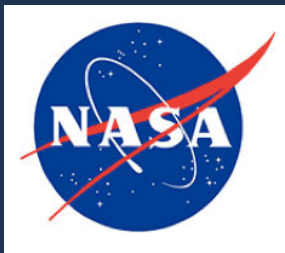




Year 2 Report: *The NASA Health and Air Quality* *Applied Sciences Team (HAQAST)*

Tracey Holloway

Gaylord Nelson Distinguished Professor
University of Wisconsin—Madison
Team Lead, NASA HAQAST



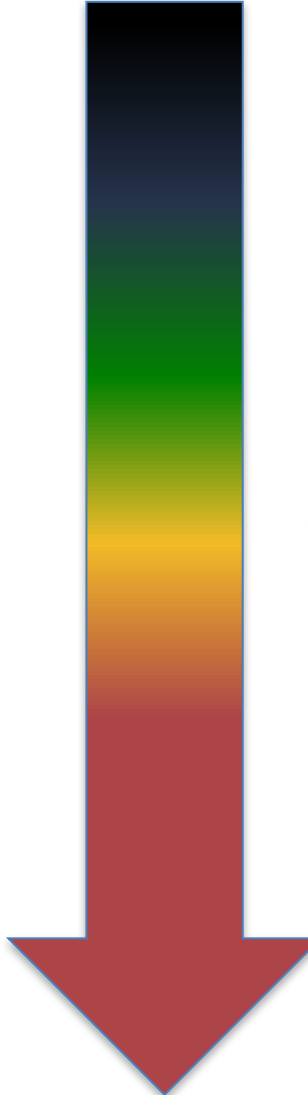
What is “hay-kast”?

- Health and Air Quality Applied Sciences Team
- NASA-funded Applied Sciences Team
- 3 – year funded project (ending summer ‘19)
- 13 Members and 70+ co-investigators
- Mission: Connect NASA science with air quality and health applications
- ~ \$12 Million Total Cost
- Three types of work:
 - Member projects
 - Tiger team projects (collaborative)
 - Outreach, engagement, rapid response





How can we link NASA science with your organization?



Unaware: What NASA data?

Uninterested: I don't think that NASA data are useful to me

Curious: I wonder if those NASA data could be useful to me?

Engaged: I'd like to start using those NASA data

Enthusiastic: These NASA data are indispensable!
Thanks, HAQAST!!

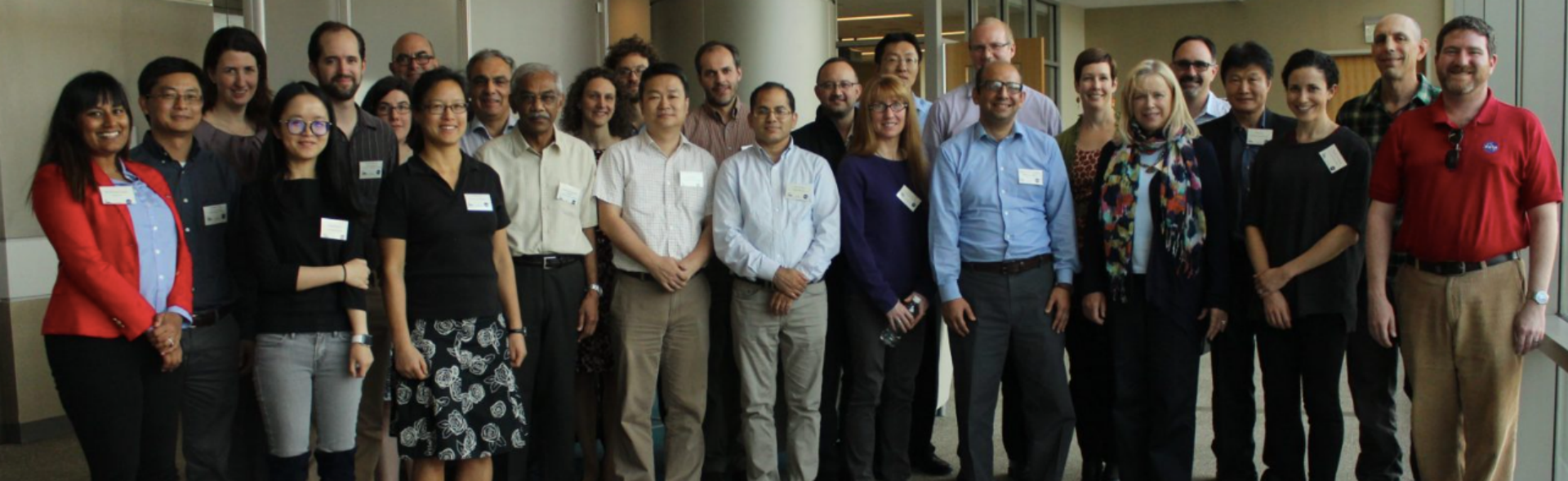
13 NASA Health and Air Quality Applied Sciences Team Members (HAQAST)



