



NOAA Air Resources Laboratory Quarterly Activity Report

(October – December 2009)

Contents

Highlights

1. *OAR Photo Content Award*
2. *EPA Roadside Sound Barrier Tracer Study*

Air Resources Laboratory - Headquarters

3. *International Aerosol Modeling Algorithms Conference*
4. *NRC Postdoctoral Associate Investigating the Climatology of Surface Based Inversions*
5. *Global Planetary Boundary Layer Climatology Study*

Atmospheric Turbulence and Diffusion Division

6. *Climate Reference Network (CRN)*
7. *Air Quality*
8. *Weather Research and Forecast Model (WRF)*
9. *Outreach*

Field Research Division

10. *ET Probe*
11. *Weather In-Situ Deployment Optimization Method (WISDOM)*
12. *U.S. Historical Climatological Network – Modernization (HCN-M)*

Special Operations and Research Division

13. *Urban Visibility Assessment*
14. *Particulate Matter National Ambient Air Quality Standards (PM NAAQS)*
15. *Rocky Mountain Atmospheric Nitrogen and Sulfur (RoMANS) Study*
16. *Interagency Monitoring of Protected Visual Environments (IMPROVE) Canada*
17. *Southern Methodist University Study Radiosonde Balloon Releases*

Highlights

1. *OAR Photo Contest Award.* Tony Hamby, from ARL/ATDD, won 1st Place in the NOAA Researchers at Work category for his photo of researchers at the Climate Reference Network Marshall Test Site near Boulder, CO, in January 2009. Congratulations Tony!



2. EPA Roadside Sound Barrier Tracer Study. The paper “Tracer studies to characterize the effects of roadside noise barriers on near-road pollutant dispersion under varying atmospheric stability conditions” was published by *Atmospheric Environment* online in November. It will appear in print in early 2010. The paper has generated considerable public interest. FRD staff conducted extended phone interviews with newspaper transportation reporters from the Bergen Record (northern New Jersey) and the Boston Globe and stories appeared in each of these newspapers. The story was also picked up by the Baltimore Sun and a Canadian wire service. An additional phone interview was conducted with the host of a live radio science show produced by Univision in Puerto Rico on December 30th. The broadcast was in Spanish with the host providing interpretation. dennis.finn@noaa.gov

As a follow-on to the field study conducted in Idaho last year, a small study of vehicle-induced turbulence began in November. A team from FRD installed a series of four sonic anemometers in a road cut along a busy section of Interstate 15 in Las Vegas, NV. Steve Perry and Vlad Isakov from the EPA, former colleagues from NOAA’s ASMD, assisted with the installation. The anemometers will remain in place for several weeks of data collection. kirk.clawson@noaa.gov and Tom Strong

Air Resources Laboratory – Headquarters

3. International Aerosol Modeling Algorithms Conference. Drs. Daewon Byun, Pius Lee, and Rick Saylor attended the International Aerosol Modeling Algorithms (IAMA) Conference on December 9-11, at the University of California at Davis. Dr. Byun moderated a session on Real-Time Forecasting and presented a talk during the session on ARL’s research efforts to improve NOAA’s Air Quality Forecasting system. rick.saylor@noaa.gov

4. NRC Postdoctoral Associate Investigating the Climatology of Surface Based Inversions. Dr. Yehui (Ally) Zhang is a National Research Council Postdoctoral Associate in ARL’s Climate Variability and Change Analysis group. A recent graduate of Wuhan University in China with degrees in Electronic Engineering and Space Physics, she is developing a global climatology of the stable planetary boundary by analysis of surface-based inversions in radiosonde data. Collaborative efforts with scientist at NOAA/Geophysical Fluid Dynamics Lab and at the National Center for Atmospheric Research will involve comparisons of observations of Arctic inversions with climate model simulations. dian.seidel@noaa.gov

5. Global Planetary Boundary Layer Climatology Study. A paper on a “Comparison of methods for estimating planetary boundary layer height from radiosonde temperature, humidity, and refractivity profiles” by D.J. Seidel, C.O. Ao, and K. Li was submitted to *JGR Atmospheres* in December 2009. This study examines seven methods for identifying the top of the boundary layer and finds significant differences among them. The findings form the basis for recommending approaches for developing several global boundary layer climatologies for different purposes. Results were presented as an ARL Seminar and at the Fourth FORMOSAT-3/COSMIC Data Users Workshop in October 2009 in Boulder, and will be presented at the AMS Annual Meeting in January 2010. dian.seidel@noaa.gov

