



NOAA ARL Monthly Activity Report



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Outreach. Jake Lambert, a third grade student at Mackay Elementary School in Idaho Falls received notoriety at the Idaho Region 6 Tech Fair this spring. Jake began using the Idaho Environmental Monitoring Program (IEMP) web site (<http://oversite.inel.gov>) to track the meteorology of his area. The web site is a joint project of FRD, the U.S. Dept. of Energy, the State of Idaho INEEL Oversight Program, and the Shoshone-Bannock Tribes. Jake organized the weather data from the web using a spreadsheet and illustrated it with computer graphics. He also visited the ARL/FRD office to meet the meteorologists behind the scenes. For his efforts, Jake receive first place in the Tool Software category. (kirk.clawson@noaa.inel.gov and staff)



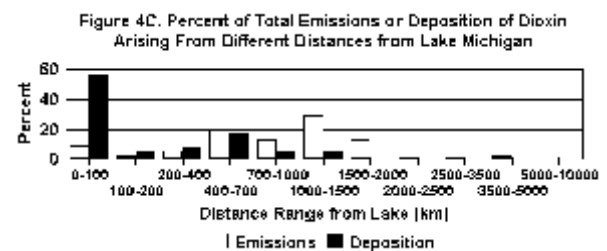
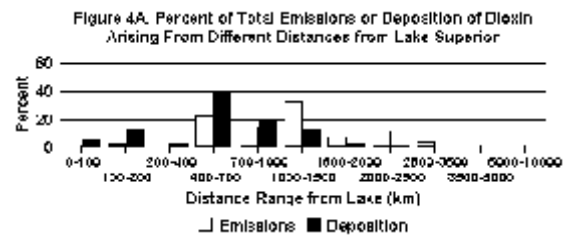
Jake Lambert visits with FRD meteorologist Kirk Clawson.

Silver Spring

1. An Anomalous Shift in Location of the North Circumpolar Vortex. After years of noting the displacement of the 300 mb north circumpolar vortex further into the eastern hemisphere, and pondering the meaning of this shift, the perversity of nature showed itself in 1998 by having the vortex centered nearer the North Pole than in any year since 1980. The shift was associated with a highly contracted vortex, the contraction a record (since 1963) in summer. During the first half of 1999, the displacement of the vortex into the eastern hemisphere was near the long-term average, so that the anomalous 1998 displacement in vortex location may be only a blip and not the harbinger of a long-term reversal in tendency. Only time will tell! (Jim Angell, 301 713 0295, x127)

2. The Transport and Deposition of Toxic Substances to the Great Lakes. Work continues on the analysis of atmospheric deposition of dioxin, atrazine, cadmium and mercury to the Great Lakes. A description of the activity is available at <http://www.ijc.org/boards/iaqab/pr9799/index.html>.

A key aspect of this work is the development of source-receptor information. Examples of the current results for dioxin are presented in the figures shown. For Lake Superior, the analysis shows that the bulk of the deposition arises from 400-1500 km from the lake. Results for Lake Huron are similar to this. Thus, the modeling predicts that regional and long-range transport of dioxin are very significant for these lakes. For Lake Michigan, more than half of the predicted deposition of dioxin arises from sources within 100 km of the lake. Lake Ontario and Lake Erie show results similar to Lake Michigan. However, even for these lakes, regional and long-range transport of dioxin is not insignificant. (mark.cohen@noaa.gov)



3. *ARL involvement in the Comprehensive Test Ban Treaty (CTBT).* The defeat of the Comprehensive Test Ban Treaty in the US Senate has directed considerable attention at the treaty and its provisions. A central consideration among those who are against the treaty is that it is “unenforceable.” In practice, ARL is directly involved in the detection side of the program, with the ARL HYSPLIT model being one of the tools used by the CTBTO International Data Centre (IDC) in Vienna, Austria, to identify the origins of any nuclear debris that is detected in the CTBT monitoring program. Roland Draxler recently attended a meeting on CTBTO collaboration with WMO. Michel Jean (Canada) suggested that the IDC and several WMO RSMCs participate in a test later this year to simulate the atmospheric modeling required for a radio-nuclide detection. The intent of the test will be to determine which and to what extent various national meteorological centers are interested in participating and supporting research and development efforts for the CTBTO.

