



NOAA Air Resources Laboratory Quarterly Activity Report FY2012 Quarter 3 (April - June, 2012)

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DISPERSION AND BOUNDARY LAYER

1. HYSPLIT Training for Weather Forecasters

Glenn Rolph and Roland Draxler traveled to the Wilmington, N.C., NWS Weather Forecast Office in April, and gave a one day training workshop on the use of the currently available web-based HYSPLIT model designed for use by weather forecasters during emergency response events. This training included a background on the HYSPLIT model and its use for emergency response applications, such as smoke from industrial fires, wild fires, and prescribed burns, as well as its use for releases of radioactive materials into the air. The presentation was well received by the forecasters, and several indicated that they will be contacting their local emergency managers to let them know of the products they can now produce for them using the web-based HYSPLIT system.

Glenn.Rolph@noaa.gov or Roland.Draxler@noaa.gov

2. Web-based HYSPLIT Application for NWS Weather Service Forecast Offices

After a few months of development and testing by ARL scientists, a web site that is used by the National Weather Service (NWS) Weather Forecast Offices (WFOs) to run the ARL HYSPLIT dispersion model officially became operationally-supported by the NOAA Chief Information Office's Web Operations Center (WOC). The URL is <https://www.hysplit.noaa.gov>. This server, physically located in Colorado, will automatically fail-over to a backup server in Maryland should the primary server fail. The system has been redesigned over the last several years to include better graphics at the local-scale level, Google Earth and Google Maps output options, the ability for users to enter a hazardous chemical source-term with resulting graphics in a format more meaningful to emergency responders, and the ability to run HYSPLIT with user-entered surface or upper-air observations. In addition, a new version of the system is currently being developed jointly between ARL and NOAA's Office of Response and Restoration (OR&R) that will allow the OR&R ALOHA chemical source term model to interface with the HYSPLIT dispersion model and provide forecasters with the capability to run detailed chemical accident scenarios through the web site. This system will be introduced and tested in the first quarter of 2013 to select users and WFOs. Glenn.Rolph@noaa.gov

3. Annual HYSPLIT Model Workshop

The annual HYSPLIT model workshop was conducted at the Silver Spring Civic Building at Veterans Plaza in Silver Spring, Maryland. The workshop focused on the use of the recently updated version 4.9 of the model and its Graphical User Interface. The workshop had participants from government, academia, and private sector, including the National Weather Service, Florida Forest Service, University of Minnesota, University of California Davis, University of Texas, Arctic Region Supercomputing Center, EPA, NASA Goddard, Tetra Tech, Inc., Trinity Consultants, Shenandoah National Park, and Red Cliff Band of Lake Superior Chippewa. One EPA participant stated that "This was, by far, the best workshop I've attended in years. It provided excellent hands-on instruction and real-world examples. Instructors were very knowledgeable and provided courteous and immediate feedback to all questions and comments. HYSPLIT will be a valuable tool to EPA in planning for and responding to airborne radioactivity releases from all sources, especially when it's used in conjunction with our RadNet fixed and deployable air monitoring system. We look forward to working with ARL in the future."

4. Best Aircraft Turbulence Probe

ATDD scientists accelerated their work with the Best Aircraft Turbulence (BAT) probe following the awarding of a National Science Foundation (NSF) grant for research in the permafrost region of

Alaska. The replacement of the Fast Ultra-Sensitive Temperature (FUST) probe with a fiber-optic temperature probe with equivalent frequency response, resolution, and accuracy is in progress. The fiber-optic system uses the temperature dependence of the semiconductor band-gap of a gallium-arsenide crystal to measure the temperature at a very small spot on the end of a glass-fiber cable. The system is built by Op-Sens and promises to eliminate the electromagnetic interference that has been encountered on all previous FUST installations during aircraft radio transmissions. Acquisition, installation, and testing of the fiber-optic temperature probe will occur next quarter.