Atmospheric Turbulence and Diffusion Division

6. Climate Reference Network (CRN). Sites of the CRN need to be separated from surfaces artificially altered, say by extensive paving or irrigation, from those characteristic of the general region. In collaboration with the University of Tennessee Space Institute (UTSI) in Tullahoma, ATDD is planning to make airborne surveys of radiometric surface temperatures within 5 km of CRN sites. A Piper Navajo airplane has been instrumented with a variety of radiation sensors in infrared (IR) and visible wavelengths, including an IR temperature sensor and a laser altimeter. The IR sensor’s calibration at ATDD shows error within ± 0.1 C between -10 C and +60 C. Preliminary flights will be made in eight-

lobe asterisk patterns over the Chestnut Ridge Environmental Study Site near Oak Ridge, and the CRN site at Crossville, TN. The patterns will first be flown at 600 m above ground and will be repeated in 150-m steps down to 150 m (500 ft) above ground. ed.dumas@noaa.gov

7. Air Quality. ATDD's participation in the air quality aspects of California's Research at the Nexus of Air Quality and Climate (CalNex2010) will focus on ammonia concentration and deposition. The site in the southern San Joaquin Valley is still under negotiation, but the utility of multiple techniques and instruments for measuring air-surface exchange of ammonia will be tested next quarter in the Atmospheric Ammonia Deposition (ADAM) Study in collaboration with the University of Tennessee's Plant-Science Department. Crops will be fertilized with urea, known to produce significant atmospheric emissions of ammonia. The atmospheric consequences of these will be sampled in real time using wavelength-scanned cavity ringdown spectroscopy and ion mobility spectrometry. More traditional post-analyzed methods of relaxed eddy accumulation and of annular-denuder sampling at two heights will be deployed as references. latoya.myles@noaa.gov

Surrogate-surface mercury samplers promise monitoring of dry deposition of atmospheric mercury to acceptable accuracy at a tiny fraction of the cost of concentration-gradient or Bowen-Ratio methods, which require expensive equipment and extensive human intervention. Such samplers are commercially available, but these are awkward to handle. Petrolatum is required to seal units against rain contamination. It can be imperfectly applied, allowing leakage, or can itself become a contaminant. A modification sealed by gasket was fabricated at ATDD and tested alongside the commercial product and the more expensive multiple-species analyzers. The modified units were found to be indistinguishable from the commercial units and gave acceptably similar deposition to that measured by the more complex instrumentation. The ground is laid for extensive deployment of a relatively coarse, but far simpler mercury monitoring network. steve.brooks@noaa.gov

8. Weather Research and Forecast Model (WRF). The operational utility of the Weather Research and Forecast Model to emergency responders in East Tennessee's particular landscape is being tested using a 2-year archive of data, analysis, and forecasts from ATDD's mesoscale network and their baseline implementation of WRF. Prominent features in the region are the large flat valley and the long ridges that corrugate the valley's floor. Preliminary analysis of the archive focused on 09 Z (4 AM local), a time of day when the flow is particularly difficult to simulate. WRF showed fairly good skill when the flow aloft is sufficient to influence the flow in the valley. Not surprisingly, trouble came when drainage in the valley ruled. The inability of WRF to resolve the corrugations on the valley floor was a clear contributor, but not the only one, to this trouble. ron.dobosy@noaa.gov

9. Outreach. Communicating science meaningfully to the general public amid all the oversimplification and misunderstanding is increasingly recognized as a fundamental part of the practice. LaToya Myles participated in a workshop, "Communicating Science: Tools for Scientists and Engineers" at the Geophysical Fluid Dynamics Laboratory in Princeton, NJ cosponsored by NOAA and the American Association for the Advancement of Science. latoya.myles@noaa.gov

Field Research Division

10. ET Probe. The 2009 field deployments for the Extreme Turbulence (ET) probes ended in early December. This was the first time the probes have been deployed in a marine environment over an extended period of time. Although the 2009 hurricane season was quiet, the deployments still provided much useful information on keeping the probes running over extended periods in a harsh environment. One probe was deployed at the end of a 560 m pier in Duck, NC operated by the U.S. Army Corps of Engineers. This probe operated throughout the deployment period albeit with some gaps in the data. The largest gap occurred when a solder joint failed on a wire connector. Overall, the probe at Duck collected

over 20 gigabytes of raw data. The highest observed wind speeds were associated with extratropical lows moving up the Atlantic Coast.

