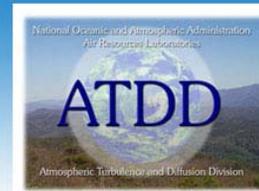




NOAA/ATDD Quarterly Activity Report

July 2009 – September 2009



*Bruce Baker, Director
Atmospheric Turbulence and Diffusion Division*

(This report is prepared for the use of the NOAA/Air Resources Laboratory and is also sent as a courtesy to other agencies. Please do not copy and forward it elsewhere.)

CLIMATE

Local Meteorological Support

Data reduction for July, August, and September were completed without problems. The monthly data (a summary file and precipitation table files for each month) have been downloaded to [ftp.atdd.noaa.gov/](ftp://atdd.noaa.gov/) (anonymous FTP, change directory to `pub/data/ormet`). The archived data are located in the sub-folder “archive.”
lynne.satterfield@noaa.gov

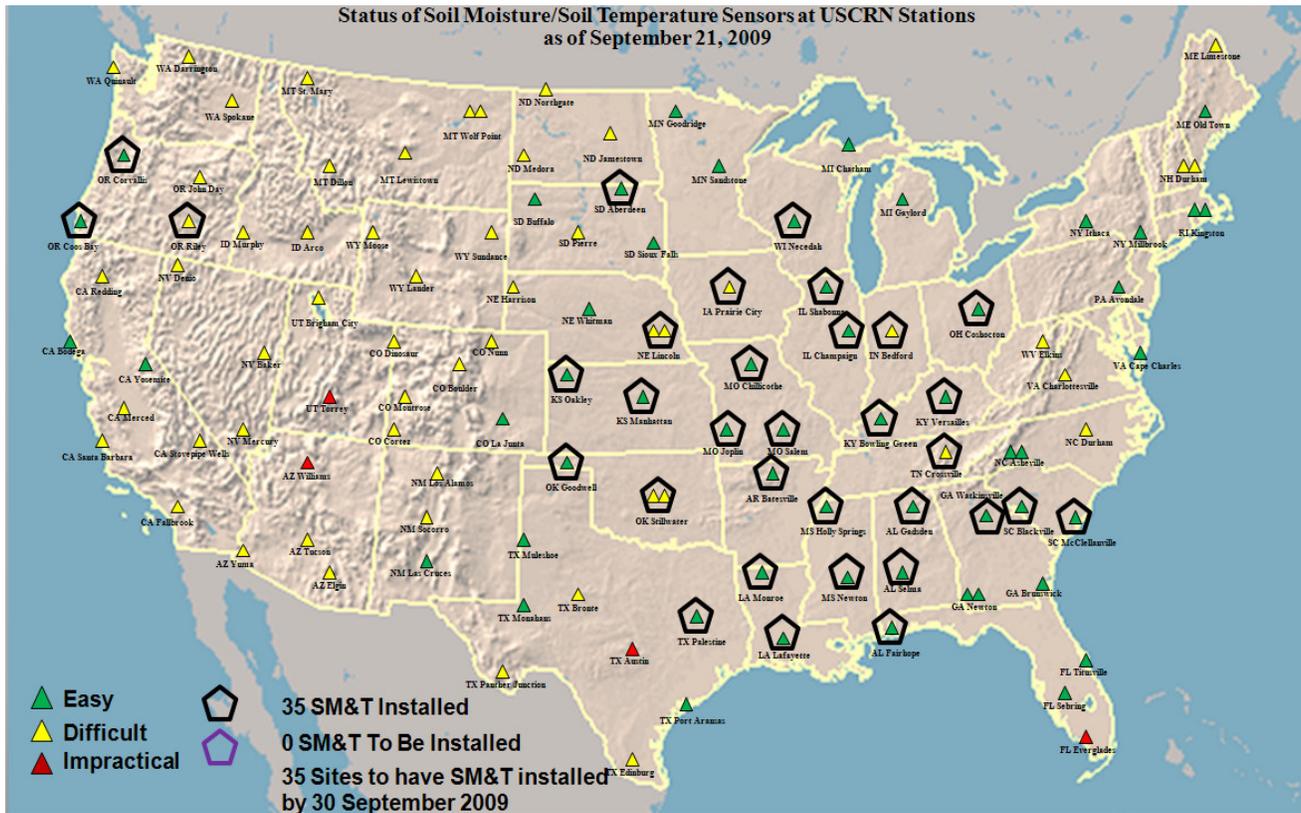
U.S. Climate Reference Network

In July, August, and September, NCDC retrieved 61 data files from CRN sites through the server [ftp.atdd.noaa.gov](ftp://atdd.noaa.gov). Data are passed to NCDC by this path when retrieved episodically by ATDD from individual sites to fill data gaps. A record is maintained of the number of missing hours of retrievable data over the past 12 months. Instruments’ characteristics for each site are maintained in the database ISIS (Integrated Station Information System) on NCDC’s server, along with a record of events which affect data quality. New events are identified from ATDD’s field crews, NCDC’s Anomaly Tracking System (ATS), and email messages. lynne.satterfield@noaa.gov

Five HCN-M sites were installed in July, bringing the total number of sites to 10. Permission to begin transmissions at these sites was given in late September. All sites were visited to verify proper operation and to turn on the transmitters.
mark.e.hall@noaa.gov

Forty-seven CRN annual maintenance visits were completed this quarter. Two sites were installed in Alaska at Sand Point and in Lake Clark National Park near Port Alsworth. The site at Port Alsworth is solar and wind powered, the first CRN site in Alaska to be off the grid. Wind power was added to four sites in the CONUS to supplement solar power. These sites were good candidates for a small wind generator. The total number of sites with soil moisture and temperature measurements climbed to 35 this quarter. mark.e.hall@noaa.gov

The CRN team installed soil moisture/soil temperature probes at 10 sites this quarter. A total of 15 probes are installed at each site at five depths: 5, 10, 20, 50 and 100 cm. Soil samples were taken at each probe location. These soil samples will be shipped to the USDA National Soil Survey Center in Lincoln NE, for a detailed analysis of important soil properties. This metadata will add to the value of the understanding of the measurements being made



