



NOAA Air Resources Laboratory Quarterly Activity Report FY2011 Quarter 2 (January – March, 2011)

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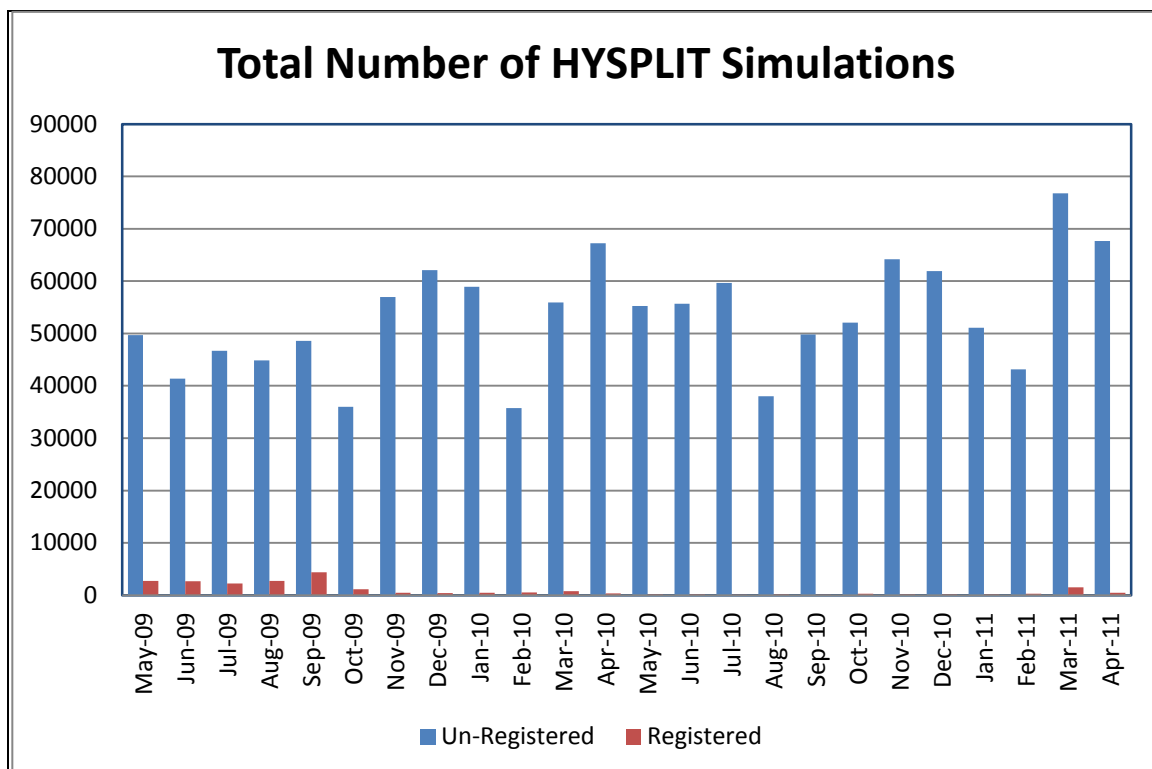
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DISPERSION AND BOUNDARY LAYER

1. Ready Usage: HYSPLIT

In the days following the earthquake in Japan and the Fukushima-Daiichi nuclear plant accident NOAA ARL had a surge of HYSPLIT registration applications for access to web-based dispersion model forecasts or the registered version of PC HYSPLIT. From March 21 through May 1, ARL processed 88 applications from users around the world, some of which indicated the need to simulate the transport patterns from Japan. In addition, HYSPLIT usage on the ARL READY web site hit a new high of 78,284 model simulations in March, of which 73,454 were trajectory simulations and 4,830 were dispersion simulations. Although the monthly numbers have been increasing the last few years, in a typical month there are about 50,000 HYSPLIT simulations from web users. (glenn.rolph@noaa.gov)