A related WMO meeting on emergency response was held in Beijing from 20-24 September. The meeting endorsed the Canadian proposal to run a more formal test between RSMCs and the IDC to test concepts and procedures in providing meteorological transport and dispersion products to the CTBTO. RSMCs were encouraged to pursue web based methods to distribute products between themselves and other national meteorological services. Although many of the countries agreed there was a need to run another international RSMC test (the last was in summer 1997), no one volunteered to coordinate the test after WMO stated that they did not have the funding to sponsor the test’s organization and evaluation. The IAEA pushed for several changes in RSMC operational procedures so that they may get products without triggering distribution of products to all regional member countries. (roland.draxler@noaa.gov)

Boulder

4. *SURFRAD.* Total Sky Imagers have been installed at the Bondville and Goodwin Creek SURFRAD stations. Several improvements were made to these stations during the installations.

One of SRRB's infrared radiometers is being included in the First Pyrgeometer/Absolute Sky-scanning Radiometer Comparison (PASRC-I; led by Ellsworth Dutton of CMDL). This comparison is designed as an effort to begin to establish a world reference standard for broadband IR measurements. Participating instruments from around the world will first be calibrated at CMDL using their absolute cavity calibration device. They will then be sent to the DOE ARM CART site in Oklahoma to be compared. (John Augustine, 303 497 6415)

5. *The Central UV Calibration Facility (CUCF).* The CUCF calibrates UVB broadband radiometers for several U.S. UV Monitoring Networks. A description of CUCF's calibration procedures for the standards that are used to calibrate radiometers within a Network has recently been published in the Journal of Atmospheric and Oceanic Technology.

The standard UVB radiometers of the CUCF are monitored throughout the year and officially calibrated once per year by comparing to simultaneous spectroradiometer data from a Brewer Spectroradiometer and a U1000 spectroradiometer. A field calibration of the two spectroradiometers was completed prior and after the data collection. In addition, the U1000 spectroradiometer wavelength range was extended out to 410 nm to provide data for calibration of several Solar Light UVA instruments. The calibration of the UVA instruments is a joint project between the CUCF, the USDA UV Monitoring Program, and NASA. Data processing is in progress.

6. *Ozone via the Umkehr Technique.* Irina Petropavlovskikh visited the Atmospheric Chemistry Program at NASA Goddard and gave a presentation describing new findings on the subtle characteristics of the Umkehr technique. Because NASA Goddard's work on the SBUV ozone profile retrieval algorithm is similar to that of the Umkehr's, a deep interest in her work at SRRB was shown by the NASA scientists. The Umkehr has been used to verify SBUV ozone profile observations since the first NASA instrument was flown in 1971. A long-term collaborative arrangement between NASA and SRRB is being established to continue work on refining trend analyses of Umkehr data, and to work on improving the SBUV ozone profile retrieval algorithm. In the mid 1980s when NESDIS added the SBUV instrument to its monitoring satellites, NASA had agreed to continue development and improvement of the ozone profile retrieval algorithm. So, Irina's new involvement with NASA acts as an additional scientific link in the longstanding NASA/NESDIS collaborative agreement.

SRRB's collaborative work with the European REVUE Team on a new method for analyzing trends from the raw Umkehr measurements, i.e. bypassing the ozone retrieval process, is still in progress. A highly intensive effort with Greek scientists is now underway to complete the work so that it can be reported at a WMO workshop in Toronto on November 14. The workshop will be mainly concerned with the use of the Brewer spectrophotometer instrument for ozone monitoring. SRRB's recent work, presented by Irina at the Crete workshop last May played a significant role in motivating the WMO Toronto workshop. (Irina Petropavlovskikh, 303 497 6279 and John DeLuisi 303 497-6824)

7. *Atmospheric Radiation Measurement (DOE/ARM).* Chris Cornwall traveled to the DOE/ARM integration site at Sandia National Labs in Albuquerque, New Mexico, to install and test instruments for the third Atmospheric Radiation and Cloud System (ARCS), being readied for deployment in the Tropical Western Pacific. NOAA personnel, along with staff from the National Renewable Energy Lab in Golden, Colorado, provide the ARM program with radiometer expertise and assistance in the Pacific, on the North Slope of Alaska, and the Southern Great Plains of Oklahoma. For more information on the ARM program, see <http://www.arm.gov>. (Chris Cornwall, 303 497 7316)