- Tracey Holloway (Team Lead, UW-Madison)
- Bryan Duncan (NASA GSFC)
- Arlene Fiore (Columbia University)
- Minghui Diao (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)

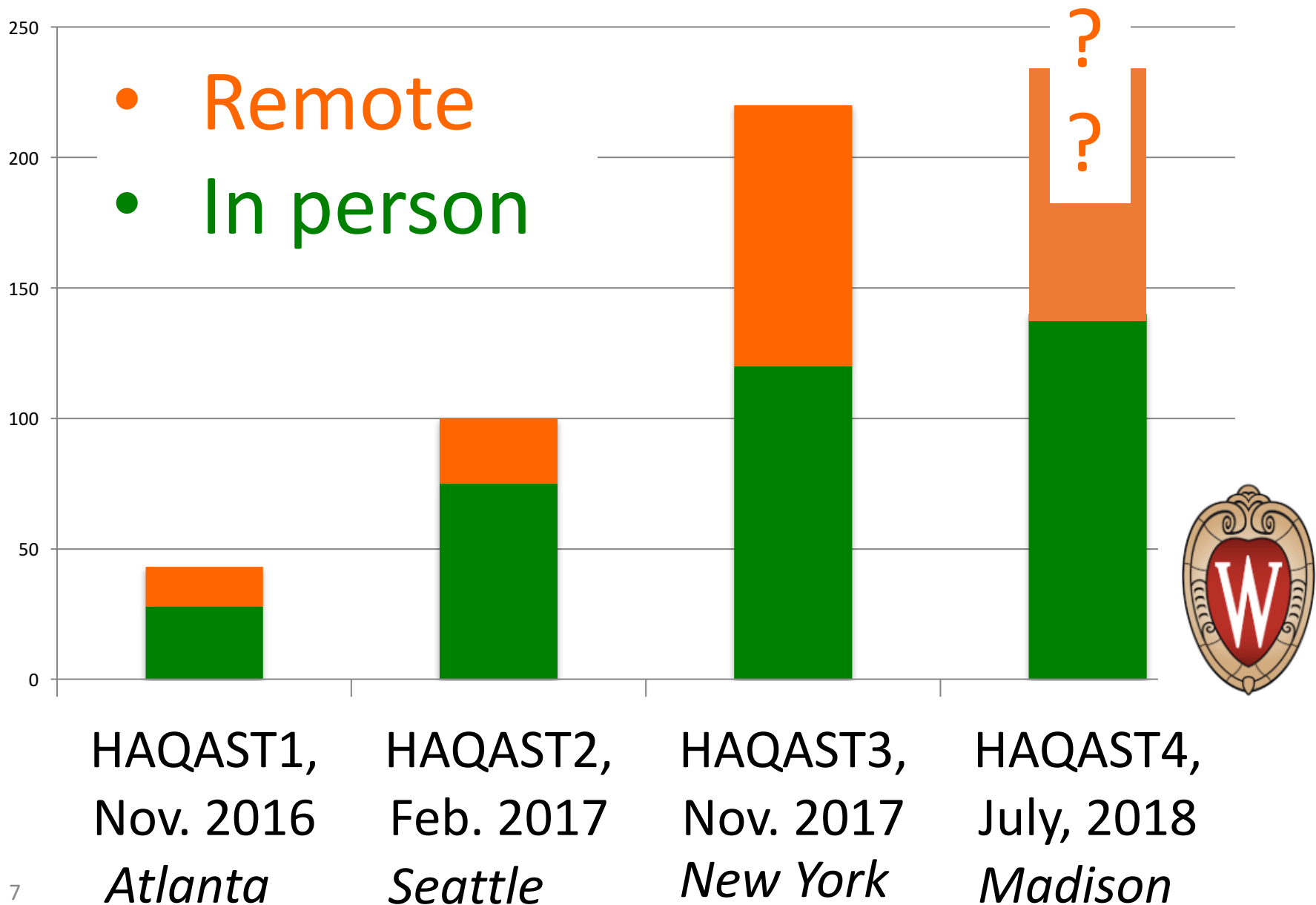
haqast.org





The team structure fundamentally changes outcomes.

