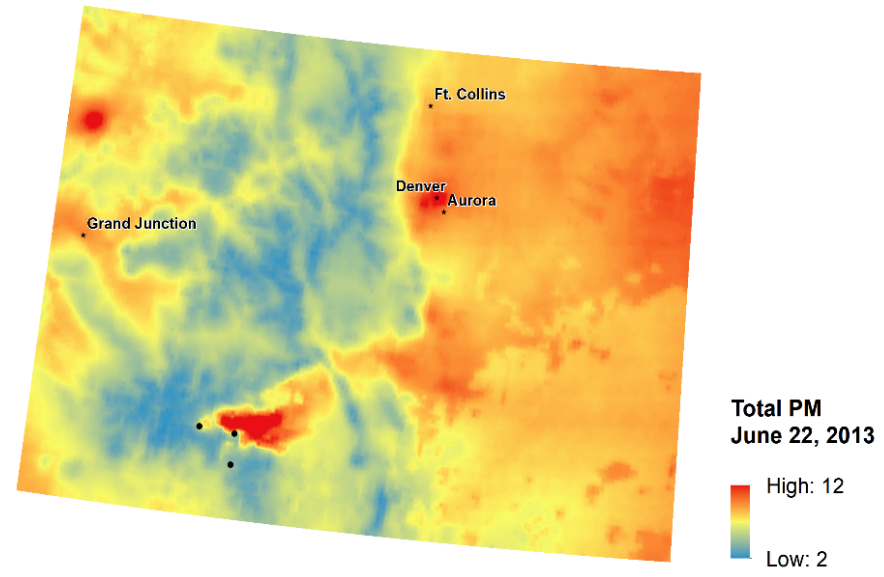
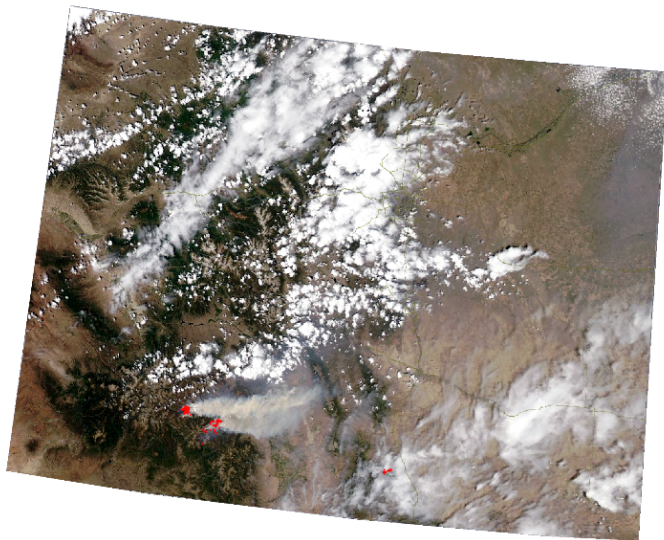
- HAQAST Lead Tracey Holloway and Monica Harkey are evaluating column HCHO from the EPA National Air Toxics Assessment (NATA), calculated with the CMAQ model, with OMI column HCHO from NASA
- Summer 2011 average OMI HCHO shows large peak in the southeastern U.S. and in smaller areas in the west
- Summer 2011 average column HCHO from the EPA NATA captures peaks in the southeastern U.S. but not in the west
- This work may aid in improving EPA emissions inventories and model mechanisms
- Contact taholloway@wisc.edu for more information



Summer 2011 average OMI and CMAQ column HCHO
(top, middle), and their correlation (bottom).