Oak Ridge

8. *Terrestrial Carbon Program.* Spatial variability of fluxes at a forest floor is being studied using three flux systems. Intercomparisons with the instruments collocated show a good match at all time scales. Other tests separated the instruments vertically or horizontally. In preliminary analysis, instruments separated horizontally report strongly different fluxes on half-hour average, but with increased averaging time the fluxes approach a common value. Vertical separation of the instruments may introduce a bias into the reported fluxes, though more analysis is needed. A first draft of a paper describing the energy budget at the forest floor has been prepared. (wilson@atdd.noaa.gov)

9. *Vertical Transport and Mixing Study – Salt Lake City.* Plans are developing for a study of the vertical structure of mixing in an urban mountain basin – Salt Lake City. The science team for this Vertical Transport and Mixing (VTMX) project met in September. A thorough set of measurements is planned for October 2000. A significant modeling component will link the observations and extrapolate to a description of the turbulent mixing throughout the Salt Lake Basin. (hosker@atdd.noaa.gov, Carmen Nappo, Ron Dobosy)

10. Canaan Valley. Installation of an Atmospheric Integrated Research Monitoring Network (AIRMoN) site within the Canaan Valley National Wildlife Refuge is progressing. Positions of the tower, instrument shelter, and precipitation collectors have been staked out. Because of changes in the positioning of a set of collectors, a new site questionnaire and an updated set of photos were sent to the National Atmospheric Deposition Program (NADP) for approval. Installing the tower, the shelter, and underground power will proceed upon approval of digging permits by the U.S. Fish and Wildlife Service. (vogel@atdd.noaa.gov)

11. East Tennessee Ozone Study (ETOS). ETOS (East Tennessee Ozone Study) continued to operate through the first two weeks of September. Over this period, the Great Smoky Mountains National Park experienced its 51st day of unhealthy ozone levels for 1999. By September 15th, ozone monitoring for ETOS had been discontinued with monitors returned to Oak Ridge for calibration checks - only two sites had calibration drifts greater than 2%. Data archives are currently under construction; the State of Tennessee has provided access to data from all of its monitoring sites for 1999. Data from regional NPS sites have also been collected. (pendergrass@atdd.noaa.gov, White, Birdwell)

12. Urban Dispersion. The evaluation and refinement of the ROADWAY-2 model using the 1976 GM tracer data continued. A factor of two overprediction of concentrations had been located, and reasons are being sought. Expressions for the eddy diffusivities K_x and K_z , and the height DDZ of initial mixing volume have now been adjusted. The latter accounts for the initial buoyancy and turbulent mixing of the vehicle emissions. A sensitivity study showed that the predicted concentrations near roadways are more sensitive to DDZ than to the K_x formulation for which there is little guidance. Finally, an expression similar to that for K_z was used for K_x also, but only using the TKE components in x and y , and DDZ was set to 3.5 m. This is close to the value (3.0 m) used in Caline-3. Two separate tests with the wind perpendicular to the roadway were simulated and their results were plotted against the observed concentrations. The agreement was excellent. Additional simulations for different wind directions need to be performed to complete the development and evaluation of the model. (rao@atdd.noaa.gov)

13. Mercury in the Arctic. The first year of monitoring total gaseous mercury at Barrow, Alaska, has been completed. From September 10 to 18, reactive gaseous mercury was also measured. Continuous monitoring of reactive gaseous mercury is scheduled to begin in January 2000. As expected, reactive gaseous mercury concentration in September was very low (1-2 pg/m^3) compared with average rural concentrations near Oak Ridge (20-50 pg/m^3). (brooks@atdd.noaa.gov, Meyers, Lindberg-ORNL)

14. NSF Multi-User Environmental Research Aircraft in the Arctic. The Sky Arrow, developed at ATDD and operated by San Diego State University, flew flux-measurement transects in Barrow, Alaska this month. The GPS week-number rollover played unexpected havoc with the GPS carrier-phase attitude system and brought aircraft operations to a halt while awaiting a software fix from the system manufacturer. The system was repaired and the aircraft returned to service by late September. The aircraft is expected to continue measurements in Barrow until mid-October. (brooks@atdd.noaa.gov, Dumas)

Mike Ledbetter, John Christensen, and Simon Stephenson of the National Science Foundation toured the aircraft operations in Barrow and discussed future aircraft and instrumentation for ongoing NSF studies. The Italian network science show "Giga" met with S. B. Brooks in Barrow to film a one-hour documentary describing the Sky Arrow's development and the Arctic field operation. (brooks@atdd.noaa.gov)

