NOAA Air Resources Laboratory
Quarterly Activity Report

(July – September 2008)

Contents

Highlights

1. Awards. Rick Jiang, was selected as NOAA's Team Member of the Month for September for his outstanding work managing ARL HQ's IT systems and for leading lab-wide IT efforts.

2. US Climate Reference Network (USCRN). With the August installation of the 114th USCRN site in Coos Bay, Oregon, the original deployment plan has been fulfilled. Effort will now focus on

measuring additional drought parameters, including relative humidity, soil temperature, and soil moisture. Expansion of the network in Alaska is also planned. mark.e.hall@noaa.gov

Air Resources Laboratory - Headquarters

3. Presentation to OAR Senior Research Council. A presentation to the NOAA OAR Senior Research Council was given September 23, 2008, regarding mercury in the environment. All of OAR was invited to the event, held at Mayorga Restaurant in downtown Silver Spring. The talk discussed the biogeochemical cycling of mercury and how this has changed since preindustrial times, the levels and factors influencing the concentrations of mercury in fish, health effects due to fish consumption, regulatory issues, and ARL atmospheric mercury research. A similar presentation was given at a Howard University Chemistry Department Seminar on October. mark.cohen@noaa.gov

4. Analysis of Atmospheric Mercury Episodes at Beltsville, MD, Grand Bay, MS, and Houston, TX. Mercury concentration events (e.g., "peaks") measured at three ARL speciated mercury measurement sites were analyzed using back-trajectory analyses. Regional meteorological data with 12-km resolution was used in all cases. Trajectories were imported into ArcView and mapped along with major mercury emissions sources. In most cases, the influence of local and/or regional emissions sources appeared to be responsible for the high concentrations of mercury observed. The Grand Bay and Beltsville analyses were conducted in preparation for a presentation at the NADP Fall meeting in Madison, WI, and the Houston analysis was carried out as part of a manuscript being prepared on ARL's Summer 2006 mercury measurements there. mark.cohen@noaa.gov, Winston Luke, Steve Brooks, Roland Draxler, Barbara Stunder and Richard Artz

5. Stratospheric Ozone Study. A paper entitled "Ground-based observations of slowdown in ozone decline and onset of ozone increase" by Jim Angell and Melissa Free was submitted to the Journal of Geophysical Research-Atmospheres in July. It uses Dobson and Brewer total-ozone data plus Umkehr and ozonesonde profiles to examine recent changes in stratospheric and total column ozone trends. melissa.free@noaa.gov

6. Comparison of Observed and Modeled Tropical Temperature Trends. A paper accepted by the International Journal of Climatology uses ARL's RATPAC radiosonde dataset, among others, to show that observed tropical temperature trends in the troposphere are not inconsistent with those in coupled general circulation models. "Consistency of Modelled and Observed Temperature Trends in the Tropical Troposphere" by B.D. Santer, P.W. Thorne, L. Haimberger, K.E. Taylor, T.M.L. Wigley, J.R. Lanzante, S. Solomon, M. Free, P.J. Gleckler, P.D. Jones, T.R. Karl, S.A. Klein, C. Mears, D. Nychka, G.A. Schmidt, S.C. Sherwood, and F.J. Wentz is a response to a paper by Douglass and others that claimed basic inconsistency between the models and data. melissa.free@noaa.gov

7. ARL Seminar: ENSO and Stratospheric Temperatures. On August 6, Melissa Free gave an ARL seminar on the effects of ENSO on stratospheric temperatures. The preliminary results using radiosonde temperature records show significant cooling in the tropical stratosphere and warming in the Arctic near the tropopause in response to ENSO events. melissa.free@noaa.gov

8. ARL Summer Student Intern. Kun Li returned to ARL for his second summer. After working as an unpaid intern in 2007, he is now in a STEP (Student Temporary Employment Program) position. He will be continuing work on the global climatology and variability of the planetary boundary layer with Dian Seidel, and working with Melissa Free on retrievals on layer-mean temperature from radiosonde data for the continuation of trends monitoring by Jim Angell. He is also helping to scan and digitize the complete library of ARL Technical Reports, Technical Memoranda, and Data Reports, currently only available in paper form; some as single copies. Kun graduated in June 2008 from the Montgomery Blair High School Science, Math and Computer Science Magnet Program and will be attending the Honors Program at the University of Maryland, College Park, this fall. Kun received a Cash-In-Your-Account award for his excellence in obtaining and preparing nonstandard data sets, despite prior lack of experience dealing with the data and tools. dian.seidel@noaa.gov

9. PBL Proposal. A proposal was submitted to the NOAA Climate Program Office's Climate Change Data and Detection element. The proposal addresses the "Global Climatology and Variability of the Planetary Boundary Layer" and is a collaborative effort with Chi Ao (NASA Jet Propulsion Laboratory), Ray Bradley (University of Massachusetts, Amherst) and Imke Durre (NOAA National Climatic Data Center). dian.seidel@noaa.gov