ed.dumas@noaa.gov, R. Dobosy, D.L. Senn, C.B. Baker

5. High Resolution Rapid Refresh Project

The new computer running the Weather Research Forecast (WRF) modeling system for forecasts for Southeast Idaho was brought on-line at FRD. The new system provides an opportunity to improve the local forecast products being generated from the High Resolution Rapid Refresh (HRRR) model run at NOAA's Earth System Research Laboratory. The HRRR model runs hourly on a 3 km horizontal grid, and FRD has been receiving HRRR output for a sub-domain covering Southeast Idaho. A set of scripts was developed for the new WRF computer that automatically generates forecast products from the HRRR output and posts them to a web site. The products include map animations, meteograms, text forecasts for selected locations, and comparisons of the model forecast with NOAA/INL Mesonet observations. (richard.eckman@noaa.gov)

6. High Performance Computing

Boise State University (BSU) refocused its work on the development of a general purpose Lagrangian dispersion kernel that could be used in a version of HYSPLIT that was optimized for parallel processing with GPUs or with other geophysical dispersion models. A prototype of this kernel had been developed and is currently being tested by the BSU graduate student. (dennis.finn@noaa.gov)

7. High Desert Prairie Grass II

During the course of this project, there has been a problem with a significant number of the sample air bags leaking. Since a sufficient quantity of reliable bags are required to complete the project and the project will likely extend over several years, FRD has identified a method of sealing the sampler bags using an industrial adhesive PLIOBOND. The adhesive is applied around the base of each fitting after the bag has been connected to an inlet tube and laid flat on a surface with the fitting facing up. PLIOBOND is a liquid and may be easily applied from a squeeze bottle. It is then allowed to cure for 24 hours. Testing indicates that this method will seal virtually 100% of the leaks around the tube fittings and also prevent the bags from developing leaks as time passes. This would leave only the bags that leak due to other problems such as pin holes. This should be less than 1% of the bags, which is an acceptable level. (roger.carter@noaa.gov)

8. Transport and Dispersion Modeling

A formal protocol was adopted for testing all facets of the NOAA/INL EOC HYSPLIT implementation (EHY version 1.0). The protocol includes testing of: 1) all preconfigured scenarios in the library; 2) all possible combinations of selecting model configuration parameters to make sure the model will execute reliably; and 3) utilities and features such as printing, saving, sharing runs, and accessing old runs. The testing is being conducted by both meteorologists and non-meteorological staff with the goal to make the implementation as robust and user-friendly as possible regardless of the skill of the user. roger.carter@noaa.gov; dennis.finn@noaa.gov

Progress continued toward an upgrade of EHY from version 1.0 to 1.1. The upgrade will include: 1) calculation of specified derived intervention levels (DILs); 2) provisions for using either preconfigured release scenarios or fully user-customized scenarios; 3) the use of a gray scale contour for showing the extent of the plume at levels below regulatory limits; and 3) improved labeling of nuclides, release scenario, and time on graphical output. Testing of the 1.1 prototype is currently being conducted through the web interface. Some preliminary work has been completed on version 2.0, which will include the ability to configure multiple sources and run plume animations, among other features. dennis.finn@noaa.gov; brad.reese@noaa.gov

Progress is continuing to be made on the integration of the WindNinja, a high resolution computer model that computes spatially varying wind fields for wildland fire application, with the EHY. WindNinja has been setup up with appropriate terrain files and input parameters so that it generates an output grid that matches the one being used by EHY. The format and content of the WindNinja output files has been determined. The next step is to develop software to integrate the WindNinja winds with the other meteorological values needed for running HYSPLIT. (roger.carter@noaa.gov)

9. Mesoscale Forecast Modeling

The Rapid Update Cycle (RUC) model was replaced by the Rapid Refresh (RAP) model at the National Center for Environmental Prediction. This required changes to the local WRF runs at FRD, which were being initialized from the RUC output. The FRD system was then upgraded to the latest version of WRF (version 3.4). After this upgrade, the transition to the use of the RAP model for WRF initial and boundary conditions was relatively smooth. (richard.eckman@noaa.gov)