A Sky Arrow aircraft has been ordered by the Italian National Research Council (CNR) for use in the European Union's upcoming Regional Estimates of Carbon Balance (RECAB) study. ATDD will provide the instrumentation for fluxes and remote sensing on this aircraft. Delivery date is February 2000. Future plans may include a collaborative ATDD/San Diego State University/CNR flux study of the Antarctic coastal regions. (brooks@atdd.noaa.gov, Dumas)

Research Triangle Park

15. Nitrogen Oxides Transport Modeling in Support of the Clean Air Act. ASMD modeling analysis and interpretation have been completed to support final action on petitions under Section 126 of the Clean Air Act. Eight northeastern states filed petitions to reduce the trans-state transport of ground-level ozone pollution. The petitions requested findings that certain utilities and other sources of nitrogen oxides (NO_x) significantly contribute to ozone problems in the eight petitioning states. Based upon the ASMD modeling results and other technical considerations, EPA made final determinations that six of the eight Section 126 petitions are partially approvable and, correspondingly, that sources in nineteen states and the District of Columbia significantly contribute to nonattainment, or interfere with the ability of states to maintain clean air, in one or more of these six petitioning states. EPA also finalized the fundamental procedures of the NO_x emissions control requirements that would apply if any Section 126 remedy is ultimately needed. Emission control approaches were also modeled and analyzed in support of this action. (Norm Possiel, 919 541 5692)

16. Ozone Forecasting System for Seoul City. Daewon Byun was invited by the Korean Society for Atmospheric Environment to provide technical advice on urban scale ozone forecasting. About twenty professors and scientists from universities and institutions and many members of the Environmental Quality Department (EQD) of the Seoul Metropolitan Government participated in the workshop, held at Kangwon University in Chun-Cheon City. (Daewon Byun, 919 541 0732)

17. Object-Based Design and Tools. The Atmospheric Sciences Modeling Division organized working meetings with Dr. Bertrand Meyer of Interactive Software Engineering, Inc. and Dr. Paul Dubois of Lawrence Livermore National Laboratory (LLNL) during September to discuss how object design and object-based computational techniques can benefit the ASMD Community Multiscale Air Quality (CMAQ) model. Meyer facilitated a working meeting to establish new Object-Oriented (OO) design ideas for CMAQ. The attendees had recently participated in an object technology training session where Meyer presented fundamental OO principles. This working meeting provided a hands-on opportunity for the Division scientists to use these fundamentals to rethink the current organization of CMAQ in order to increase its maintainability, extendability, reliability, and reusability. The meeting results provide an excellent start to a new object design for CMAQ, which will be a continuing effort for the next several months.

A meeting was also held with Dubois to better understand how these OO fundamentals can be implemented in numerical models using Fortran 90, which is an updated version of the programming language currently used for CMAQ. Fortran 90 tools were presented that can be used to design object-based code, increase flexibility, reduce potential for error, and ease code modifications. These tools have been successfully implemented in a global climate model under development at LLNL, and Division scientists are currently considering how these techniques could be useful for the Community Multiscale Air Quality (CMAQ) model. Dr. Dubois has also developed a course and tutorials on Object-based Fortran 90, and he has made these

materials available at http://ftp_icf.llnl.gov/pub/OBF90 for anyone who would like to learn more about Fortran-90 and its object-based capabilities. (Alice Gilliland, 919 541 0347)

18. Atrazine Emissions Inventory for the Lake Michigan Mass Balance Study. The modeling of atrazine deposition to Lake Michigan has three essential components - the emission of atrazine following its application; transport by and chemical transformation in the atmosphere; and wet and dry removal from the atmosphere to the lake. An hourly atrazine emissions data set for the period April 1, 1995 - July 16, 1995 has been completed using Canadian ORTECH Environmental's Pesticide Emission Model (PEM) driven by mesoscale meteorological conditions estimated using MM5. Emissions have been computed over a 36 km x 36 km rectangular grid extending eastward from the Rocky Mountains to the Atlantic Ocean and from the Gulf of Mexico through southern Canada. The episodic atrazine inventory will be input to the Community Multiscale Air Quality (CMAQ) model of atmospheric transport, transformation and deposition which is being modified to address trace chemical species issues. Results of the linked PEM/MM5/CMAQ system will then be provided to the in-lake fate and transport model MICHTOX. This enhanced information should, in turn, improve our ability to evaluate the effect of management decisions on atmospheric loadings of atrazine to Lake Michigan.

