AQAST Retrospective: 2011-2016

(*Bryan's Perspective*)

Oversimplification of AQAST's Goal: *Facilitate the use of satellite data by the AQ community.*

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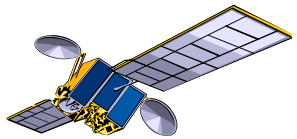
Atmospheric Chemistry & Dynamics Laboratory

NASA Goddard Space Flight Center

November 3, 2016; HAQAST #1 – Emory University

NASA Air Quality Applied Sciences Team

Earth Science Serving Air Quality Management Needs



satellites

suborbital platforms

models

AQAST

Pollution monitoring
Exposure assessment
AQ forecasting
Source attribution
Quantifying emissions
External influences
Exceptional events
Climate interactions

Earth Science resources

US air quality management

AQAST members

- **Daniel Jacob (leader),** Loretta Mickley (Harvard)
- **Tracey Holloway (deputy leader),** Steve Ackerman (U. Wisconsin); Bart Sponseller (Wisconsin DNR)
- **Greg Carmichael** (U. Iowa)
- **Dan Cohan** (Rice U.)
- **Russ Dickerson** (U. Maryland)
- **Bryan Duncan**, Lok Lamsal (NASA/GSFC)
- **David Edwards** (NCAR)
- **Arlene Fiore** (Columbia Univ.); Meiyun Lin (Princeton)
- **Jack Fishman,** Ben de Foy (Saint Louis U.)
- **Daven Henze**, Jana Milford (U. Colorado)
- **Edward Hyer,** Jeff Reid, Doug Westphal, Kim Richardson (NRL)
- **Pius Lee,** Tianfeng Chai (NOAA/NESDIS)
- **Yang Liu**, Matthew Strickland (Emory U.), Bin Yu (UC Berkeley)
- **Richard McNider**, Arastoo Biazar (U. Alabama – Huntsville)
- **Brad Pierce** (NOAA/NESDIS)
- **Ted Russell,** Yongtao Hu, Talat Odman (Georgia Tech); Lorraine Remer (NASA/GSFC)
- **David Streets** (Argonne)
- **Jim Szykman** (EPA/ORD/NERL)
- **Anne Thompson**, William Ryan, Suellen Haupt (Penn State U.)

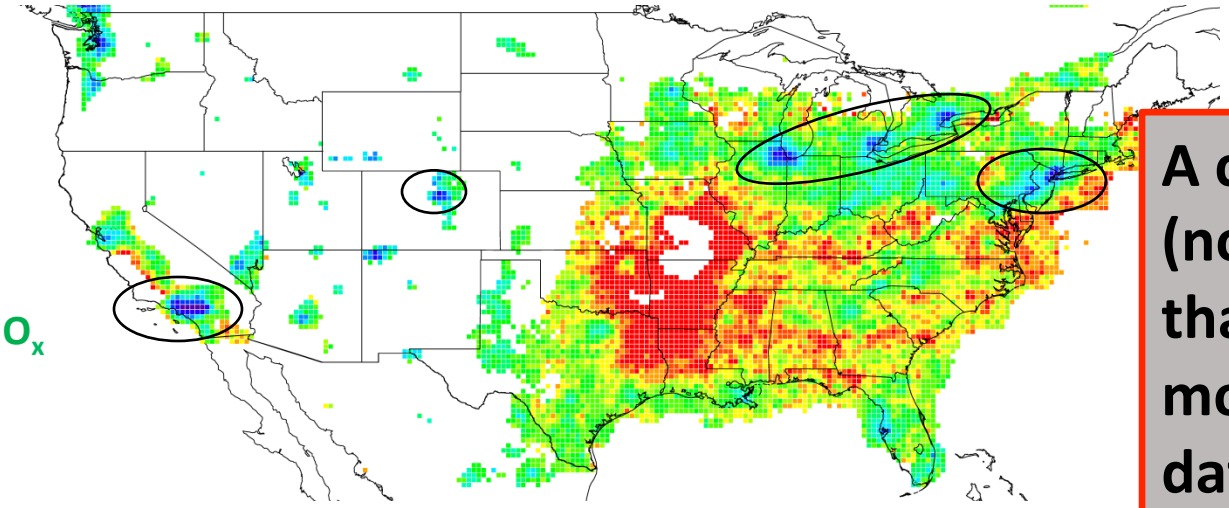
2011-2013: AQAST is formed! So, what do we do?