2. Duke Energy

ATDD continues to work with Duke Energy Generation Services (DEGS) to develop and evaluate techniques to improve the forecast of the 80 m turbine hub-height winds. Modifications of the ATDD 30 m flux tower included additional measurements of winds and temperature at 10 m and 17 m. The additional observations will facilitate evaluation of surface layer fluxes of winds and temperatures which control the winds powering wind turbines. A technical exchange meeting was held with the DEGS meteorological staff to review the joint meteorological monitoring program and discuss how to evaluate potential impacts on the DEGS's wind turbine forecast program. (will.pendergrass@noaa.gov)

3. Arctic Carbon Exchange: Collaboration with Harvard University

The BAT (Best Atmospheric Turbulence) probe is being characterized for accuracy using data taken in the Wright Brothers Wind Tunnel at MIT last October. Two primary directions are being pursued. First, the accuracy to be expected from a generic BAT probe optimized by

maneuvers in flight is being described. Although this has been found to be acceptable, as expected from the many years of successful use of the BAT probe, the wind-tunnel study revealed certain details in the probe's behavior about which there had previously only been guesses. Understanding these details promises further significant reduction in the systematic error and is being vigorously pursued. ron.dobosy@noaa.gov, E. Dumas, B. Baker

4. NOAA INL Meteorological Partnership Oversight and Reporting

On March 24, a presentation was given to the INL Monitoring and Surveillance Committee on the HYSPLIT Decision Support Tool being developed by FRD. The presentation included a demonstration of the tool. Brad.Reese@noaa.gov

5. HRRR Weather Forecast Model Evaluation

FRD has been downloading subsets of the High Resolution Rapid Refresh (HRRR) model since last year. The model forecasts are being compared with observations from the NOAA/INL Mesonet. On average the model wind speeds are only about 2/3 of the observed values. At the initial time of the model runs the analyzed model winds often appear to be closer to the observations (as one would expect), but the winds rapidly decelerate to significantly lower speeds by the first hour into the model run and stay low thereafter. This is rather perplexing, because preliminary reports from the ARL Atmospheric Turbulence and Diffusion Division (ATDD) indicate the HRRR wind forecasts are doing much better over one of their field sites in Texas. One possibility is that the model's boundary-layer parameterization does not work as well in the complex terrain of the Intermountain West. Richard.Eckman@noaa.gov

6. Transport and Dispersion Modeling

Initial work began on developing an upgrade for the FRD implementation of HYSPLIT for use in radiological modeling at the Emergency Operations Center of the INL. Portions of this work are being done in collaboration with the overall ARL effort to upgrade the HYSPLIT model. Elements of the HYSPLIT work at FRD have either already been incorporated into ARL HYSPLIT or will be adopted in the future.

Last year FRD conducted a modeling study related to the Advanced Test Reactor (ATR) at INL. This study used five years of data from the NOAA/INL Mesonet to develop climatology of dispersion from the ATR. During the second quarter, INL requested that FRD perform additional modeling simulations for the reactor. The original modeling runs assumed a surface release from the reactor site, while the new ones will assume an elevated release. A statement of work is being developed for the new effort. Kirk.Clawson@noaa.gov

7. HYSPLIT Prognostic Model Collaboration with SORD

FRD has started collaboration with the ARL Special Operations and Research Division (SORD) at the Nevada National Security Site (NNSS) on developing improved methods for generating input for the HYSPLIT dispersion model. HYSPLIT already has an extensive capability to use prognostic model forecasts to drive the dispersion, but it has only a limited capability to use observations from meteorological networks (mesonets) such as those operated by FRD and SORD. The current capability is limited to simple interpolation between towers in the mesonets. FRD and SORD plan to collaborate on developing a new capability that uses mesonet observations but also includes physical constraints to the air flow around and over topography. Initially the effort

will investigate whether existing software, such as the Local Area Prediction System (LAPS), can be adapted for use with HYSPLIT. Kirk.Clawson@noaa.gov, Walt.schalk@noaa.gov

8. Consequence Assessment

Kip Smith and Walt Schalk participated in a Nevada Test Site pre-exercise emergency response drill. They were responsible for monitoring current weather conditions, providing weather forecasts as required, performing plume dispersion modeling for consequence assessment activities, and interpreting the results for the emergency responders. Walt.schalk@noaa.gov, Kip.smith@noaa.gov

