



NOAA Air Resources Laboratory Quarterly Activity Report

(January – March 2010)

Contents

Highlights

1. *NOAA Distinguished Career Award*
2. *Wildfire Smoke Forecasting*

Air Resources Laboratory - Headquarters

3. *Analysis of the Climatology of the Polar Planetary Boundary Layer*
4. *Satellite/Radiosonde Comparison Study*
5. *Boundary Layer Climatology Study*
6. *Progress on GCOS (Global Climate Observing System) Reference Upper Air Network (GRUAN)*
7. *HYSPLIT Updated on ARL Server*
8. *READY Updates*

Atmospheric Turbulence and Diffusion Division

9. *Climate Reference Network (CRN) and Historical Climatology Network's Modernization (HCN/M)*
10. *Collaboration with Harvard University*
11. *Atmospheric Mercury*
12. *Collaboration with Jackson-State University, Mississippi*
13. *Tennessee Science Olympiad*

Field Research Division

14. *ET Probe*
15. *WISDOM/Cheaperclipper*
16. *U.S. Historical Climatological Network – Modernization*
17. *HCN-M AMV Training*
18. *EPA Roadside Sound Barrier Tracer Study*
19. *JU03 Urban Plume Dispersion*
20. *Miscellaneous*

Special Operations and Research Division

21. *Urban Visibility Assessment*
22. *Particulate Matter National Ambient Air Quality Standards (PM NAAQS)*
23. *National Park Service*
24. *DOE Meteorological Coordinating Council (DMCC)*

Highlights

1. *NOAA Distinguished Career Award.* Congratulations to Maureen McMahon for receiving the NOAA Distinguished Career Award for exemplary, sustained and broad administrative support for the Air Resources Lab while also setting high standards for professionalism and courtesy.

2. *Wildfire Smoke Forecasting.* In March of 2007, the National Weather Service transitioned into operations a wildfire smoke forecasting capability for the Continental United States that was developed at

ARL in collaboration with the National Environmental Satellite, Data, and Information Service (NESDIS) and the National Weather Service (NWS). Smoke forecasts are produced with the ARL HYSPLIT model, which is preconfigured to run over the entire country once a day to produce a 24-hour analysis and a 48-hour forecast with the NOAA NCEP NAM/WRF 12 km meteorological forecast data. In September 2009, a separate smoke forecast capability for Alaska was also transitioned into NWS operations after extensive testing during the summers of 2008 and 2009. In February 2010, the smoke forecasting capability was expanded with a successful implementation of an operational smoke forecast for Hawaii. Smoke forecasts and verification information can be accessed from the following two web sites: ARL: <http://ready.arl.noaa.gov/smoke.php> NWS: (<http://www.weather.gov/aq/>) glenn.rolph@noaa.gov, roland.draxler@noaa.gov

Air Resources Laboratory – Headquarters

3. Analysis of the Climatology of the Polar Planetary Boundary Layer. For the first time, an analysis of the climatology of surface-based temperature inversions in the polar regions of both hemispheres has been made. Surface-based inversions are a frequent feature of the Arctic and Antarctic atmosphere, particularly in winter, at nighttime and in the inland areas. Because they are stable and inhibit exchanges of energy, moisture and pollutants between the surface and free-troposphere, they likely affect climate feedback processes involving clouds and ice and thus climate sensitivity to anthropogenic changes. Working with Dian Seidel (ARL HQ) and collaborators from NOAA's Geophysical Fluid Dynamics Laboratory and from the National Center for Atmospheric Research, Dr. Yehui (Ally) Zhang has analyzed several key characteristics of surface-based temperature inversions, including their frequency of occurrence, intensity and depth. Observational results from several decades of radiosonde data are being compared with simulations of the polar boundary layer in two state-of-the-art climate models (from NCAR and GFDL) and with depictions of the boundary layer in reanalyses. While some aspects of surface-based inversion climatology are well-captured by the models, some biases are also revealed. Dr. Zhang is a 2009 graduate of Wuhan University in China and is currently a National Research Council Postdoctoral Associate at ARL HQ. This study is part of a more comprehensive project exploring various aspects of the global climatology of the planetary boundary layer. dian.seidel@noaa.gov; ally.zhang@noaa.gov