Surface Energy Balance Network (SEBN)

Extensive sampling along the forest floor is being conducted at the Chestnut Ridge Environmental Study Site (CHESS). Sampling includes leaf area indices, soil CO₂ respiration, and leaf litter wetness. This supplementary data, coupled with the ongoing meteorological measurements, will provide further understanding of soil respiration dynamics. mark.heuer@noaa.gov

AIR QUALITY

Atmospheric Integrated Research Monitoring Network(AIRMoN)

Since the early 1980's, AIRMoN data has been used to determine the extent to which changes in emissions affect air quality and atmospheric deposition. While the current focus is on wet deposition and precipitation chemistry (AIRMoN-wet), dry deposition estimates were a fundamental component of the AIRMoN program for many years. Preparations are underway to finalize the AIRMoN-dry dataset, which includes gaseous and particulate concentrations derived from chemical filter-pack samplers and deposition velocity estimates from the inferential method model. It is anticipated that the complete AIRMoN-dry dataset will be available on the ARL website. latoya.myles@noaa.gov

Atmospheric Mercury Initiative Site at Allegheny Portage, PA

The initial intent of the Allegheny Portage site was to determine speciation and estimate deposition 25-45 km downwind of three major coal-fired power plants, Reliant Energy's Conemaugh Generating Station and Keystone Power Plants and Edison International's EME Homer City Plant. Two of these plants are the largest point-sources in Pennsylvania. Analysis of the first few months of data indicate that the site appears to be dominated by mine reclamation areas and smaller waste coal facilities 9-13 km upwind within Cambria County. According to the Pennsylvania Department of Environmental Protection, annual mercury emissions reported by these smaller facilities (Ebensburg Power Co., Colver, and Cambria Congen) average less than 1 kg yr⁻¹. Mercury speciation measurements suggest upwind point source(s) totaling ~800 kg yr⁻¹. Moreover, the bulk of these emissions appears to be gaseous elemental mercury (GEM), which is inconsistent with direct coal combustion products. Based on the high GEM concentrations and the late-spring (after snow melt) and early-summer peaks in GEM, we are beginning to consider emissions from local waste coal power plants, specifically the local reclamation sites (Colver, Cambria Cogen, and Revloc) which are associated with the deposition of vast amounts of waste coal ash.

