NASA Air Quality Applied Sciences Team
Quarterly Newsletter

March 2014 "Earth science serving air quality management needs"

Highlights:
AQAST7 Date & Location Set

The next AQAST meeting (AQAST7) will be held June 17-19, 2014 (Wednesday-Friday) at Harvard University in Cambridge, MA. The meeting is open to all, and AQ managers are particularly invited. Go to the **meeting website** for more information and to register. Indicate when you register if you would like to give a presentation. We look forward to seeing you in Cambridge in June!

Ozone Garden Featured on Public Radio

The Saint Louis University (SLU) Ozone Garden enjoyed its second year of successful education and outreach in 2013 under the guidance of AQAST member Jack Fishman. Coverage by St. Louis Public Radio can be found **here**. The 2013 status report is **here**.

AQAST6 recap & highlights

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The AQAST6 meeting at Rice University in January 2014 promoted an exciting exchange of information on advanced science for AQ managers. All presentations can be accessed **here**.

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EM Special Issue Features AQAST Work

Environmental Manager, the monthly magazine of the Air & Waste Management Association, devoted its February 2014 issue (**available here**) to AQAST activities in service of air quality management. The issue features an AQAST overview and six feature articles written by AQAST members. The feature article, led by AQAST Director Daniel Jacob of Harvard University, highlights the team's recent achievements including:

- Providing North American background ozone estimates for the US EPA's Integrated Science Assessment toward revision of federal ozone standards
- Partnering with the US National Park Service to quantify and attribute nitrogen deposition in national parks
- Development of a user-friendly tool called GLIMPSE that quantifies the climate applications of different air quality management options
- Development of the Wisconsin Horizontal Interpolation Program for Satellites (WHIPS) to process satellite data for model comparison
- Development of the Remote Sensing Information Gateway (RSIG) to download processed data in easy-to-read formats

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This photo depicts the DISCOVER-AQ aircraft during one of its multiple flights over the Houston-Galveston area during September 2013. The P3-B aircraft was equipped with a wide variety of air quality monitoring equipment to better understand Houston air quality and relate surface to satellite measurements.

AQAST6 Highlights

AQAST6 was held January 15-17 at Rice University in Houston. The meeting featured presentations by AQAST members and other scientists covering a range of applications of Earth Science data and models to air quality issues. A special session led by Principal Investigator Jim Crawford focused on early results from the DISCOVER-AQ aircraft campaign in Houston in September 2014 (read full story here).

A half-day air quality managers' session brought together representatives of air quality agencies and industry groups to discuss pressing air quality issues where AQAST could help. Specific issues included background ozone over Texas, **emissions from the oil/gas industry, and emissions from residential biofuel.**

AQAST Year 2 Tiger Teams reported on their progress and new Year 3 Tiger Teams were introduced. These Year 3 Tiger Teams focus on:

- Web-enabled tools for AQ management decision support
- Quantifying source contributions to interstate pollution episodes in eastern US
- Natural inputs for AQ models
- Using satellites to observe trends in US NOx emissions and related AQ
- Using satellites to observe emissions from oil/gas extraction
- AQ reanalysis (translating research to services)

All AQAST6 presentations can be found here.

<<Recently published

AQ User's Guide to Satellite Data

Duncan, B.N., et al., Satellite data for U.S. air quality applications: Examples of applications, summary of data end-user resources, answers to FAQs, and common mistakes to avoid,, submitted to *Atmospheric Environment*, February 2014. Article

Effect of climate change on wildfires

Yue, X., L.J. Mickley, and J.A. Logan, Projection of wildfire activity in southern California in the mid-21st century, in press, *Climate Dynamics*, 2014. Article

Interstate pollution transport in the Northeast

He, H., et al., An elevated reservoir of air pollutants over the Mid-Atlantic states during the 2011 DISCOVER-AQ campaign: Airborne measurements and numerical simulations, *Atmospheric Environment*, 85, 18-30, 2014. Article