4. Satellite/Radiosonde Comparison Study. A paper on "Comparing radiosonde and COSMIC atmospheric profiles data to quantify differences among radiosonde types and the effects of imperfect collocation on comparison statistics" was submitted for internal ARL and NESDIS review. The collaborative study by Bomin Sun (NESDIS), Anthony Reale (NESDIS), Dian Seidel (ARL), and Douglas Hunt (NCAR) quantifies biases in radiosonde temperature, humidity and (calculated) refractivity profiles and develops a methodology for estimating uncertainties in comparisons between satellite observations and in situ soundings, due to imperfect space and time matching. dian.seidel@noaa.gov

5. Boundary Layer Climatology Study. First results from our project to study the climatology and variability of the global planetary boundary layer (PBL) have been reported in a paper recently accepted by the *J. Geophys. Res. - Atmospheres*. The study entitled "Estimating climatological planetary boundary layer heights from radiosonde observations: Comparison of methods and uncertainty analysis" lays the groundwork for development of a global climatology of the PBL by exploring different methods of defining PBL height and quantifying uncertainties in climatological estimates. Co-authors are Dian Seidel (Air Resources Laboratory), Chi Ao (Jet Propulsion Laboratory, California Institute of Technology) and former ARL summer intern Kun Li (now at University of Maryland). dian.seidel@noaa.gov

6. Progress on GCOS (Global Climate Observing System) Reference Upper Air Network (GRUAN). The 2nd Implementation and Coordination Meeting for GRUAN was held at the Payerne (Switzerland)

Observatory in March 2010. Dian Seidel presented the work of the GRUAN Analysis Team for Network Design and Operations Research, an informal international team performing research in support of GRUAN. She also participated in a meeting of the GCOS Working Group on Atmospheric Reference Observations, an advisory group for GRUAN. dian.seidel@noaa.gov

7. HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory Model) Updated on ARL Server. A multitude of bug fixes and updates have been implemented with this update: terrain projection for backward trajectory plots, color overlays for KML/KMZ output formats, fixing the map scale in trajectory plots, now using cloud cover fraction to reduce precipitation totals, trajectory frequency grid point offset error, grib conversion software can now handle un-ordered pressure level data, the file check utility can now handle files with multiple index records, 10 m winds and 2 m temperatures are now estimated if missing from file, the PC and UNIX installation procedure for the working directory has been simplified, trajectory starting point tests the location on each input file rather than just the first, correction to the computation of the lowest grid cell layer depth in the global model subroutines, and file and directory names greater than 80 characters are now permitted. Modifications to the graphical user interface include: the GDAS archive sets the week number from the day of the month, a browse button was added for map background files, most menus now permit the search of directory names with embedded spaces, wildcard base names can now be specified when defining the input files for trajectory frequency plots and clustering, and clustering can be run from any directory. The trajectory clustering program has been completely revised, so that it now uses a projected coordinate system rather than a lat-lon system, which had issues with trajectories crossing the international dateline. Also the cluster program was modified to permit the clustering of trajectory files that contained supplemental information, such as the meteorological conditions along the trajectory. Several new programs and features have been added such as: the conversion of the binary output files to the DATTEM format and the corresponding statistical software to compute verification, a menu configure the addition or masking of binary concentration output files, menus to create text files used in labeling various plots, the extraction of concentrations at selected sampling locations can now be converted to Google Earth. roland.draxler@noaa.gov

8. READY Updates. A new web-based program has been posted to READY (Real-time Environmental Applications and Display sYstem) that will allow users to create an extract (time, area, or both) of our forecast or archived meteorological datasets and download them to the PC for use with the PC HYSPLIT dispersion model. Links to the programs can be found in the left navigation bar of READY or by using the following links: Forecast: <http://ready.arl.noaa.gov/ready2-bin/extract/extractf.pl>; Archived: <http://ready.arl.noaa.gov/ready2-bin/extract/extracta.pl> glenn.rolph@noaa.gov

