



# NOAA ARL Monthly Activity Report



**June 2005**

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**Air Resources Laboratory**

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## Highlights

**1. Air Quality Forecast Model Development, Testing, and Evaluation.** Air quality forecast applications with the Eta-CMAQ modeling system have been initiated over the eastern United States domain. In addition, a developmental forecast simulation over the continental United States using a 12-km resolution horizontal grid has also been initiated. Model predictions from both forecast streams are being continually evaluated against available surface O<sub>3</sub> observations on a daily basis. Comparisons of distributions of gaseous and particulate species, which are derived from both the operational O<sub>3</sub> and developmental PM model forecast runs from the summer of 2004, are being compared against measurements collected onboard the NOAA P3 and NASA DC8 aircrafts during the 2004 International Consortium for Atmospheric Research on Transport and Transformation (ICARTT) field study. An assessment of the ability of the model to represent the vertical distributions of O<sub>3</sub> through comparisons with ozonesonde data from the Intercontinental chemical Transport Experiment (INTEX) Ozonesonde Network Study deployed during the ICARTT study was also initiated.

[rohith.mathur@noaa.gov](mailto:rohith.mathur@noaa.gov)

**2. Great Lakes Mercury Report to Congress.** The FY 2005 Congressional Appropriations Bill contains language from the House Appropriations Committee that directs NOAA "...to report to the Committee on mercury contamination in the Great Lakes, with trend and source analysis, by July 31, 2005." A report was prepared, and is presently under review by NOAA, DOC, and OMB. The report is scheduled for release on July 31, 2005. Briefings have been given to the staff and the House member [Rep Kirk (R-IL)] responsible for the language in the Bill. [mark.cohen@noaa.gov](mailto:mark.cohen@noaa.gov)

**3. 4<sup>th</sup> NOAA/EPA Scientist-to-Scientist Meeting on Multimedia Aspects of Environmental Pollution in Coastal and Marine Environments.** On June 1–3, 2005, 55 NOAA and EPA scientists and managers met at the Patuxent Research Refuge of the National Wildlife Center near Laurel, Maryland, to discuss "Multi-Media Aspects of Environmental Pollution in Coastal and Marine Environments." This meeting was the fourth in a series of NOAA/EPA scientist-to-scientist meetings. The focus was on connections between atmospheric deposition and its effects in coastal ecosystems. The objective of this meeting was to forge collaborative efforts between NOAA and EPA to advance the application and development of multi-media measurement capabilities and modeling tools for ecosystem-based management and protection of inland, coastal, and marine waters. The agenda for the meeting contained sessions to outline multi-media environmental problems from the user perspective, discuss approaches to managing problems, and identify current and proposed capabilities to address these problems. Following the presentations, the attendees divided into two workshop sessions to develop recommendations for collaboration dealing with "Mercury" and "Nitrogen" multi-media issues. The agenda, presentations, and a short summary report of the conclusions are available on the Atmospheric Sciences Modeling Division (ASMD) website under "hot topics." [robin.dennis@noaa.gov](mailto:robin.dennis@noaa.gov)

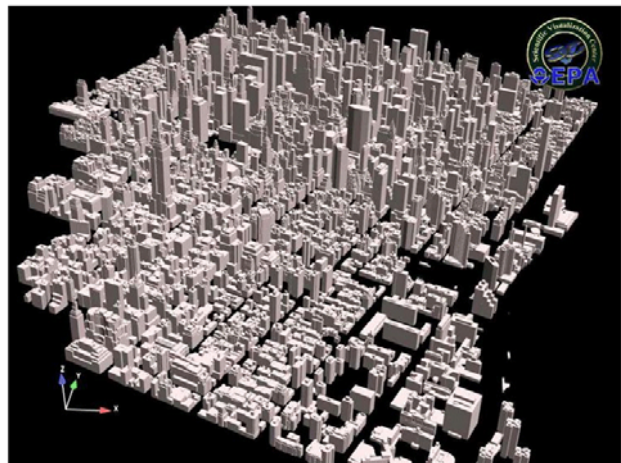
**4. The New York Urban Dispersion Program.** Three ARL divisions will be heavily involved in the study to be held in New York, starting in August. Funding for the ARL participation comes from DHS, DOD, and EPA.

