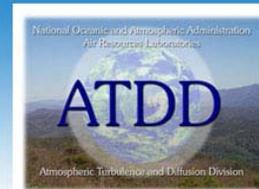




## NOAA/ATDD Quarterly Activity Report

October 2009 – December 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 October, November, and December was completed without problems. The monthly data (a summary file and precipitation tables for each month) have been downloaded to <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](mailto:lynne.satterfield@noaa.gov)

#### *U.S. Climate Reference Network*

In October, November, and December, NCDC retrieved 53 data files from CRN sites through the server <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](mailto:lynne.satterfield@noaa.gov)

Twenty-five CRN annual maintenance visits were completed this quarter. Annual maintenance was also completed on 12 HCN sites in Alabama. Five CRN sites had soil moisture and temperature probes installed. Six unscheduled maintenance visits were performed during this period, and six HCN-M sites were installed. Additional installations were postponed due to inclement weather and logistical issues.

[mark.e.hall@noaa.gov](mailto:mark.e.hall@noaa.gov)

#### *University of Tennessee Space Institute Collaboration*

NOAA/ATDD's collaboration with the University of Tennessee Space Institute (UTSI) Aviation Systems and Flight Research Department in Tullahoma, TN continues to move forward. All instruments have been acquired, and installation has begun on the Piper Navajo aircraft. The first flights are expected by the first week of February, 2010.

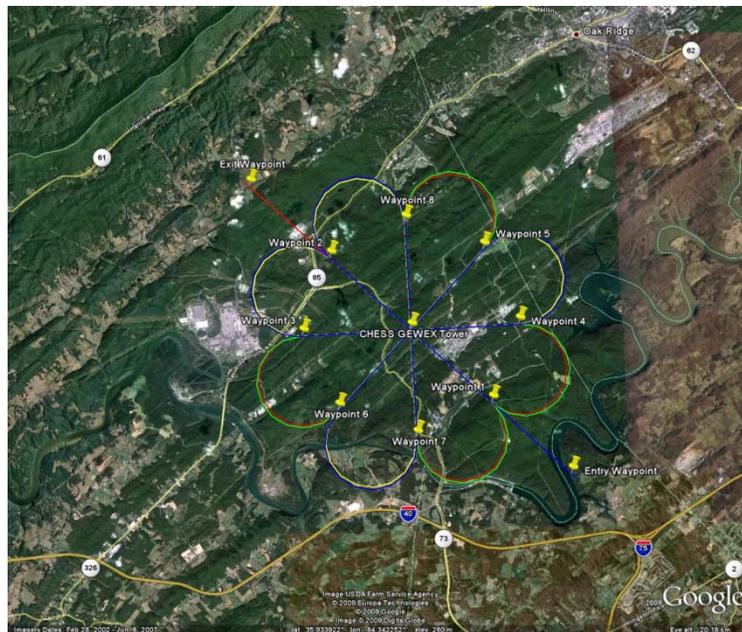
The Piper Navajo aircraft has much of the basic infrastructure already installed, including power supplies, GPS/INS systems for measuring the attitude, position, and velocity of

the aircraft, and data acquisition systems, both analog and digital. Scientific instruments carried for ATDD will include a Kipp & Zonen SP radiometer, a pair of Apogee PAR sensors, a Heitronics infrared (IR) temperature sensor, a Riegl laser altimeter. A pair of Ocean Optics spectrometers will be installed after the test program.