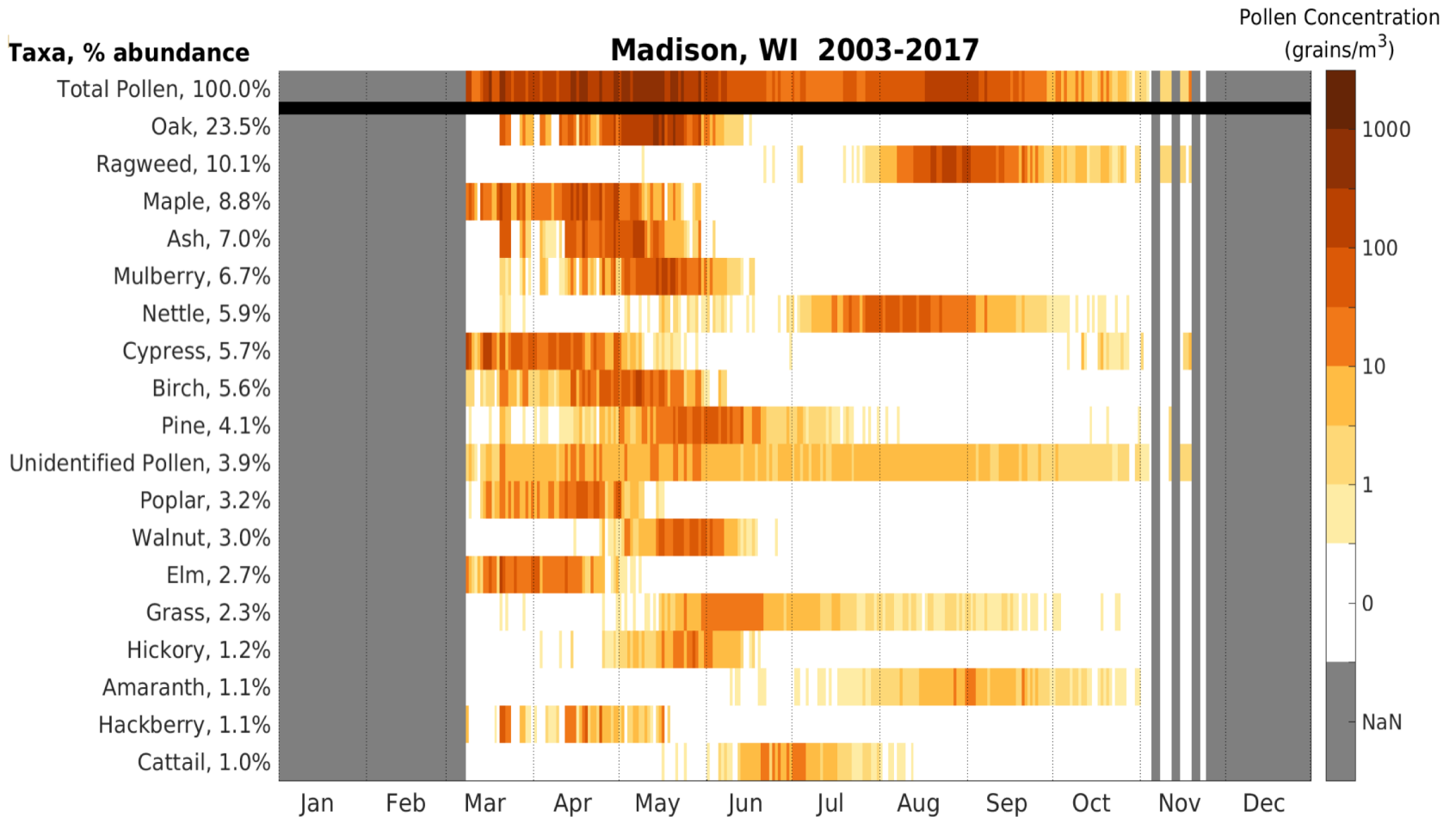
Wildfire PM_{2.5} and ED Visits in Colorado— PM Liu



Ratios of fire PM_{2.5} to total PM_{2.5} ranged from 0 to 99.56%, with a mean ratio of 0.006%.