- Increased visibility of work and resources to end-users
- Culture to support and promote collaborations and synergies
- Growth of two-way dialogue
- Increased collaborations to meet stakeholder needs
- Rapid spin-up of high-value activities





NASA HEALTH AND AIR QUALITY APPLIED SCIENCES TEAM

Connecting NASA Data and Tools with Health and Air Quality Stakeholders

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Getting Started

Download Data

Tools

NASA ARSET
Training

AQAST 2011-2016

Links to Health and
Air Quality
Community

Glossary

Tutorials and webinars can be found here.



HAQAST Supports 2 Types of Projects: Individual & Tiger Team

Sept. 2016

Sept. 2017

Sept. 2018

Sept. 2019

13 HAQAST Members' Proposed Initiatives
with stakeholders & Co-I collaborators

Now =

- 2/3 through individual projects
- End Year 1 Tiger Teams
- Start Year 2 Tiger Teams

Year 1 "Tiger Teams"
4 larger collaborations
Focused, stakeholder-
based, short-term

Year 2 "Tiger
Teams"
... just announced



Year 2 Progress Update, PI Holloway

Integrating Satellites into Health and Air Quality Management

- Connect OMI HCHO with EPA National Air Toxics Assessment
 - Reports submitted to EPA, Two papers in prep with EPA co-authors
- Supporting model evaluation with satellite data
 - Ongoing development of WHIPS & guidance docs; Two papers assessing CMAQ over India published; one in prep AOD
- Novel applications of satellite data
 - 1 paper published on birds + air quality; 2 papers submitted (global cities + Kazakhstan); 1 paper in prep (US cities); 1 paper in prep (diurnal NO₂)
- 13+ academic talks; 7+ stakeholder or public talks; Guidance documentation on haqast.org; videos; Twitter @NASA_HAQAST; D. Miller *Physics Today* blog

Tiger Team Participation

- Co-I Brad Pierce Leading Tiger Team on Improved NO_x emissions using OMI
 - Completed demonstration within the NWS air quality forecast system; presented to NOAA/NWS). Results led to an improvement in ozone prediction.
- TT Fiore: Satellite Data in SIPS. Our group extended TT mission to public health.
 - Co-I Jonathan Patz + Holloway + Student Grace Choi have conducted a series of meetings with health stakeholders
 - Comparison of surface PM_{2.5} datasets available, including a county-level comparison (in prep as part of Diao et al. review paper.)