- We spent a few years finding our footing as a team (and even as individual PIs for some of us).
  - A few of us, including me, "*didn't get it*". We acted more like research scientists instead of like members of AQAST, whose primary goal was to work with AQ managers on their urgent needs.
  - Daniel Jacob *(the fearless and benevolent AQAST lead)* worked tirelessly to gently nudge team members onto the right path. He had to kick some of us in the pants!

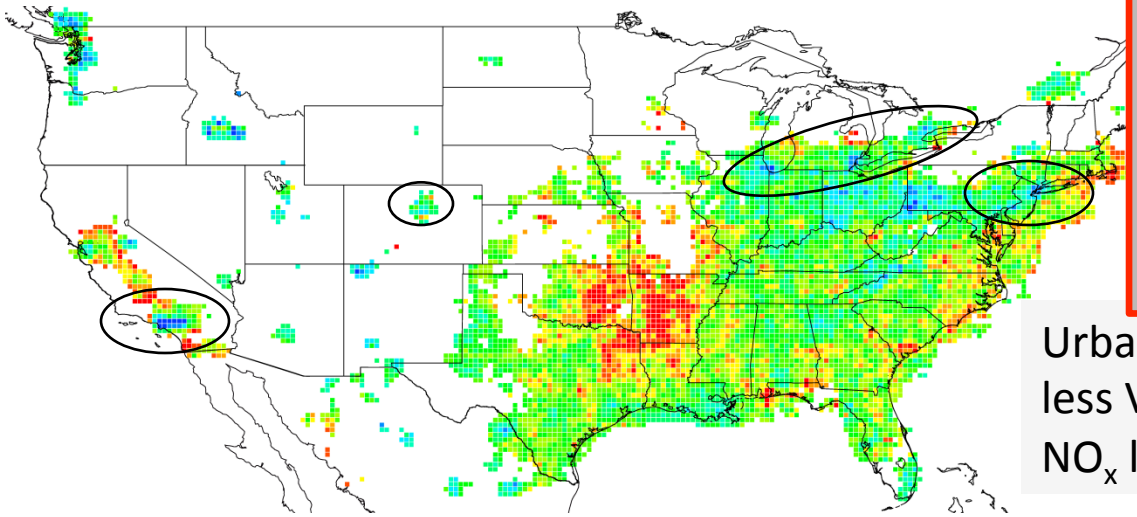
- We also had to convince many reluctant AQ managers of the value of satellite data for their applications – the onus was on AQAST!
  - We also had to convince ourselves in many cases (i.e., transition from research to application).

Proposed AQAST Idea: OMI HCHO/NO_2 : *A Proxy for Ozone Formation Sensitivity*

2005



2013

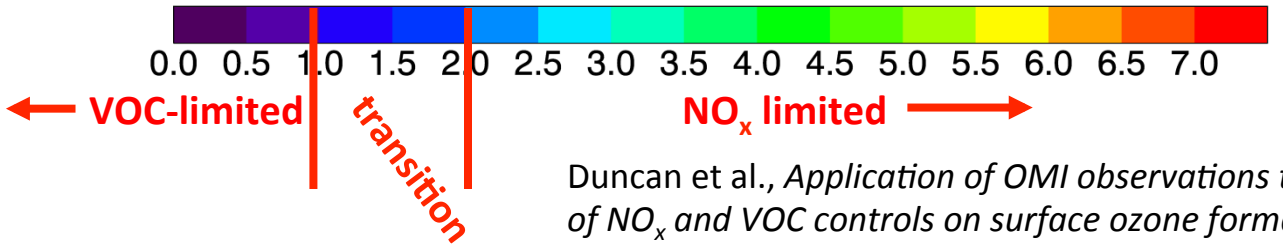


M. Dodge: VOC/NO_x
S. Sillman: in situ
R. Martin: GOME

A cool idea (not mine!) that makes the most of NASA data.

No End-Users needed to be identified.

Urban areas becoming less VOC-limited : more NO_x limited.



Duncan et al., *Application of OMI observations to a space-based indicator of NO_x and VOC controls on surface ozone formation,* Atmos. Environ., 44, 2213-2223, doi:10.1016/j.atmosenv.2010.03.010, 2010.