Analyzing the Allergenic Airborne Pollen Season for Health Stakeholders

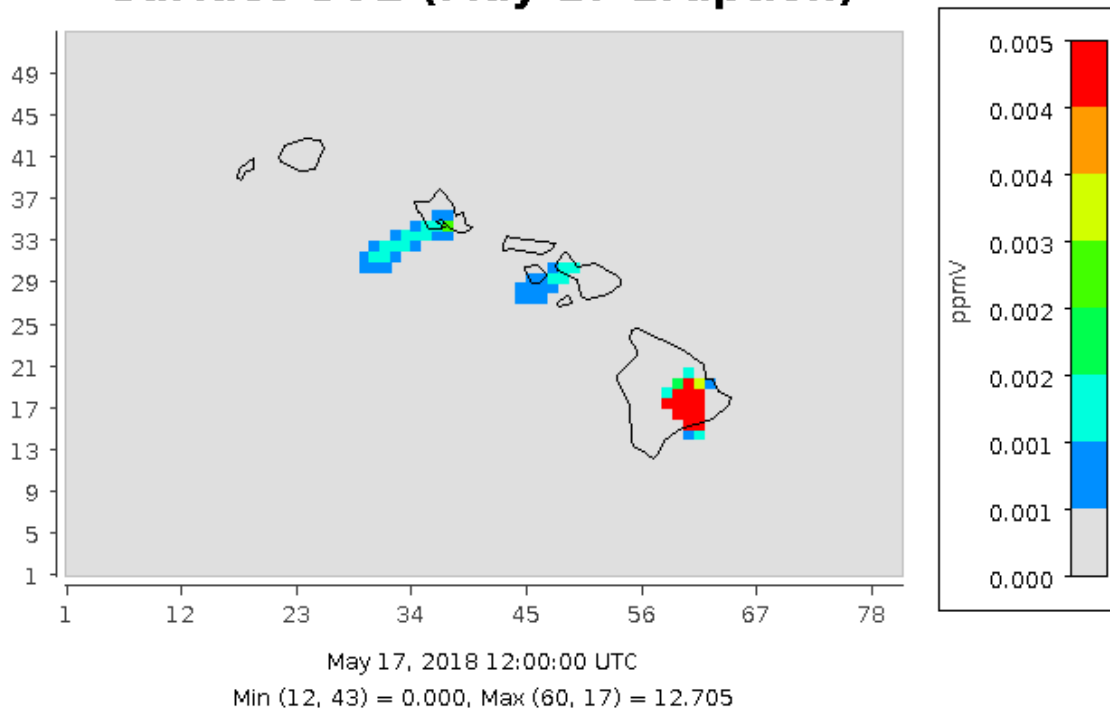




HAQAST Responding to Kilauea Eruption

- NASA HAQAST member, Daniel Tong leading interagency, multi-stakeholder effort.
- Partnering with Western Region Air Partnership, HI Department of Health, Army Research Lab, EPA Region 9.
- Developing OMI/OMPS-based volcano emissions product
- Supporting multi-agency modeling groups
- Assembling VOG forecasts
- Coming soon? Ground observations; health effects of short-term exposure; addressing stakeholder needs.
- NASA involvement: HAQAST; OMI; OMPS

