NOAA ARL Monthly Activity Report

July 1999

Bruce B. Hicks, Director
Air Resources Laboratory

Highlights

1. Development of Smart Balloons for Hurricane Research. A program is about to start to develop and deploy smart balloons as part of a Lagrangian experiment to better characterize the evolution of the energy content of the marine boundary-layer inflow to hurricanes and its relationship with hurricane intensity changes. This will be a NOAA and NSF sponsored project involving the FRD (Idaho Falls) smart balloon and instrument capability and the hurricane research program at the University of Hawaii. The development work on the smart balloon will build on previous smart balloon experiments and field projects. New features that are planned for the smart balloons and hurricane research include a high accuracy aspirated temperature and relative humidity sensor which will be installed on the transponder. The goal is temperature accuracy of better than 0.5C and relative humidity accuracy of better than 3%. A light weight precision barometric pressure sensor will be installed to provide absolute barometric pressure accuracy of better than .5 mb and a resolution of .05 mb. Differential GPS correction capability will be added to increase the absolute accuracy of the smart balloon altitude. This will be especially important inside a hurricane where barometric pressure is changing fast enough that it cannot be used for altitude calculations. An improved altitude control algorithm will be developed, to control balloon altitude to within tens of meters rather than the present 100 meters. A protocol to communicate with the balloons using new low earth orbit satellites will be developed; data and control commands were previously sent with a direct radio link between an aircraft in the study area and the balloon. The transponder portion of the smart balloon will be fastened directly to or inside the smart balloon shell. This should help protect the transponder electronics and make launching the balloon easier. (randy.johnson@noaa.gov)

2. Western Region Air Partnership (WRAP) Meeting. WRAP is comprised of western state, tribal, and federal agencies working together to respond to the need for regional scale air quality assessment and planning to meet the requirements of the federal Regional Haze Rule. NOAA SORD staff is involved in leading the WRAP Ambient Monitoring and Reporting Forum (AMRF), which is comprised of government and non-government stakeholders from the western states. At a meeting in Salt Lake City (July 20-21), an outline for the technical work plan for the next two years was developed. The AMRF will be responsible for establishing current visibility conditions and estimates of natural background levels for the visibility protected areas (national parks and wilderness areas) in the western U.S. Among the tasks required to meet these goals is establishing a database, preparing annual data reports, and periodic interpretive reports for visibility, air quality and meteorological data. (Marc Pitchford, 702 895 0432)

General

The topics that are presented are sorted according to their contribution to the NOAA Strategic Plan, as follows:

Sustain Health Coasts: 26, 27
Short-term Forecasting and Warnings: 1, 6, 7, 8, 14, 15, 16, 18, 22, 23, 32, 34, 37, 40, 42
Seasonal to Interannual: 9, 11, 17
Decadal to Centennial: 3, 4, 5, 10, 12, 13, 19, 20, 21, 24, 28, 31, 33, 35
Crosscutting: 2, 25, 29, 30, 36, 38, 39, 41, 43

Silver Spring

3. Update on Chapman Conference. Seventy-one abstracts were received for the upcoming ARL-led Chapman Conference on Water Vapor in the Climate System. The abstracts were sorted into five topics and distributed to the program committee for review. A draft program is under preparation. (rebecca.ross and dian.gaffen@noaa.gov)

4. Radiosonde Temperature Trends. A study has been made of the differences in temperature trend for the period 1979-1996 of Microwave Sounding Unit (MSU) data and the period 1961-1996, twice as long. Globally, the surface temperature trends are almost the same for 36-year and 18-year periods (0.13 and 0.12K/decade, respectively) but 850-300 mb (tropospheric) trends for the 2 periods are significantly different (0.14 and 0.02K/decade, respectively). This difference is particularly obvious in north extratropics where the surface warming during 1979-1996 is twice that of 1961-1996 but the 850-300 mb warming is slightly less during 1979-1996 than 1961-1996. While this supports the finding of less tropospheric warming than surface warming since 1979 based on MSU and extensive surface-temperature networks, a more important conclusion of the present study is that temperature records beginning in 1979 are often too short for the obtaining of trends representative enough to be applied to global-warming issues. (Jim Angell, 301 713 0295, x127)

