



NOAA Air Resources Laboratory Quarterly Activity Report

(April – June 2010)

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Highlights

1. WMO/UNEP Scientific Assessment of Ozone Depletion: 2010. Along with other NOAA colleagues, Dian Seidel has been contributing to the quadrennial international scientific assessment of the ozone layer, a report to the Parties of the Montreal Protocol. The report was finalized at a late-June panel review meeting in Les Diablerets, Switzerland; however, full text of the report is embargoed until it is presented to the Parties in December. A main focus of the 2010 assessment is the role of the Montreal Protocol in protecting not only the ozone layer but also the climate system, through reductions in emissions of ozone-depleting substances that are also powerful greenhouse gases. Dian contributed to the report as a lead author of the chapter on stratospheric changes and climate and as a reviewer of other chapters. dian.seidel@noaa.gov

2. 2010 PC HYSPLIT Workshop. Forty-five attendees participated in a 3-day HYSPLIT workshop in Silver Spring, June 23-25. The workshop focused on the use of the recently updated version 4.9 of the PC model and its Graphical User Interface (GUI). Presentations and workshop materials can be found at: http://www.arl.noaa.gov/HYSPLIT_workshop.php glenn.rolph@noaa.gov

3. Mercury: Gulf Coast, Appalachian Mountains, Houston, Instrumentation. Relationships between samplers of high and low cost and labor intensity for mercury's atmospheric concentration and surface deposition are being explored. An improved passive surrogate-surface sampler is among the low-cost instruments. It was found well correlated to a current commercially available version in tests using ATDD's wind tunnel. Plans have been made with USDA to study potential atmospheric mercury emissions from prescribed forest burns at higher elevations in the Appalachian Mountains of West Virginia in 2011 for the USDA. Mercury content of the forest increases with elevation. Analysis of data from the Study of Houston Atmospheric Radical Precursors found an unexpected source of reactive chlorine. It might explain the high levels of the more reactive forms of mercury in near-surface air along the Gulf Coast. A sampling method for gaseous elemental mercury in the pore spaces of surface soils has been developed and reported in a manuscript submitted to *Air, Water, and Soil Pollution*. steve.brooks@noaa.gov

4. Big Southern Butte Fire Weather Research. Deployment of instrumentation for the Big Southern Butte field study began in June. This study is being conducted for and in collaboration with the U.S. Forest Service to develop a database for testing and improving wind models in complex terrain for wild fire applications. FRD and Washington State University (WSU) are providing support for the field study.

FRD deployed four sonic anemometers at existing Idaho National Laboratory mesonet sites in support of the project during the first week of June. Data collection began at the time of installation and will continue until the end of the project in October. FRD will also provide a complete record of all Weather Research Forecast (WRF) model runs for southeast Idaho to the Forest Service for the duration of the project. The plans call for 2-3 intensive measurement periods during high wind events at which time additional instrumentation will be deployed. During these intensive measurement periods, FRD will also deploy a radar profiler and two sodars upwind of the butte to characterize the approach flow. These will be supplemented by two additional sodars furnished by the Forest Service and WSU. dennis.finn@noaa.gov, S. Beard, T. Strong, R. Eckman

Air Resources Laboratory – Headquarters

5. *Strengthening NOAA Science.* Dian Seidel participated in the April 20-23, Workshop on Strengthening NOAA Science, as a member of the program committee, serving as facilitator for breakout groups and making a short presentation on scientific integrity and professional ethics. The workshop identified grand scientific challenges for NOAA and practical ways to improve how NOAA conducts science. A workshop report has recently been finalized. The report is being used by the Research Council and by NOAA strategic planning and budgeting activities and will be the basis for continuing discussions on how to strengthen NOAA science. dian.seidel@noaa.gov

6. *Outreach: Podcasts on ARL Upper-Air Climate Research Program.* Significant progress was made this quarter in the preparation of a series of podcasts on the Climate Variability and Change Analysis group's research program employing radiosonde data to study upper-air climate change. With Linda Joy (NOAA/OAR Public Affairs) and Maggie Kerchner, ARL has developed a plan for a set of short (~5 min) recordings describing our work in lay language. This spring and summer, interviews are being recorded with Jim Angell, Melissa Free, and Dian Seidel. Linda Joy will produce the podcast using these interviews for sound bites and as the basis for the narrated script. dian.seidel@noaa.gov