9. Southern Methodist University Extended MOU

The Memorandum of Understanding with the Southern Methodist University (SMU) was signed by NOAA, extending the MOU for an additional 2 years. ARL/SORD collaborates with SMU in data collection for experiments in infrasound. Walt.Schalk@noaa.gov

AIR QUALITY

10. Invited Lecturer

Ariel Stein was an invited lecturer of the Master Interunivesitario en Ingenieria Ambiental teaching the graduate course entitled "Contaminacion Atmosferica: Origen, Tratamiento y Control", at the Universidad Internacional de Andalucia in Huelva, Spain. This graduate course is considered one of the top courses in Spain regarding environmental pollution and air quality. Ariel.Stein@noaa.gov

11. Visiting Scientist

Dr. Xinrong Ren from Florida State University has joined ARL as a visiting scientist. Dr. Ren's research interests and expertise lie in the development of novel techniques for the measurement of trace reactive nitrogen species in the troposphere. Dr. Ren is involved with ARL's air quality measurements program as a vital contributor to field intensive research and long-term monitoring of nitrogen and mercury compounds in the troposphere. Winston.Luke@noaa.gov

12. Air Quality Forecasting

Daniel Tong gave an invited talk titled "Emission forecasting for the National Air Quality Forecasting in the United States" at a workshop on near real-time data application in air quality forecasting held in Hangzhou, China. The workshop was organized by the World Meteorological Organization as part of the Global Atmosphere Watch/Urban Research Meteorology and Environment (/GURME/) pilot projects. Daniel.Tong@noaa.gov

13. Grand Bay Mercury Project

Winston Luke, Steve Brooks, Mark Cohen, and Xinrong Ren met with partners from Florida State University, Georgia Tech University, University of Miami, and the University of Tennessee Space Institute to examine and discuss data from Grand Bay Mercury Project Summer 2010 Intensive and to plan activities for the upcoming 2011 Intensive. ARL provided presentations to the project partners summarizing ARL's measurement and modeling activities. Winston.Luke@noaa.gov

14. Review of NOAA's Research for the Great Lakes Restoration Initiative

Mark Cohen attended a review meeting of NOAA's FY2010 participation in the Great Lakes Restoration Initiative (GLRI), held on the campus of the University of Michigan in Ann Arbor. Principal investigators and project coordinators for all of the NOAA's GLRI projects presented summaries of their projects to eight external reviewers. Goals of the meeting included a formal review of NOAA's GLRI programs and the facilitation of collaborations, both internal to NOAA and with external partners. Mark gave a presentation summarizing ARL's GLRI project modeling atmospheric mercury deposition to the Great Lakes. Mark.Cohen@noaa.gov

15. Texas Christian University-ARL Mercury Collaboration

Mark Cohen met with Professor Mike Slattery of Texas Christian University (TCU) to further discuss a collaborative project involving analysis of mercury deposition in Texas, Oklahoma, Arkansas, and Louisiana. Initial meetings and discussions of this project began in November 2010. Dr. Slattery and colleagues at TCU have developed a database of fish-tissue mercury concentrations in 800+ waterbodies in this 4-state region. In the TCU-ARL collaborative work, HYSPLIT and HYSPLIT-Hg are being used to examine source-receptor relationships in the region and to attempt to interpret and understand the variations in fish mercury concentrations throughout the region. Mark shared numerous techniques and tips for running back-trajectories using HYSPLIT and methodologies for analyzing the back-trajectories using clustering and grid-frequency approaches. Since the meetings with ARL, Professor Slattery has begun his analyses. Mark.cohen@noaa.gov