The Field Research Division (Idaho Falls) will be conducting tracer releases. Several continuous analyzers are being conditioned for the project and all auxiliary systems are being checked. The automatic gas samplers are being tested. Supplies have been ordered, deployment plans have been developed, and all other logistical arrangements have been made. The field team is due to arrive in New York at the end of July. [kirk.clawson@noaa.gov](mailto:kirk.clawson@noaa.gov)

Related work at the Atmospheric Turbulence and Diffusion Division at Oak Ridge is also ratcheting up.

ATDD participated in a survey of potential sodar and radar profiler sites in and near NYC on June 6, and in an UDP planning meeting on June 7 – 8, which included a street level survey of possible wind measurement systems in Midtown Manhattan. [ray.hosker@noaa.gov](mailto:ray.hosker@noaa.gov)

At Research Triangle Park, the Atmospheric Sciences Modeling Division is focusing on modeling – both physical (wind tunnel) and numerical (Computational Fluid Dynamics – CFD). CFD simulations prior to the Spring 2005 field tests were found to be very useful in supporting the study design. The digital description of the array of buildings has required some detailed attention. Recent photographs from the area and notes taken during a walk-around are being used to define the final building geometry. The figure (left-to-right) shows the Times Square area through the Rockefeller Center area to the UN building. Some Preliminary CFD simulations are planned for completion



during July in time to support the field study in August. The building geometry data have been processed to support the construction of a wind tunnel model. [alan.huber@noaa.gov](mailto:alan.huber@noaa.gov)

**5. *The Demise of ISIS.*** Because of a lack of funding, the ISIS solar radiation network is likely to be closed. ISIS includes solar-only stations at Albuquerque, NM; Bismarck, ND; Hanford, CA; Madison, WI; Oak Ridge, TN; Seattle, WA; Salt Lake City, UT; Sterling, VA; and Tallahassee, FL (already closed). If you have concerns or questions about the demise of ISIS, please contact [john.a.augustine@noaa.gov](mailto:john.a.augustine@noaa.gov)

## Silver Spring

**6. *Atmospheric Mercury Modeling with HYSPLIT.*** A new version of HYSPLIT-Hg is being developed that will have several advantages over the previous version. The updated code will be able to estimate the relative importance of sources in other countries to the mercury deposition observed at locations in the United States. The new simulations will also include natural mercury sources and re-emissions of previously deposited mercury. The first exercise of the new model will be to compare its predictions against the atmospheric mercury measurements made during Summer 2004 at two sites on the Eastern Shore of the Chesapeake Bay (Oxford and Wye). [mark.cohen@noaa.gov](mailto:mark.cohen@noaa.gov)

As an extension of this work, a multi-media mercury modeling system is being developed in a collaborative project involving EPA, NOAA, and the Environmental and Occupational Health Sciences Institute at Rutgers University. The modeling system being developed will involve modules addressing atmospheric fate and transport, aquatic fate and cycling, aquatic bioaccumulation, human exposure, and risk assessment. The model is currently being developed for Lake Ontario, but will subsequently be adapted for more general use. A symposium on the project was held in June 2005 in connection with the International Joint Commission's Biennial Meeting in Kingston, Ontario. A copy of the presentation given at that symposium is available at: <http://www.arl.noaa.gov/ss/transport/cohen.html#item31> [mark.cohen@noaa.gov](mailto:mark.cohen@noaa.gov)

**7. *Educational Partnerships Program.*** ARL is hosting an Undergraduate Scholar in the Educational Partnership Program (EPP) during summer 2005. Marcus Rountree is an Environmental Science major at North Carolina Central University and is in between his Junior and Senior year. He is investigating source-receptor relationships for mercury, using back-trajectory and GIS tools. [mark.cohen@noaa.gov](mailto:mark.cohen@noaa.gov); [marcus.o.rountree@noaa.gov](mailto:marcus.o.rountree@noaa.gov)

**8. *HYSPLIT Updates.*** Several updates have been made to the HYSPLIT code, to correct some inconsistencies in the context of pollutant mass balance, to permit more options for computing trajectories, and to facilitate display of the results. The revised programs will be available for distribution in July. [roland.draxler@noaa.gov](mailto:roland.draxler@noaa.gov)