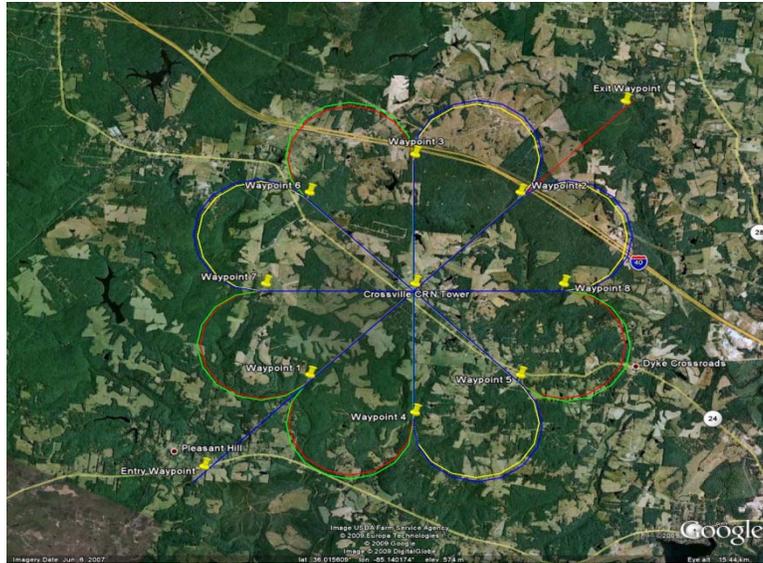
Test flights are planned over the CRN site in Crossville, Tennessee and NOAA/ATDD's Chestnut Ridge research tower (CHESS) near Oak Ridge, TN. To measure uniformly the spatial variability of surface temperature, a variant of the "asterisk" pattern flown in the 1990's by ATDD's Long-EZ aircraft will be used. In this flight plan the aircraft makes multiple passes over the tower on eight headings at various altitudes, within a 5 km radius of the tower using shallow banked turns to maximize the usable data. The patterns will be flown at 2000 feet, 1500 feet, 1000 feet, and 500 feet above the highest obstacle in the vicinity of the tower. [ed.dumas@noaa.gov](mailto:ed.dumas@noaa.gov), C.B. Baker, T.P. Meyers, D. Senn



NOAA/ATDD instruments and their locations on the UTSI Piper Navajo (N11UT).



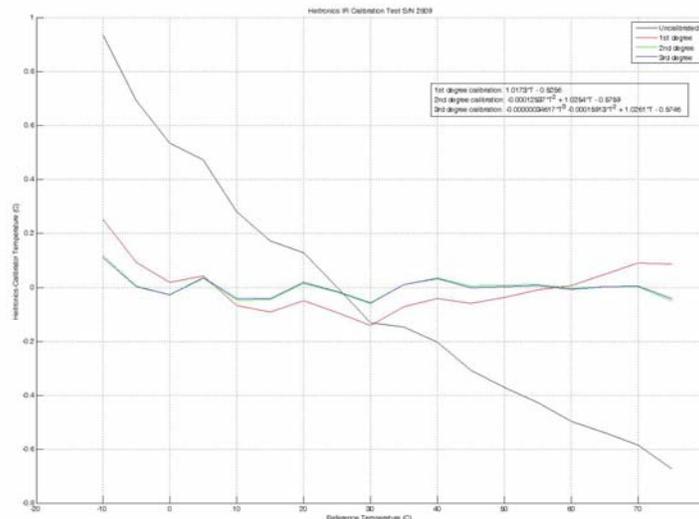
Proposed flight plan over the Chestnut Ridge Environmental Study Site (CHESS) tower near Oak Ridge, TN.



Proposed flight plan over the Crossville, Tennessee CRN tower.

### *Infrared Instrument Calibrations*

Facilities for calibrating infrared temperature sensors for both the UTSI aircraft and the CRN stations have been improved following the acquisition of a Hart Scientific 4180 IR calibrator. This instrument is radiometrically calibrated to NIST standards, and software has been developed to allow automatic operation of the IR calibrator and data collection during the calibration process.. In addition, fixtures have been built to allow IR temperature sensors to be placed close to the calibrator target to control the variance of reflected radiation that might adversely affect the calibration. The accompanying graph shows a calibration curve for the Heitronics KT19.85 II produced with the Hart Scientific 4180 calibrator. The x-axis shows the calibration target temperature, and the y-axis shows the difference between the Heitronics temperature and the calibration target temperature. The uncorrected curves, plus three best-fit polynomial curves which minimize the error are shown. [ed.dumas@noaa.gov](mailto:ed.dumas@noaa.gov), C.B. Baker



### *Presentations*

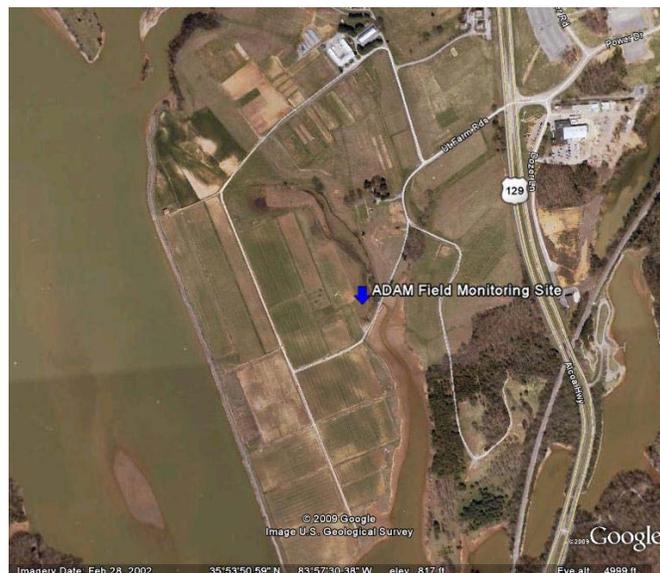
E. Dumas presented a paper entitled “Use of airborne incident and reflected solar radiation to characterize spatial variability of land use and Earth skin temperature around research tower sites” at the 2010 15th Symposium on Meteorological Observations and Instrumentation (SMOI) at the 90th American Meteorological Society (AMS) meeting in Atlanta, GA on Tuesday, January 19, 2010. [ed.dumas@noaa.gov](mailto:ed.dumas@noaa.gov)