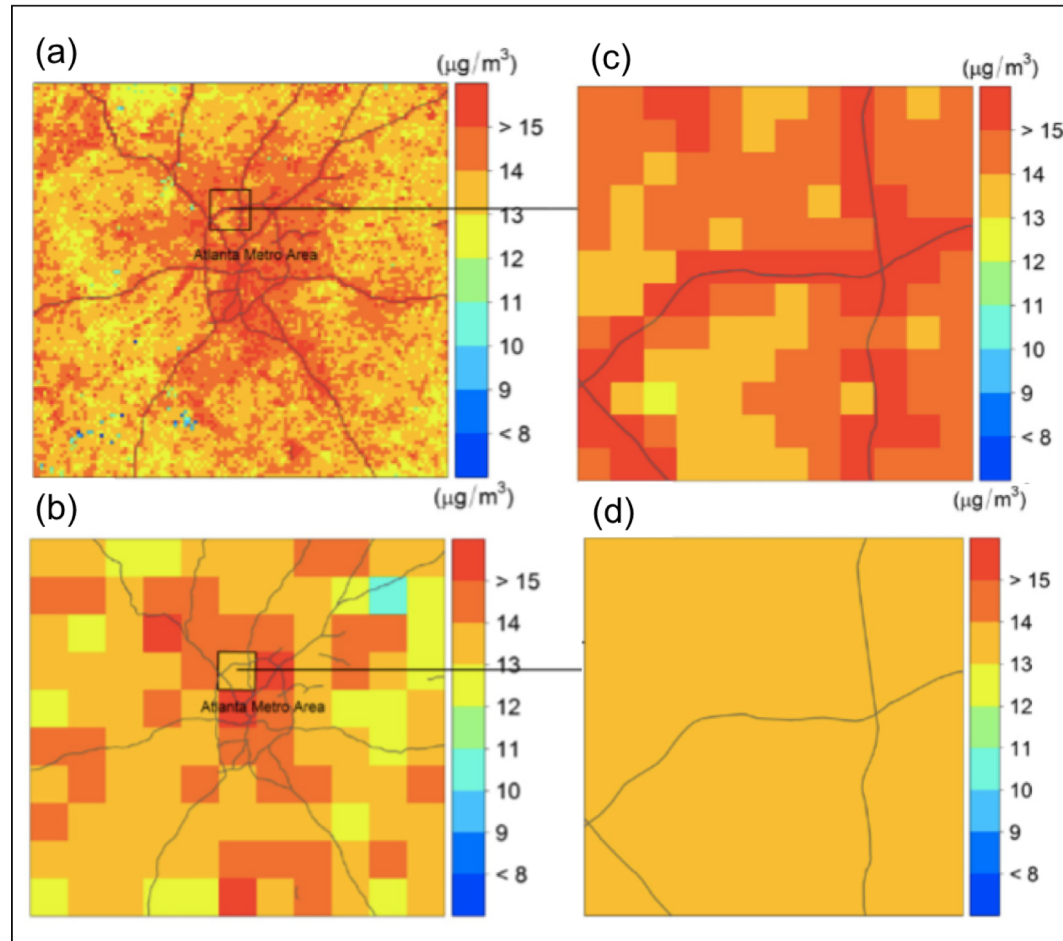
Surface SO₂ (May 17 Eruption)



Kilauea plume formed a caterpillar shape, affecting air quality over the entire state (animation plays in slide mode).

Results and Milestones—Tiger Teams

From:
High Resolution
Particulate Matter Data
for Improved Satellite-
Based Assessments of
Community Health,
Tiger Team led by Pat
Kinney



Annual mean PM_{2.5} for the Atlanta Metro area estimated using MAIAC (a) and MODIS (b). MAIAC estimation of PM_{2.5} concentrations within a CMAQ (12×12 km) grid cell (c), compared to MODIS estimation (d). Adopted from Hu et al. (2014).



Compete for Ideas

- Assume that all HAQAST members will participate equally in the Tiger Team process
- Members and Co-I expertise could support many different projects
- After projects were selected, people are reallocated to contribute to selected teams



Tiger Team Overview

- 13 Members selected for the NASA Health and Air Quality Applied Sciences Team (HAQAST) in 2016 via a peer-reviewed process
- In 2017, \$1.5 Million allocated to support 4 Tiger Teams. Feedback from participants suggests that teams are successful and productive.
- In 2018, \$1.6 Million allocated for 4 new Tiger Teams.



Round 1 Tiger Teams (2017 – 2018)

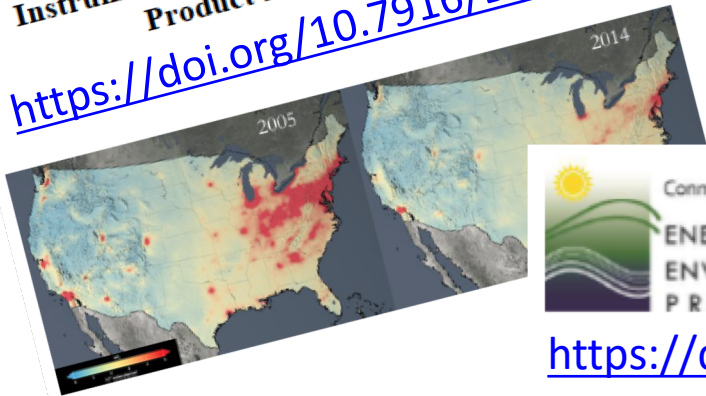
- **Led by Bryan Duncan & Jason West:** Demonstration of the Efficacy of Environmental Regulations in the Eastern U.S. for Health and Air Quality
- **Led by Arlene Fiore:** Supporting the use of satellite data in State Implementation Plans (SIPs)
- **Led by Pat Kinney:** High Resolution Particulate Matter Data for Improved Satellite-Based Assessments of Community Health
- **Led by Brad Pierce & Daniel Tong:** Improved NEI NO_x emissions using OMI Tropospheric NO₂ retrievals