A collaborative study with NOAA/GFDL is underway as an outgrowth of earlier work on statistical methods to detect artificial jumps in radiosonde temperature time series. The earlier findings indicated the strong sensitivity of temperature trends to the existence and adjustments of such jumps, and the difficulty of distinguishing artificial jumps from abrupt, but real, climate variations. John Lanzante has developed regression techniques to model the natural variations, thus allowing more confident identification of artificial changes. The methods rely on station history metadata and the judgments of a team of experts, who, following a detailed protocol, examine the data, regressions, and metadata; reach decisions about potential change-points; and document their reasoning to create an additional metadata record. The process is rather time consuming, but the potential benefit — an improved long-term radiosonde temperature data set — makes this unique effort worthwhile. (dian.gaffen@noaa.gov)

5. AIRMoN Program Update. ARL has been working with the Illinois State Water Survey to couple AIRMoN-wet trajectory information with the chemistry database for the precipitation samples. Although the final product is under construction, Barbara Stunder has prepared an interim product showing 48 hour back trajectories beginning at each of the AIRMoN-wet sites which is run at 12Z each day. Graphics and

endpoints are available through the ARL READY air quality page or directly using http://www.arl.noaa.gov/ready/traj_airmon.html.

The National Atmospheric Deposition Program (NADP) has a lot of field equipment in serious need of modernization. AIRMoN-wet is a NADP subnetwork and also suffers from aging infrastructure. In an effort to upgrade the precipitation chemistry collector, a Small Business Innovation Research Subtopic was submitted and accepted by NOAA entitled: Modernization of Aging Infrastructure in the National Atmospheric Deposition Program. The intent is to get a few good proposals that will result in the generation of a prototype precipitation chemistry sampler capable of improving sampler reliability and associated downtime while permitting simultaneous collection of weekly, event, and mercury samples. (richard.artz@noaa.gov)

6. WMO - CTBTO. A position paper was prepared for the upcoming WMO emergency response meeting. The paper supports continued dispersion model testing between national meteorological centers and the Comprehensive Test Ban Treaty Organization with the intent to help them refine their meteorological requirements. (roland.draxler@noaa.gov)

7. Prototype RSMC Joint Web Page. A prototype web page that will have RSMC dispersion forecasts from the U.S., Canada, and Australia has been developed for presentation at the next WMO sponsored RSMC working meeting to be held in China in September. A joint page should help the end-users to view and compare the three center's products side-by-side in one location. It is conceivable that all the RSMC centers could be included in the future. It is hoped that the use of the Internet for product retrieval can become the standard distribution method in the future. (glenn.rolph@noaa.gov)

8. NCEP/ARL Collaboration. As a step towards implementing the ARL/NCEP radiological emergency response modeling system on NCEP's Cray computer system, a paper was prepared for presentation at the next CAFTI meeting describing the history and operational characteristics of the system. The paper will be published as a NWS Technical Procedures Bulletin (see http://tgsv5.nws.noaa.gov/om/tpb/458.htm). (roland.draxler@noaa.gov)

9. Changes in the North Polar Vortex. A presentation on trend and decadal variability of the north polar vortex was given at IUGG99 in Birmingham, England. The preliminary results show that the vortex is becoming smaller but more intense, and that it is moving away from the north pole. These changes are accompanied by warming in the boundary layer and cooling in the lower stratosphere of the polar cap region. Subsequently, meridional gradients of temperature and pressure over mid-latitudes are increasing, which might be related to the increase of violent weather observed in recent years. (julian.wang@noaa.gov, and James Angell, 301 713 0295 x127)