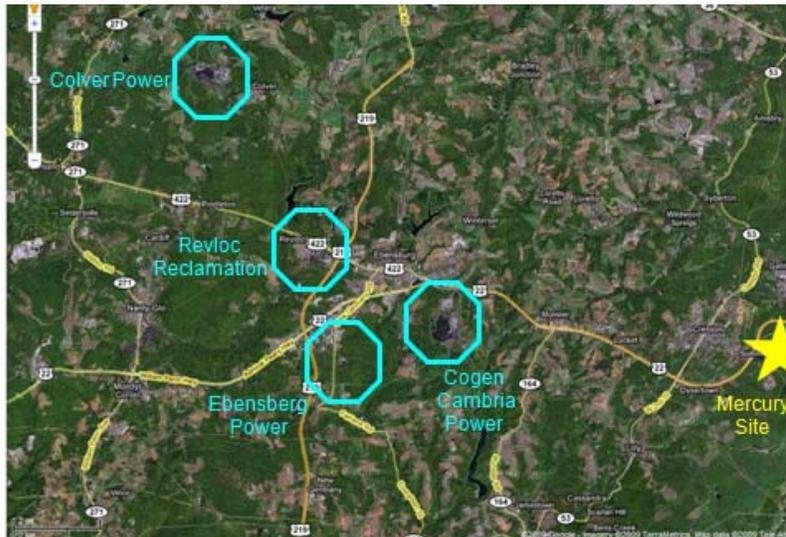
In the U.S., there are currently 18 waste coal burning electrical generation facilities (primarily in Pennsylvania) and 13 additional plants that use waste coal as a secondary fuel. Thirteen more plants are in the proposal stage, mostly in Pennsylvania, West Virginia, and Kentucky. Waste coal combustion in Pennsylvania alone has risen from near zero in 1988 to ~11 million tons/yr today. According to the U.S. DOE Energy Information Administration 2004 Energy Outlook Report, normal bituminous coal in Northern Appalachia (Pennsylvania, Ohio, Maryland, and West Virginia) averages 11.3 lbs Hg per TeraBTU whereas waste bituminous coal (the waste variety utilized in Cambria County) has an average mercury content of 63.9 lbs of Hg per TeraBTU. This equates to 3 – 4 tons of mercury (~10% of all mercury emitted from all coal-fired power plants nationwide) moving through the waste coal plants of Pennsylvania alone. Assuming that the vast majority of this mercury (99%) ends up in the ash, even if only a tiny fraction is emitted to the atmosphere, this is still a large source. Potentially, the high

surface area of the ash, the high mercury content, and the wide exposure to ambient air when used to reclaim waste coal piles could result in a significant mercury source to the atmosphere.

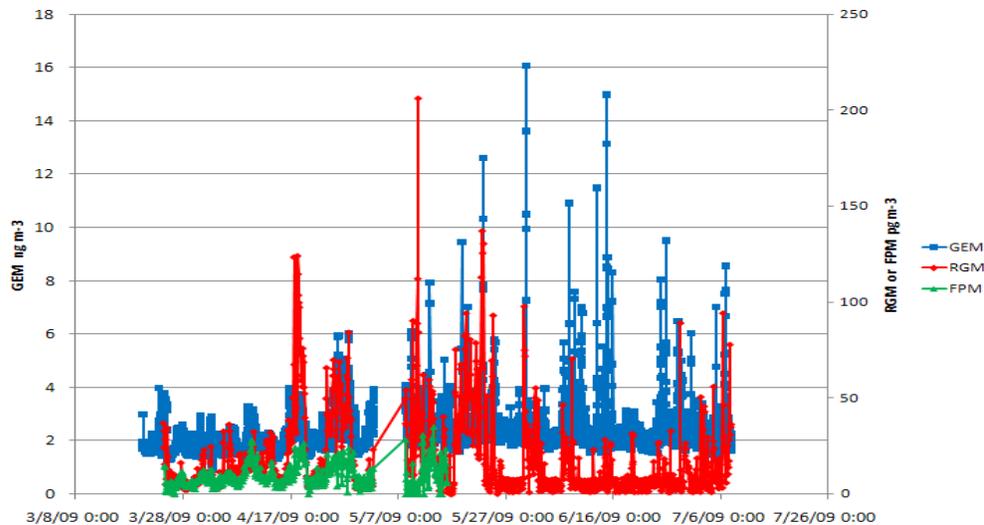
Waste coal is a mix of coal and 'rock' which was rejected for sale after being extracted from mines. Typically waste coal is dumped in large piles which accumulate over decades, often in low lying areas near the mine exits. These piles often block natural streams and contribute significantly to downstream acidity. The larger and older piles with higher coal/waste ratios were re-mined in recent decades (1970s and 1980s) to extract and utilize the useable coal. Piles with smaller coal/waste ratios (such as those in Cambria County) are presently utilized on-site at waste coal combustion facilities to produce electrical power. The waste coal is burned and the resultant ash is used as backfill to reclaim the waste coal piles areas. The reclaimed waste coal piles are touted as a success story by the industry which cites ~300 acres of annual reclamation within Pennsylvania alone at no cost to the taxpayer. Periodic tests of groundwater and surface water do show reduced acidity and no increases in most contaminants compared to the original waste coal piles. However, potential emissions to the atmosphere have never been measured.