The HYSPLIT code run at NCEP was modified by adding hourly output for volcanic ash dispersion forecasts. The hourly output can be seen by the Washington Volcanic Ash Advisory Center (W-VAAC) personnel on the NCEP N-AWIPS computer system. Model output to the public was not changed. On N-AWIPS, images of model output layers may be viewed individually, and the images may be animated. The W-VAAC requested this high temporal resolution output for their use in producing Volcanic Ash Advisory messages. The key to formatting the data for display on N-AWIPS was to convert the HYSPLIT concentration output into the WMO-standard GRIB (GRIded Binary) format, since then it could be readily input to N-AWIPS processing programs. The W-VAAC is operated by NCEP Central Operations and NESDIS Satellite Analysis Branch, with modeling support provided by ARL. [barbara.stunder@noaa.gov](mailto:barbara.stunder@noaa.gov)

**9. *Climate Change Science Program Synthesis and Assessment.*** Work continues on the CCSP synthesis and assessment product on temperature trends in the lower atmosphere. In response to a formal review of the first draft of this report by a National Research Council panel, the author team has been revising the report. New calculations of temperature variability and trends, based on updated datasets were prepared, and

considerable revision of the figures, tables and text is ongoing. The next step in the process will be to finalize a draft for public review, now planned for mid-August 2005. [dian.seidel@noaa.gov](mailto:dian.seidel@noaa.gov)

**10. *Nature Journal Club Article.*** In response to an editorial request, a short article was prepared for Nature's Research Highlights section, for a new feature called "Journal Club" in which a working scientist explains an influential recent study that has influenced the direction of his/her own research. The article discusses work by Santer *et al.* on the global tropopause as an indicator of climate change and how it has motivated an ongoing collaborative research project at ARL and NCAR. [dian.seidel@noaa.gov](mailto:dian.seidel@noaa.gov)

## **Boulder**

**11. *SURFRAD/ISIS.*** New information has been supplied, via the SURFRAD web page and ftp site, to allow SURFRAD data users to correct UVB erythemal irradiances reported in SURFRAD data files for the actual ozone over a station at the time of the measurement, if known. Because we generally don't know the total ozone over a SURFRAD station at the time of an individual UVB measurement, a nominal value of 300 Dobson units (DU) is assumed in the daily processing. However, total ozone can vary between <200DU to >400DU. By applying the proper coefficients and actual total ozone at the time of the measurement, a correction factor can be computed. Tests have shown that the corrections range from 0 to 5%. [john.a.augustine@noaa.gov](mailto:john.a.augustine@noaa.gov)

**12. *Houston Aircraft Validation Experiment.*** Actinic flux measurements taken on board the WB57 aircraft, as part of the Houston Aircraft Validation Experiment campaign 2005, have been analyzed. The instrument used was modified to reduce sensitivity of the measurement to the variability of scattered light over an inhomogeneous background. Preliminary results suggest that measurements are now more sensitive to the aircraft's roll and pitch movements. More analyses have to be done before instrument modifications are accepted as final. [irina.petro@noaa.gov](mailto:irina.petro@noaa.gov)

## **Oak Ridge**

**13. *Chesapeake Bay Mercury Study.*** Atmospheric mercury enters freshwater and marine ecosystems through direct deposition onto water surfaces and by deposition onto the watershed with subsequent transport into receiving waters. In most ecosystems, atmospheric deposition is a very significant pathway. Airmass trajectory analysis suggests this to be true for the Chesapeake Bay region. In June an airborne mercury monitoring system was installed at the edge of the Piankatank River near Harcum, Virginia. The system measures individually the three primary forms of atmospheric mercury: gaseous elemental mercury (GEM), ionic, and particulate. Knowing only the total amount of atmospheric mercury is insufficient for understanding its deposition to the surface. The relative behavior of the three forms under wet and dry deposition differs dramatically. Our preliminary results from June indicate downward mixing of reactive gaseous mercury to the surface by midday convection in the boundary layer, in line with last summer's results from Wye, MD and Oxford, MD. GEM concentrations are similar among Harcum, Wye and Oxford, although the GEM signal at Harcum is smoother due to a lack of local sources. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