Preliminary tests have been completed on a probabilistic WRF forecast system that attempts to account for model bias and uncertainty. It uses past comparisons of the WRF forecasts with NOAA/INL Mesonet observations to generate predictive distributions for forecast variables such as 10m wind speed and 2m temperature. The intent is to provide a range of values (such as an interquartile range or 95% probability interval for the wind speed) in a point forecast rather than just a single value. The system is adaptive in that the probabilities are adjusted as new forecasts and observations come in. (richard.eckman@noaa.gov)

10. NOAA/DOE Wind Forecast Improvement Project

FRD performed regularly scheduled maintenance visits at the Wind Forecast Improvement Project (WFIP) sites in Texas. Problems were detected with equipment primarily at the Colorado City site. This was likely due to electrical storms in the area. Sodar and surface flux measurement data from the sonics covering the period from late February to late May were provided to Will Pendergrass at ATDD and Jeff Freedman from AWS Truepower. The WFIP is slated to end at the end of August, and there is only one more regularly scheduled maintenance visit. (dennis.finn@noaa.gov)

11. Support for Experiments on the Nevada National Security Site

James Wood, Rick Lantrip, and Walt Schalk provided enhanced weather support for two non-proliferation experiments conducted on the Nevada National Security Site (NNSS) over a two-week period. This support included weather forecasts (beginning 3 days prior) and data collection (event days) with multiple radiosonde and pilot balloon launches and enhanced weather surveillance, such as a lightning watch, focused on the experiment location. These activities are necessary to provide data for use and analysis in the experiment, the safe execution of the experiment under given criteria, and for the safety of the personnel. Pre-event forecasts were instrumental in the delay of the

first event and the acceleration of the second as the predicted weather did not fall within acceptable weather criteria. Follow-on data quality assurance was performed and all surface and upper air data collected in the area was assembled and distributed to the Principle Investigator. (james.s.wood@noaa.gov, rick.lantrip@noaa.gov, walter.w.schalk@noaa.gov)

12. Consequence Assessment for the NNSS

Kip Smith and James Wood participated in a full scale venue emergency response drill and a full scale emergency response exercise as the Consequence Assessment Team (CAT) for the National Nuclear Security Administration's Nevada Site Office. The exercise was conducted on the NNSS. In this exercise, Kip and James provided dispersion expertise, hazardous material plume projections, and weather data and forecasts. The drill was conducted in preparation for the full scale exercise. The exercise was conducted to comply with DOE Emergency Response Directives. The drill and exercise involved several different events that were the result of a local earthquake that caused damage to facilities. Walt Schalk participated in this exercise as a Controller/Evaluator providing the weather data for the exercise and documenting the activities of the CAT. (kip.smith@noaa.gov, james.s.wood@noaa.gov, walter.w.schalk@noaa.gov)

AIR QUALITY

13. Deep Convective Clouds and Chemistry Study

Dr. Xinrong Ren participated in the NSF/NASA Deep Convective Clouds and Chemistry (DC3) field study in collaboration with a research group at Pennsylvania State University. The study investigated the impact of deep, mid-latitude continental convective clouds, including their dynamical, physical, and lightning processes, on upper tropospheric composition and chemistry in three locations: 1) northeastern Colorado, 2) central Oklahoma, and 3) northern Alabama. Dr. Ren and his collaborators measured a few key chemical species using a laser instrument on the NASA DC-8 airplane. The measurements included the hydroxyl (OH) and hydroperoxyl (HO₂) radicals and OH reactivity, which play central roles in air chemistry and have significant impact on air quality and climate. Details about the DC3 project can be found at www.eol.ucar.edu/projects/dc3/. Xinrong.Ren@noaa.gov

14. Fire Weather Products

Barbara Stunder developed two products on the ARL web server in support of National Weather Service (NWS) fire weather activities. A set of trajectories over the southwest U.S. are automatically generated four times a day (http://ready.arl.noaa.gov/READY_traj_southwest_us.php). The Forest Service reported they are pleased with this product; they used it daily during a period with ongoing fires in Arizona and New Mexico. In addition, NWS fire weather forecasters and partners may now request HYSPLIT forecast trajectories from a NWS web page, which emails the request to ARL's server for the trajectory computation, and emails the reply with text and graphical (gif, Google Earth) trajectory products. The NWS is testing and evaluating these trajectory-by-email products through the end of 2012. See http://www.srh.noaa.gov/ridge2/fire/docs/HYSPLIT_one-pager_final.docx. barbara.stunder@noaa.gov