7. *READY Update.* As a result of lessons learning during a spring NOAA 2010 Continuity of Operations (COOP) exercise, a new web-based program is being developed that uses the HYSPLIT transport and dispersion model to simulate the detonation of a surface-based nuclear explosion. The nuclear cloud activity distribution is adapted from the ARL Fallout Prediction Technique (Heffter, 1969, ERLTM-ARL 13), a method for determining the fallout distribution developed using measurements of ground activity versus time of arrival data from nuclear tests conducted at the Nevada Test Site in the 1950's. The initial nuclear cloud is defined as a cylinder that is divided into 12 layers (disks) between the surface and the top of the cloud. The thickness and height of each layer depends on the nuclear yield. Within each layer, HYSPLIT defines ten "particles" or parcels: one for all Noble gases and 9 for various particle sizes. Each particle is given a gravitational settling velocity based on its radius as defined by the Norwegian Meteorological Institute's Severe Nuclear Accident Program (SNAP) model (Bartnicki and Saltbones, 2003). Approximately 200 nuclear species are considered in the calculation of dose rates. The program is now undergoing testing and will eventually be made available to the National Weather Service's local forecast offices through the READY web site. glenn.rolph@noaa.gov and roland.draxler@noaa.gov

In early May, automated trajectories over the Gulf of Mexico were made available through the READY web site (http://ready.arl.noaa.gov/READY_traj_pick.php) to provide information for people considering burning oil slicks from the Deep Horizon oil well spill. glenn.rolph@noaa.gov and barbara.stunder@noaa.gov

8. *Support to NOAA Volcanic Ash Efforts following Eyjafjallajokull.* Barbara Stunder has been heavily involved in volcanic ash work following the April-May eruption of Eyjafjallajokull, in Iceland, in which airspace in Europe was closed for several days. Although Barbara and others in

NOAA are members of the OFCM Working Group on Volcanic Ash and support the Federal Aviation Administration (FAA) representative to the International Civil Aviation Organization International Airways Volcano Watch Operations Group, a NOAA Volcanic Ash Working Group (VAWG), with members from OAR, NWS, and NESDIS, was quickly created to answer questions from NWS management and develop a high-priority plan to be able to better respond to similar long-lived volcanic eruptions in which ash from outside the US area of responsibility reaches the US, or for similar eruptions within the US area of responsibility. Granted, there have been large eruptions within the US area of responsibility, and elsewhere in the world, and the current system has worked, however, the response to this particular eruption pointed out some different practices which need to be resolved, as well as prompting some improvements to NOAA's system. The VAWG was divided into a Science Team, led by Barbara, and a Services Team. A NOAA Science Position Paper was written, describing NOAA's volcanic ash forecasting and observing capabilities, plans, and issues, with input from several groups within OAR, plus NESDIS and NWS. As part of the VAWG, Barbara supported the NWS representative to the WMO Executive Council meeting in June. The timeline to make the high-priority changes to the operational HYSPLIT system at NCEP required initial submission to NCEP in mid-July to allow time for training, testing, and evaluation prior to operational implementation. barbara.stunder@noaa.gov

9. Air Quality. Dr. Rick Saylor continued investigation of the underlying causes of differences in ozone production between carbon bond IV and carbon bond mechanism versions of the National Air Quality Forecast Capability and presented preliminary results to EPA collaborators on May 7. rick.saylor@noaa.gov

Atmospheric Turbulence and Diffusion Division

10. Climate Reference Network (CRN) and Modernization of Historical Climatology Network (HCN-M). Soil-moisture is now measured at 20 sites and growing. Six HCN-M sites were also installed during the quarter in the Southwest. mark.e.hall@noaa.gov