16. Third HYSPLIT Dioxin Workshop in Mexico City

Mark Cohen co-led another HYSPLIT Dioxin workshop with Paul Bartlett of St. Peter's College. The workshop was held again in Mexico City for roughly 15 Mexican government scientists of the National Institute of Ecology (INE) and the Ministry of Environment and Natural Resources (Semarnat). This was the third workshop in a series of workshops to train the scientists on the use of the HYSPLIT model to simulate the fate and transport of polychlorinated dibenzo-p-dioxins and furans (PCDD/F) (aka "dioxin"). The workshop was sponsored by the Commission for Environmental Cooperation (CEC). Mark participated in the workshop remotely via Go-To-Meeting. Mark.Cohen@noaa.gov

17. Mauna Loa Observatory Mercury Operations

Winston Luke and Paul Kelley traveled to the Mauna Loa Observatory (MLO) to assume the operational responsibilities for speciated mercury measurements being collected there and to establish the site as a member station in the NADP Atmospheric Mercury Network (AMNet). Previously, mercury measurements at MLO were conducted under the auspices of EPA's National Exposure Research Laboratory in partnership with NOAA and MLO scientists and staff. While EPA retains ownership of the mercury sampling equipment, operational oversight of the measurements has been assumed by ARL scientists, with funding from EPA's Clean Air Markets Division, in collaboration with NOAA site operators at MLO. Winston.luke@noaa.gov

18. Mercury in Frogs and Salamanders of Canaan Valley

In collaboration with the Fish and Wildlife Service at Canaan Valley, we sampled the egg masses of wood frogs (*Rana sylvatica*) and spotted salamanders (*Ambystoma maculatum*) in shaded

(canopy-covered) and unshaded vernal pools. Previous collaborative work with the University of Maryland Appalachian Laboratory had shown that total mercury levels were higher in shaded pools compared to unshaded pools. We hypothesize that this is due to mercury loss via photoreduction in the unshaded pools. The mercury levels in the egg masses varied between 7.6 and 17.1 ng/g, with higher levels in the salamanders compared to the frogs. On average, the mercury levels were 13.5% higher in the shaded pools, consistent with our measurements of total mercury in the pool waters. steve.brooks@noaa.gov

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

Ammonia concentration data collected during CalNex 2010 will be utilized by scientists at the Université Libre de Bruxelles as part of their satellite validation research. ATDD scientists measured ammonia concentrations and deposition near Modesto, CA, in the northern San Joaquin Valley. The Brussels group is very interested in comparing ATDD's data to their satellite ammonia product from the Infrared Atmospheric Sounding Interferometer (IASI) on board the meteorological platform MetOp-A. latoya.myles@noaa.gov, M. Heuer

20. NOAA Signs MOU with Environment Canada for an IMPROVE site

Through the hard work of Marc Pitchford and Karen Balecha NOAA signed a Memorandum of Understanding (MOU) with Environment Canada that calls for the establishment of a visibility and particle speciation monitoring site in remote Western Canada. The site will be operated as part of the U.S. 160+ site Interagency Monitoring of Protected Visual Environments (IMPROVE) network (<http://vista.cira.colostate.edu/improve/>). The new IMPROVE site was installed at the Barrier Lake Station, a research facility operated by the University of Calgary near Banff National Park in Alberta, Canada, on January 7, 2011. The local operators are from the research staff at the Barrier Lake Station. The first samples are to be collected on January 15, following the completion of all tests and calibrations. This site, sponsored by Environment Canada through the MOU, is the second IMPROVE site in Canada, the first having been installed at Egbert, Ontario, in 2005 and sponsored by the U.S. Environmental Protection Agency. Marc.pitchford@noaa.gov

21. 5th IMPROVE Network Report

Marc Pitchford completed review of the draft version of the 5th IMPROVE (Interagency Monitoring of Protected Visual Environments) Network Report, <http://vista.cira.colostate.edu/improve/Publications/Reports/2011/2011.htm>. The report is an extensive summary and assessment of data from ~170 sites in the IMPROVE Network and its 200+ site urban counterpart at the Chemical Speciation Network. The report includes chapters on spatial and season pattern and trends of aerosol concentration and light extinction, as well as descriptions of the measurements and network configurations, and assessments of data quality and comparability. Review comments from the public received by April 22, 2011, will be considered in the preparation of the final report that should be completed this summer. Marc.pitchford@noaa.gov