10. Air Stagnation Atlas. The atlas of air stagnation climatology for the United States (1948-1998), published in April, has become quite popular since being advertised on the CLIMAT network, with recent requests from the UK, Spain, Korea, Russia, Canada, Italy, and Australia, and more than 20 US states. The requests come from universities, state government, private companies, federal agencies, and the White House. A short article to introduce the atlas and to update the results for this year is under preparation. A paper on

the topic will be presented at the **11th Joint Conference on the Applications of Air Pollution Meteorology with the Air and Waste Management Association** at the 80th AMS annual meeting in Long Beach, CA. (julian.wang@noaa.gov, and James Angell, 301 713 0295 x127)

Boulder

11. SURFRAD. Repairs have been completed at the Bondville SURFRAD station, which had been struck by lightning on June 4, 1999, resulting in the loss of nearly all of the measured meteorological and the upwelling solar pyranometer data. As of July 22, the Bondville station was back to normal operation.

The work on validating the SURFRAD interpolated soundings using ARM SGP central facility data continues. Software was written to reduce the ARM soundings to 25 mb vertical resolution was written and tested. Now we have interpolated and actual ARM Central Facility soundings in the same format and resolution for all of 1998, and ready for comparison. (John Augustine, 303 497 6415).

Oak Ridge

12. CO_2 Program. The tower at Walker Branch Watershed will need to be relocated in the future due to the proximity of the planned Spallation Neutron Source facility. Visits were made to a number of state and federally owned forests in Tennessee to identify potential candidates for tower relocation. A site at Fall Creek Falls state park was the most promising. A future visit is planned to determine if park and state officials are agreeable. Data analysis focused on the forest floor energy balance. Based on eddy covariance and litter wetness data, forest floor evaporation is highly sensitive to litter wetness. However, the water holding capacity of litter at Walker Branch is relatively small (less than one mm), so high soil evaporation rates do not occur for long periods of time. Carbon fluxes are also related to soil wetness and soil evaporation rates, so this analysis has direct implications on the carbon budget at Walker Branch. (wilson@atdd.noaa.gov)

13. Canaan Valley. The AIRMON dry and wet deposition site installation planned within the Canaan Valley National Wildlife Refuge on the Canaan Valley, WV floor is proceeding. Instrumentation and equipment is being inventoried at ATDD and being readied for shipment up to the sites. Discussions with the U.S. Fish and Wildlife Service (USFWS), managers of the refuge, are ongoing in planning the exact site locations and installation procedures. Tentative sites have been located and are awaiting formal approval through the USFWS. Completion of the site installation is expected within two months. Also, a series of meetings were held with ATDD investigators concerning future measurement strategies and investigative direction. A primary goal was to utilize these sites as a state-of-the-art research facility for future investigation into pollutant deposition in a region strongly suspected of being influenced by anthropogenic pollutant sources. (vogel@atdd.noaa.gov)

14. CASES-99. Much of the CASES-99 activity in July was associated with putting together an aircraft operations plan. An aircraft coordinator has been chosen to organize the contributions from the various aircraft groups. The kinds of issues that have come up include air-to-air and ground-to-air communications, minimum flight altitudes, and preflight briefings. In late July, the FAA in Kansas City was contacted by the aircraft coordinator to brief them on the planned aircraft activities during CASES-99. (eckman, dumas@atdd.noaa.gov)

Construction of the new generation of microbarograph was started. Completion and testing is expected by mid-September. Fortran programs for wavelet and spectral analyses of pressure signals, and for beam steering of coherent pressure signals, *i.e.*, gravity waves, have been written and tested on the FLAT pressure data. An analysis of the FLAT pressure data continues with these newly-developed analytical tools. (nappo, auble, eckman@atdd.noaa.gov)

15. LES Ozone Modeling. To study the influence of dry deposition on volume-averaged concentrations of chemical species involved in ozone generation, an LESchem simulation was conducted with the deposition turned off. Comparing the two simulations (*i.e.*, with and without dry deposition) revealed only slight to insignificant differences in the horizontally-averaged trace gas mixing ratio profiles, except for nitric acid (HNO_3), which was about 14% less in the CBL when deposition was enabled. New post-processing software is being developed to examine more turbulence statistics from the CBL generated by LESchem. These programs will be used to more thoroughly gauge the realism of the LES dynamics generated by the model, and the effects of changing such parameters as the surface heating and characteristics, grid resolution, and time step size. (herwehe@atdd.noaa.gov)