A second ET probe was deployed in the Florida Keys at Tennessee Reef. This deployment was a last-minute addition organized very quickly in September, and it ended up being less successful. The main problem was that the location was only accessible by boat, so we had to rely on a person at the Keys Marine Laboratory for transportation to the site, power, and servicing. This person underestimated the effort required and ran into problems due to a serious breakdown of his boat. In addition, this site had a large bird population that quickly coated the probe with feces that plugged some of the pressure ports. Nonetheless, the deployment was a learning experience that will lead to modifications of the probe design, including the installation of spikes to deter birds from landing on the top of the probe. richard.eckman@noaa.gov, Roger Carter, Tom Strong, Shane Beard, and Randy Johnson

11. Weather In-Situ Deployment Optimization Method (WISDOM). Randy Johnson, Shane Beard, and Kirk Clawson completed a 4-week deployment in the Azores, in Dakar, Senegal, and in Bermuda, respectively, in support of the 2009 field campaign. Unfortunately there was very little tropical storm development in the tropical Atlantic during deployment. Tropical Depression 8 (25-26 September), Tropical Storm Grace (4-6 October), and Tropical Storm Henri (6-8 October) were the only systems of note. However, the team successfully launched a total of 30 balloons: 7 from the Azores, 6 from Bermuda, and 17 from Dakar, Senegal. One of the balloons launched from the Azores on 05 October traveled over Paris, France, then Moscow, Russia, and was last observed near Tashkent, Kyrgyzstan. A balloon launched from Bermuda on 04 October traveled over Morocco, then Rome, Italy, and was last observed over Pakistan. Several balloons launched from Senegal traveled west across the Atlantic Ocean and were last observed over northern South America.

The launch equipment used in the Azores, Bermuda and Dakar for the WISDOM project has been returned to the NOAA Lab in Boulder, Colorado. All of the WISDOM Balloon Launch Reports, created for each launch by the three deployed FRD personnel, have been sent to Tim Lachenmeier at Near Space Corporation in Tillimook, Oregon for further analysis. kirk.clawson@noaa.gov, Randy Johnson, and Shane Beard

12. U.S. Historical Climatological Network – Modernization. FRD has been tasked to help with the quality control of the new Historical Climate Network – Modernization (HCN-M) program. The HCN-M, which is designed to measure regional climate trends in temperature and precipitation, complements the U.S. Climate Reference Network which measures national trends. . Currently there are 33 stations located across Alabama and the Southwest United States.

A number of new products have been developed to assist with FRD's efforts to provide quality control of the data and determine instrument malfunctions. These new products have been placed on a newly created web site located at <http://www.noaa.inel.gov/crn/crn.htm>. One new product is a daily contour map of maximum and minimum air temperature and precipitation. The contour maps show a bull's-eye where there could be possible instrumentation problems. Another new product combines all of the hourly flag files into a single file which makes it easier to find recurring problems. A third product is a map of all the daily flags. This map is a visual representation of all problem stations and will be used to plan maintenance trips. A fourth product is a time history plot of flag occurrences for each station. All of these products are reviewed daily in order to find instrumentation problems, which are reported as they occur to the ATDD Supervisory Engineer so that the problem can be fixed. A summary of instrumentation problems together with a report of newly created products are submitted monthly. Overall, the stations are performing rather well. jason.rich@noaa.gov and Neil Hukari

Special Operations and Research Division

13. Urban Visibility Assessment. Marc Pitchford attended the Environmental Protection Agency (EPA) Clean Air Science Advisory Committee (CASAC) meeting at Research Triangle Park, NC in October. CASAC provided feedback on their review of documents supporting the EPA particulate matter national ambient air quality standard review. Marc is a principal author of the visibility effects sections of the second review draft Integrated Science Assessment (ISA), the first review draft of the Urban Focused Visibility Assessment (UFVA), and the visibility sections of the preliminary draft Policy Assessment. Marc interacted with the CASAC to ensure that their comments and suggestions were understood so they could be reflected in the revised documents. Overall, the CASAC comments were positive and supportive. In addition, Marc participated in conference calls with the CASAC to discuss the preparation of first draft final comments. A second review draft of the ISA and UFVA documents were prepared at the end of CY 2009 and the Policy Assessment will be completed early next calendar year. The current version of these documents is available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html. marc.pitchford@noaa.gov

14. Particulate Matter National Ambient Air Quality Standards (PM NAAQS). Marc Pitchford is working with the EPA on the inclusion of optical monitoring instrumentation in an on-going field study in Cleveland, OH. Specifically they want to add ambient temperature/humidity measurements of light scattering using nephelometers for the last 12 months of the field study, and a newly developed combination nephelometer and photoacoustic absorption spectrometer. These and other instruments are being considered for use in conjunction with the possible new secondary national ambient air quality standard that may result from EPA's PM NAAQS review. marc.pitchford@noaa.gov

15. Rocky Mountain Atmospheric Nitrogen and Sulfur (RoMANS) Study. The peer review report for the National Park Service-sponsored ROMANS study final report was completed. The report concluded that the study participants satisfactorily addressed all of the comments of the three peer reviewers and that the final report provides a high quality, objective and credible assessment of the sources and characteristics of nitrogen and sulfur deposition at Rocky Mountain National Park. marc.pitchford@noaa.gov