Atmospheric Turbulence and Diffusion Division

9. Climate Reference Network (CRN) and Historical Climatology Network's Modernization (HCN/M). With more than 100 CRN sites in place and high quality to maintain, the schedule is heavy. During winter quarter, the Southeastern sites get attention, since they are closer and are less affected by cold weather. Thirty-seven visits were completed to CRN sites, about one visit every 2.5 calendar days. In addition, four HCN/M sites were installed in Arizona, and two existing sites required unscheduled maintenance visits. mark.e.hall@noaa.gov

10. Collaboration with Harvard University. The airborne turbulence-measurement capability of ATDD is being paired with innovative developments in cavity-ringdown spectroscopy by the Anderson Group at Harvard. This high-sensitivity cousin to an infrared gas analyzer can measure concentrations of CO₂ and CH₄ at high sample rates, even discerning individual isotopes of carbon. It can be carried on a moderately small airplane allowing airborne observation of air-surface exchanges not previously measurable in such a way. The goal is to have a preliminary deployment in the Arctic before the autumn freeze-up this year.

Wind-tunnel calibration early next quarter of ATDD's BAT probe fitted with Harvard's sample tubes and vacuum pump will be followed by integration by Aurora Flight Sciences of the probe and gas samplers onto a twin-engine airplane. So far the project is on track. ed.dumas@noaa.gov, Ron Dobosy, David Senn

11. Atmospheric Mercury. A review of atmospheric mercury measurements in Antarctica and the resultant understanding of mercury dynamics has appeared in *Atmospheric Chemistry and Physics (ACP)*: Dommergue, A., F. Sprovieri, N. Pirrone, R. Ebinghaus, S. Brooks, J. Courteaud, and C. Ferrari, 2010: Overview of mercury measurements in the Antarctic troposphere, *ACP* **10**, 3309 – 3319. It compares the results of multiple campaigns, discusses what was learned about mercury's chemistry near the coast and on the polar plateau, and notes what needs to be investigated further. Other reports were presented at the American Meteorological Society's 2010 Annual Meeting and the Geological Society of America's 2010 Annual Meeting describing mercury chemistry in Houston's warm-climate industrial setting and West Virginia's cold-season snow cover. The nature of mercury chemistry has been found to vary considerably from one region to another. steve.brooks@noaa.gov

12. Collaboration with Jackson-State University, Mississippi. Atmospheric dispersion and air chemistry in the Gulf-Coastal environment of Mississippi was the object of the summer campaign at Gulfport in 2009. First results were reported in five oral presentations at the 2010 Annual Meeting of the American Meteorological Society in Atlanta. Four of these presentations were made in Session 4 of the 15th Symposium on Meteorological Observations and Instrumentation; the fifth was in Joint Session 3 of the 16th Conference on Air Pollution. latoya.myles@noaa.gov, Will Pendergrass, Chris Vogel

13. Tennessee Science Olympiad. A challenging test of meteorology knowledge was prepared by several members of ATDD's scientific staff for the middle-school division of the Tennessee-Wesleyan-College Region of the Tennessee Science Olympiad. Entrants from the Oak Ridge and Knoxville areas competed for participation in the state competition at the University of Tennessee at Knoxville. The feedback on the test was very positive. ron.dobosy@noaa.gov

Field Research Division

14. ET Probe. Funding for the 2010 ET probe activities continued to be uncertain until late in the second quarter. ARL will be receiving a little less than the 2009 funding level. As a result, the planned deployments for this hurricane season have been scaled back commensurately. One of the primary activities this quarter has been to address issues that arose during last year's field deployments. One problem was that the data computer unexpectedly restarted on occasion. This was traced to problems with the SD card used for data storage. The manufacturer upgraded a computer component under warranty that may have been part of the problem. Other modifications, such as bird spikes to deter birds from perching on the probes, are also being installed.