22. New Visibility Index

Marc Pitchford worked on the development of a new visibility index that is provisionally being termed visual impact range. It is analogous to visual range which is the distance beyond which you can't see an object, except it is a much shorter distance beyond which the scenic features are degraded compared to their appearance viewed through a pollution-free environment. Like

visual range it can be calculated from atmospheric light extinction with certain assumptions. Visual impact range should be useful in helping to define the fraction of objects in a scenic vista that are impacted at any level of pollution. Marc.pitchford@noaa.gov

CLIMATE

23. GCOS Reference Upper Air Network

Dian Seidel participated in the 3rd Implementation and Coordination meeting for the GCOS Reference Upper Air Network (GRUAN), hosted by the Lauder, New Zealand observatory. Major milestones at the meeting included: release of the first GRUAN data products (upper air profiles with complete uncertainty estimates), agreement on general principles for evaluating and certifying GRUAN sites, and slight restructuring of GRUAN task teams and oversight bodies to better meet network needs. While in New Zealand, Dian also gave a seminar and met with climate scientists at the National Institute of Water and Atmospheric Research offices in Wellington. dian.seidel@noaa.gov

24. AMS Committee on Environmental Responsibility

Dian Seidel began a two-year term as chair of the American Meteorological Society's Committee on Environmental Responsibility. The committee met during the January 2011 AMS Annual Meeting in Seattle and developed a work plan, including nine specific activities focused on two main goals: greening AMS and outreach. The committee holds quarterly conference calls during which task teams report on progress on their aspects of the committee's work plan. dian.seidel@noaa.gov

25. Podcasts on "What the Upper Atmosphere Reveals about Climate"

Jim Angell, Melissa Free, and Dian Seidel worked with Linda Joy, NOAA Public Affairs office, to create a series of five short podcasts on "What the Upper Atmosphere Reveals about Climate." The podcasts explain ARL's upper air climate research in non-technical terms. The podcasts have been posted to the OAR website: <http://www.research.noaa.gov/podcast/arl/arl-1.php>
dian.seidel@noaa.gov

26. Review of IPCC Special Report

Dian Seidel provided a review (as part of the US Government review) of the IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. dian.seidel@noaa.gov

27. U.S. Climate Networks

ATDD's field team has completed 53 annual maintenance visits this quarter at USCRN sites, including sites in the southern part of the US and two sites in Hawaii. A site survey was conducted on the island of Maui for the Global Climate Observing System (GCOS) program.

Also, a new electronic interface board was designed for CRN sites with soil moisture probes and installation is underway. This board is designed to eliminate a problem experienced at some sites caused by an impedance issue due to cable lengths. Soil moisture/temperature probes were installed at an additional four sites. The two sites in Hawaii were the last in the network to be upgraded to the CR3000 data logger. mark.e.hall@noaa.gov

ARL 2nd Quarter Publications

Published:

Brooks, S. B., C. Moore, D., Lew, B., Lefer, G. Huey, and D. Tanner (2011). Temperature and sunlight controls of mercury oxidation and deposition atop the Greenland Ice Sheet. *Atmospheric Chemistry and Physics Discussions*, 11, 3663-3691, www.atmos-chem-phys-discuss.net/11/3663/2011/ doi:10.5194/acpd-11-3663-2011

Gabriel, M., D. G. Williamson, and **S. Brooks** (2011). Potential impact of rainfall on the air-surface exchange of total gaseous mercury from two common urban ground surfaces. *Atmospheric Environment*, 45(9), 1766-1774.

Escudero, M., **A. F. Stein, R. R. Draxler**, X. Querol, A. Alastuey, S. Castillo, and A. Avila (2011). Source apportionment for African dust outbreaks over the Western Mediterranean using the HYSPLIT model. *Atmospheric Research*, 99, 518-527, doi:10.1016/j.atmosres.2010.12.002.