NAQFC Evaluation

Chai, T., Kim, H.-C., Lee, P., Tong, D., Pan, L., Tang, Y., Huang, J., McQueen, J., Tsidulko, M., and Stajner, I.: Evaluation of the United States National Air Quality Forecast Capability experimental real-time predictions in 2010 using Air Quality System ozone and NO_2 measurements, *Geoscientific Model Development*, 6, 1831-1850, doi:10.5194/gmd-6-1831-2013, 2013. Article

Ozone inflow to California

Pfister, G., S. Walters, L.K. Emmons, and D.P. Edwards, Quantifying the contribution of inflow on surface ozone over California, *Journal of Geophysical Research*, 118, doi:10.1002/2013JD020336, 2013 Abstract

Secondary standard for ozone

Lapina, K., D. K. Henze, J. B. Milford, M. Huang, M. Lin, A. M. Fiore, G. Carmichael, G. G. Pfister, and K. Bowman, Assessment of source contributions to seasonal vegetative exposure to ozone in the U.S., *Journal of Geophysical Research: Atmospheres*, 119, doi:10.1002/2013JD020905, 2014. Article

GLIMPSE decision tool for climate and air quality

Akhtar, F. H., R. W. Pinder, D. H. Loughlin, and D. K. Henze, GLIMPSE: A rapid decision framework for energy and environmental policy, *Environmental Science & Technology*, 47, 12011-12019, doi:10.1021/es402283j, 2013. Article

US ammonia emissions

Paulot F., Jacob, D.J., Pinder R.W., Bash J.O., Travis, K., Henze D.K., Ammonia emissions in the United States, Europe, and China derived by high-resolution inversion of ammonium wet deposition data: Interpretation with a new agricultural emissions inventory (MASAGE_NH3), submitted to *Journal of Geophysical Research*, 2014. Article

Visit aqast.org for a full list of AQAST publications.

EM Special Issue Highlights

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In addition to the overview article, the *EM* special issue included six articles that focus on AQAST's engagement with air quality managers. The major themes of the articles include using satellites to quantify emissions for regulatory compliance and health studies, understanding the cause and effect of background ozone, and predicting future air quality trends and patterns. The articles display the wide spectrum of AQAST research, as well as the practical uses of satellite data to solve air quality problems.

Air Quality & Emissions Viewed from Space

AQAST member Yang Liu reported on using satellite data to quantify the exposure risk of humans to particulate matter in areas where there are few, if any, ground-level monitors. While the US has about 1,200 particulate matter monitors, they are located in just 30% of the nation's 3,100+ counties. Liu's use of a two-stage statistical model to predict surface particle concentrations in Georgia produced a detailed map of pollution levels that closely matched data retrieved from ground monitors in the area.

Further research is needed to fill data gaps left by clouds and bright surfaces that cause, on average, 40-50% data loss from satellite observations. Although the techniques Liu and other AQAST researchers are using are still in the early stages of development, they hold great potential for air quality managers.

AQAST members are developing new techniques to measure the contribution of power plant emissions to ground-level pollution. AQAST members David Streets, Bryan Duncan and colleagues aim to refine and manipulate satellite data in order to measure emissions from power plants for regulatory compliance. In quantifying emissions from power plants built after 2005 in China and India, researchers found a steady increase since the mid-2000's.

Predicting Air Quality

Tracking emissions from Asia's growing economic powers is also useful for policymaking activities in the US. Work done by AQAST members Arlene Fiore, Brad Pierce and Russell Dickerson, along with co-investigator Meiyun Lin, evaluates the cause of high ozone events measured by ground-level monitors. Their work attributes elevated background ozone levels to one of three specific sources; wildfires, stratospheric intrusions, and pollution originating from Asia. Stratospheric intrusions have been difficult to detect, but AQAST research found that thirteen such episodes contributed to high ozone levels in the western US during the summer of 2010.