In September, we conducted limited small chamber measurements of the Revloc reclamation site on undisturbed surfaces and surfaces on which we poured distilled water. The resultant fluxes over the undisturbed surface were in the range of 41-90 ng m⁻² hr⁻¹, while two measurements with distilled water showed fluxes of 145 and 182 ng m⁻² hr⁻¹. There are clear problems and errors associated with deriving fluxes from small chambers, however, the results clearly indicate that these "reclamation" surfaces are significant, and previously unrecognized, mercury sources to the atmosphere.

steve.brooks@noaa.gov



The ARL Mercury site is located atop Cresson Ridge (at the far right). The potential local mercury sources shown are all within Cambria County and ~9-13 km upwind of our mercury site.



Mercury speciation atop Cresson Ridge.

Research at the Nexus of Air Quality and Climate Change (CalNex 2010)

In collaboration with the California Air Resources Board (CARB) and the California Energy Commission (CEC), NOAA is proposing a joint field study of atmospheric processes over California and the eastern Pacific coastal region in 2010. This study will particularly emphasize the interactions between air quality and climate change issues, including those affecting the hydrologic cycle. It will constitute one of a series of comprehensive regional air quality and climate assessments conducted by NOAA and an expansion of CARB's leadership of California air quality studies. Scientists and engineers from ATDD plan to participate in the CalNex field study in May/June 2010. One instrumented tower will be placed at the CalNex Supersite on a rooftop in downtown Los Angeles. Measurements will include high frequency u, v, w wind components, high frequency temperature, humidity, CO₂, O₃, infrared surface temperature, solar irradiance, net radiation, and mean measurements of standard meteorological quantities, such as wind speed, wind direction, air temperature, and relative humidity. In addition, instrumentation is being developed to attempt to obtain skin temperatures and temperature profiles (vertical and horizontal) of building walls and roadways in order to generate quantities needed in modeling the bulk urban canopy heat flux. will.pendergrass@noaa.gov

Manuscripts

A manuscript entitled "Measurement of trace gas fluxes over an unfertilized agricultural ecosystem using the modified Bowen ratio technique" was submitted to the 'Special Collection on Air Quality Research,' a special issue of the *Journal of Environmental Quality*. The manuscript, which is authored by L. Myles, J. Kochendorfer, M.W. Heuer, and T.P. Meyers, detailed the results of a 2006 field study to measure the air-surface exchange of trace gases over a soybean field near Lillington, NC. latoya.myles@noaa.gov

S. Brooks prepared and submitted a chapter section to the 2010 Arctic Monitoring and Assessment Program (AMAP) Mercury Report. The section, which will be included in Chapter 5 (Trends and Fate) of the report was reviewed and comments were returned. steve.brooks@noaa.gov

Presentations

Five abstracts detailing research findings from the joint ARL/ATDD and Jackson State University Mississippi Coastal Atmospheric Dispersion Study (MCADS) were accepted for presentation during the technical program of the 2010 American Meteorological Society Annual Meeting. Title and authors, with presenting authors underlined, are listed below.

'Evaluation of PM_{2.5} source regions over the Mississippi Gulf Coast using WRF/HYSPLIT modeling approach' - L. Myles, W. Pendergrass, C. A. Vogel, Y. Anjaneyulu, V. B. R. Dodla, H. P. Dasari, C. V. Srinivas, F. Tuluri, J. M. Baham, R. Hughes, C. Patrick, J. Young, and S. Swanier.

'Observation, analysis, and modeling of the sea breeze circulation during the NOAA/ARL-JSU meteorological field experiment summer 2009' - W. Pendergrass, L. Myles, C. A. Vogel, Y. Anjaneyulu, V. B. R. Dodla, H. P. Dasari, J. M. Baham, R. Hughes, C. Patrick, J. Young, and S. Swanier.