3 papers published

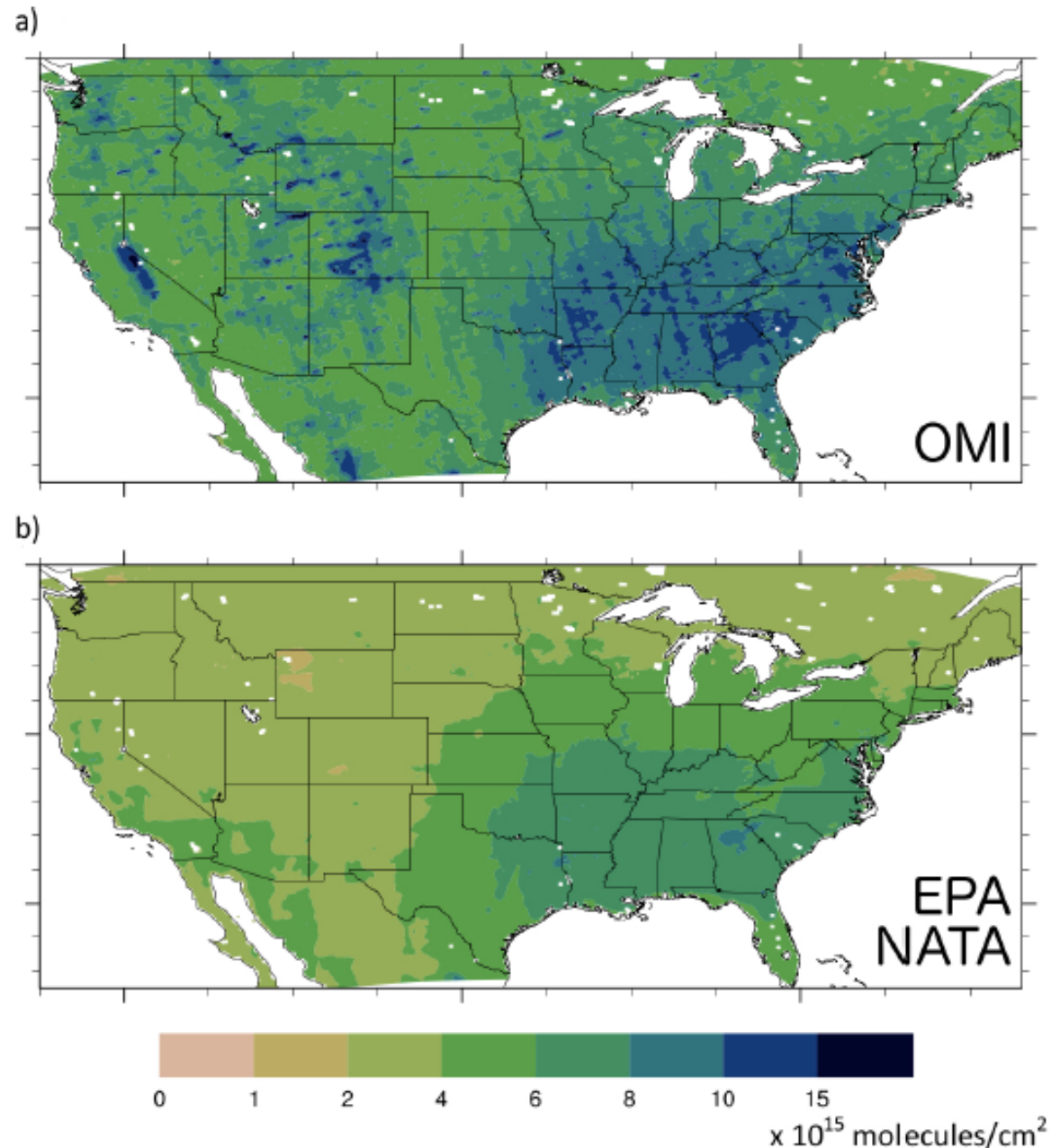
3 papers submitted

6 in prep

“Nationwide, the key pollutants that contribute most to overall cancer risks are **formaldehyde**, benzene, and acetaldehyde”
- 2011 EPA National Air Toxics Assessment (NATA)



Harkey, Holloway, Baker, Henderson, et al. in prep



Year 2 Progress Update, PI Holloway

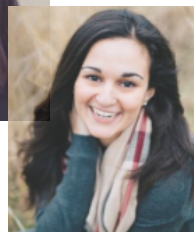
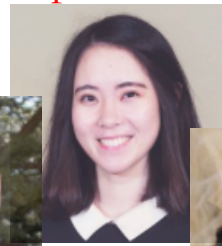
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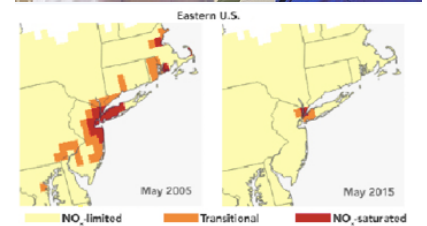
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Y1 Tiger Teams \$1.5 M