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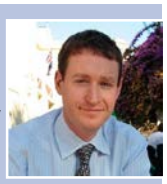
More AQtivities:



AQAST investigator **Scott Spak** led a Q&A session on Johnson County air quality, recent trends, and regulatory updates with the Joint Meeting of the Johnson County Boards of Directors and Public Health. Read more about Johnson County AQ issues at this website)

Dr. Spak also gave the following presentation at the Tallgrass Prairie & Oak Savanna Regional Fire Science Consortium in October 2013: **Beyond the Stability Index—Fire management & forecasting tools for air quality, weather & climate impacts of prescribed fires (**view the webinar **here**)

Early results from the new AQAST Tiger Team project on emissions from US oil & gas recovery activities (PI **Anne Thompson**) will be presented at the 2014 Midwest and Central States Air Quality Workshop in St. Louis on April 22-24, sponsored jointly by LADCO and CenSARA.

Registration information is at this website. Workshop agenda is on this website.

AQAST researchers use a variety of satellite instruments, including OMI and MODIS, to provide daily measurements of many species of air pollutants (image *EM*).

Story continues from page 3

Air quality managers can use these methods to support "exceptional event" claims by providing multiple lines of evidence showing that high ozone levels were outside of their control. AQAST's research into background ozone has also been used to support EPA's review of federal ozone standards that is scheduled for release in September.

There are many tools that air quality mangers can use to forecast ozone and particulate matter concentrations. One of the primary tools is the National Air Quality Forecasting Capability (NAQFC), which has benefited from improved computational horsepower, and more timely data availability from satellite instruments. Beyond the day-to-day forecasts of the NAQFC, AQAST members work to estimate the effects of climate change on air quality. Models suggest that warmer temperatures could reduce the frequency and strength of low-pressure systems, which serve as a natural ventilation system. As a result, there may be more high pollution events. In addition, the warmer, drier climate of the 2050's could increase in wildfires and lead to higher levels of particulate pollution in the western US.

Connecting with Air Quality Managers

Patrick Reddy of the Colorado Department of Public Health and Environment worked with AQAST authors to describe how satellite data informed ozone reduction policies in Colorado's Front Range. Assessing ozone formation in the Front Range region is difficult because of the sparse network of ground-based monitors. The lack of reliable monitoring data makes satellite observations valuable to air quality managers in the region. Reddy's satellite data analysis built on earlier work that he presented to the Colorado Air Pollution Control Board.

Looking Forward to Future Partnerships

AQAST's nineteen members are dedicated to high quality research across the wide spectrum of air quality and climate topics with the goal of providing new tools and support for local, regional, and federal air quality managers. All of these research efforts are described in *EM* magazine. The team hopes that this month's issue of *EM* will stimulate further cooperation among AQAST members and air quality stakeholders.

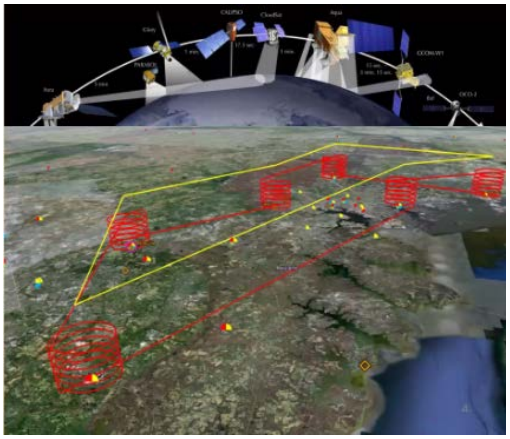
Read the full *EM* special issue **here**.

DISCOVER-AQ Special Session at AQAST6 Meeting

The image below shows a diagram of the DISCOVER-AQ project. The project combined measurements of various air pollutants at different altitudes in a P3-B aircraft, along with column measurements from satellites and ground-based monitors. The initial study results found that the CMAQ model generally performed well when compared against actual measurements. But CMAQ did not capture the effect of bay breezes that contributed to a high ozone event on September 25, 2013.

Researchers at Rice University and the University of Houston provided another unique perspective to the DISCOVER-AQ project. The research teams used a mobile air quality laboratory to measure pollution beneath the aircraft's flight path to determine the sources of emissions contributing to elevated pollution concentrations in the Houston area.

Read the full story **here**.



Next AQAST Biannual Meeting (AQAST7)

AQAST7 will be held June 17-19, 2014, at Harvard University in Cambridge, MA. Our host will be AQAST Leader **Daniel Jacob**. **Click here to register**!