11. University of Tennessee Space Institute (UTSI) Collaboration. NOAA's CRN routinely makes single-point measurements of the surface temperature. Distributed over the whole U.S., these measurements show promise for calibration and validation of surface temperature sensed from satellites. Utilizing them for such a purpose requires determining the area they properly represent and characterizing the spatial variability over that area. Assembly over previous months of a suite of commercial radiation sensors, both airborne and ground based, along with a flight protocol, have led this quarter to the first flights in UTSI's Piper Navajo airplane. Patterns of 5-km radius over the CRN site at Crossville, TN, and the Chestnut Ridge Environmental Study Site (CHESS) near Oak Ridge, TN and have yielded encouraging results. Additional CRN sites will be visited this year. praveena.krishnan@noaa.gov, E. Dumas, B. Baker, T. Myers

12. Collaboration with Harvard University. Following the very instructive wind-tunnel tests at Massachusetts Institute of Technology early in 2010, the BAT (airborne turbulence) probe has been further characterized in road tests, which confirmed the wind-tunnel results and verified the frequency response of the instruments (see image). These new calibrations and tests are making important contributions to understanding how and how well the probe works. The results promise to be valuable to all groups now using the BAT probe. Preparations are moving toward a second set of wind-tunnel tests in September. The synergy with the Integrated Cavity Output Spectroscopy system from Harvard's Anderson Group will provide airborne measurement of Arctic air-



surface carbon exchange, including isotope information, to explore the effect of Arctic warming on the potential release of large quantities of stored carbon to the atmosphere. ed.dumas@noaa.gov, R. Dobosy, D. Senn, B. Baker

13. Ammonia: Tennessee, California, Instrumentation. The Atmospheric Deposition of Ammonia experiment at the University of Tennessee examined emissions from wheat fertilized with urea and irrigated. High concentrations of NH_3 after fertilization reduced after 24 hr. Similar measurements were deployed in Modesto, California, for CalNex 2010, Research at the Nexus of Air Quality and Climate Change. Corn fields, alfalfa fields, and a large dairy surrounded the site. Flux-gradient and relaxed eddy-accumulation techniques were used to measure the ammonia deposition. A commercial Picarro Wavelength-Scanned Cavity Ringdown Spectrometer system newly developed for ammonia was tested. After some initial instrument problems it successfully measured atmospheric concentration in half-hour averages with considerably less labor than the usual method, which requires preparation and post analysis of many sample tubes. Data are being analyzed for presentation at the American Geophysical Union's Fall Meeting. Earlier comparative measurements of ammonia in a rural forested area and in a suburban area adjacent to an interstate highway are reported in a manuscript submitted to *Science of the Total Environment*. At the suburban area there was some elevation of ammonia concentrations in flow from the highway's direction. latoya.myles@noaa.gov, M. Heuer

14. DCNet Urban Mesoscale Network. Stark differences between wind profiles observed by sodar and predicted by well-known parameterizations were found over rooftops in downtown Washington, DC. Results presented at the Fifth International Symposium on Computational Wind Engineering in Chapel Hill, North Carolina, May 23 – 27 make a strong case for additional study of wind speeds and wind shear through the roughness sublayer above urban canopies. chris.vogel@noaa.gov, W. Pendergrass

Field Research Division

15. Extreme Turbulence (ET) Probe. Due to funding constraints, FRD will be deploying only two ET) probes during the hurricane season rather than the five originally planned. The probes have received several upgrades based on experience gained during last year's deployments, including less noisy power supplies and bird spikes to deter perching birds. Both of the deployment sites are offshore navigation lights located in the Florida Keys. A two-person team from FRD will be traveling to the Keys in late July to deploy the probes. richard.eckman@noaa.gov, R. Carter, T. Strong, S. Beard, R. Johnson

16. CheaperClipper. Work has started on the CheaperClipper project. CheaperClipper is a low cost, long term, simple to use balloon system that is designed be used in large numbers to provide information from "data poor" regions in the Atlantic. Data from CheaperClipper will be used to help understand and characterize the evolution of the energy content of the low marine boundary-layer inflow to hurricanes, its relationship with hurricane intensity changes, the influence of ocean temperature, and estimates of surface fluxes.