### **AIR QUALITY**

#### *Atmospheric Deposition of Ammonia (ADAM) Study*

Ammonia is a primary pollutant that reacts readily with other gases such as sulfuric acid and nitric acid to form ammonium particulates and aerosols, which deteriorate ecosystem health and contribute to respiratory problems in humans. Ammonia is also a form of reactive nitrogen and, as such, has received increased scientific attention for its ‘cascading effects’ in the atmosphere, hydrosphere, and biosphere. Over the coming months, ATDD researchers will conduct a series of studies to quantify the magnitude of ammonia air-surface exchange rates in an agricultural ecosystem during periods of pre- and post-fertilization with a suite of real-time and integrated measurement systems.

In collaboration with researchers and staff from the University of Tennessee (UT) College of Agricultural Sciences and Natural Resources, ATDD scientists and engineers will conduct field experiments at UT Plant Sciences Unit Campus (see image below) in Knoxville, TN beginning in February 2010. Plots of wheat, soybean, and other agricultural crops are scheduled for fertilization with urea fertilizer, which has been shown to increase local ammonia emissions from vegetation by several orders of magnitude. It is anticipated that the measurement techniques will therefore be tested over a wide range of conditions including deposition and emission. At present, two real-time ammonia measurement systems, a Picarro WS-CRDS Ammonia Analyzer and an IonPro Ion Mobility Spectrometer, are available for testing. A Relaxed Eddy Accumulation system and a gradient configuration using annular denuders will also be deployed as reference measurements. Data from this study will be used to determine the applicability of the various methods to air-surface exchange research and to guide decisions for participation in the upcoming CalNex 2010 field campaign. [latoya.myles@noaa.gov](mailto:latoya.myles@noaa.gov), M. Heuer



#### *Atmospheric Mercury at Canaan Valley, WV*

Eight surrogate surface samplers were fabricated at ATDD in October 2009 as a low-cost, low-tech alternative to replace, or supplement, difficult Tekran mercury speciation measurements. These samplers were deployed at the Canaan Valley and Big Piney (Frostburg State University) mercury sites. Weekly samples and field blanks were analyzed by Frostburg State and compared to commercial Aerohead samplers manufactured by Frontier Geosciences. ATDD surrogate samplers produced consistently low field blanks. Weekly samples compared very well to commercial units and to measured Tekran reactive gaseous mercury concentrations. ATDD surrogate samplers were easier to clean and deploy and were less susceptible to rain water contamination. Both of these advantages were in stark contrast to the commercial units, which experienced contamination issues forcing a discard of samples prior to analysis.

Mark Castro (Frostburg State) is leading our collaborative effort to seek funding from the Maryland Department of Natural Resources to fabricate and deploy the ATDD surrogate samplers on a much wider scale. In our proposal, we would fabricate an additional 100 samplers. Eight different sites would receive four loaded samplers per week. One will be deployed and immediately removed as a field blank, while the other three will be deployed for a week (Tuesday to Tuesday). The following Tuesday the used samplers will be replaced and shipped to Frostburg State, where they will be analyzed, cleaned, reloaded, and returned. The proposed initial sites are Canaan Valley, WV; Allegheny Portage, PA; Beltsville, MD; Grand Bay, MS; Frostburg, MD (two sites); Smithsonian Environmental Research Center, MD; and Chestnut Ridge, TN. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

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

Planning continued for ATDD's research studies in association with CalNex 2010. The air quality portion of ATDD's efforts will focus on measuring atmospheric ammonia air-surface exchange over an agricultural ecosystem in the southern San Joaquin Valley (SoSJV). This will include characterization of the fundamental processes that influence ammonia air-surface exchange, including micrometeorological factors. Several real-time measurement techniques, including a Picarro WS-CRDS Ammonia Analyzer and an Ion Pro Ion Mobility Spectrometer, may be deployed during the study. A gradient configuration of annular denuder systems and a relaxed eddy accumulation system will be also be deployed as benchmark measurements.