**14. *Spatial Heterogeneity Study.*** Collaborations began with the Univ. of Alabama (operators of the Sky Arrow research aircraft), Univ. of Illinois, and Illinois State Water Survey for a summer intensive at the AmeriFlux/BigFoot site near Champaign, Illinois in June. Several measurement systems, including wind profile, temperature profile, CO<sub>2</sub> profile, soil heat flux variability, modified Bowen ratio, and continuous soil CO<sub>2</sub> were set up. Work was also performed on quantifying evaporation in the litter layer. Flux data are being collected from seven towers as well as from the University of Alabama Sky Arrow flights. The data will be analyzed in conjunction with the ALEXI suite of ecosystem models to improve treatment of subpixel heterogeneity in determining bulk air-surface exchange over a landscape. The data collection appears to have gone well all around. Analysis is in progress. [tilden.meyers@noaa.gov](mailto:tilden.meyers@noaa.gov); Wilson, Senn, and Heuer

**15. Hurricane Turbulence Measurements (airborne).** An eddy flux instrumentation package was installed on NOAA's P3, N43RF, to prepare for this season's measurements of air-sea exchange in hurricanes. This is the fourth year in a row for N43RF. The instrument package performed well during ground tests; however the data system proved unreliable after arrival at the Aircraft Operations Center in Tampa. The problem was traced to damage during shipment from ATDD. The data system was returned to ATDD where work continues to replace and test components before the flight test set for early August. N43RF is currently in Costa Rica supporting a study of the genesis of east-Pacific tropical storms. Although the ATDD instrumentation is installed on the P3, no boundary-layer flights are possible during the genesis study and thus the projected dates for obtaining measurements with the BAT are from August 15 through September 30. Analysis continues of data collected during the 2003 and 2004 hurricane seasons. Drafts of two papers are in preparation. One highlights the first-ever direct measurements of surface fluxes over the ocean in winds exceeding  $22 \text{ m s}^{-1}$ . [ron.dobosy@noaa.gov](mailto:ron.dobosy@noaa.gov); [ed.dumas@noaa.gov](mailto:ed.dumas@noaa.gov)

## Research Triangle Park

**16. Community Multiscale Air Quality Model - Testing for 2005 Model Release.** Many new and upgraded features are being tested and evaluated for the next major release of the Community Multiscale Air Quality (CMAQ) modeling system. New capabilities include sea-salt emissions, chemical interaction with fine mode aerosols, improved aerosol thermodynamic transformations, subgrid convective cloud transport, minimum eddy diffusivity, dry deposition velocity for aerosols, mass continuity, and biogenic emissions of isoprene and terpenes. Initial testing has shown that these modifications cause significant changes in the results. An investigation of the differences in sulfate predictions for CMAQ simulations with 36-km and 12-km grid cell sizes continued this month. Previous results had shown that sulfate was 40-50% higher for the finer grid resolution. Examination of the results showed that the sulfate differences were mainly due to lower precipitation for the 12-km simulation as compared to precipitation in the 36-km MM5 model runs. An evaluation of the precipitation data showed that 12-km MM5 precipitation better matched the observations (normalized mean bias: NMB=4.53 percent) than did the 36-km run (NMB=38.4 percent). Evaluation of model results compared to observed gas and aerosol concentrations is underway. [jonathan.pleim@noaa.gov](mailto:jonathan.pleim@noaa.gov); [shawn.roselle@noaa.gov](mailto:shawn.roselle@noaa.gov)

In addition, progress is being made on the new parallel domain decomposition scheme for the air quality version of CMAQ (CMAQ-F). In this method, the computational domain array "CGRID" is transposed for efficient advection computations, then re-transposed for efficient chemistry computations. The method assists the development of new advection schemes particularly related to a modified Arakawa E-Grid, which is used in one of the meteorological models that will drive CMAQ-F, thereby allowing for tighter coupling with a future version of CMAQ-F. [jeffrey.young@noaa.gov](mailto:jeffrey.young@noaa.gov)

The CMAQ Meteorology-Chemistry Interface Processor (MCIP) Version 3 entered a beta testing phase to prepare for its release with CMAQ in fall 2005. The major change in MCIP Version 3 is the capability to process output from the Weather Research and Forecasting (WRF) model in addition to output from MM5. The goals of the beta testing program are (1) to broaden the suite of test data sets, hardware architectures, and compilers, (2) to gain feedback from the user community to improve the code prior to the release to prevent unnecessary "quick fixes" to the code upon its release to the community, (3) to leverage the community members' experience with different configurations of WRF, and (4) to allow dedicated community members to gain access to a pre-release version of the code. This beta testing phase also satisfies one of the recommendations of the CMAQ Peer Review from December 2003. Thirty-six members of the CMAQ community were invited to participate in the beta testing program, and more than half have agreed to participate. The beta testing will end on 1 August, and user feedback from the program will be incorporated into the released code for fall 2005. [tanya.otte@noaa.gov](mailto:tanya.otte@noaa.gov)