What I actually ended up working on (after a gentle ass-kicking by Daniel).

Communications!

Atmospheric Environment 94 (2014) 647–662

Contents lists a http://dx.doi.org/10.1016/j.atmosenv.2014.05.061

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

Review

Satellite data of atmospheric pollution for U.S. air quality applications: Examples of applications, summary of data end-user resources, answers to FAQs, and common mistakes to avoid

Bryan N. Duncan [a, *], Ana I. Prados [a, b], Lok N. Lamsal [a, c], Yang Liu [d], David G. Streets [e], Pawan Gupta [a, c], Ernest Hilsenrath [b, f], Ralph A. Kahn [a], J. Eric Nielsen [g], Andreas J. Beyersdorf [h], Sharon P. Burton [h], Arlene M. Fiore [i], Jack Fishman [j], Daven K. Henze [k], Chris A. Hostetler [h], Nickolay A. Krotkov [a], Pius Lee [l], Meiyun Lin [m], Steven Pawson [a], Gabriele Pfister [n], Kenneth E. Pickering [a], R. Bradley Pierce [o], Yasuko Yoshida [a, g], Luke D. Ziemba [h]

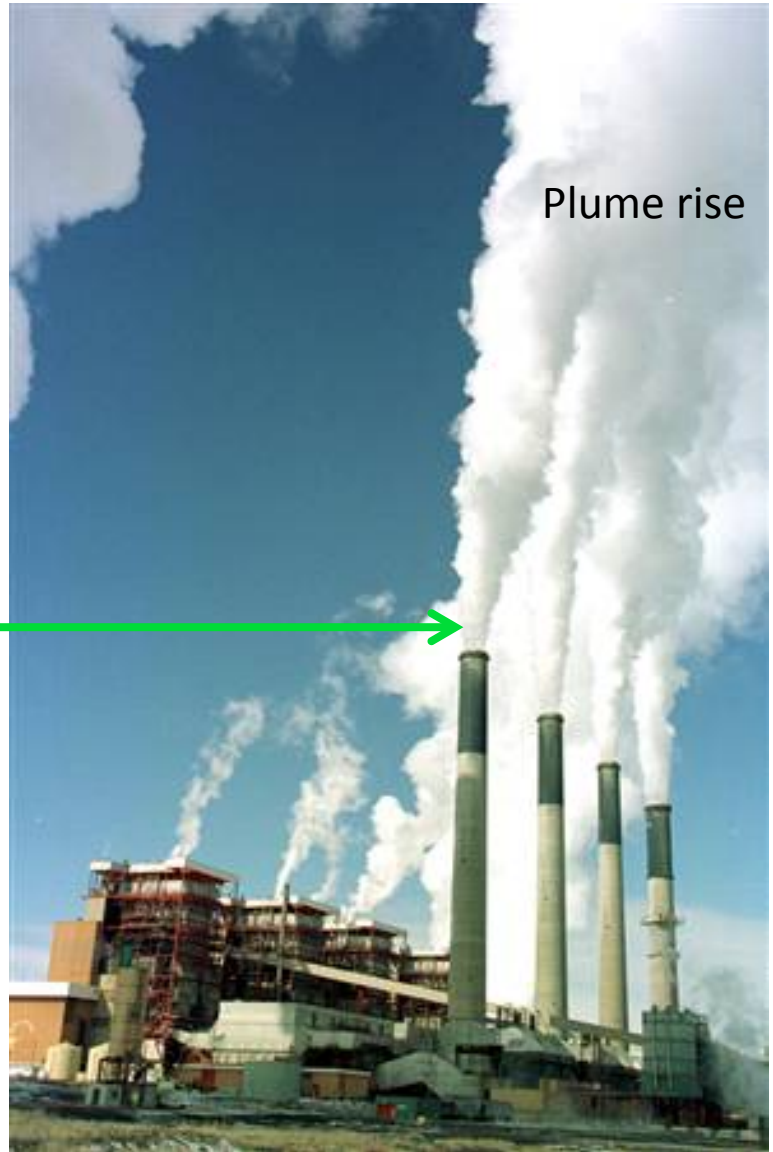
What I actually ended up working on (with Lok Lamsal (NASA)).