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



Images from
inhabit.com; rochdaleonline.co.uk; NASA;
Shutterstock

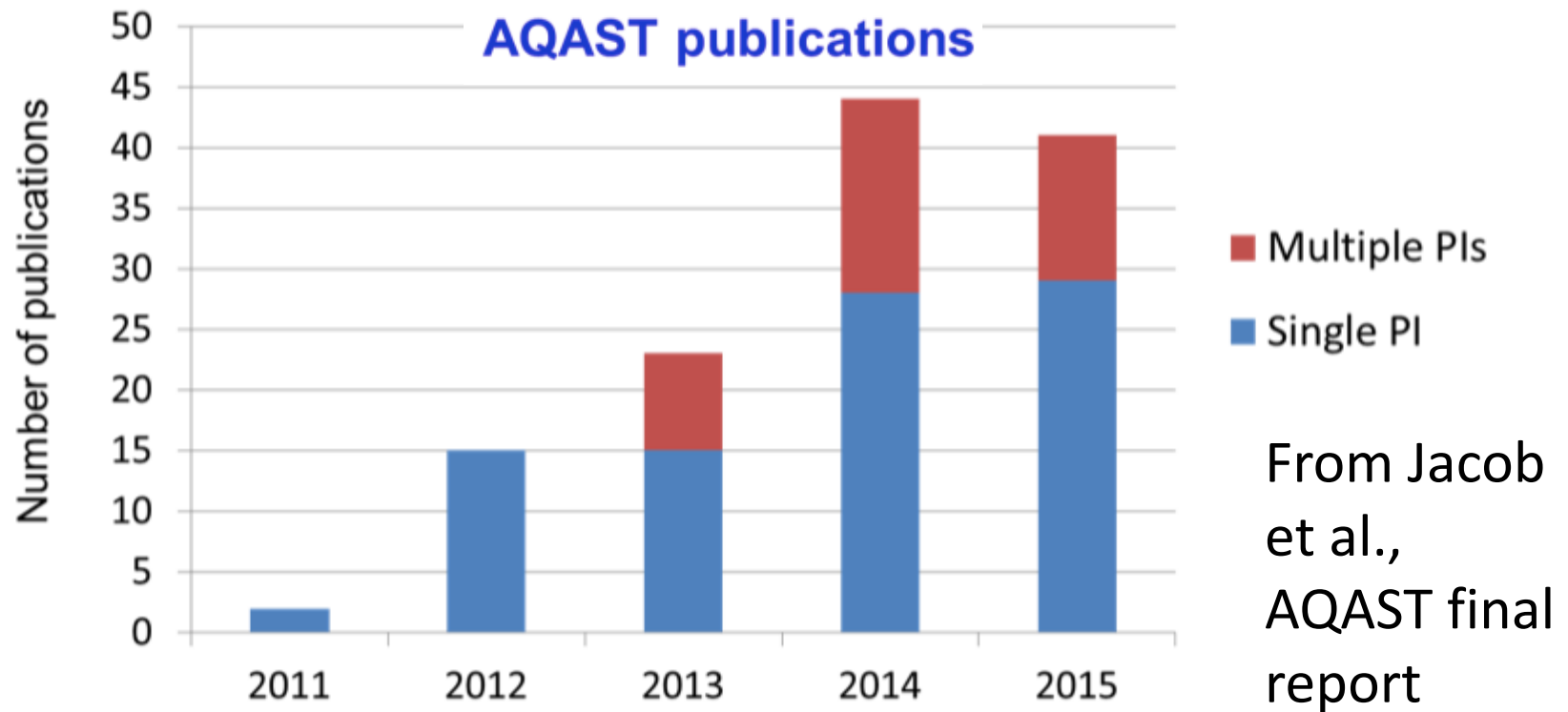
New!! Y2 Tiger Teams

\$1.6M

- **Susan Anenberg**: Using satellite remote sensing to derive global climate and air pollution indicators
- **Arlene Fiore**: Supporting the use of satellite data in regional haze planning
- **Jessica Neu**: Satellite-evaluated and satellite-informed O_3 distributions for estimating U.S. background O_3
- **Susan O'Neill**: Air quality and health burden of 2017 California Wildfires