**17. Nudging the WRF model -- Progress.** A new program has been written to support the development of the WRF model four-dimensional data assimilation nudging scheme, in collaboration with Penn State and the

National Center for Atmospheric Research (NCAR). This program converts surface analyses from the Penn State/NCAR Mesoscale Model (MM5) into the input/output format used by the WRF model. This program will support initial testing of the surface nudging capability that is being developed for WRF, and it will enable comparisons of the nudging capability between MM5 and WRF. This program also can be used with the soil moisture nudging capability in the Pleim-Xiu land-surface model in WRF. [tanya.otte@noaa.gov](mailto:tanya.otte@noaa.gov)

**18. North American Mercury Model Intercomparison.** Development of initial condition/boundary condition (IC/BC) files for regional-scale modeling in the North American Mercury Model Intercomparison Study (NAMMIS) was completed. These IC/BC files were developed from global-scale atmospheric mercury model simulations performed by Atmospheric and Environmental Research, Inc. and Environment Canada. A third global model simulation is expected to be completed by Harvard University using the GEOS-CHEM model by the end of July. The IC/BC files are being placed on a publicly-available FTP file server to allow easy access to these files by other regional modelers participating in the NAMMIS. [russell.bullock@noaa.gov](mailto:russell.bullock@noaa.gov)

**19. Wildfire Emissions.** Emission estimates for wild-land fires are currently available from the BlueSky Framework and the National Emission Inventory (NEI). The emission calculation within the BlueSky framework is derived from the combination of two models, CONSUME and Emissions Production Model (EPM). CONSUME is a fuel consumption model and EPM is a model that predicts the time rate of fuel consumption and emissions from wild-land biomass burns. The NEI emission estimates are based on state-level fuel consumption information and state-level emission factors and is what is currently available from the EPA. The Florida Department of Forestry has recently provided a detailed activity database of wild land fires for the State of Florida for the year 2001. A comparison of the emission estimates from both sources has revealed a number of significant differences between the two methods. The CONSUME/EPM was written in the early 1990s making it somewhat archaic; it estimates emissions using fuel loading information supplied by the user, and within the BlueSky framework the fuel loading information for Florida is from the National Fire Danger Rating System (NFDRS) 1 kilometer database. The total fuel consumed is based on the fire size and the fuel loading information. A number of key assumptions are made to arrive at emission estimates on a fire by fire basis. In the NEI, the emission estimates are made at the state level (not on a fire by fire basis). For Florida in the year 2001, the original NEI estimate was 136,000 tons of PM<sub>2.5</sub> based on 500,000 acres burned. The BlueSky framework estimate using the detailed activity database (400,000 acres burned) was more than an order of magnitude less. Using revised information from the state of Florida and the updated fuel consumption factors, the NEI system then yielded a new estimate for Florida wildfire emissions of about 37,000 tons. This update to the NEI was then used in the upcoming 2001 annual CMAQ simulation. On a number of grounds, emission estimates from the BlueSky framework are likely to be too low and were not used for modeling. FEPS is a much improved version of CONSUME that has not yet been incorporated into the BlueSky Framework. [george.pouliot@noaa.gov](mailto:george.pouliot@noaa.gov)

**20. Chemical Data Assimilation for Air Quality Forecasting.** A NOAA-sponsored Workshop on Chemical Data Assimilation and Data Needs for Air Quality Forecasting was held during June 20–22, 2005, in Silver Spring, Maryland. The Workshop conveners were Ken Schere (ASMD), Georg Grell (NOAA/FSL), and Greg Carmichael (University of Iowa). The Workshop brought together 36 representatives of the research and operational modeling communities to discuss the current state of knowledge in assimilating trace gas and particle data into air quality simulation forecast models, to provide better chemical initialization and overall accuracy of the forecasts. Data needs and data availability of real-time monitoring data from surface-based, sounding, and satellite platforms were also discussed. The goal is to identify promising techniques that may be capable of being transitioned to an operational forecasting system, and to identify needed research to improve the state of knowledge in this emerging field. Three Division members participated in the Workshop. [kenneth.schere@noaa.gov](mailto:kenneth.schere@noaa.gov)