How does an Aura Ozone Monitoring Instrument (OMI) Column Nitrogen Dioxide (NO_2) Data Relate to Quantities Familiar to the AQ Community??

Satellite measures an "atmospheric column" (molecules/cm^2)

Emissions

"Nose-level" concentrations.



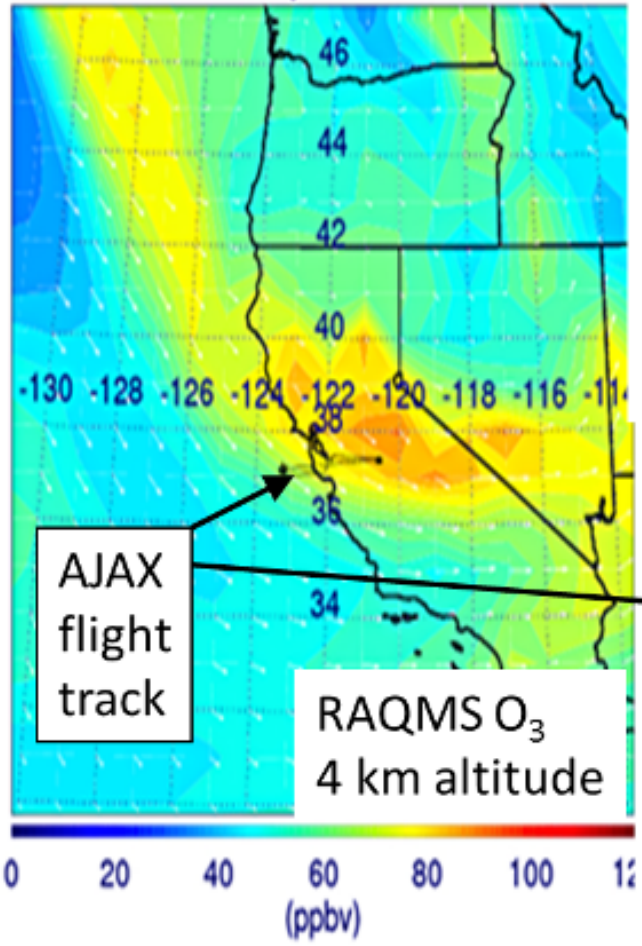
2014-2016: AQAST found its groove!

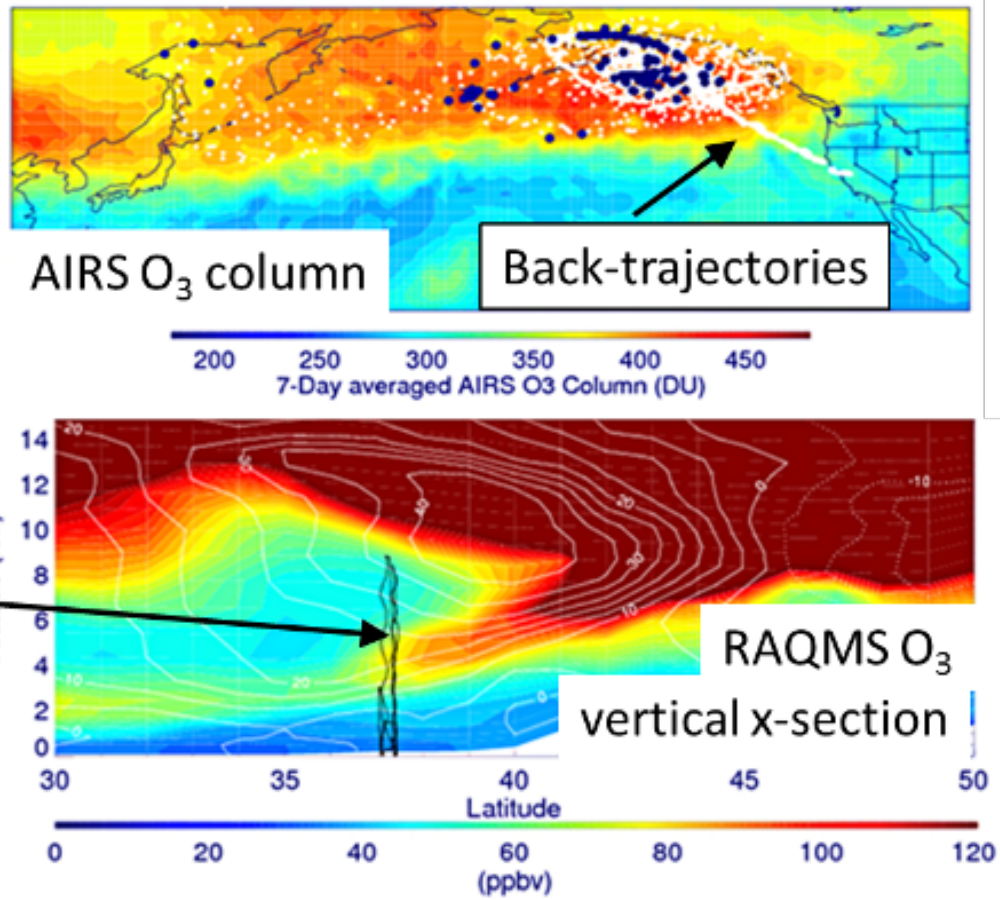
- **AQAST gets the word out!** Showed how satellite data are useful for AQ managers, even if the data aren't useful for all applications. *Communications, communications, communications!*
  - Spatial coverage is the primary advantage of satellite data, which complements existing surface networks.