15. Air Quality Forecasting Support

ARL's air quality team has maintained the continuous supply of pollutant emission files and technical support for the National Weather Service's national forecasting program for surface ozone

concentrations. Significant updates were made to the emission inventories for the 2012 ozone season. Point sources were updated based on the latest available readings for 2010 from the U.S. Electric Generation Units. They were then projected to 2012 emission levels in accordance with the Department of Energy's growth projection due to its Annual Energy Outlook. The latest EPA 2012 dataset for off-road and mobile emissions, based on its Cross State Air Pollution Rule, was used as input for emissions modeling to represent temporal variation across the season. Canadian emissions for areal, mobile and point sources were updated to the 2006 inventory. By the end of July the entire set of the emission files for the 2012 ozone season will be delivered to the National Center for Environmental Prediction. Pius.Lee@noaa.gov

16. Ammonia Air-Surface Exchange Study

The ambient ammonia study at the University of Tennessee, East Tennessee Research and Education Center ended in late June after almost five months of continuous measurements. Ammonia, which is a particulate matter precursor, was measured with a Picarro cavity ring-down spectrometer and annular denuder system. Initial results indicate that the Picarro performed well, but experienced intermittent loss of data as temperatures exceeded 100 degrees for several consecutive days at the site. Analysis of the data continues, and an abstract of preliminary findings will be presented at the 2012 American Geophysical Union (AGU) meeting. latoya.myles@noaa.gov, M. Heuer, S. Klemenz

17. National Atmospheric Deposition Program Atmospheric Mercury Network

ATDD researchers coordinated with the National Atmospheric Deposition Program's (NADP) Atmospheric Mercury Network (AMNet) for site inspections. Mark Olsen of NADP traveled to the ARL AMNet sites and conducted the inspections. Apart from a faulty thermocouple for an internal case temperature, no other problems were identified. The faulty thermocouple was not critical to the measurements, and was replaced the same week. steve.brooks@noaa.gov

CLIMATE

18. Climatological Study of the Planetary Boundary Layer

With collaborators from NOAA ESRL and GFDL, NCAR, and the European Center for Medium Range Weather forecasting, Dian Seidel and Yehui Zhang (former NRC Postdoctoral Associate, now at Nanjing University) completed a study of the "Climatology of the Planetary Boundary Layer over the Continental United States and Europe", soon to appear in the Journal of Geophysical Research-Atmospheres. Although boundary layer processes are important in climate, weather and air quality, boundary layer climatology has received little attention, partly for lack of observational datasets.

The paper presents an analysis of boundary layer climatology over Europe and the continental U.S. Seasonal and diurnal variations during 1981-2005 are estimated from radiosonde observations, a reanalysis that assimilates observations, and two contemporary climate models that do not. The four datasets show similar patterns of spatial and seasonal variability, but with biases that vary spatially, seasonally, and diurnally. This unique new dataset has applications to climate, air quality, and carbon cycle modeling, and is already being used in an international intercomparison of carbon cycle models, whose simulations are very sensitive to the representation of boundary layer mixing. The study is part of a larger project to understand the climatology of the planetary boundary layer globally and complements recent studies focusing on Arctic and Antarctic boundary layer climatology.

19. Study of Tropical Tropopause Trends

James Wang (now at NASA), Dian Seidel and Melissa Free published a study entitled "How well do we know recent climate trends at the tropical tropopause?" in the Journal of Geophysical Research-Atmospheres. The tropical tropopause is a transition layer between the troposphere and stratosphere that influences global climate and atmospheric chemistry. Several previous studies reported multi-decadal tropical tropopause cooling and have suggested a correlation between observed tropopause temperature and stratospheric water vapor. This more rigorous examination of the observations shows tropopause trends have greater uncertainty than previously suggested and the cooling may not be statistically significant. The new results are consistent with expectations from a conceptual model of tropopause changes and could resolve discrepancies between complex climate models and observations.