Supporting satellite data in SIPs—PI Fiore

A Brief Tutorial on Using the Ozone Monitoring Instrument (OMI) Nitrogen Dioxide (NO₂) Data Product for SIPs Preparation

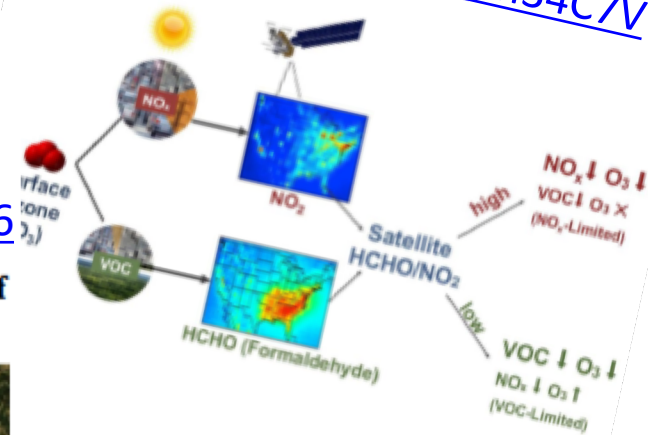
<https://doi.org/10.7916/D80K3S3W>



**Archived at
Columbia U
Academic
Commons
Repository**

Using satellite observed formaldehyde (HCHO) and nitrogen dioxide (NO₂) as an indicator of ozone sensitivity in a SIP

<https://doi.org/10.7916/D8M34C7V>



Lead Author: Bryan N. Duncan (NASA)
Contributing Authors: Michael Geigert (CT DEEP)



<https://doi.org/10.7916/D84B4HT6>

**Guide to Using Satellite Images in Support of
Exceptional Event Demonstrations**



Michael Geigert
CTDEEP
March 2018

Authors: Xiaomeng Jin and Arlene Fiore (LDEO Columbia)
Michael Geigert (CT DEEP)
Publication Date: June 12, 2018



Links to docs are now up on NASA's air quality from space website "Managers" tab



AQ Managers

Publicly available NASA satellite data can help with State Implementation Plans (SIPs)

Background: NASA's Earth science program maintains a large fleet of earth-observing satellites, all of which offer free data products. A number of these can be used to illustrate NO_x emissions trends and their relevance to ozone attainment, as well as for weight-of-evidence under the EPA's Exceptional Events Rule. A collaborative team of NASA-funded scientists and public stakeholders has recently developed a suite of easy-to-follow technical guidance documents to support state and local air quality agencies that want to bring the power of NASA's satellites to bear on the documentation of exceptional events. This work is a product of the NASA **Health and Air Quality Applied Sciences Team (HAQAST)** Year 1 (2017-2018) Tiger Team "Supporting the Use of Satellite Data in State Implementation Plans (SIPs)"

What, specifically, can NASA help me with? Our team has developed three guidance documents:

Thanks to Bryan Duncan and his team for hosting these!



One-page memos available for a quick overview

PROJECT Update: Publicly available NASA satellite data can help with State Implementation Plans

Background: NASA's Earth science program maintains a large fleet of earth-observing satellites, all of which offer free data products. A number of these can be used to illustrate NO_x emissions trends and their relevance to ozone attainment, as well as for weight-of-evidence under the EPA Exceptional Events Rule. A collaborative team of NASA-funded scientists and public stakeholders developed a suite of easy-to-follow technical guidance documents to support state and local air quality agencies that wish to incorporate NASA satellite products into their policy planning documents. This work is a product of the NASA HAQAST 2017-2018 Tiger Team "[Supporting the Use of Satellite Data in State Implementation Plans \(SIPs\)](#)."