## Idaho Falls

**21. Smart Balloon.** Several urethane bladders used for the smart balloon have been received and are being tested. Three bladders are used in every balloon system -- a helium bladder, an air bladder and the outer rain covering.. The newly refined system has survived one unintended balloon flight from Idaho Falls to Rexburg (25 miles). The balloon and the transponder were recovered in a small pasture with very minor damage. This could be considered our first flight of the current balloon design. [randy.johnson@noaa.gov](mailto:randy.johnson@noaa.gov)

**22. Transport and Dispersion Modeling.** In June, a request was received for dispersion estimates for the Idaho National Laboratory, covering calendar year 2004. Model simulations are performed with a special version of the MDIFF puff model that uses hourly average data from the INL mesonet. The results of the 2004 simulations have been delivered. Overall, there were no great surprises in the 2004 simulations. The 2004 concentration isopleths are consistent with the patterns observed in prior years. [richard.eckman@noaa.gov](mailto:richard.eckman@noaa.gov)

The spring season was relatively wet in Southeast Idaho this year, with almost three times the normal precipitation in May. As a result, fire activity has so far been limited in Idaho. However, the spring rain has increased the vegetation growth, which may become an issue later in the summer as this vegetation dries. FRD is again preparing to provide meteorological assistance in the event of any fires at the INL. One aspect of this assistance is an ability to forecast fire spread based on meteorological conditions. A new version of the fire modeling system is now available, with more fire algorithms and an expanded list of fuel models. FRD staff is looking into adapting this system for INL use. [richard.eckman@noaa.gov](mailto:richard.eckman@noaa.gov)

## Las Vegas

**23. Urban Atmosphere Research Program – Las Vegas.** ARL and the Cooperative Institute for Atmospheric Sciences and Terrestrial Applications (CIASTA) are collaborating on an extensive study of urban air quality and dispersion in Las Vegas. One key question to be addressed relates to the contribution of pollution from local sources to the ozone exceedance problem that Las Vegas is confronting. The ARL Special Operations and Research Division in Las Vegas is working with CIASTA in several ways.

Ozone monitoring. Two ozone analyzers borrowed from ARL are being operated at remote sites to document the regional background levels during the ozone season for Las Vegas. CIASTA is making measurements within the Las Vegas urban area. Measurements at Desert Rock, NV, about 60 miles northeast of Las Vegas and at a site in the Mojave National Preserve about 50 miles south of Las Vegas demonstrate that regional ozone concentrations can be a large fraction of the air quality standard. Observations at the two upwind locations show remarkable similarity, with values occasionally exceeding the 8-hour, 80 ppb ozone standard at. Neither of these upwind sites is typically affected by wind from the Las Vegas metropolitan areas. The next step is to compare these with observations from the ozone network set up in the Las Vegas urban area. Already, it is clear that the Las Vegas ozone problem cannot be addressed as solely a local issue. [marc.pitchford@noaa.gov](mailto:marc.pitchford@noaa.gov)

Mesonet and other data. A new computer program was written to display wind fields generated by the ARL mesonet and by the intensive pibal and radiosonde soundings that ARL is providing. A total of 40

PIBALS and 9 upper-air soundings were taken during June. The graphics can be seen on SORD's Web Page. [raymond.dennis@noaa.gov](mailto:raymond.dennis@noaa.gov), [douglas.soule@noaa.gov](mailto:douglas.soule@noaa.gov), Sanders Lantrip, Abbott,

**24. Dispersion Forecasting for Brush Fire Smoke.** On June 3, 2005, an intense brush fire spread rapidly across the desert near the Nevada Test Site (NTS). This fire was activated by cloud-to-ground lightning. This

was verified by the ARL lightning mesonet. As the fire spread onto the western edge of the NTS it was moving toward a "RADEX" (radiologically contaminated) area, causing safety and health concerns for the lofting of radioactive material into the atmosphere. SORD researchers provided numerous dispersion forecasts and plume projections to DOE the Emergency Operations Center; making comprehensive use of the NTS mesonet and mobile meteorological equipment. [walter.schalk@noaa.gov](mailto:walter.schalk@noaa.gov)