Ngan, F. and D. W. Byun, 2011: Classification of Weather Patterns and Associated Trajectory Analysis of High Ozone Episodes in Houston during the 2005/2006 TexAQS-II. *Journal of Applied Meteorology & Climatology*, Vol. 50, No. 3, 485 – 499.

Free, Melissa (2011) The Seasonal Structure of Temperature Trends in the Tropical Lower Stratosphere. *Journal of Climate*, 24, 859–866. doi:10.1175/2010JCLI3841.1. The paper shows a strong seasonal variation of temperature trends in the tropical stratosphere since 1979, with significantly greater cooling in December and January and little cooling in March-April.

Kochendorfer, J., and K. Tha Paw U (2011). Field estimates of scalar advection across a canopy edge. *Agricultural and Forest Meteorology*, **In Press**, Corrected Proof, Available online 5 February 2011, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2011.01.003.

Kochendorfer, J., E. G. Castillo, E. Haas, W. C. Oechel, and K. Tha Paw U (2011). Net ecosystem exchange, evapotranspiration and canopy conductance in a riparian forest. *Agricultural and Forest Meteorology*, **In Press**, Corrected Proof, Available online 31 January 2011, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2010.12.012.

Moore, C. W., M. S. Castro, and **S. B. Brooks** (2011). A Simple and accurate method to measure total gaseous mercury concentrations in unsaturated soils. *Water, Air, and Soil Pollution*. 218:3-9 doi:10.1007/s11270-010-0691-7.

Thorne, P. W., J. R. Lanzante, T. C. Peterson, **D. J. Seidel**, and K. P. Shine (2011). Tropospheric temperature trends: history of an ongoing controversy. *Wiley Interdisciplinary Reviews: Climate Change*, 2(1), 66-88. DOI: 10.1002/wcc.80.

Yerramilli, A., Dodla, V.Challa., Srinivas, C.V., **Myles, L., Pendergrass, W.R., Vogel, C.A.**, Dasari, H.P., Tulari, F., Baham, J.M., Hughes, R., Patrick, C., Young, J., and Swanier, S. 2011. An integrated WRF/HYSPLIT modeling approach for the assessment of PM2.5 source regions over

Mississippi Gulf Coast Region. **Published On-line** by Air Quality, Atmosphere, & Health, 1-12, DOI: 10.1007/s11869-010-0132-1.

Alonso-Perez, S., E. Cuevas, C. Perez, X. Querol, J. M. Baldasano, **R. Draxler**, and J. J. De Bustos (2011). Trend changes of African air mass intrusions in the marine boundary layer over the subtropical Eastern North Atlantic region in winter. *Tellus B*, 63(2), 255-265.

Peterson, R., P. Webley, R. D'Amours, R. Servranckx, **B. Stunder**, and K. Papp (2011). Volcanic ash cloud dispersion models. Chapter 7, *Volcanoes of the North Pacific: Observations from Space*. Springer-Praxis, **In press**.

Accepted:

The paper "Radiosonde Balloon Drift Climatology" by **Dian J. Seidel**, Bomin Sun, Michael Pettey, and Anthony Reale was accepted for publication in the *Journal of Geophysical Research*.
dian.seidel@noaa.gov

A paper entitled "Ambient ammonia in terrestrial ecosystems: A comparative study in the Tennessee Valley" by R. Allen, **L. Myles**, and **M. Heuer** has been accepted for publication in *Science of the Total Environment*. The paper describes work conducted by Allen, an undergraduate student at Spellman College, during her summer internship at ATDD. The objective of the study was to measure and compare ammonia concentrations in two Tennessee Valley ecosystems: a forested rural area and a metropolitan site adjacent to a main transportation route. At the metropolitan site, ammonia concentrations were slightly higher in winds emanating from the direction of the interstate highway. latoya.myles@noaa.gov, M. Heuer

A paper entitled "An integrated WRF/HYSPLIT modeling approach for the assessment of PM2.5 source regions over Mississippi Gulf Coast Region" has been accepted for publication in *Air Quality, Atmosphere, & Health*. **LaToya Myles**, **Will Pendergrass**, and **Chris Vogel** serve as co-authors of the paper, which is a result of the collaboration between ATDD and Jackson State University's Trent Lott Geospatial and Visualization Research Center.