16. East Tennessee Ozone Study (ETOS). The ETOS program continues to gain new members to the program's Science Team. New participants include representatives from East Tennessee State University (Johnson City, TN) and Tusculum College (Greenville, TN). Both organizations provided representatives from their respective environmental departments. The expanded ETOS Science Team met July 28 to review current measurement efforts. Preliminary observations from the aircraft sampling program were presented along with maps of the current ozone and meteorology monitoring deployment. The next meeting was scheduled for September 8, in Oak Ridge.

The first study intensive, scheduled for the last two weeks of July, was partially successful. NOAA/ARL's Twin Otter sampling aircraft was able to spend two days in the East Tennessee area before continuing to the North Carolina Coastal variability study. Two sampling passes were made across the East Tennessee Valley on July 26 and July 27. Ozone concentrations well above 100 ppb were measured across the Valley at 3000-5000 feet. Measurements at times exceeded 150 ppb near the Great Smoky Mountains. These observations were supplemented with measurements made from a Cessna 172 operated by ATDD. This aircraft followed a similar flight pattern and confirmed the high ozone concentrations observed during the Twin Otter flights.

With the cooperation of Roland Draxler (NOAA/ARL/SS), ATDD has been able to establish a web site (http://www.atdd.noaa.gov/etos) to provide both forward and backward trajectories using the HYSPLIT4 trajectory model and the NWS ETA 40 kilometer forecast model output. In addition, Ariel Stien (Penn. State University) provided a chemistry module to the HYSPLIT model which ATDD is using to produce experimental24 and 48 hour ozone forecasts for the East Tennessee Valley. Evaluation of the ozone forecast products is currently under way. (pendergrass, white, birdwell, dumas, mcmillen, gunter@atdd.noaa.gov)

An ozone flux system was located above the forest at the Walker Branch Watershed in Oak Ridge, TN, to monitor ozone deposition. Ozone fluxes at this low elevation site will be compared to deposition rates at a higher elevation site in the Great Smoky Mountains, where the winds and ozone concentrations are greater. (meyers@atdd.noaa.gov)

17. Arctic Monitoring and Assessment. Analysis of the total gaseous mercury data obtained at Barrow showed that springtime episodic depletions are strongly correlated to surface ozone concentrations and are strong functions of wind speed (boundary layer entrainment rate) and temperature (chemical reaction rate). The springtime episodic depletions abruptly ended at snow melt (julian day 163) and the mercury concentrations increased from an average of 1.35 ng/m^3 for the week prior to snow melt (minima = 1.0 ng m^{-3}) to 2.40 ng/m^3 for the week after snow melt (maxima = 3.0 ng m^{-3}). This is possibly to interaction of the accumulated mercury from the snow pack with the vegetation and organic surface soil layer which was exposed after snow melt. Soils and vegetation are well known to readily emit mercury back to the atmosphere. Alternatively, this mercury could simply be emitted to the atmosphere directly from the liquid water surface on the melting snow, a process which involves photoreduction of HgII compounds, and is also well known to occur in other surface waters. (brooks, meyers@atdd.noaa.gov)

ATDD began work on the EPA-sponsored effort "Assessment and Reduction of Atmospheric Mercury Transport and Deposition to the Arctic". This new study (Co-PIs Ray Hosker and Steve Brooks) is part of the U.S. Arctic Monitoring and Assessment Program (AMAP) National Implementation Plan. (brooks, hosker@atdd.noaa.gov)