FRD is working on the balloon design and lift testing, sea ballast with tethering system, and the containment of the WISDOM Sonde inside the balloon (see images below). ESRL (Jim Jordan and Russ Chadwick) are checking out the WISDOM Sondes and making arrangements to use the military satellite system that has been used for WISDOM. FRD hopes to be able to deploy four balloons in the next month or so into the open ocean under ideal conditions (no real storms and no islands in the way). We hope to be able to track these balloons for two weeks and possibly longer. randy.johnson@noaa.gov



17. HRRR Collaboration with ESRL. As part of collaboration with the Global Systems Division at ESRL, FRD is planning on obtaining output from the High Resolution Rapid Refresh (HRRR) forecast model. This model runs hourly at 3 km horizontal grid spacing over the Continental U.S. FRD is interested in obtaining a subset of the model output covering Southeast Idaho. These high-

resolution forecasts are potentially useful for FRD's partnership with the INL, including using the output to provide dispersion forecasts based on the HYSPLIT model. Additionally, the output will be useful as part of a potential wind-energy study at the INL. richard.eckman@noaa.gov

18. JU03 Urban Plume Dispersion. The paper "Analysis of urban atmosphere plume concentration fluctuations" was accepted for publication at the journal *Boundary-Layer Meteorology* (DOI:10.1007/s10546-010-9510-3). dennis.finn@noaa.gov

19. NOAA Continuity Operations (COOP) Drill. As part of a reach-back effort, FRD became involved in a NOAA Continuity of Operations (COOP) drill related to a simulated terrorist nuclear device detonation in a Midwestern city. NOAA staff involved in the drill requested support from ARL, and the request was routed to FRD because it was late in the day on the East Coast. The ARL HYSPLIT model did not have a source-term algorithm for such a release at the time, so the model was used to generate plume trajectories for several different altitudes above the ground. As a result of the drill, a nuclear-device source term algorithm is now being added to HYSPLIT [see related item in ARL HQ report]. richard.eckman@noaa.gov

20. Miscellaneous. With the upcoming retirement of Neil Hukari at the end of July, FRD is continuing to train personnel and create job procedures and checklists for his position as lead duty NOAA/INL weather forecaster and head Mesonet QC manager. With the training and procedures expected to be complete in July, FRD is expecting a smooth transition after his departure. Neil has been the NOAA/INL duty forecaster for over 25 years. Jason Rich represented FRD in a booth at the INL Safety and Health Fair on May 18, 2010. Jason handed out NOAA/INL weather safety information and met with a number of clients during the event. jason.rich@noaa.gov

Special Operations and Research Division

21. Environmental Protection Agency Clean Air Science Advisory Committee (CASAC) Meeting. Marc Pitchford attended, via conference call, a two-day meeting of the EPA CASAC. The purpose of the meeting was two-fold: to finalize summary comments on 1) the second review draft of the Urban Focused Visibility Assessment; and 2) the Particulate Matter National Ambient Air Quality Standards (PM NAAQS) Policy Assessment document. Overall, the Urban Focused Visibility Assessment document has been favorably received although there are specific comments that need to be addressed in the final visibility assessment.

The PM NAAQS Policy Assessment document has also been favorably received. Although, there are specific comments that need to be addressed in the second draft policy assessment document. The Policy Assessment document is the last in the series of documents prior to EPA's proposed rule making (i.e., modifications to the PM national standards) which is scheduled for February 2011. The second review draft version of the policy assessment document will be issued by the end of June and reviewed by CASAC at their next meeting in July 2010. CASAC's comments on the visibility effects portion of the policy assessment were generally few and positive, though they are asking for substantial additional information to be included in the next version. The document is available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_2007_pa.html. marc.pitchford@noaa.gov

22. Visibility Information Exchange Web System (VIEWS). Marc Pitchford participated in a conference call to lay plans for continued operations of VIEWS for next fiscal year. Without intervention, VIEWS would have ceased operations in September because the support from the five Regional Planning Organizations is no longer available. VIEWS operations will be cost-shared by several organizations which have continuing need for access to data, and data display and summary tools. The purpose of the call was to develop an equitable cost-sharing and management scheme for multiple sponsorship of the basic VIEWS capabilities that encourages additional organizations to sponsor enhanced capabilities. marc.pitchford@noaa.gov

23. Department of Energy (DOE) Meteorological Coordinating Council (DMCC). Walt Schalk visited FRD as part of the DMCC Assist Team. The purpose of the visit was to look at the meteorological monitoring program with respect to DOE's Idaho National Laboratory needs and requirements. This visit was a follow up to a visit conducted in 2004. FRD staff, DOE customers, and State of Idaho users were interviewed and several weather tower site locations were visited. An initial briefing was held and a draft report will be written and submitted in two months. walter.w.schalk@noaa.gov