10. Climate Change Educator Conference. On July 23, 2008, Dian Seidel participated in a panel discussion at the "Climate Change Educator Conference: Earth Then, Earth Now, Our Changing Climate," held in the NOAA auditorium and sponsored by Sally Ride Science. The conference was designed to help educators teach today's hottest topic and learn how to integrate the science of Earth's changing climate into their classrooms. It explored how Earth has changed in the 25 years since Dr. Ride first viewed it from above. Over 200 teachers attended the 1.5 day event. Frank Neipold, Climate Education Coordinator in the NOAA Climate Program Office, coordinated and moderated the panel, which included scientists from U.S. Forest Service and NASA. Further details about the conference are at http://www.sallyridescience.com/for_educators/conferences/climate dian.seidel@noaa.gov

11. GRUAN Paper Accepted. A manuscript describing the GCOS (Global Climate Observing System) Reference Upper Air Network (GRUAN) was accepted for publication in the Bulletin of the American Meteorological Society.

Seidel, D. J., F.H. Berger, H. Diamond, J. Dykema, D. Goodrich, F. Immler, W. Murray, T. Peterson, D. Sisterson, M. Sommer, P. Thorne, H. Vömel, J. Wang. Reference upper-air observations for climate: Rationale, progress, and plans. *Bull. Amer. Meteorol. Soc.* dian.seidel@noaa.gov

Atmospheric Turbulence and Diffusion Division

12. Atmospheric Mercury. S. Brooks and D. Lew have generated monthly maps of estimated mercury deposition for the ice caps of Greenland and Antarctica using a chemical model based on observed mercury oxidation rates at many polar locations. Data indicate oxidation of Hg^o in the polar atmosphere by atomic bromine. The controls are the photodissociation of Br_2, and the lifetime of the radical, HgBr, against thermal dissociation. At Summit Greenland, for example, mercury

oxidation and deposition requires a solar elevation angle greater than 5^{o} in air colder than -15^{o}C. An invited abstract: "Temperature and sunlight controls on mercury oxidation and deposition atop the Greenland Ice cap" was submitted to the polar session of International Conference on Mercury as a Global Pollutant (ICMGP) meeting in China in June 2009.

Mercury species in polluted urban air were sampled in Houston, Texas, by ARL scientists S. Brooks, W. Luke, M. Cohen, and P. Kelley. Near-surface concentrations of gaseous elemental and particulate-bound mercury were elevated in shallow nocturnal boundary layers, while reactive gaseous mercury concentrations were elevated in midday convective conditions. Notably, mercury in the Houston area appears from these measurements to arise from a source other than combustion. A paper: "Mercury species measured atop the Moody Tower TRAMP site, Houston, Texas" has been submitted to the guest editors of a special issue of *Atmospheric Environment* detailing the Radical and Aerosol Measurement Program (TRAMP) of the Texas Air Quality Study II (TexAQS II) steve.brooks@noaa.gov

13. USDA Ammonia Flux Experiment. The QA/QC of the data set from the third phase (July 2007) of the USDA Ammonia Flux Experiment was completed by L. Myles, M. Heuer, and T. Meyers. Atmospheric ammonia fluxes were determined using a gradient system and annular denuders over a mature maize crop in North Carolina. The data set was submitted to the US EPA for incorporation into a collaborative research manuscript. latoya.myles@noaa.gov

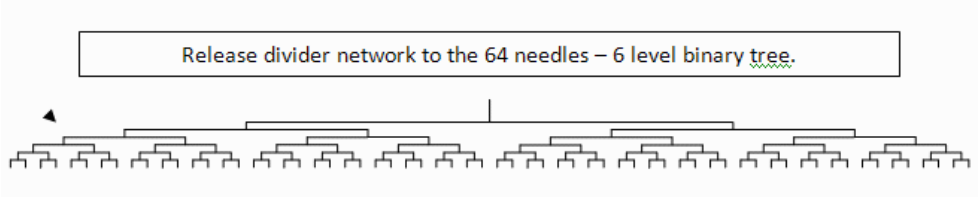
14. Earth Science Women's Network. LaToya Myles was selected to participate in the first Career Workshop of the Earth Science Women's Network. The workshop, which will be held in December 2008 (www.joss.ucar.edu/joss_psg/meetings/Meetings_2008/eswn_workshop/index.html) is designed to build leadership skills that will contribute to the success and advancement of women in scientific organizations. latoya.myles@noaa.gov

Field Research Division

15. Research Barrier Tracer Study. The Field Research Division is preparing to conduct a roadside barrier tracer study sponsored by the U.S. Environmental Protection Agency (EPA). The purpose of this project is to quantify the effects of roadside barriers on the downwind dispersion of atmospheric pollutants emitted by roadway sources, e.g., vehicular transport. The current AMS/EPA Regulatory Model AERMOD performs well for modeling vehicle pollutants but does not take into account sound barriers near roadways that may increase pollutant concentrations and pose increased health problems to surrounding neighborhoods. To test this theory, a mock sound barrier 6m in height and 90m in length, constructed of 300 1-ton straw bales, has been built at the Grid 3 facility on the INL (Fig. 1). Pollutant transport and dispersion will be measured in field tests using the atmospheric tracer sulfur

hexafluoride (SF6) tracer as a pollutant surrogate. The turbulence field driving the dispersion will also be measured with fast-response high-fidelity sonic anemometers. The experiments will be conducted in October over a range of atmospheric conditions.