What, specifically, can NASA help me with? Our team has developed three guidance documents:

- [Using satellite observed formaldehyde \(HCHO\) and nitrogen dioxide \(NO₂\) as an indicator of ozone sensitivity in a SIP](#)
- [A Brief Tutorial on Using the Ozone Monitoring Instrument \(OMI\) Nitrogen Dioxide \(NO₂\) Data Product for SIP Preparation](#)
- [A Guide to Using Satellite Images in Support of Exceptional Event Demonstrations](#)

Have air quality managers used satellite data in submitted SIPs? Yes. Our technical guidance documents were developed in close concert with air quality experts at state air agencies, including the Texas Commission on Environmental Quality (TCEQ) and the Connecticut Department of Energy and Environmental Protection (DEEP). Satellite data can be used as one component in overall weight of evidence (alongside evidence from ground monitors, models, etc.). These technical guidance documents provide field-tested examples of successful uses.

Where can I go to find out more? Each of the technical guidance documents is available at <https://airquality.gsfc.nasa.gov/aq-managers>, which also provides links to data and visualization tools, demonstrations of real-world uses, and other useful information for the health and air quality management communities.

Based on a suggestion from Zac Adelman (LADCO).

Thanks to Daegan Miller for drafting this "team overview" memo + one memo for each technical guidance doc



Round 2 Tiger Teams 2018 – 2019

Satellite-Evaluated and Satellite-Informed O₃ distributions for estimating U.S. background O₃



Lead HAQAST PI: Jessica Neu (NASA JPL)

Stakeholders: Local air agencies – California Bay Area, and California South Coast =; State air agencies – California,], New Hampshire], New York, and Texas; Regional & national – WESTAR and WRAP, US EPA; others may join throughout the project.

Project:

- Goal is to improve the quantification of background O₃ in SIPs.
- Will provide a coordinated set of boundary conditions for O₃, background O₃ (no U.S. anthropogenic emissions), and natural O₃ (no global anthropogenic emissions) for 2016.
- Will establish ‘best practices’ for evaluating models with satellite O₃ measurements.

Supporting the use of satellite data in regional haze planning



Lead HAQAST PI: Arlene Fiore (Columbia/LDEO)

Stakeholders: Barron Henderson and Brett Gantt (U.S. EPA OAQPS), Gail Tonnesen (U.S. EPA Region 8), Julie McDill (MARAMA), Paul Miller (NESCAUM), Stephanie Shirley (TCEQ), Tom Downs (ME DEP), Michael Geigert and Kate Knight (CT DEEP).

Project:

- Identify a few case studies of natural events and transport events from upwind agricultural and/or international sources for analysis with satellite data.
- Select an upwind nation or two and estimate emissions trends, over at least the past decade, in trace gas precursors to haze: NO_2 , and SO_2 , and NH_3
- Examine NH_3 from agricultural sources in the eastern US.
- Develop technical guidance documents that describe our approaches to using satellite data for regional haze applications.

Using satellite remote sensing to derive global climate and air pollution indicators



Lead HAQAST PI: Susan Anenberg (George Washington University; member of Daven Henze's team)

Stakeholders: Rich Fuller and Phil Landrigan (Co-Chairs, Lancet Commission on Pollution and Health), Nick Watts (University College London/Lancet Countdown), Katy Walker (Health Effects Institute/State of Global Air)

Project:

- Transfer knowledge and global-scale datasets tracking indicators for ozone and NO₂ concentration, PM_{2.5} and ozone disease burden in cities, and wildfire occurrence;
- Scope the potential for using satellite remote sensing to track global airborne dust storms and pollen season start date and duration.



Round 2 Tiger Teams 2018 – 2019

Air Quality and Health Burden of 2017 California Wildfires



Lead HAQAST PI: Susan O'Neill (US Forest Service)

Stakeholders: Bay Area Air Quality Management District, NOAA, USFS, EPA, Sonoma Technology Inc., NPS.