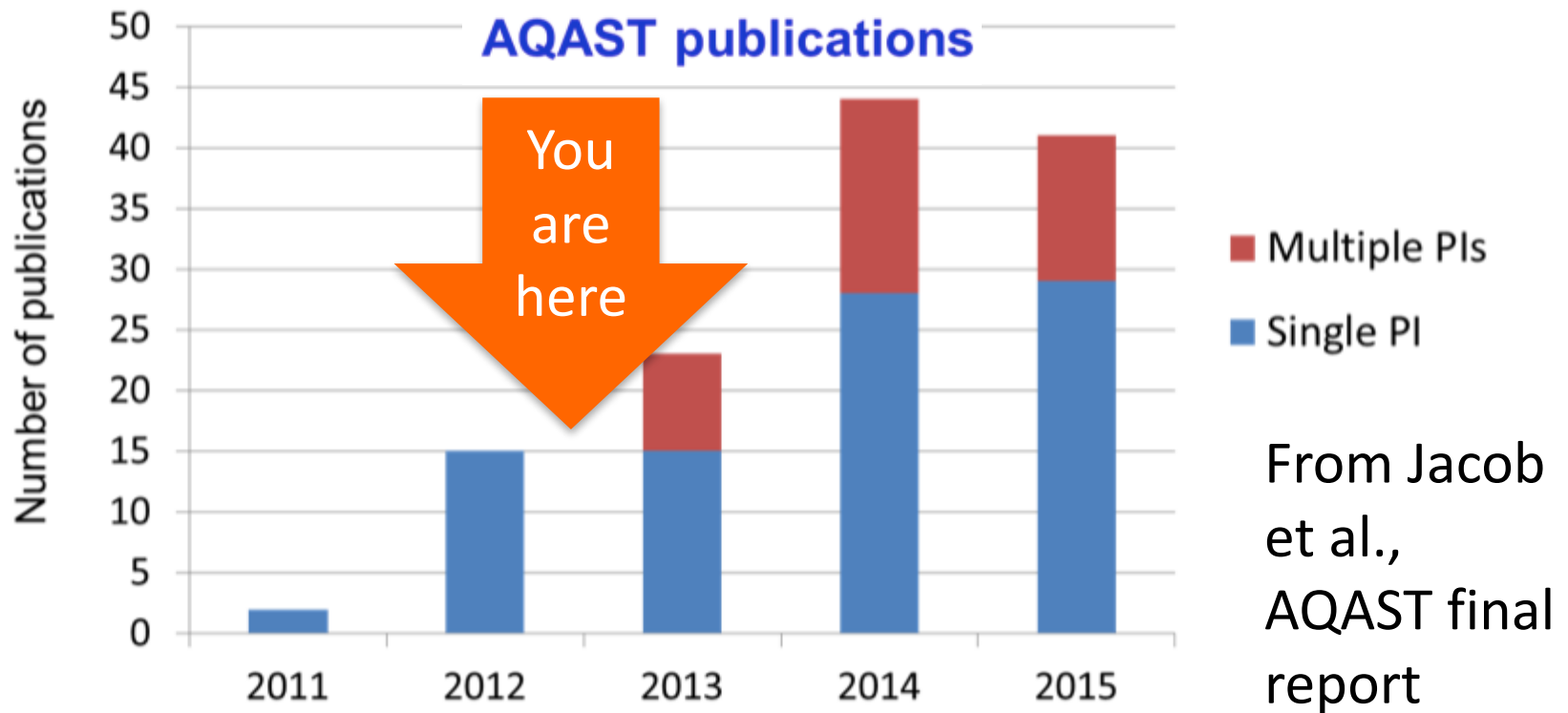
Images from NASA; NOAA; NASA; SCPR





Culture to support and promote collaborations and synergies

- Collaborative peer-review publications grew in later years of AQAST
- HAQAST Tiger Team process has been a catalyst for collaboration (12 collaborative proposals submitted in Year 1; 8 in Year 2)
- Most HAQAST researchers are involved in multiple Tiger Teams
- When needs arise – like Hawaii volcanic explosions – sub-teams form quickly and easily.