- NASA AQAST (Jacob et al.)
- Integrating satellite data into air quality management: experience from Colorado (Witman and Holloway)
- Monitoring $PM_{2.5}$ for health: past, present, and future directions (Liu)
- Air quality forecasting (Hu et al.)
- Interactions between climate change and US air quality (Mickley et al.)
- Using satellite observations to measure power plant emissions and their trends (Streets et al.)
- Detecting and attributing episodic high background ozone events (Fiore et al.)

Wyoming Exceptional Event Demonstration

Wyoming DEQ/AQD used AQAST resources to issue an exceptional event demonstration package for an ozone exceedance at Thunder Basin, June 6, 2012



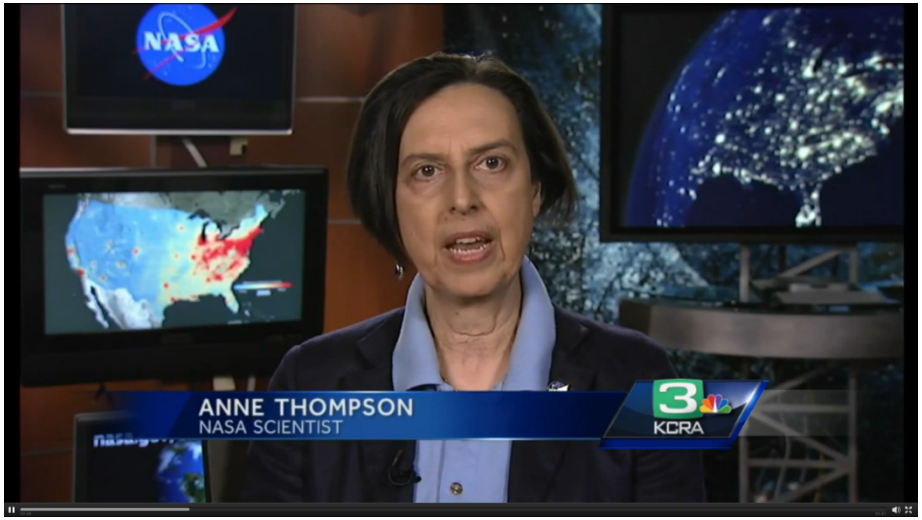


AQAST PI: Pierce

AQAST
NASA Air Quality Applied Sciences Team

Press Releases & More

- More Communications
  - Tracey showed us how not to be shy!