16. Interagency Monitoring of Protected Visual Environments (IMPROVE) Canada. Marc Pitchford continued email communications to foster direct talks between the lawyers at DOC and Environment Canada (EC) regarding the proposed EC - NOAA Agreement to fund operations of an Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring site in western Canada. The Memorandum of Understanding (MOU) is in legal review with Environmental Canada. The goal was to finalize the agreement by the end of CY 2009 in order to begin monitoring early next year. The progress of the MOU will be monitored and encouraged. marc.pitchford@noaa.gov and karen.balecha@noaa.gov

17. Southern Methodist University Study Radiosonde Balloon Releases. Ray Dennis, Rick Lantrip, James Wood, and Walt Schalk met with Southern Methodist University (SMU) principle investigator Dr. Paul Golden and field technicians to discuss and finalize plans for upper-air data balloon releases in support of a SMU study. Critical communication issues were resolved (decided to use satellite phones). Working with the SMU principal investigator, remote release locations were identified. A new SORD single-person balloon inflation/release technique was developed to be used in windy situations using a standard pick-up truck. An Operations Plan was developed, supplies were acquired, and Ray Dennis, James Wood, and Rick Lantrip tested and improved procedures for single-person radiosonde balloon launches. The idea was developed from researching NSSL techniques and then considered one-man operation, portability, ease of operation, available resources, and poor soil (ground staking and holding) conditions.

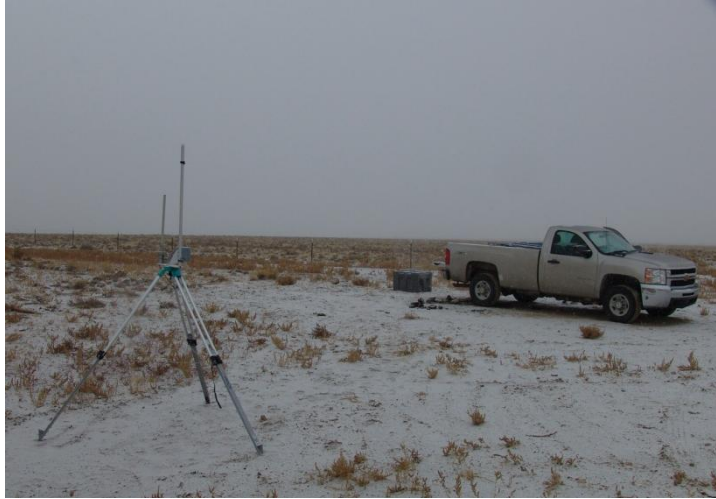


Figure 1. Remote balloon launch site 60 miles east of Tonopah, NV. James Wood worked out of the pickup using the Vaisala Digicora Upper-air sounding system with a 600 gram balloon and a Vaisala RS-92 radiosonde. Cold Day 3.

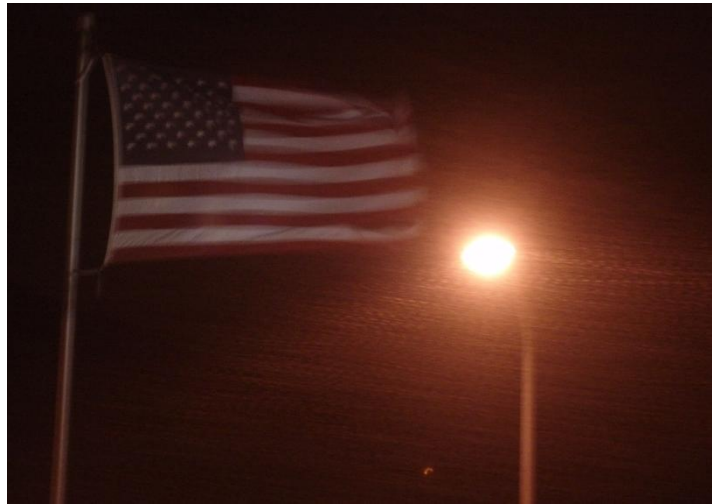


Figure 2. Photo is showing the streaks of horizontal snow on Night 1 in Tonopah, NV.

Rick Lantrip and James Wood successfully released radiosonde balloons and collected upper-air data in support of experiments being conducted by the Southern Methodist University. Dealing with snow storms and cold temperatures, two one-man Met Tech “teams” were deployed to two different locations east and west of Tonopah, NV. Feedback from SMU has been very positive. Data from the balloon releases were combined, reviewed, and distributed to the principle investigator. Lessons learned and improvements from this event were discussed and an implementation plan will be developed for the next support mission next year. walter.w.schalk@noaa.gov, James Wood, Rick Lantrip, and Raymond Dennis.