Discussions with researchers from the California Air Resources Board and associated academic partners were held to determine a measurement site in the SoSJV. The CalNex air quality supersite in the SoSJV is located near Bakersfield, CA (35°20'46.15" N, 118°57'55.87" W). However, the site is not suitable for trace gas flux measurements due to insufficient fetch (adjacent two-or-three-story buildings) and a lack of ammonia emission sources in the vicinity. Alternative sites to the southwest of the Bakersfield supersite are being considered. Several issues will influence the selection of a suitable site, including physical parameters (fetch and power), environmental dynamics (vegetation and soil characteristics), and coordination with other research, particularly airborne ammonia measurements being made aboard the NOAA WP-3D aircraft with a CIMS technique and ground-based trace gas measurements being proposed by Lawrence Berkley Laboratory. [latoya.myles@noaa.gov](mailto:latoya.myles@noaa.gov), M. Heuer

### *Manuscripts*

An extended abstract entitled "Evaluation of PM<sub>2.5</sub> Source Regions over the Mississippi Gulf Coast using WRF/HYSPLIT Modeling Approach" by L. Myles, W.R. 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 was drafted and submitted for inclusion in the 2010 Annual Meeting Proceedings of the American Meteorological Society. It is available online at <http://ams.confex.com/ams/pdfpapers/162474.pdf>. [latoya.myles@noaa.gov](mailto:latoya.myles@noaa.gov), W. Pendergrass, C.A. Vogel

### *Presentations*

A presentation entitled "Preliminary Results from a Mercury Dry Deposition Measurement Methods Intercomparison" by F. Marsik, S. Brooks, M.S. Gustin, T. Holsen, M. Landis, E. Prestbo, and L. Poissant was given at the 2009 Fall Meeting of the American Geophysical Union in San Francisco, CA. The presentation detailed results from a summer 2008 field study at the University of Michigan which compared various methods of measuring mercury concentrations in the atmosphere and of estimating mercury deposition. During the study, ATDD scientists deployed a modified-Bowen ratio flux tower for the determination of gaseous elemental and reactive gaseous mercury concentrations and surface fluxes. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

A presentation entitled "Atmospheric Mercury Speciation at the Western Edge of the Houston Ship Channel, TEXAQS 2009 SHARP Study" by S. Brooks, W. Luke, M. Cohen, P. Kelly, B. Rappenglueck, B. Lefer and J. Golovko was given at the 2010 American Meteorological Society Annual Meeting in Atlanta, GA. The presentation detailed mercury speciation measurements taken by ATDD scientists during the spring and summer of 2009 in Houston, TX. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

An abstract entitled "Mercury Deposition, Photoreduction, and Gaseous Elemental Mercury Emissions from the Seasonal Snow Surface at Canaan Valley, WV" by S. Brooks was accepted for oral presentation during the *Mercury in the Environment* session of the 2010 Geological Society of America Meeting. The abstract will also be published in GSA Abstracts Vol. 42, No. 1. The presentation will discuss the mechanism by which the seasonal snowpack isolates recently deposited oxidized mercury from soil and surface organics and subsequently facilitates its photoreduction and surface emissions as gaseous elemental mercury. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

An abstract entitled "Bromine Cycling in Snow, Firn Air, and the Atmospheric Boundary Layer at Summit, Greenland During the GSHOX Field Campaign" by J.L. Thomas, C. Haman, K. Gorham, L.D. Ziemba, J. Luxford, J. Liao, D. Tanner, S. Hurlock, C. Clements, C. Beals, M. Schneider, S. Brooks, D. Blake, G. Huey, B. Lefer, J. Stutz, R. von Glasow, and J.E. Dibb was submitted to the June 2010 International Polar Year Science Meeting in Oslo, Norway. The presentation will detail 2007 and 2008 mercury speciation measurements at Summit, and subsequent modeling, including boundary layer dynamics, chemistry, and snow surface exchange. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