Project:

- Assess the effects of wildfire smoke on air quality and human health burden resulting from October 2017 California wildfires.
- Create a fire emission inventory
- Improve AQ modeling and prediction with satellite observations
- Conduct health impact analysis



Results and Milestones—Communications

The screenshot shows the top section of the HAQAST website. On the left is the HAQAST logo, which includes a satellite icon and the text 'HAQAST'. To the right of the logo is the text 'NASA HEALTH AND AIR QUALITY APPLIED SCIENCES TEAM' in a bold, sans-serif font, followed by the tagline 'Connecting NASA Data and Tools with Health and Air Quality Stakeholders' in a smaller font. In the top right corner, there is a search bar with a magnifying glass icon and the word 'Search'. Below the header is a black navigation bar with white text and dropdown arrows for 'ABOUT', 'PEOPLE', 'PROJECTS', 'NEWS', 'TOOLS AND RESOURCES', 'MEETINGS', and 'CONTACT'. The main content area features a large background image of a satellite in orbit over Earth. A semi-transparent white box is overlaid on the image, containing the text: 'Our mission is to bring the power of NASA science down to earth and into your life.'

www.haqast.org



HAQAST Builds Portal to Promote NASA Tools for Stakeholders

- NASA Health and Air Quality Applied Sciences Team (HAQAST)
- Website (www.haqast.org) features NASA tools and data
- Tools section designed in consultation with ARSET
- Developed how-tos for two of the most useful tools for HAQAST stakeholders, Worldview and Giovanni; includes short video tutorials

The screenshot shows the HAQAST website header with the logo and navigation menu. The 'TOOLS AND RESOURCES' menu is open, highlighting 'Getting Started' and 'NASA Tools'. Below the menu, the 'NASA TOOLS' section is visible, with a red box around the 'NASA WORLDVIEW' title. A red arrow points from the 'Getting Started' menu item to the text 'Click on Getting Started for a brief primer to the benefits and limitations of satellite data.' Another red arrow points from the 'NASA WORLDVIEW' title to the text 'Clicking on the title takes you directly to the tool's NASA page.' Below the 'NASA WORLDVIEW' description, a red box highlights the text 'And here's a tutorial (you can find a downloadable pdf here).', with a red arrow pointing to the text 'Tutorials available (online, pdf, and video formats)'. At the bottom, a red box highlights the 'NASA GIOVANNI' section, with a red arrow pointing from the text 'Very brief descriptions of each tool.'

Getting Started
NASA Tools
NASA ARSET Training
Meetings
AQAST 2011-2016
Links to Health and Air Quality Community

NASA TOOLS

NASA WORLDVIEW
NASA Worldview is the best starting point for users to interactively browse global, full-resolution satellite imagery updated within three hours of observation, essentially showing the entire Earth as it looks "right now." This supports time-critical application areas such as wildfire management, air quality measurements, and flood monitoring. View current natural hazards and events using the Events tab which reveals a list of natural events, including wildfires, tropical storms, and volcanic eruptions. Animate the imagery over time. Arctic and Antarctic views of several products are also available for a "full globe" perspective.

You can view a webinar [here](#).

And [here's a tutorial](#) (you can find a [downloadable pdf here](#)).

NASA GIOVANNI
Along with Worldview, members of the health and air quality community will find Giovanni extremely helpful. Giovanni is a web-based interface that allows users to interactively analyze gridded data online without having to download anything. It is a flexible platform that allows a user to average data over time, create a range of plot types and formats, compare variables, and graphically display information. You can also download plot source files in netCDF format.

Very brief descriptions of each tool.



NASA HAQAST in the News

- NASA HAQAST communications coordinator, Dr. Daegan Miller, publishes overview of NASA HAQAST in *Physics Today*
- Article has been shared widely—14k+ times.
- Article highlights work of HAQAST PIs Holloway, Russell, Freedman, Fiore
- Article promotes freely available NASA data and tools
- Popularity highlights the interest in NASA and public health
- NASA resources used: NASA HAQAST grant, WorldView

PHYSICS TODAY

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DOI:10.1063/PT.6.1.20171122a

22 Nov 2017 in Research & Technology

Using satellites to improve public health

Scientists are tapping into NASA remote-sensing data to track wildfire smoke, estimate local automobile pollution, and coordinate states' air-quality monitoring.