20. NOAA State of the Science Fact Sheet on Climate Engineering

The NOAA Research Council has adopted a new NOAA State of the Science Fact Sheet on Climate Engineering. The two-page fact sheet explains the basic science of climate engineering in non-technical language and is part of a series of fact sheets on research areas which may be of high interest to the public, and where there may be a diversity of science views within NOAA. This fact sheet was developed by a team of more than two dozen NOAA scientists, chaired by Dian Seidel. The Fact Sheet will be posted to the NOAA Research Council Website:

<http://www.nrc.noaa.gov/stateofsciencefactsheets.html>, Dian.Seidel@noaa.gov

21. Analysis of U.S. Cloud Cover Data

Melissa Free, along with Bomin Sun of the National Environmental Satellite, Data, and Information Service (NESDIS), continued efforts to test homogeneity of ground-based U.S. cloud cover data and correct problems in those data. They have been working with NESDIS' National Climatic Data Center to better understand cloud data derived from their Integrated Surface Dataset and to suggest improvements for future iterations of that data archive. In related work, Hyun Kim (ARL) began obtaining and processing satellite cloud data for comparison with the ground-based cloud information. melissa.free@noaa.gov

22. Collaboration with University of Tennessee Space Institute

Flights were performed over Bondville, Illinois, using the University of Tennessee Space Institute (UTSI) Navajo aircraft carrying instrumentation to measure surface temperature, upward- and downward-looking PAR (photosynthetically active radiation) sensors, and upward- and downward-looking Ocean Optics spectrometers. The spectrometers are a new addition to the instrument suite and ATDD researchers are currently evaluating their performance on the aircraft.

ed.dumas@noaa.gov, P. Krishnan, J. Kochendorfer, T. Meyers, C.B. Baker

23. Climate Reference Networks

Fifty-three annual maintenance visits were made during this quarter. These visits were to Climate Reference Network (CRN) sites. Five unscheduled maintenance visits were made to CRN sites as well.

mark.e.hall@noaa.gov

24. World Meteorological Organization Solid Precipitation Intercomparison Experiment

John Kochendorfer and Bruce Baker attended a World Meteorological Organization Solid Precipitation Intercomparison Experiment (WMO SPICE) meeting in Boulder, CO, June 11-15. There was international participation from the US, Canada, China, Switzerland, Finland, New Zealand, and

Norway. Other countries that may be included in WMO SPICE include Japan, Russia, and Poland. The meeting addressed planning, scheduling, and coordination of SPICE and covered the selection, configuration, and operation of instrumentation; data quality and data archival; publication and data protocol; data analysis procedures; selection of the sites; and review and approval of the sites layout and instruments' configuration. The US, Norway, Canada, Finland, and New Zealand each have a site. The US site is in Marshall, CO, which will also collect the data from all of the sites and coordinate the analysis of the data for SPICE. john.kochendorfer@noaa.gov, bruce.baker@noaa.gov

25. Visiting Scientist at National Center for Atmospheric Research Foothills Laboratory

John Kochendorfer was an invited visiting scientist at the NCAR Foothills Laboratory from June 7-27. He recorded vibration and wind-speed measurements in and around precipitation gauges at the Marshall, CO solid precipitation testbed. He met with colleagues at the US Forest Service Mountain Research Station in Fort Collins, CO, and he participated in the second meeting of the WMO International Organizing Committee for Solid Precipitation Intercomparison Experiment (IOC-SPICE) and the NCAR Lower Atmosphere Observing Facility Workshop. john.kochendorfer@noaa.gov

ARL 3rd Quarter Publications

Barrett, Steven, Steve Yim, Christopher Gilmore, Lee Thomas Murray, Stephen Kuhn, Amos Tai, Robert Yantosca, Daewon Byun, **Fong Ngan**, Xiangshang Li, Jon Levy, Akshay Ashok, Jamin Koo, Hsin Min Wong, Olivier Dessens, Sathya Balasubramanian, Gregg Fleming, Matthew Pearlson, Christoph Wollersheim, Robert Malina, Sarav Arunachalam, Francis Binkowski, Eric Leibensperger, Daniel J. Jacob, Jim Hileman, and Ian Waitz (2012) Public Health, Climate and Economic Impacts of Desulfurizing Jet Fuel, Environ. Sci. Technology 46:8 pp4275-4282. doi: 10.1021/es203325a.