Walt Schalk completed preparations and chaired the 17th Annual Meeting of the DMCC held in Las Vegas, NV on 3 May. Presentations consisted of an "Overview of DMCC Activities" and the "Nevada Test Site" update. The DMCC Annual Report was also presented to the Emergency Management Issues, Special Interest Group (EMI-SIG) Steering Committee Meeting. walter.w.schalk@noaa.gov

Kip Smith also attended the DMCC 17th Annual Meeting and presented the "Relationship between Eastern Equatorial Pacific Ocean Sea Surface Temperatures and Precipitation at NTS." In addition, Kip attended the EMI-SIG Steering Committee meeting. Information related to Consequence Assessment Training was collected and preliminary work to potentially use this information in training additional SORD personnel was completed. kip.smith@noaa.gov

24. SORD/Nevada Test Site (NTS) Lightning Detection Network. The SORD-Nevada Test Site Lightning sensor upgrade project completed the physical installation of 4 new sensors. Power and communication conduits for the off-site sensor were redone. New communications equipment and computer hardware was purchased. Installation of the new communications equipment by the NTS communications contractor and SORD was completed. Much work with NTS Communications on configuring routers and modems and testing signal quality over existing lines was done. Connectivity between the data collection/processing computers and the four field sensors was established. The sensors were reconfigured for detection ranges applicable for the Nevada Test Site. The next step is to tune the triangulation portion of the sensor system. This requires actual lightning strikes, on the order of 2-3000, to be detected by the sensors – so we are waiting for activity in the region. Paul Rogers, Phil Abbott, James Wood, Rick Lantrip and Raymond Dennis are all a part of the team working on this project. paul.rogers@noaa.gov

25. Other Activities. Walt Schalk did a weather demonstration at a local Elementary School. A variety of weather instruments were displayed, passed around, and demonstrated. Various weather experiments were performed and explained which included: formation of dew and frost, cloud

formation, circulation, lightning, upper-air winds, and making a dust devil. NOAA stickers and cloud charts were given to the class and teacher. walter.w.schalk@noaa.gov

ARL 3rd Quarter Publications List

The following papers were published during this time period.

Bao, H., S. Yu, and D. Tong (2010). Massive volcanic SO₂ oxidation and sulphate aerosol deposition in Cenozoic North America. *Nature* 465:909-912, doi:10.1038/nature09100.

Castell, N., A.F. Stein, E. Mantilla, R. Salvador, and M. Millán (2010). Evaluation of the use of photochemical indicators to assess ozone - NO_x - VOC sensitivity in the Southwestern Iberian Peninsula. *Journal of Atmospheric Chemistry* 63(1):73-91.

Choi, Y. G. Osterman, A. Eldering, Y. Wang, E. Edgerton (2010). Understanding the contributions of anthropogenic and biogenic sources to CO enhancements and outflow observed over North America and the western Atlantic Ocean by TES and MOPITT. *Atmospheric Environment* 44:2033-2042.

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, C. Biltoft, and M. Leach (2010). Analysis of urban atmosphere plume concentration fluctuations. *Boundary Layer Meteorology*, Vol. 136(3): 431-456, doi:10.1007/s10546-010-9510-3.

Seidel, D. J., C. Ao, and K. Li (2010). Comparison of methods for estimating planetary boundary layer height from radiosonde temperature, humidity, and refractivity profiles. *Journal of Geophysical Research*, Vol. 115, D16113, doi:10.1029/2009JD013680.

Yang, Q. D. Cunnold, Y. Choi, et al. (2010). A study of tropospheric ozone column enhancements over North America using satellite data and a global chemical transport model. *Journal of Geophysical Research*, Vol. 115, D08302, doi:10.1029/2009JD012616.

Zhao, C. Y. Wang, Q. Yang, R. Fu, D. Cunnold, and Y. Choi (2010). Impact of East Asian summer monsoon on the air quality over China: View from space. *Journal of Geophysical Research*, Vol. 115, D09301, doi:10.1029/2009JD012745.