18. Urban Dispersion. The ROADWAY-2 code was modified specifically for simulating the 1975 GM tracer data. The model's vertical and horizontal grids were re-designed to agree with the SF_6 sampler locations in the experiment. The estimation of the emission rate required by the model from tracer release rate proved to be a difficult problem; this was done several times to check the accuracy of the calculation. The model concentrations, output in ppb, were higher by a factor of 4 or so, compared to the observed values. The output needs to be studied carefully and the specification of the eddy diffusivities, among other things, needs to be adjusted to improve the agreement. More testing, using additional data and model runs, will be necessary to evaluate the model. (rao@atdd.noaa.gov)

19. Infrared Gas Analyzer (IRGA) Developments. ATDD has become a major supplier of IRGAs; a commercial source has not yet been found. During July, two new IRGA's were completed. One of the new units will be kept at ATDD. The other unit will be sent to another laboratory for collaborative research efforts. A new design for the IRGA power supply was completed. Better markings and surge protection should make it more robust, easier to assemble, and easier to service. (auble@atdd.noaa.gov)

20. NSF Multi-User Environmental Research Aircraft. The San Diego State University and ATDD-developed Sky Arrow aircraft received an FAA airworthiness certificate in San Diego. The aircraft was then operated on checkout flights for the installed ATDD-developed Mobile Flux Platform (MFP) instrument package. The aircraft and instrumentation were transported up to the Alaskan North Slope, where measurements will begin in August. (brooks, dumas@atdd.noaa.gov)

21. SOS – Nashville. Since mid-June, three flux tower systems have been operating within the Nashville area to characterize the energy, carbon, and ozone fluxes for the three dominant land uses (grassland, forest, agriculture). Although the Nashville Southern Oxidants Study officially ended on July 18, the sites remained in operation for the remainder of July to fully characterize the impact of the local drought on the energy, carbon, and ozone fluxes. (meyers@atdd.noaa.gov)

22. Upper Troposphere Refractive Turbulence Study. Detailed in-situ turbulence measurements in the vicinity of the (Southern Hemisphere) wintertime subtropical jet are in progress, using the Grob EGRETT airplane. Three BAT probes, developed by ATDD and Airborne Research Australia, of Adelaide, for boundary-layer turbulence, have been fitted to the only two-seat EGRETT in the world. This airplane offers relatively low-cost ($1200/hr) direct measurement of turbulence and wave motions at altitudes up to 15 km. The airplane is unusual in its ability to fly at low speed, allowing turbulence to be sampled in great detail. The current set of measurements over Adelaide examines the influence of turbulence on the propagation of electromagnetic radiation. It concludes a set of three campaigns to the wintertime subtropical jet over Adelaide, Australia, and Tokyo, Japan. Measurements of gravity-wave structure at the tropopause, supplementing remote sensing, are planned for January 2000. (dobosy@atdd.noaa.gov)

23. Rocket Exhaust Dispersion Study. The TRIAD simulations of ATDD/FRD tracer tests at Cape Canaveral were completed. These simulations compared 1/2-hour maximum surface concentrations with observed concentrations obtained from mobile sampling vans. Some 640 model runs were done. The simulations tested: spatially-uniform and spatially varying horizontal wind fields; on-site turbulence parameters versus a "split-sigma" scheme; and partial vertical mixing versus full-developed vertical mixing schemes. The results show that for this coastal location, which is fairly flat but complex in surface condition, a spatially-varying wind field determined from a number of meteorological towers, is as accurate as a uniform wind field determined from a single tower near the source point. However, the dispersion parameters over-estimate the turbulence in the on-shore flow, which is generally more stable than over a heated land surface, so that concentrations are under-predicted. These results are being prepared for publication. (nappo, essa@atdd.noaa.gov)

The HYPACT-predicted plume direction for MVP Test 304 is about 45 to 30 degrees counter-clockwise from the observed plume direction. Work is under way to determine the cause. (rao@atdd.noaa.gov)