FRD intends to deploy four probes this hurricane season, one at Duck, NC and the others along the Florida Keys. This will require the construction of new probes. The deployments along the Keys will be the most difficult because the sites must be reached by boat. In addition, the structures on which the probes are to be mounted are all rather large navigation-light structures that have considerable flow distortion. FRD is collaborating with a person from the University of South Florida who services the existing meteorological instruments at the Keys sites. richard.eckman@noaa.gov, Roger Carter, Tom Strong, Shane Beard, Randy Johnson

15. WISDOM/Cheaperclipper. The use of balloons to measure the low altitude atmospheric characteristics in tropical cyclones over the ocean has been difficult and expensive. The French Aeroclipper experiment (BAMS, Jan09, pp 63-71) in the Indian Ocean showed that it is possible to

deploy a lighter-than-air balloon tethered to a watercraft near a tropical cyclone and have it drawn to the center and track the tropical cyclone for more than a week. This arrangement would provide a platform for continuously monitoring hurricane central pressure, an important element of hurricane forecasting. However, on the negative side, the Aeroclipper is expensive and difficult to launch.

FRD is working with ESRL on a proposal to make an easy to use and inexpensive platform that is referred to as the Cheaperclipper. We propose incorporating available technology in combination with testing that will allow us to deploy a low altitude measurement platform in a very short period of time. Experiments will be done at our facility to test and characterize balloons, ballast platforms, and electronic subsystems that will allow us to deploy an operational CheaperClipper in just a few months. randy.johnson@noaa.gov

16. U.S. Historical Climatological Network – Modernization. FRD continues to assist ATDD in the daily quality control of the Historical Climate Network –Modernization (HCN-M) program. The HCN-M is an offshoot of the U.S. Climate Reference Network, but focused solely on temperature and precipitation. The number of stations has increased to 37 with locations across Alabama and the Southwest United States.

New products have been developed that are helping in the daily quality control. These products include a map of the daily flags and then maps of each individual flag. These maps provide a visual representation of possible instrument malfunctions at each station and are used to help plan maintenance visits. The flags maps as well as precipitation and temperature contour maps are emailed daily to the ATDD Supervisory Engineer for review so any instrument malfunctions identified with these techniques can be quickly repaired. A summary of instrumentation problems are submitted monthly. All of these products are also located on the FRD HCN-M website at <http://www.noaa.inel.gov/crn/crn.htm>. Overall, the stations continue to perform rather well. jason.rich@noaa.gov and Neil Hukari

17. HCN-M Annual Maintenance Visits (AMV) Training. Tom Strong, Shane Beard and Randy Johnson from FRD, joined Mark Hall and Kyle Johnson from ATDD, to receive training on the annual maintenance visits for the HCN-M climate stations. The training took place at five of the existing stations in Southern Alabama. FRD personnel are now ready to perform AMVs for the HCN-M in the southwestern United States during 2010. randy.johnson@noaa.gov, Tom Strong and Shane Beard

18. 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” continued to generate media and public interest during the first quarter of 2010. These included The Urban Transportation Monitor, J.R. Souken Information Systems in Japan, and Environmental Health Perspectives. dennis.finn@noaa.gov

19. JU03 Urban Plume Dispersion. Review comments were received from the journal Boundary Layer Meteorology for the paper ‘Analysis of urban atmosphere plume concentration fluctuations’. Revisions were made in response to the comments and the paper was resubmitted to the journal along with responses to reviewer comments. dennis.finn@noaa.gov

20. Miscellaneous. The United States Patent and Trademark Office (PTO) issued a "Notice of Allowance and Fee(s) Due" for the Stepped Electric Field Detector patent application. The actual patent should be issued "soon. roger.carter@noaa.gov