A tracer release line 56m in length will disseminate the SF6 tracer upwind of the mock sound barrier. The line will be constructed from polyurethane and latex tubing. Flow metering orifices will regulate the flow from the tubing to the atmosphere and will act as the actual tracer dissemination devices. The metering orifices will be made from 64 small hypodermic needles (31 gage). To deliver equal pressure to each metering orifice, a 6-level binary tree network (Fig. 2) will be used to divide the flow to each of the 64 hypodermic needles. Creating a binary tree for the release system makes the line resistance, distance, and pressure drop equal at each of the 64 release points.



A downwind sampling grid of 58 bag samplers and a mobile real-time analyzer will measure the dispersion characteristics of the mock sound barrier up to 180m downwind. A nearby grid, identical to the grid described above will be set up to monitor unmodified dispersion characteristics. Comparison of data from the two grids will show the effects of the roadside barrier.

A Quality Assurance Project Plan for the project was completed and accepted by the EPA in September. The real-time analyzers, gas chromatographs, samplers, cartridges, and sonic anemometers have all undergone pre-study conditioning and quality control testing and should be ready for the first practice test on October 1st. kirk.clawson@noaa.gov and staff

16. Fast Response Analyzer Data System Upgrade. The upgraded data system is complete, installed, tested, and will be used on the Roadside Barrier Tracer Study.

17. Low Cost Tracer Detector. The semipermeable membrane was received on July 25 during the preparations for the Roadside Barrier Tracer Study. This allowed very little time for working with the membrane. A few days of testing was conducted on the membrane to determine its water and oxygen separation capabilities, but it has not yet been used with the new detector. roger.carter@noaa.gov, and Shane Beard

Special Operations and Research Division

18. IMPROVE Project - NASA. Participated in a meeting with National Park Service (NPS) and NASA staff in Ft. Collins, CO on July 23 to discuss the possibility of NASA funded projects to demonstrate the utility of satellite and ground-based remote sensing to supplement IMPROVE visibility monitoring for remote areas sites. NASA is encouraging applications to a research grant

program managed by their Earth Science Division, Science Mission Directorate for projects that may develop long-term uses for satellite air quality observations. Subsequent to this meeting several proposals were submitted to NASA by university and non-profit research groups associated with IMPROVE. marc.pitchford@noaa.gov

19. IMPROVE Project – Environment Canada. Participated (one of two US participants) in the Visibility Monitoring Workshop, sponsored by Environment Canada (EC) in Vancouver B.C. on July 3rd and 4th, 2008. The workshop was one of several activities by EC to provide the knowledge base for planning a possible Canadian visibility protection policy. EC interest and motivations include the provisions of the Canada-US Air Quality Accord that recognize the importance of "...protecting visibility for international parks national, state and provincial parks and wilderness areas" and requires Canada to "...develop and implement means affording levels of prevention of significant air quality deterioration and protection of visibility...with respect to sources that could cause significant transboundary air pollutions." Development of a visibility protection policy similar to the U.S. would be consistent with the Canada-wide Standards for PM that calls for continuous Improvement and keeping clean areas clean. There is also interest in urban area visibility protection in Canada. A planning goal for a Canadian visibility monitoring programs is data comparability with the U.S. IMPROVE visibility monitoring network. Towards that end, EC has expressed interest in having an IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring site in the Canadian Rocky Mountains. On behalf of the IMPROVE Steering Committee that he chairs, Dr. Pitchford offered to work with EC towards that goal. marc.pitchford@noaa.gov

20. Consequence Assessment. Continued training on the Department of Energy (DOE), National Nuclear Security Administration (NNSA), National Security Technologies, LLC, consequence assessment procedures and methods for the Nevada Site Office (NSO) and Nevada Test Site (NTS). The training included radiological and chemical scenarios that require event classification, protective action recommendations, dispersion model predictions, and graphical product development for health physicists, industrial hygienists, incident commanders, safety advisors, and emergency managers. In addition, participation in meetings, tabletop drills, and venue-specific drills continued. Testing on Consequence Assessment Team (CAT) procedures and activities occurred and SORD will receive responsibility of the CAT function on 1 Oct 2009. walter.w.schalk@noaa.gov

21. Air Permit Modeling. Air permit modeling support to NNSA/NSO for the NTS was completed. AERMOD was run with PM_{10}, SO_2, CO, NOx, and VOC NTS source terms. The Open Burn/Open detonation Model (OBODM) was run for explosive sources. Meteorological inputs were developed and NTS source term information used. kip.smith@noaa.gov

22. Test-Readiness/Sub-Critical Tests. Final planning meeting was held, and exercise weather graphics were generated to support the Under Ground nuclear Testing Tabletop Exercise held in September. The exercise weather was briefed to the player participants during play. UGT Support Staff attended the exercise. walter.w.schalk@noaa.gov