Research Triangle Park

24. Subgrid Scale Plume-in-Grid Photochemical Modeling. A plume-in-grid (PinG) modeling technique to simulate the dynamic and chemical processes of selected point source pollutant plumes has been incorporated into the Models-3 Community Multi-Scale Air Quality(CMAQ) modeling system. This collaborative research and development effort among ASMD, TVA, and University of Alabama-Huntsville researchers has culminated in an integrated, operational version of PinG which was part of the June 1999 public release of the Models-3 CMAQ science programs. The PinG algorithms have been designed to simulate the relevant processes impacting individual pollutant plumes emanating from major elevated point sources during a subgrid scale transport period. PinG has been fully integrated into the CMAQ Eulerian chemical transport model and is executed simultaneously along with the grid model. Feedback of pollutant species occurs when the horizontal dimension of a plume segment reaches the model grid cell size. The Lagrangian PinG method and preliminary simulation results were presented at the AMS Symposium on Interdisciplinary Issues in Atmospheric Chemistry. Visualization of subgrid plume cell concentrations superimposed on the gridded concentration field is currently underway to assist in the interpretation of PinG simulation results. Comparisons of modeled plume concentrations to observed plume data collected by airborne traverses through power plant plumes in the Nashville, TN, area during summer 1995 field study periods are planned. (Jim Godowitch, 919 541 4802)

25. Assistance to Krakow, Poland. John Irwin recently completed a third visit to Krakow, Poland, to teach air pollution modeling techniques for managing a program to reduce air pollution impacts. The CALPUFF modeling system is being used, given the transport issues arising from emissions from a heavy industrial region 100 km west of Krakow, and the air stagnation episodes that commonly occur in the southwest of Poland. During this trip, we were able to test 1) techniques for better simulating the three-dimensional wind field, 2) methods for processing mobile source emissions, 3) methods for processing and quality-control checking of point source emissions, 4) how to edit, recompile and map the dispersion model for handling large inventories of source emissions, and 5) produced scoping analyses to better understand the computer resources needed for such analyses. Processing the mobile source emissions was relatively painless, but the point source emission inventory was very new and untested. Many problems were detected. The students learned first-hand the unfortunate lesson that, more often than not, it is the air quality modeler who is first to detect the inconsistencies in the input data needed by the model, but produced by experts in other scientific disciplines (e.g., geographical terrain and land-use characterizations, or emission characterizations). The next major event will be in September 1999, when four or five of the students will travel to Research Triangle Park, NC, for an intensive training course on the CALPUFF modeling system, and to meet with other specialists in emission characterization and air pollution modeling. (John Irwin, 919 541 5682)

26. Chesapeake Bay Airshed. A new oxidized nitrogen airshed was developed for the Chesapeake Bay Watershed to replace the older one developed in 1995. Using the same methodology as before, but rerunning some subregions to clean them up and being cognizant of the future development of an ammonia airshed, a more refined analysis was conducted of the NO_x emission subregions' contribution to deposition in the Chesapeake Bay watershed. This resulted in a revised estimate of the Chesapeake Bay airshed. In the original 1995 estimate, the size of the airshed was approximately 900.000 km^2, or roughly 5.5 times larger than the watershed. The new airshed is 1,081,600 km^2 or 6.5 times larger than the watershed. The new airshed is similar to the old one in the north and west but the new one extends farther south into South Carolina. The percent of the oxidized nitrogen deposition explained by the NO_2 emissions in the new airshed is 76%, about the same as before. The new airshed can be viewed at the Chesapeake Bay website: (http://www.chesapeakebay.net/data/model/mod_gis/air_dom.gif). (Robin Dennis, 919 541 2870)

27. Nutrient Deposition Modeling. The Regional Acid Deposition Model (RADM) was enhanced by adding several additional modules to represent the various atmospheric physical and chemical pathways governing the fate of emitted NH_3. The resulting version of the model is referred to as the Extended-RADM. This will allow us to investigate ammonia deposition as well as oxidized nitrogen deposition for the Chesapeake Bay Program in a timely fashion while waiting for the new Models-3/CMAQ to go through testing and evaluation. The significant increase in hog farming in North Carolina, as well as the high concentration of confined animal operations on the Delmarva Peninsula, indicates that the Bay Program needs to take a serous look at atmospheric ammonia. With the Extended-RADM we will be able to develop approaches for the Bay watershed modelers to allow them to incorporate dry deposition of ammonia and ammonium, which to date have been ignored. The Extended RADM has been used successfully to perform a crude model inversion of the NAPAP ammonia inventory. The results are very useful and we will be extending the ammonia inversion effort to the latest EPA ammonia inventory. (Robin Dennis, 919 541 2870)