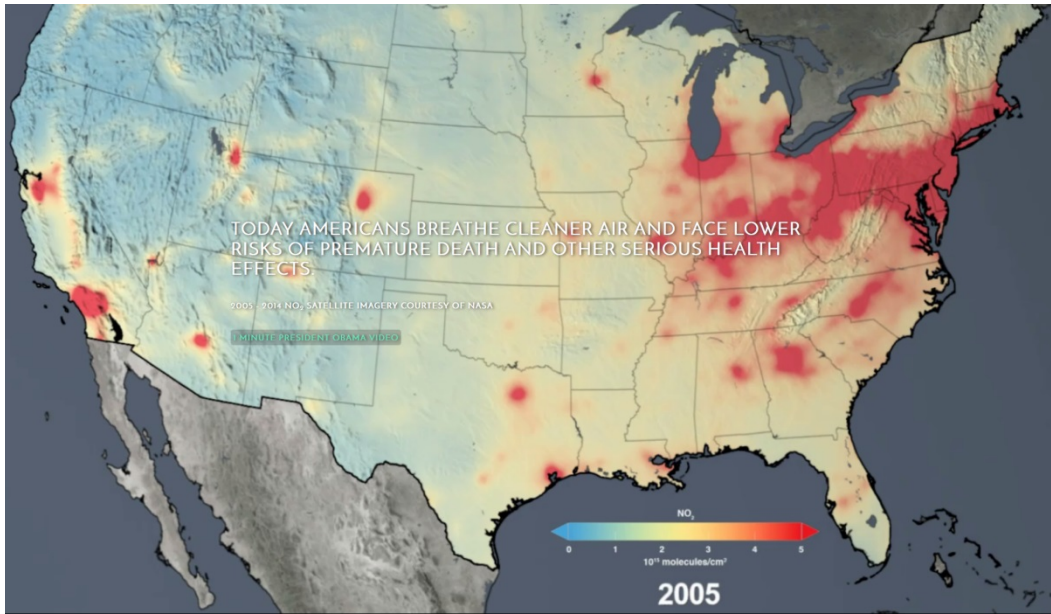


Some High Profile Signs of AQAST's Success

On April 12, 2016, President Obama uses OMI NO_2 data to explain how pollution affects our planet: https://www.youtube.com/watch?v=LKe5FdKInJs

Obama's message: CAA is working!

EPA Air Trends Report 2015: This is the first time that satellite data showed up in a major EPA report!



Most Importantly, AQAST Worked with Many AQ Managers

AQ agency partner

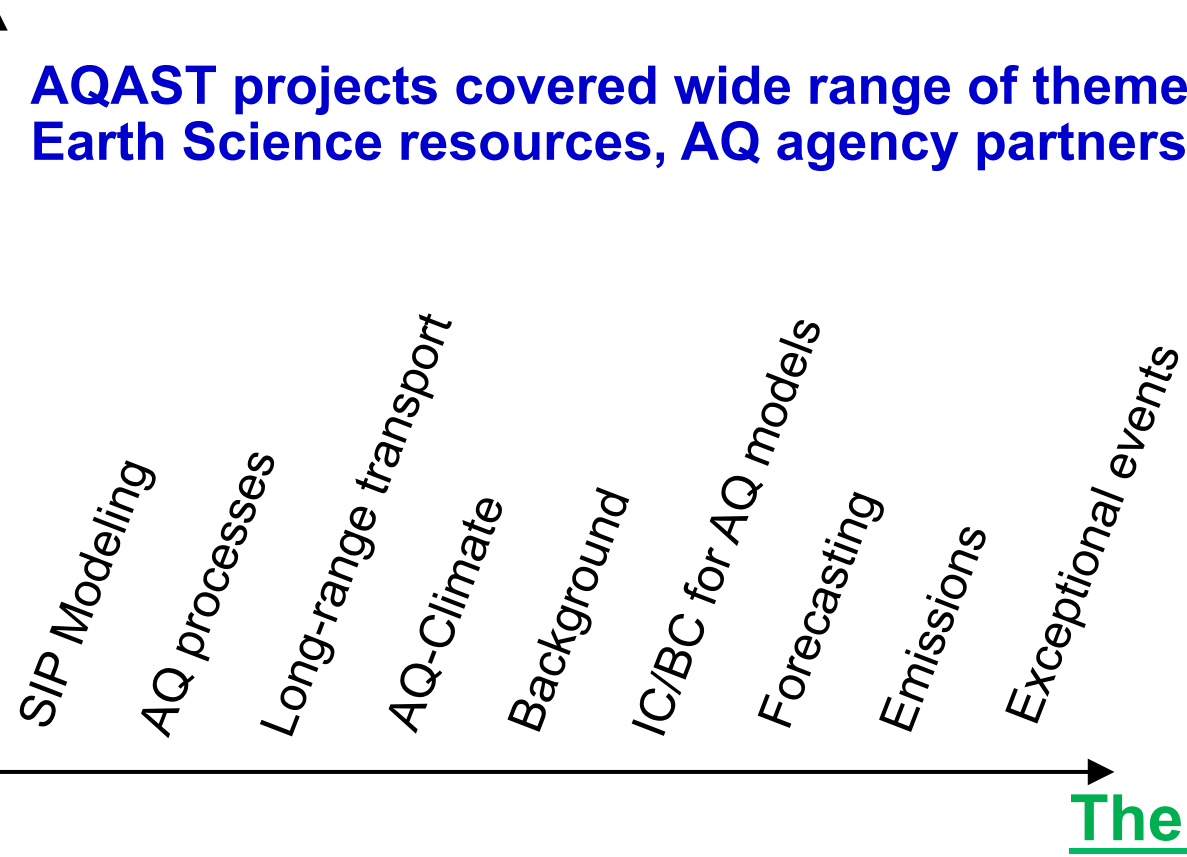
Local (6): BAAQMD, EWGAQAC, MBG, MCAQA, SCAQMD, SJVAPCD