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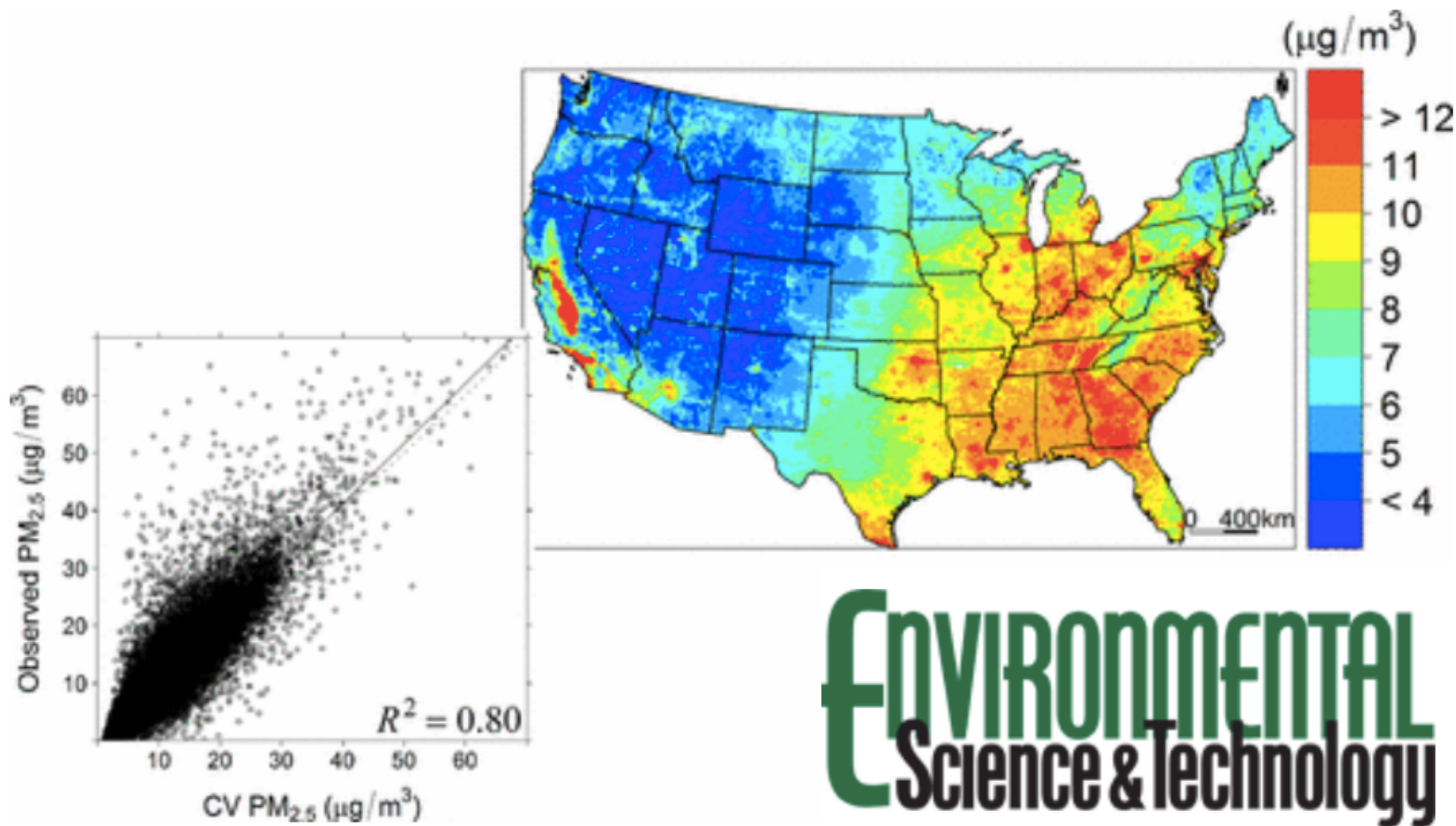


Today Americans breathe cleaner air and face lower risks of adverse health effects.

2005 - 2016 NO₂ satellite imagery courtesy of [NASA](#)

Rapid spin-up of high-value activities

- In AQUEST, early work on NO₂ showed close agreement with ground-based monitors (Duncan), utility in assessing emissions (Streets, deFoy), utility in evaluating models (Holloway, Dickerson), and general interest to air quality managers. → Regular meetings, collaborative projects, and growing public engagement propelled this application area forward quickly
- In HAQUEST, interest in PM_{2.5} for health impacts, air management, fire management, etc. has been growing this area and engaging users
- DISCOVER-AQ → LMOS → Long Island Sound study



Estimating PM_{2.5} Concentrations in the Conterminous United States Using the Random Forest Approach

Xuefei Hu[†] , Jessica H. Belle[†], Xia Meng[†], Avani Wildani[‡], Lance A. Waller[§], Matthew J. Strickland[†], and Yang Liu^{†*} 