Gitelson, Anatoly A., Yi Peng, Jeffery G. Masek, Donald C. Rundquist, Shashi Verma, Andrew Suyker, John M. Baker, Jerry L. Hatfield, **Tilden Meyers**. (2012). Remote estimation of crop gross primary production with Landsat data. Remote Sensing of Environment. 121, 404–414. doi: 10.1016/j.rse.2012.02.017.

Kochendorfer, John, Tilden P. Meyers, John Frank, William J. Massman and **Mark W. Heuer** (2012). How Well Can We Measure the Vertical Wind Speed? Implications for Fluxes of Energy and Mass was published on-line in Boundary Layer Meteorology. Using a new technique, the accuracy of traditional field methods used to measure the surface –atmosphere exchange was evaluated. A significant error in the vertical wind speed was found. The effect of this error on surface-atmosphere exchange measurements was presented, and the lack of energy budget closure that has plagued these studies for several decades was explained. Simple methods available to correct past measurements and guidance on how to avoid future errors by redesigning the wind-velocity sensor are offered.

Rasmussen, Roy, **Bruce Baker, John Kochendorfer, Tilden Meyers**, Scott Landolt, Alexandre P. Fischer, Jenny Black, Julie Theriault, Paul Kucera, David Gochis, Craig Smith, Rodica Nitu, Mark Hall, Steve Cristanelli, and Ethan Gutmann (2012). How Well Are We Measuring Snow: The NOAA/FAA/NCAR Winter Precipitation Test Bed. Bulletin of the American Meteorological Society., 93, 811–829. doi: <http://dx.doi.org/10.1175/BAMS-D-11-00052.1>

Wang, J. S., **D. J. Seidel**, and **M. Free** (2012) How well do we know recent climate trends at the tropical tropopause? Journal of Geophysical Research, 117, D09118, doi:10.1029/2012JD017444.

Wilson, T.B., T.P. Meyers, J. Kochendorfer, M. C. Anderson, and M. Heuer (2012). The effect of soil surface litter residue on energy and carbon fluxes in a deciduous forest was published on-line in *Journal of Agriculture and Forest Meteorology* Volume 161, 15, Pages 134–147.

An article entitled "Summary of the 3rd International Workshop on Air Quality Forecasting Research: November 29 - December 1, 2011" by **Pius Lee, Rick Saylor** and Jim Meagher was published in *Eos*, the American Geophysical Union's international newspaper. The article summarized the latest development and areas of active research associated with several national air quality forecasting programs in Europe, Asia and Americas. Workshop participants were from 17 countries. They repeatedly emphasized the need for research on trends of increasing urbanization and the world's population clustering within merging and existing mega-cities and air quality issues related to climate change. ARL hosted the 3rd International Workshop in Washington D.C.

Conference Presentations/Reports

Pius Lee and Hyuncheol Kim presented a poster (via remote access) at the 32nd NATO International Air Pollution Modeling and Its Application conference in Utrecht, Netherlands. The poster, titled "Ingestion of intermittent sources within and around the air quality forecasting domain," quantifies improvement of ozone and particulate matter forecasting by taking into account satellite observed forest fire emissions within and around the forecast domain.

Ariel Stein presented a talk entitled "Sulfate aerosol formation and oxidation pathways: sensitivity to the choice of chemical mechanism employed in simulations" at the American Chemical Society, Middle Atlantic Regional Meeting.