'Analysis and prediction of the atmospheric boundary layer characteristics during the NOAA/ARL-JSU meteorological field experiment, summer-2009' - W. Pendergrass, L. Myles, C. A. Vogel, H. P. Dasari, V. B. R. Dodla, Y. Anjaneyulu, J. M. Baham, R. Hughes, C. Patrick, J. Young, and S. Swanier.

'Numerical prediction of atmospheric mixed layer variations over the Gulf Coast region during NOAA/ARL-JSU meteorological field experiment summer 2009—sensitivity to vertical resolution and parameterization of surface and boundary layer processes' - W. Pendergrass, L. Myles, C. A. Vogel, Y. Anjaneyulu, V. B. R. Dodla, H. P. Dasari, J. M. Baham, R. Hughes, C. Patrick, J. H. Young, and S. Swanier.

'Short range numerical weather prediction for the Gulf Coast region during the NOAA/ARL-JSU meteorological field experiment of summer 2009' - W. Pendergrass, L. Myles, C. A. Vogel, V. B. R. Dodla, H. P. Dasari, Y. Anjaneyulu, J. M. Baham, R. Hughes, C. Patrick, J. H. Young, and S. Swanier.

An abstract entitled 'Mercury Speciation at the Western Edge of the Houston Ship Channel Petrochemical Complex' was accepted for oral presentation during the technical program of the 2010 American Meteorological Society Annual Meeting. steve.brooks@noaa.gov

L. Myles gave two invited presentations at Spelman College in Atlanta, GA, on September 24-25. The first was a research presentation entitled "From the Biosphere to the Atmosphere and Back Again: Quantifying Air-Surface Exchange of Ammonia" given to a university-wide audience. The second was an overview presentation about transitioning undergraduate and graduate education into a research career given to the Sophomore/Senior Biology Colloquium. The Howard Hughes Program at Spelman hosted the seminars and facilitated research discussions with Spelman faculty. latoya.myles@noaa.gov

L. Myles presented a poster entitled "Measurement of ammonia, nitric acid, sulfur dioxide, and sulfate (PM_{2.5}) fluxes over soybeans using the modified Bowen-ratio

method” at the 238th American Chemical Society National Meeting and Exposition in Washington, DC, on August 17. The poster was presented during the Managing Agricultural Gas and Particle Emission Symposium and the Sci-Mix Session. Coauthors were J. Kochendorfer, M.W. Heuer, and T.P. Meyers. latoya.myles@noaa.gov

DISPERSION

Washington, DC Mixing-Height Study

A team of ATDD researchers conducted a radiosonde study on September 14-20 to investigate heights of the mixed layer over the Washington, DC, metropolitan area. This was part of a larger collaboration with the National Center for Environmental Prediction (NCEP) to investigate the evolution of the daytime planetary boundary layer (PBL) and the associated mixed-layer height. Accurate prediction of the mixed-layer height is critical to numerous prediction capabilities related to air quality, climate, and atmospheric dispersion. A primary focus of this study was to improve forecasts of plume dispersion in a highly populated urban region. Other collaborators included investigators from Howard University (HU), the National Aeronautical and Space Administration (NASA), the National Center for Atmospheric Research (NCAR), and the University of Maryland – Baltimore County (UMBC). ATDD’s set of measurements were combined with model-generated and other measured values for the region to produce an evaluation database for assessing model behavior.

The ATDD team conducted the balloon launches from two locations: the Howard University central quadrangle and the east parking area of RFK Stadium. Radiosonde were released on four days, when conditions were favorable, at 2-hour intervals between 0900 and 1800 local time. Prior to each launch, all necessary clearances were obtained from designated security entities. Data on wind speed, wind direction, temperature, and humidity as a function of height were relayed to a ground station and presented on a web site in real time, allowing immediate viewing of the existing structure of the lower atmosphere by those interested in the study.