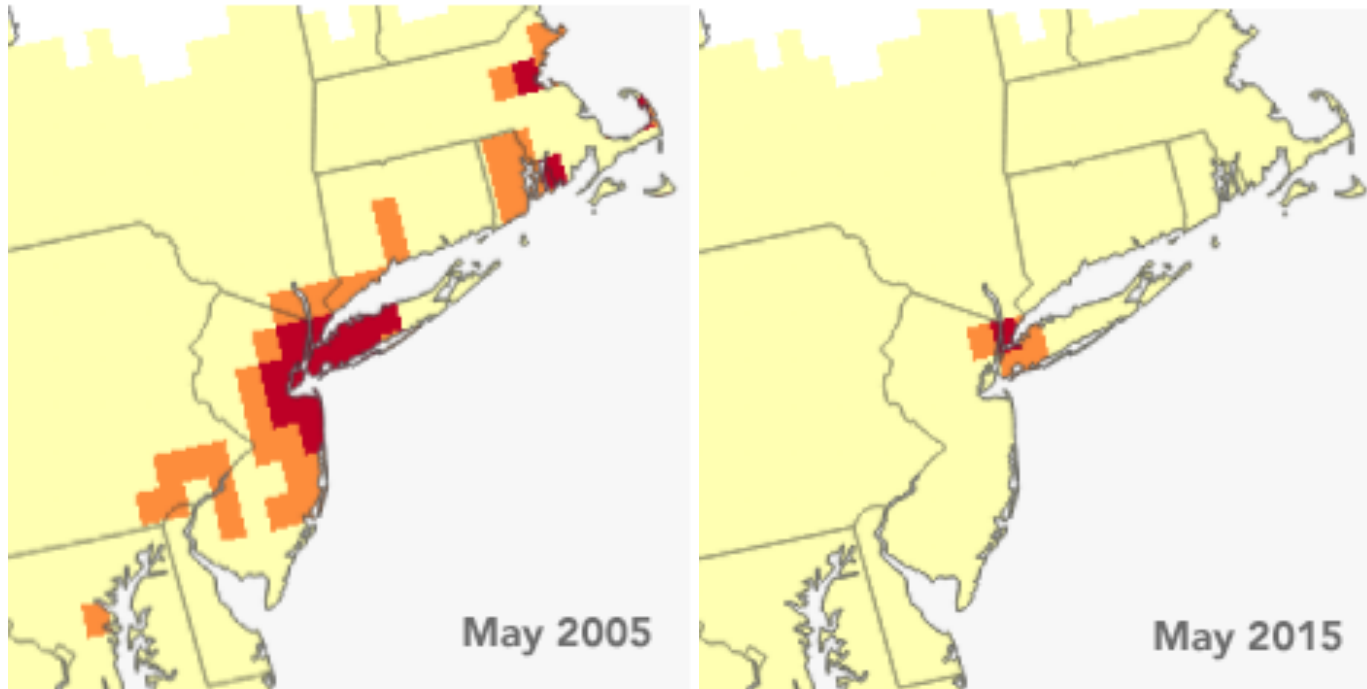
[†]Department of Environmental Health, Rollins School of Public Health, [‡]Department of Mathematics and Computer Science, and [§]Department of Biostatistics & Bioinformatics, Rollins School of Public Health, Emory University, Atlanta, Georgia 30322, United States

[†] School of Community Health Sciences, University of Nevada Reno, Reno, Nevada 89557, United States

NASA Aura OMI satellite products support state air planning

November 7, 2017 NASA Image of the Day
<https://earthobservatory.nasa.gov/IOTD/view.php?id=91234>

Jin et al., JGR, 2017



HAQAST PI Arlene Fiore and Xiaomeng Jin provided figures that CT DEEP included in their Ground-level Ozone State Implementation Plans (SIPs).

NO_x-limited Transitional NO_x-saturated

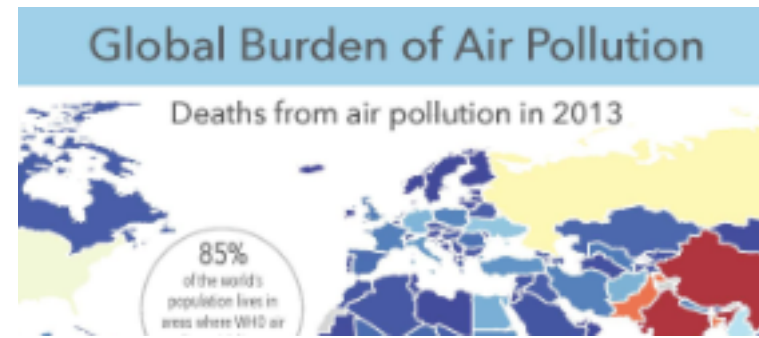
OMI formaldehyde and nitrogen dioxide columns in 2015 vs. 2005 indicate:

- ozone production responds strongly to changes in precursor emissions of NO_x (vs. VOC) during the warm season;
- an earlier springtime transition to NO_x-limited ozone formation.



(U.S.) Air Quality Management

- Clean Air Act
- Compare w/ Monitoring
- Litigious
- Federal (especially EPA)
- States, sometimes counties
- Regulated pollutants
- Exceptional Events
- Key opportunities:
 - Model validation
 - emissions inventories
 - Trends



Public Health

- No legal framework
- Open to new data
- Research-oriented
- Global (WHO, other countries)
- Federal (CDC, NIH, EPA)
- Cities & Communities
- All pollutants of interest
- Key opportunities:
 - Population health risk
 - Connect with low cost sensors
 - Public outreach



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science down to earth and into your life.

haqast.org