States (16): CA, CO, CT, GA, IA, MD, ME, MI, NH, NV, NY, OK, TX, VA, WI, WY

Regional (9): CenSARA, EPA2, EPA5, EPA8, LADCO, MARAMA, NESCAUM, OTC, WRAP

National (5): BLM, EPA, NOAA, MPS, USDA

AQAST projects covered wide range of themes, Earth Science resources, AQ agency partners



Satellites: MODIS, MISR, MOPITT, AIRS, OMI, TES, GOES, GOME-2

Suborbital: ARCTAS, DISCOVER-AQ, ozonesondes, PANDORA

Models: MOZART, CAM, AM-3, GEOS-Chem, RAQMS, STEM, GISS, CMIP

Earth Science resource

Official AQAST Retrospective (aqast.org)

NASA Air Quality Applied Sciences Team

Earth Science Serving Air Quality Management Needs

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AQAST site search

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- Presentations
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AQAST10 meeting at Research Triangle Park, North Carolina, January 5-7, 2016: click to access presentations.

AQAST is a NASA Applied Sciences Team of atmospheric scientists working in partnership with US air quality managers to exploit the power of Earth Science tools to address air quality issues. We conduct a wide range of projects using satellite data, suborbital data, and models, and work with air quality agencies at the local, state, regional, and national level. We are eager to hear from air quality managers about new issues where we may help. Please contact AQAST leader Daniel Jacob to inquire and get more information.

Recent news

BUILDING THE AQAST LEGACY: A RETROSPECTIVE

Read this report to NASA on the 2011-2016 record of AQAST accomplishments, including surveys of air quality managers.

AQAST FOCUSES MEDIA ATTENTION ON GLOBAL EMISSION TRENDS.

AQAST members Russ Dickerson, Bryan Duncan, and Anne Thompson received considerable media attention at their December AGU press conference on global NO2 trends seen from space. See the articles from CNN and from the BBC.

TOP DOWNLOADED ENERGY & EARTH

Profound Thoughts?

- None from me, but here's a few of my pragmatic thoughts on AQAST:
  - AQAST succeeded! The team showed the value of satellite data to AQ managers for many of their applications, but the road was bumpy in the beginning.
  - Communications, communications, communications! From day-to-day interactions between AQAST members & AQ managers (i.e., building relationships) to review articles to press releases – all are necessary & all are important!
  - Advice to HAQAST Newbies
    - ✓ *You are in HAQAST to help Health & AQ managers.* This doesn't mean that publications aren't important.
    - ✓ *Form collaborations with HAQAST members* – learn from the diverse team!
    - ✓ *Step out of your comfort zone.*
  - Health & Air Quality Managers
    - ✓ *Take advantage of the diverse expertise of HAQAST. Don't be shy!*
    - ✓ *We look forward to continue working with AQAST AQ managers & new ones too!*
    - ✓ *We look forward to the opportunity to begin work with the health community!*
  - Advice to AQAST Alums
    - ✓ *The "T" in HAQAST is "Team".*
    - ✓ *Reach out to the HAQAST newbies.*