Submitted and under journal review:

The paper "Stratospheric Temperature Trends: Our Evolving Understanding" by **D.J. Seidel**, N.P. Gillett, J.R. Lanzante, K.P. Shine, and P.W. Thorne was submitted to *Wiley Interdisciplinary Research: Climate Change*. dian.seidel@noaa.gov

The paper "Comments on Impacts of California's Air Pollution Laws on Black Carbon and their Implications for Direct Radiative Forcing" by R. Bahadur, et al." was submitted to the journal *Atmospheric Environment*. This manuscript was prepared to discuss inappropriate analysis conducted using IMPROVE data in a recent paper published in *Atmospheric Environment*.

Awards, Honors, Recognition

Sharon Conger (ATDD) received the NOAA Distinguished Career Award. The Distinguished Career Award is designed to recognize long-term achievement in advancing the goals and mission of NOAA. The intent of the Career Award is to honor contributions which represent sustained excellence--rather than a single, defined accomplishment.

Richard Eckman (FRD) received his 25 year length of service certificate in January.

Outreach

Dian Seidel (HQ) has agreed to serve as a docent for the NOAA Science on a Sphere exhibit at the AAAS meeting at the Washington Convention Center on February 18, 2011. In addition, Dian will serve as a judge for the Eleanor Roosevelt High School (Greenbelt, MD) science fair, on February 16, 2011, and as judge for Science Montgomery, the Montgomery County middle and high school science fair, on March 19, 2011. Dian.seidel@noaa.gov

LaToya Myles (ATDD) participated in the Black Executive Exchange Program (BEEP) at Lane College in Jackson, Tennessee, on March 10-11, 2011. She served as visiting professor for ecology, chemistry, and biology lectures with a total of ~45 students. BEEP is a voluntary partnership between the National Urban League, corporate America, government, non-profits, and other institutions to loan African-American executives to participating colleges as "Visiting Professors." Visiting Professors lecture in credit-bearing courses that correspond to their industries and participate in other BEEP-related activities such as networking sessions, workshops, and mock job interviews. BEEP's mission is to share learning experience across generations, cultivate new leaders, and inspire achievements "beyond the possible" through committed involvement and operational excellence.

LaToya Myles served as the master of ceremonies for the 2011 Blacks in Government (BIG) Scholarship Luncheon, an annual celebration of Black History Month hosted by the Oak Ridge Chapter of BIG.

LaToya also gave an environmental talk to an eighth grade science class at Vine Magnet Middle School in Knoxville, TN, on February 10, 2011. Dr Myles volunteers as part of Vols4STEM, an innovative resource that connects science, technology, engineering, and math (STEM) professionals with educators and students. latoya.myles@noaa.gov

Maggie Robinson (ATDD) continues to distribute the NOAA Teacher at Sea books to schools in the area. She recently gave two sets of books to the librarian at Lake City Middle School in Lake City, Tennessee. Maggie.robinson@noaa.gov

Dennis Finn, Randy Johnson and Rick Eckman (FRD) provided a tour of the FRD facility and shared their expertise on various projects with several students (age 17-18 years) from Hillcrest High School in Idaho Falls. Demonstrations were given of the Smart Balloon, ET probe, sonic anemometer, and tracer sampling equipment. Dennis.finn@noaa.gov , R. Johnson, R. Eckman

Rick Eckman (FRD) answered another Ask a Scientist question submitted to the Idaho Falls Poster Register newspaper. The question was related to the lag observed between the astronomical and meteorological seasons. Jason Rich (FRD) also answered an Ask-a-Scientist question. The question was related to possible lake-effect snows caused by the Great Salt Lake and another large reservoir in Southeast Idaho. Richard.eckman@noaa.gov , J. Rich

Rick Eckman continued to serve as a committee member for a Ph.D. candidate at the University of Wyoming in Laramie. A brief committee meeting was held in March, and the student's final exam is scheduled for late May. Richard.eckman@noaa.gov