Also, student involvement was an important component of the research. Throughout the study, under the close supervision of ATDD researchers, students from the Howard University Department of Physics and volunteers from the student population at large, aided in conducting the measurements. Pictures of the studies at were taken by NOAA photographers and can be viewed at http://photos.imagesbyvi.com/arl_howardu.chris.vogel@noaa.gov, Pendergrass, Senn, White, and Dumas

Weather Research and Forecast Model (WRF) at ATDD

We are developing tools to aid response to an unanticipated release of toxic materials to the atmosphere in the complex ridge-valley terrain of East Tennessee. Expanding on our Regional Air Monitoring and Analysis Network (RAMAN), we are implementing the Weather Research and Forecast (WRF) Model in two modes. The WRF has run regularly since March 2008, drawing initial and boundary conditions from the Rapid Update Cycle (RUC) model. Current forecasts are posted on the web and all forecasts are archived. Current work is to incorporate RAMAN data, along with any vertical soundings that may be available, by variational assimilation. ron.dobosy@noaa.gov

Presentations: Modeling Dispersion in East Tennessee

Description: Two reports on simulation of atmospheric dispersion in a β -mesoscale valley have been accepted for oral presentation at the American Meteorological Society's Annual Meeting in Atlanta next January. They are "Emergency dispersion forecasts for east Tennessee: How best to utilize WRF?" by R. Dobosy and D.J. Gagne II, and "An evaluation of WRF model output statistics techniques in eastern Tennessee," by Gagne and Dobosy. The first presentation quantitatively assesses the WRF model's fidelity in representing known mesoscale features of a broad valley. The second examines the value added to forecasts through model output statistics (MOS) of the traditional type and of a more recent and sophisticated type. ron.dobosy@noaa.gov



C.A. Vogel and a Howard student study the wind and temperatures profiles from a



Dr. James A. Donaldson, Dean of the College of Arts and Sciences at Howard University joins the ATDD team and Howard students in a radiosonde launch.



D. Senn prepares to release a radiosonde at RFK Stadium.



R. White and a student release a radiosonde on the campus of Howard University.

MISCELLANEOUS

Eight middle-school students and their advisers visited ATDD on July 23. They were part of a science camp operated by the Science Education Program of Oak Ridge Associated Universities (ORAU) for students from Appalachian states. Their topic was wind energy. They had built wind turbines using small DC generators, PVC pipe, and blades of their own design and construction. The designs were marvelously varied. ATDD provided the wind-tunnel test. The turbines' performance ranged from falling apart up to producing a higher voltage than the "target" device: a generator driven by a commercial toy pinwheel. Randy White, Brent French, Ed Dumas, and David Senn (ATDD) ran the tests and discussed with the students why some designs performed better than others. ron.dobosy@noaa.gov

Global warming was discussed at a meeting of Oak Ridge's Kiwanis Club. Ron Dobosy (ATDD) presented findings from the Fourth Report of the Intergovernmental Panel on Climate Change (IPCC), along with some perspective from Danish economist Bjorn Lomborg. IPCC basically finds the planet to be warming and human activities to be a major reason. ron.dobosy@noaa.gov

L. Myles penned an article for the Fall 2009 NOAA Central Region Newsletter. The article highlighted ATDD's five Summer 2009 research interns: Ridwaana Allen, David J. Gagne II, Kenneth Pratt, Aziza Marchant, and Samuel Ubanyionwu. Pictures of the interns along with brief descriptions of their research were featured. latoya.myles@noaa.gov

TRAVEL

Dobosy, R., Boulder, CO, June 21-26, 2009, to attend a workshop for users of the Weather Research and Forecast Model.

Bryant, D. and Rutherford, M., Forrest City, AR; Amarillo, TX; Socorro, NM; Holbrook, AZ; Farmington, NM; Albuquerque, NM; Kanab, UT; and Flagstaff, AZ, July 6-16, 2009, to install HCN-M stations.

Burris, J. and French, B., Forrest City, AR; Santa Rosa, NM; Reserve, NM, Holbrook, AZ; Farmington, NM; Page, AZ; and Green River, UT, July 7-15, 2009, to install HCN-M stations.

Boice, M. and Edgemon, T., Lexington, KY; Cambridge, OH; Indianapolis, IN; Bedford, IN; and Champaign, IL, July 7-15, 2009, to conduct CRN maintenance visits.

Hamby, T., Tuscaloosa, AL, July 9-10, 2009, to perform unscheduled maintenance visit.

Heuer, M., Kochendorfer, J., and Miller, J., Champaign, IL, July 14-17, 2009, to visit SEBN site.

Jordan, J. and Randolph, J., Sitka, AK; Anchorage, AK; Barrow, AK; Fairbanks, AK; and St. Paul, AK, July 14-28, 2009, to perform annual maintenance at four CRN stations.

Haire, D. and Hamby, A., Kingdom City, MO; Loveland, CO; Boulder, CO; Craig, CO; Fruita, CO; Cortez, CO; and South Fork, CO, to perform annual maintenance in Nebraska and Colorado.