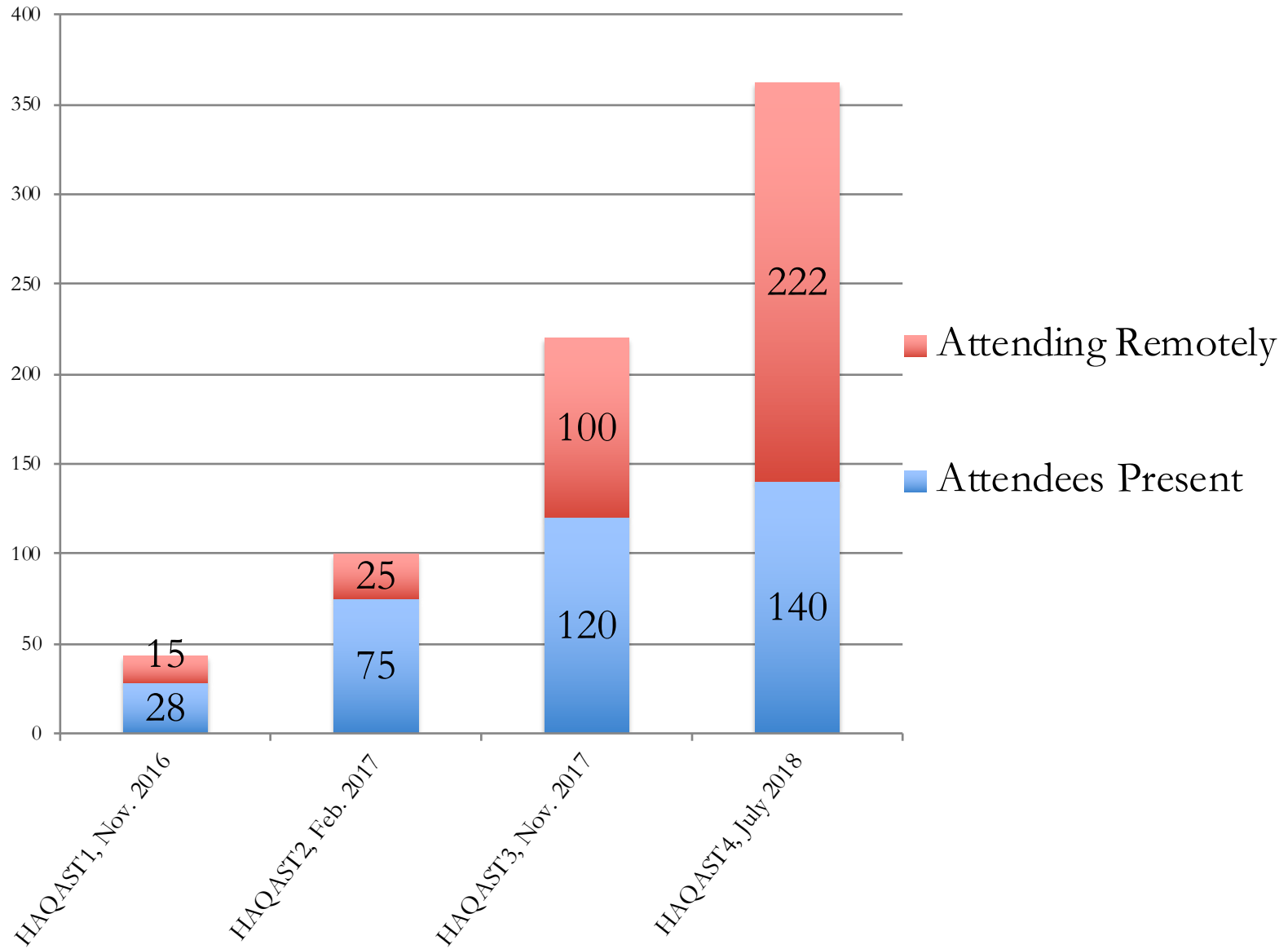
D. R. Miller

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HAQAST Meeting Participation



HAQAST4, July 16 – 17, Madison, WI



140 in-person attendees, and more than 200 connecting remotely. Our biggest meeting yet.



HAQAST4, July 16 – 17, Madison, WI