John Kochendorfer presented a talk on "The measurement of leaf litter water content in a deciduous forest", by Tim Wilson, John Kochendorfer, Mark Heuer, Katie Sloop, Jesse Miller, and Tilden Meyers, at the 30th Conference on Agricultural and Forest Meteorology in Boston, MA. The talk was on the importance of litter moisture in the carbon cycle in deciduous forests, and it described new field techniques developed at ATDD to monitor litter moisture and litter respiration.

Awards, Honors, Recognition

Dian Seidel received a Bronze Medal, as part of a NOAA-wide team, "for developing a NOAA administrative order on scientific integrity policy and accompanying handbook on scientific misconduct."

Daniel Tong received an EPA 2011 Science and Technology Achievement Award (STAA) (Level II), along with his colleagues, Shaocai Yu of US EPA and Huiming Bao of Louisiana State University, for their work on aerosol formation from volcanic emissions. Using isotope measurements and a 3-D atmospheric sulfur chemistry and transport model, they demonstrated that atmospheric secondary sulfate preserved in continental deposits represents an unexploited geological archive for sulfur dioxide oxidation chemistry in the atmosphere. Their work was published in a 2010 issue in *Nature*. Daniel also received an Honorable Mention from the STAA Committee for his contribution in improving the atmospheric chemistry modeling in the CMAQ model.

Outreach

LaToya Myles gave an invited talk at the Project Grad Career Day at Pellissippi State Community College in late June. Her presentation discussed NOAA's mission and work across the US. She also highlighted ARL's air quality research to the audience of high school students.

LaToya also made a presentation during the NOAA Student Orientation Program in Silver Spring. The program provides an introduction in NOAA's program offices and laboratories for both the Hollings Scholarship program and the Educational Partnership Program Undergraduate Scholars Program.

Tim Wilson and Randy White gave a weather and climate presentation to a local Cub/Boy Scout group of about 25 people at the ATDD facility. The indoor portion of the presentation was held in the auditorium. The outdoor presentation included showing a wind tunnel demonstration, the Alaska Climate Reference Network equipment and setup, the workshop/machine shop, and chemistry lab. Safety and the use of safety equipment were highlighted along the way while the visitors were in the wind tunnel facility and chemistry lab.

Randy White and Chris Vogel talked to 2nd graders at St. John Neumann Catholic School in Farragut, TN about the behavior of the atmosphere, meteorological instrumentation, and taking measurements. Presentations were conducted outside on a soccer field for over an hour, and the demonstrations included a radiosonde launch, and various types of instruments. There were close to 40 students and 3 teachers and lots of interest (and questions) about their work.

Chris Vogel and Mark Hall gave presentations to gifted high school students sponsored by Fernbank Science Center in Atlanta, and the Georgia Tech Research Institute, as well as associated staff, and a host group from Oak Ridge Associated Universities. The interactive talks, which included a radiosonde (weather balloon) launch, and examples of state-of-the-art atmospheric measurement systems, were held outdoors on the ORAU main campus. The outreach effort exposed the students and others to the value of atmospheric field research.

James Wood and Walt Schalk participated in the annual "Take Your Daughters and Sons to Work Day" on May 10th. James and Walt gave three 45 minute weather demonstrations to over fifty 11 to 13 year olds that included: a brief talk about what we do and why we do what we do for the Nevada National Security Site; visual evolution of radiosondes, wind and temperature instruments; physical demonstrations of dew and frost (for real, even in the desert), atmospheric circulations, cloud formation, and a dust devil ("tornado box"); and the release and visual tracking of a Pilot Balloon. (james.s.wood@noaa.gov, walter.w.schalk@noaa.gov)

Walt Schalk visited a local Elementary School and gave a weather presentation and demonstrations to a 4th grade class. The demonstrations included the showing of ABC's "Schoolhouse Rock's, The Weather Show", a visual history of wind and temperature instruments; physical demonstrations of dew and frost, atmospheric circulations, cloud formation, and a dust devil ("tornado box"); and the release and visual tracking of a dozen helium filled latex balloons. (walter.w.schalk@noaa.gov)