## **DISPERSION**

The operational utility of the Weather Research and Forecast model (WRF) to emergency responders in East Tennessee is being examined. Behind a handy and

intelligible user interface, a simple straight-line dispersion model often suffices for the first response. Even so the nearest observation in complex terrain may not reliably estimate the current wind and dispersion at the spill. East Tennessee has a large valley with ridges corrugating its floor. The people live and work mostly between these ridges. Will a mesoscale atmospheric model help? Many factors influence the answer. Certainly a model must at least get the general valley conditions right before it can provide a reliable local estimate. We have acquired 18 months of analysis and forecasts from a base version of WRF, version 2.2, paired with wind and temperature measurements from a mesoscale network in the Valley of East Tennessee. Preliminary examination for the particularly troublesome pre-dawn period attributes to WRF a fair degree of skill in representing wind direction on the ridgetops if the large-scale flow (geostrophic wind) is strong enough to influence the valley. Absent this strong guidance, the valley's air primarily drains to the southwest, not well simulated by this configuration of WRF. Furthermore, WRF at 3.3-km grid spacing does not resolve the corrugations, hence poorly represents flow between the ridges. Since this misrepresentation is largely a bias, however, we have found model output statistics to provide improved estimates. These results were presented at the 16<sup>th</sup> Conference on Air Pollution at the 90<sup>th</sup> Annual Meeting of the American Meteorological Society in January 2010 in Atlanta, Georgia. [ron.dobosy@noaa.gov](mailto:ron.dobosy@noaa.gov)

### **MISCELLANEOUS**

S. Brooks completed an invited review of the Maryland Department of Natural Resources sponsored mercury research program at the Smithsonian Environmental Research Center in Edgewater, MD. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

L. Myles participated in a one-day workshop "Communicating Science: Tools for Scientists and Engineers" on Tuesday, October 27 at the NOAA Geophysical Fluid Dynamics Laboratory in Princeton, NJ. The American Association for the Advancement of Science (AAAS) Center for Public Engagement with Science and Technology partnered with NOAA to help researchers communicate more broadly with the public. Although traditional scientific training typically does not prepare scientists and engineers to be effective communicators outside of academia, NOAA and other agencies are increasingly encouraging researchers to extend beyond peer-reviewed publishing and communicate their results directly to the greater public. [latoya.myles@noaa.gov](mailto:latoya.myles@noaa.gov)

L. Myles served on the 2009 Southeast Regional Meeting Planning Committee of the National Organization of Black Chemists and Chemical Engineers (NOBCChE). The planning committee coordinated registration and abstract acceptance for the Regional Meeting, which was held November 6-7 at the University of Maryland University College Conference Center. [latoya.myles@noaa.gov](mailto:latoya.myles@noaa.gov)

The Anderson County Youth Leadership program toured ATDD facilities in October 2009. The group consisted of 30 high school juniors and seniors attending Clinton and Anderson County high schools. The goal of the program is to provide an overview of Anderson County, giving the students a broad perspective of the community, while developing their leadership and communications skills. [bruce.baker@noaa.gov](mailto:bruce.baker@noaa.gov)

ATDD is distributing the NOAA *Teacher at Sea* program books throughout Anderson County, Tennessee. Maggie Robinson is coordinating this project, and she is interacting with science coordinators, librarians, and school administrative personnel to place this collection in public and private schools as well as in public libraries. This collection is being enthusiastically received by educators and librarians, and it is being recognized as an excellent tool to use in science classes. [maggie.robinson@noaa.gov](mailto:maggie.robinson@noaa.gov)

## TRAVEL

Bryant, D. and Johnson, K., Kingdom City, MO; Sundance, WY; Sundance, MT; Wolf Point, MT; Great Falls, MT; St. Mary's MT; Dillon, MT; and Idaho Falls, ID, September 28 – October 8, 2009, to conduct CRN annual maintenance visits.

Black, M. and Edgemon, T., Harrisburg, PA; Port Jarvis, NY; Ithaca, NY; Dover, DE; Waynesboro, VA; Weston, WV; and Charlottesville, VA, September 28-October 5, 2009, to conduct CRN annual maintenance visits.

Meyers, T., Washington, DC, September 30 – October 1, 2009, to accept the NOAA Leadership Award.

Hall, M., Fruita, CO; Tropic, UT, Holbrook, AZ; Socorro, NM; Pagosa Springs, CO; Pueblo, CO; Fort Morgan, CO; Louisville, CO; and Denver, CO, September 28 – October 10, 2009, to service HCN-M stations in CO, NM, AZ, and UT, and CRN test site near Boulder.

Baker, B., Kochendorder, J., and Meyers, T., Boulder, CO, October 5-9, 2009, to attend a CRN meeting regarding research activities at the Marshall Test Bed site.