The initial hourly emissions database has been completed. Additional model runs to expand the inventory through mid-September are currently underway. A report documenting the April through June 1995 hourly atrazine emissions inventory is available at <http://www.epa.gov/asmdnerl/massb.html>. Questions regarding the Pesticide Emissions Model (PEM) should be directed to Dr. Trevor Scholtz of ORTECH Environmental at tscholtz@ortech.ca. Requests for a CD-ROM copy of the hourly emissions inventory described in the report should be directed to Dr. Ellen Cooter at cooter.ellen@epa.gov. (Ellen Cooter, 919 541 1334)

Idaho Falls

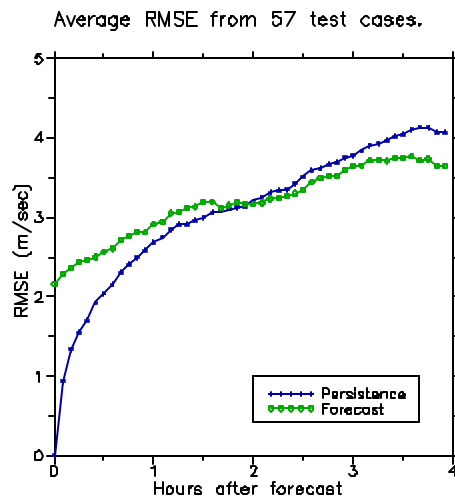
19. Hurricane Balloons. The next generation of smart balloons will be controlled by a light weight micro computer measuring only 2 x 2.6 inches. One of these systems was received this month and is undergoing testing. It incorporates an analog to digital converter and the digital input/output lines necessary to monitor and control the functions of the balloon. Initial evaluation indicates that it should fill the requirements quite well. The smart balloons are being developed to monitor conditions inside of hurricanes. (roger.carter@noaa.gov, randy.johnson@noaa.gov)

20. Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study. Two of the tracer release systems at the Eagle Pass Texas location have been releasing tracer during alternate 12 and alternate 24 hour periods. These releases were discontinued on September 13 and the systems were moved to locations in south central San Antonio and at the Parrish Power plant south of Houston. Tracer release at both sites began on 09/17/99. The releases will terminate on November 1 at 8:00 am. (tom.watson@noaa.gov)

21. Jackson Hole, WY, Claims Downwind Status. The concern of Jackson Hole residents about the proposed construction of the Advanced Mixed Waste Treatment Plant on the INEEL makes news at least weekly. This plant is a key to treating and removing radioactive waste from Idaho, as is legally required. Several groups have now organized to fight the construct of the plant, including a group called "Keep Yellowstone Nuclear Free." A law suit has been filed to block the plants construction. Conversations continue between FRD and DOE-ID and State of Idaho officials over the ongoing debate. The idea of a

tracer study was developed at FRD to measure the impacts of the proposed treatment plant. We are currently looking for a source of support for the tracer study. (kirk.clawson@noaa.gov, Tom Watson, and staff)

22. Automatic Transport and Dispersion Forecasts. A short term dispersion forecast for the INEEL is provided by an historical pattern matching computer code that runs every 30 minutes in the FRD office. In an effort to quantify the success of this forecast technique, standard model comparison measures have been applied to the wind fields generated by it and to persistence wind fields for 57 cases selected from throughout the year. The root-mean-square error (RMSE) was calculated for the 12 stations on the INEEL site for each case. This plot shows the average RMSE for all 57 cases as a function of time after the forecast was made. As expected, the RMSE values for persistence are lower initially, but after about two hours, the RMSE values for the forecast are lower. Since the primary goal of the forecast is dispersion and transport forecasting, the next step will be to apply these measures directly to the transport calculations. (roger.carter@noaa.gov)



23. Inclusion of Idaho INEEL Oversight Program in FRD EOC Operations. A meeting of parties involved in INEEL (and related) Emergency Preparedness was held on 02 September to discuss FRD inclusion as a formal partner in the Oversight Program. This will enhance the prestige of the MDIFF model and aid the counties in their protective action and evacuation efforts, should it ever become necessary. (kirk.clawson@noaa.gov, Brad Reese)