FRD has continued to actively participate in an effort to improve wind forecasts for wind-energy applications. The work is a partnership between NOAA and the Department of Energy. The plan is to deploy enhanced instrumentation in a limited region for one year and assimilate the resulting data into a

high-resolution prognostic model [the ESRL High Resolution Rapid Refresh (HRRR) is the leading candidate]. The model forecasts will be evaluated to see if the added observations significantly improve short-range wind forecasts. FRD is planning to contribute a 915 MHz profiler and a couple of sodars to the study. richard.eckman@noaa.gov, Kirk Clawson

Special Operations and Research Division

21. Urban Visibility Assessment. Marc Pitchford attended the meeting of the EPA Clean Air Science Advisory Committee (CASAC) in RTP, NC on March 10-11. The purpose of the meeting was to provide technical review comments and advice on the second review draft of the PM Health Risk Assessment and Urban Focused Visibility Assessment (authored by Marc) documents. The overall comments were complimentary and there were relatively few specific comments. The CASAC panel was also given the first draft of the PM Policy Assessment document, which they will review over the next month. This is all part of the 5-year review process that traditionally leads to new or revised air quality standards. The end of this cycle is anticipated in July 2011. Assessment document and it is publicly available on EPA's web site at <http://www.epa.gov/ttn/naaqs/standards/pm/data/20100121UFVAforCASAC.pdf>. marc.pitchford@noaa.gov

22. Particulate Matter National Ambient Air Quality Standards (PM NAAQS). Marc Pitchford attended an EPA Science Advisory Committee, Ambient Air Monitoring and Methods Subcommittee (AAMMS) meeting in Washington DC on February 24-25 that was held to advise EPA on monitoring methods for Particulate Matter (PM) light extinction. This is being done in support of a possible secondary PM National Ambient Air Quality Standard designed to protect the public from adverse visibility conditions. The AAMMS reviewed the EPA white paper on PM light extinction monitoring approaches that was prepared. Their input will be in response to a series of charge questions designed to elicit their opinion on the technical merits of the various monitoring options and the appropriate evaluation and approval process to be used. The AAMMS report to EPA on PM light extinction monitoring should be available in 3rd Quarter of FY10.

Marc Pitchford participated in an EPA Clean Air Advisory Committee (CASAC) Ambient Air Monitoring and Methods Subcommittee meeting on March 26 via conference call to finalize review comments on the PM Light Extinction Monitoring white paper that he prepared for EPA as part of the process to review the PM National Ambient Air Quality Standards. Overall the subcommittee agreed with the information contained in the white paper with respect to the instrumental approaches currently available to conduct light extinction monitoring and the promise of even better approaches using not yet proven methods. They offered numerous detailed comments and suggestion on how best to implement monitoring if a secondary standard with light extinction as the indicator is promulgated. Their comments and the white paper are available at the following link. <http://yosemite.epa.gov/sab/sabproduct.nsf/MeetingCal/72B081422DC87002852576A900517480?OpenDocument> marc.pitchford@noaa.gov

23. National Park Service. Marc Pitchford participated in a meeting in Denver of the nationwide air quality staff for the National Park Service. The purpose of the meeting was to review activities of the past several years, develop strategy and discuss organizational changes in light of recent and pending retirements by key staff including Dr. William Malm, Bruce Polkowsky, and Christine Shaver, Air Resource Division Chief. marc.pitchford@noaa.gov

24. DOE Meteorological Coordinating Council (DMCC). Walt Schalk met with the DOE NA-41 sponsor for the DOE Meteorological Coordinating Council (DMCC) at the Forrestal Building in Washington, DC on February 26. Topics of discussion were the upcoming conference in May, funding,

program direction, and the Assist Visit program. (this program provides an external look at DOE site meteorology programs and offers suggestions for program improvements, if necessary).

Walt Schalk is working with a DMCC Team and Kirk Clawson, Director of FRD, on an Assist Visit for the Idaho National Laboratory in Idaho Falls, ID for late April. The Assist Visit program provides an external look at DOE site meteorology programs and offers suggestions for program improvements, if necessary. walter.w.schalk@noaa.gov