28. Improved Tools for Estimating Dispersion of Toxic Pollutants in a Convective Boundary Layer. A three-year ASMD research program, funded through a competitive Internal Grant Program, was recently begun at the Fluid Modeling Facility. Our internal grant, entitled *Improved Tools for Estimating the*

Dispersion of Toxic Air Pollutants in a Convective Boundary Layer, is designed to use the convection tank for developing an improved understanding of the physical processes that are important to dispersion in the highly convective daytime atmospheric boundary layer. Because of the highly varying nature of turbulent flows within the convective boundary layer, an ensemble of repeated experiments (under stationary conditions) is necessary to obtain statistically acceptable and physically meaningful information. Physical modeling has been shown to be an effective method for such investigation.

The convective boundary layer is simulated in the convection tank by first moving a heating grid through the upper portion of the tank to create an elevated temperature gradient and then uniformly heating the aluminum floor of the tank with electric heaters. A buoyant effluent is released from a source (a steady release of buoyant fluid for a continuous source or an instantaneous release of a small volume of buoyant fluid for a transient source) containing a small amount of fluorescent dye. The resulting plume or expanding puff is illuminated with a vertical sheet of laser light and its time history is recorded with a video camera connected directly to a PC. The video images are converted into concentration fields and the results from a large number of repeated experiments are combined to obtain ensemble statistics. The turbulent velocity field is measured with a newly acquired video particle tracking system. Dr. Jeffrey Weil, University of Colorado, will collaborate in this effort by participating in the data analysis and development of computer algorithms for use in air pollution dispersion models. Upon completion of the laboratory studies, a data-rich characterization of the convective boundary layer will support the development and evaluation of more physically realistic atmospheric dispersion models. (Roger Thompson, 919 541 1895; Bob Lawson, 919 541 1199; Steve Perry, 919 541 1896).

29. Object Technology for Scientific Computing Training Course. A course "Object Technology for Scientific Computing" was sponsored by ASMD during July 12-16, 1999, in Research Triangle Park, NC. The course was attended by 65 representatives from both government and academia and included scientists and managers. Object technology is a proven method for building quality software with long-term maintainability, extendability, reliability, and reusability. These are valuable traits for scientific modeling and data management software, which benefit from increased flexibility to adapt as the state-of-science grows. Attendees heard about applying object technology to scientific modeling and data. The techniques presented applied to a variety of environmental modeling developments, and were not specific to a certain programming language. The object technology principles provided insight into model development and data management approaches to help meet the future needs of environmental modeling.

The course's authors are three leaders in the field: Bertrand Meyer; a pioneer in object technology and author of several classic books in the field including *Object-Oriented Software Construction*; Paul Dubois, who works extensively with large code development at Lawrence Livermore National Laboratory and is the author of *Object Technology for Scientific Computing* and the scientific programming editor of IEEE Computing in Science and Engineering; and David Butler of Limit Point Systems, which specializes in systems for processing scientific data for applications such as geophysics, atmospheric physics, and medical physics. Meyer and Butler were instructors as well. (Joan Novak, 919 541 4545)

30. State/Federal Transportation Group Meeting. Bill Benjey participated in a follow-up meeting of the Transportation Group of the State/Federal Virtual Laboratories Research Project, held at the Georgia Transportation Institute of the Georgia Institute of Technology in Atlanta. The group first met at the Microelectronics Center of North Carolina in Research Triangle Park on April 15, 1999, as a part of a planning meeting for the project. The effort was initiated by Governor Hunt and is coordinated by the EPA

Office of Science Technology Policy, with the intent of encouraging five southeastern states (Alabama, Georgia, North Carolina, South Carolina, and Tennessee) and Federal research laboratories to use pooled high performance computing technology to address mutual cross-boundary problems. The Transportation Group follow-up meeting was intended to explore what actions might be taken to plan and implement a pilot project arising from the transportation-related capabilities and ideas discussed in April. Representatives of ASMD, DOT, EPA, Georgia Institute of Technology, U. of South Carolina, Georgia Department of Transportation and others participated.