Galloway, K. and Hall, M., Old Town, ME; and Providence, RI, July 21-August 3, 2009, to perform annual maintenance for CRN sites in ME, NH, and RI.

Myles, L., Nashville, TN, July 25-26, 2009, to represent ATDD at the National Association of Counties meeting.

Baker, C., Arlie, VA, July 27-30, 2009, to attend leadership training.

Vogel, C., Washington, DC, July 27-30, 2009, to attend DCNet meetings and site visits.

White, J., Washington, DC, July 28-31, 2009, to repair Urbanet site at NRL and visit sites at US Arboretum, Hoover building, National Park Service, and Howard University.

Wilson, T., Silver Spring, MD, July 28-31, 2009, to attend OAR-NESDIS workshop in Silver Spring, MD.

Meyer, R., Ocean Springs, MS, August 4-7, 2009, for Mesonet maintenance.

Pendergrass, W., Norman, OK, August 9-13, 2009, to attend the 2009 AMS Summer Community Meeting.

Boice, M. and Burris, J., Tomah, WI; Sandstone, MN; Thief River Falls, MN, Marquette, MI; Sault Ste. Marie, Canada, Egbert, Ontario, Canada; and Sarnia, Ontario, Canada, August 11-21, 2009, to conduct maintenance at USCRN stations in the U.S. and Canada.

Myles, L., Washington, DC, August 16-18, 2009, to attend the ACS National Meeting.

French, B., Galloway, K.; and Rutherford, J., Sand Point, AK, August 17-24, 2009, to install USCRN site in Alaska.

Myles, L., Research Triangle Park, NC, August 19-21, 2009, to attend CASTNET Workshop.

Bryant, D. and Johnson, K., Sioux Falls, SD; Aberdeen, SD; Jamestown, ND; Kenmare, ND; Mdeora, ND; Spearfish, SD; and Mitchell, SD, August 24 – September 4, 2009, to perform maintenance on USCRN weather stations.

Edgemon, T. and Randolph, J., Grants, NM; Barstow, CA; Santa Barbara, CA; Santa Nella, CA; Mariposa, CA; Manteca, CA; Bodega Bay, CA; Williams, CA; Redding, CA; Bandon, OR; and Corvallis, OR, August 27 – September 12, 2009, to perform annual maintenance of CRN stations.

Wilson, T., Silver Spring, MD, September 8-11, 2009, to attend SMAP Workshop.

Hamby, A. and Jordan, J., Portland, OR; Lacey, WA; Marysville, WA; Cheney, WA; John Day, OR; Hines, OR; Lakeview, OR; Carlin, NV; and Grand Junction, OR, September 11-25, 2009, to perform annual maintenance of CRN stations.

Dumas, E., Senn, D., Vogel, C., and White, R., Washington, DC, September 13-21, 2009, to participate in urban boundary layer study.

Boice, M., Tuscaloosa, AL and Millbrook, AL; September 16-18, 2009, to perform unscheduled maintenance at HCN-Alabama sites.

Brooks, S., Oak Ridge, TN, September 20-25, 2009, traveled to ATDD for instrument repair, instrument mounts and to take required training.

Pendergrass, W., Cocoa Beach, FL, September 20-25, 2009, to attend INSRP meeting.

Burris, J., French, B., Galloway, K., and Rutherford, J., Port Alsworth, AK, and Anchorage, AK, September 21-27, 2009, to install USCRN station.

Myles, L., Atlanta, GA, September 23-26, 2009, to speak and participate in events at Spelman College.

Edgemon, T., Gainesville, AL, September 25, 2009, for unscheduled maintenance visit at HCN site.

Meyers, T., Washington, DC, September 30 – October 1, 2009, to receive NOAA Administrator's Award.

cc:

Abelquist, E.
Artz, R.
Bach, W. D.
Baldocchi, D.D.
Berlinrut, D.
Cunningham, D.C.
Dahlman, R. C.
Fine, S.
Hanna, S.R.
Hicks, B.B.
Hildebrand, S.G.
Holland, M.
Hosker, R.P.
Jacobs, G.
Mann, R.
Michalsky, J.
Mills, D.
Mills, G.A.
Page, A.
Petty, R.
Radcliffe, L.
Randerson, D.
Riches, M.R.
Roberts, S.
Roddy, L.C.M.
Wilson, K.B.
Womack, J.