24. Portable Meteorological Station for Rapid Deployment. The INEEL is developing an emergency response vehicle to be deployed near a potential hazardous or radioactive release as the result of a transportation mishap. FRD is designing a portable meteorological monitoring station to be installed on or near this vehicle. The system must be rapidly deployed (<5 minutes effort) and must be rugged. It must also transmit data via the existing mesonet communication link to be incorporated in INEELViz. (kirk.clawson@noaa.gov and Randy Johnson)

25. LongEZ leaves FRD for work in CASES and SHOWEX. Final preparations were completed for the participation of the LongEZ in CASES II (October) and SHOWEX II (November). Major work focused on continuing flight tests and instrument calibration to assure proper operation of the instruments and data system. Several test flights were conducted in September to verify the proper operation of the mobile flux platform (MFP) data acquisition system. Flight maneuvers included pitch and yaw calibrations. Wind circles and boxes were included to verify the proper measurement of the wind. Low-level legs were also included over Mud Lake near Terreton, Idaho to verify the proper operation of the laser altimeters and the Ka-band radar (scatterometer). To learn more about the unusual LongEZ and its instrumentation, visit: <http://www.noaa.inel.gov/frd/Capabilities/LongEZ>. In addition, the data acquisition and post-processing software packages that are to be used for these experiments were updated to provide a more robust system than in previous field campaigns. FRD scientists continue to work closely with ATDD scientists Ed Dumas and Rick Eckman as the MFP system continues to evolve. Ed Dumas visited FRD during the final days of

September to work with FRD staff on the interface module between the BAT-REM boards the MFP data system. Ed Dumas left FRD on the 29th, flying the LongEZ to Oklahoma for work in CASES II. (jeff.french@noaa.gov, Jerry Crescenti, Tim Crawford)

Las Vegas

26. NOAA Cooperative Institute for Atmospheric and Terrestrial Applications (CIASTA). Several collaborative research projects were funded in September through CIASTA, a NOAA joint institute with the University and Community College System of Nevada. Titles of these projects include: “Southeast Agricultural Data Acquisition and National Drought Product Development”, \$40,000; “Presentation of Cloud Condensation Nuclei Spectra”, \$97,400; “Big Bend Regional Aerosol and Visibility Observational Study (BRAVO)”, \$255,000; and “Collaborative Studies of the Response of Aeolian Processes to Climate Change and Variability” \$2,500. (Marc Pitchford, 702 895 0432, and Barbara Pierce, 702 295 1233)

27. Mesoscale Modeling of the Las Vegas area . The alternate routing of the model initializing ETA data was added to improve transfer speeds for a more timely transfer and provide a back-up source for model initialization data. A "draft" web page has been developed on the internal web server for output products. There was continuing work/discussion on the usage of the University of Nevada-Las Vegas (UNLV) computer cpus and memory. Work continued on fine tuning of the higher resolution nested grids. SORD has been making one model run a day, at a minimum, based on 00 UTC initialization data until the NCEP Cray burned. Moreover, RAMS 48-m wind forecasts were used for test readiness operational support. (Walt Schalk, 702 295 1262, and Jim Sanders, 702 295 2348)

28. Hazardous Materials (HAZMAT) Spills Center (HSC). SORD supported the Remote Sensor Test Range (RSTR) Nighthawk Episode. The Nighthawk Episode is a continuation of the multiple year effort of development, characterization, and testing of remote sensors of chemical effluents. Chemical releases used the existing wind tunnel to provide a large diameter, well characterized, open air, plume containing various concentrations of chemical vapors and a 50-foot tall, hot air, stack source. This test series included sensors on aircraft flying at various altitudes, anywhere from near the surface to above 50,000 feet. Weather support include our normal twice daily NTS forecast and a weather and climate briefing for the HSC Safety Panel. This test series continued into the first two weeks of September. (Jim Sanders, 702 295 2348)

29. Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study Field Trip. SORD staff led a seven-day 2000-mile BRAVO Study technical managers tour of Texas from Houston to El Paso to review monitoring sites and gain first-hand experience of the nature of the study region including terrain, land-use, and pollutant source configurations. During the tour, surface soil samples were gathered to generate compositional profiles by size for each monitoring site for use in identifying the local dust contribution to atmospheric aerosol samples. The four-month (July–October) field-monitoring phase of the BRAVO Study involves over 40 monitoring sites including aerosol, gaseous, and tracer monitoring; continuous upper air meteorological monitoring; and tracer release from four pollutant emission locations. Data analyses and regional scale modeling will be conducted over the next 18 to 24 months followed by report preparation. (Marc Pitchford, 702 895 0432)