Boice, M. and Hamby, T., Idaho Falls, ID; Jackson, WY; Meridian, ID; Ogden, UT; Rock Springs, WY; Gillette, WY; Spearfish, SD; Evansville, WY; Ogallala, NE; and Kansas City, KS; October 10 – 21, 2009, to conduct CRN annual maintenance visits.

Edgemon, T., Guntersville, AL, October 14, 2009, for an unscheduled maintenance visit.

Haire, D. and Randolph B., Maumelle, AR; Amarillo, TX; Taos, NM; Alamosa, CO; La Junta, CO; Springfield, CO; Amarillo, TX, and Russellville, AR, October 19 – October 27, 2009, to install HCN-M infrastructure.

Edgemon, T., Coshocton, OH, October 20-21, 2009, to make an unscheduled maintenance visit.

Land, G., Washington, DC, October 25-29, 2009, to attend Contracting With Small Business Training.

Myles, L., Princeton, NJ, October 26-28, 2009, to attend the "Communicating Science" workshop at NOAA GFDL.

Brooks, S., Oak Ridge, TN, October 26-30, 2009, for required training and fabrication of surrogate surface samplers.

Baker, B., Orlando, FL, October 28-31, 2009, to attend the Dupont Safety Seminar.

Jordan, J. and Rutherford, M., Warrenton, MO, Salina, KS; La Junta, CO; Alamosa, CO; Taos, NM; Pagosa Springs, CO; and Oklahoma City, OK, October 28 – November 5, 2009, to install hardware at HCN-M stations.

Meyers, T., Kochendorder, J., Miller, J., and Heuer, M., Champaign, IL, November 2-6, 2009, to install GEWEX tower.

Burris, J. and Galloway, K., Kingdom City, MO and Fairview Heights, IL, November 3-5, 2009, to perform annual maintenance on CRN and HCN sites.

White, R., Washington, DC, November 3-4, 2009, to perform maintenance at DCNET sites.

Baker, B., Boulder, CO, November 8-13, 2009, to participate in the National Science Foundation's final design review for NEON program.

Dumas, E., Tullahoma, TN, November 9, 2009, to install instruments in an aircraft at the University of Tennessee Space Institute.

Edgemon, T. and Hamby, A., Conway, AR; Santa Fe, NM; Los Alamos, NM; Socorro, NM; Flagstaff, AZ; Page, ZA; Torrey, UT; Durango, CO; La Junta, CO; and Salina, KS, November 10 – 21, 2009, for CRN and HCN site visits.

Haire, D., and Johnson, K., Ashville, NC, November 19-20, 2009, to make the annual maintenance visit.

Jordan, J., Kimball, TN, November 28-29, 2009, to make an Alabama HCN-M unscheduled maintenance visit.

Meyers, T., Reston, VA, November 30 – December 2, 2009, to participate in the USGS Land Science Panel.

Bryant, K. and Galloway, K., Forrest City, AR; Amarillo, TX; Albuquerque, NM; Holbrook, AZ; Camp Verde, AZ; Flagstaff, AZ; Gallup, NM; Springfield, CO; Amarillo, TX; and Forrest City, AR, November 30 – December 11, 2009, to make six HCN-M site installs.

Pendergrass, W., Charlotte, NC, December 1-2, 2009, to participate in meetings at Duke Power Renewable Energy.

Edgemon, T. and Burris, J., Hilo, HI, December 1-8, 2009, to perform annual maintenance at the USCRN weather stations.

Hall, M., Lincoln, NE, December 6-7, 2009, to perform maintenance at the two CRN sites.

Haire, D., and Johnson, K., Durham, NC, December 8-9, 2009, to perform annual maintenance at CRN site.

Jordan, J., and Rutherford, M., Birmingham, AL, December 8-17, 2009, to conduct annual maintenance at AL-HCN site.

Hamby, T., and Randolph, B., Clovis, NM; Heber, AZ; and Cameron, AZ, December 11-20, 2009, to conduct HCN site work.

Kochendorfer, J., Louisville, CO, December 13-17, 2009, to install a rain gauge at the Marshall Test Bed.

Land, G., Vienna, VA, December 13-19, 2009, to attend the Contracting Officer's Representative Course.

Jordan, J., and Rutherford, M., Florence, AL; Tuscaloosa, AL; and Selma, AL, to make an HCN-M annual maintenance visit.

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.  
Roddye, L.C.M.  
Wilson, K.B.  
Womack, J.