The group is interested in tying traffic data to environmental effects. For this reason, there is interest in using Models-3 to import and process the traffic data to produce mobile vehicle emission estimates. This could be done as road-segment-specific "link-node" format in the Models-3 emission processor, or eventually by using the Modal Transportation Model for mobile source emissions developed specifically for Atlanta under the auspices of the EPA National Risk Management Research Laboratory. The use of the current Models-3 processors would entail substantial effort in organizing and checking the large (and growing data set). Use of the Modal Transportation Model would require software design and implementation work to tie to the Models-3 system. (Bill Benjey, 919 541 0821)

Idaho Falls

31. BRAVO Tracer Program. The Big Bend Regional Aerosol and Visibility study (BRAVO) is a field program designed to determine the sources of haze episodes which reduce visibility at Big Bend National Park (BBNP). The cause of these episodes is sulfate aerosol formed from gaseous sulfur emissions which result from the combustion of coal. The worst periods of visibility degradation occur from July to the end of October. The study is designed to use ambient monitoring, tracer release and sampling, and modeling to identify the sources of the haze.

Tracer releases began at a location on the Mexican border, Eagle Pass, Texas, on July 5 at 08:00. Three different perfluorocarbon tracers are being released at this location to identify transport times as well as sources. One tracer will be released continuously. One will be released for twenty-four hours on alternate days, and one will be released from 08:00 to 20:00 every day. Tracer release began from the Big Brown power plant on July 9. The release rate data from Units #1 and #2 located at Eagle Pass are plotted daily and can be seen at the FRD Bravo website at http://www.noaa.inel.gov/frd/Projects/bravo.html. Release rates and schedules for each location are:

Location	**Eagle Pass**	**Eagle Pass**	**Eagle Pass**	**Big Brown**
Tracer	oPDCH	PDCB	PTCH	i-PPCH
Release Rate (kg/hr)	0.155	0.525 alternate days (8am-8am) CDT	0.184 8am CDT-8pm CDT only	0.092

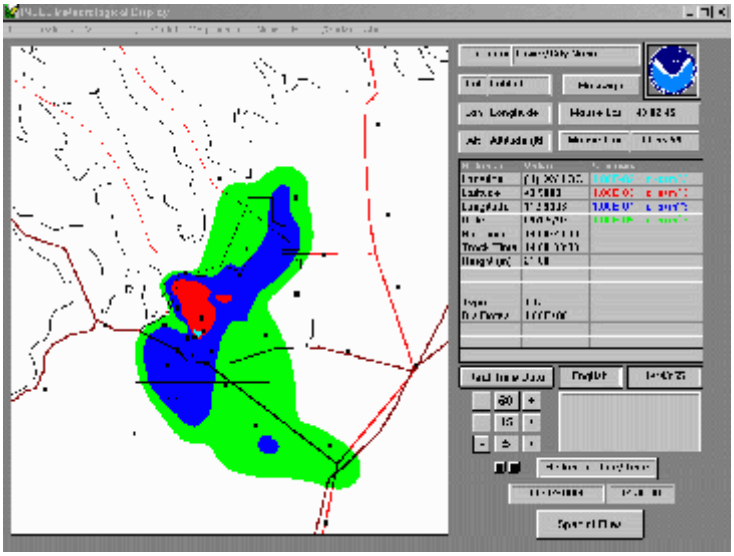
(tom.watson@noaa.gov)

32. Upper-Air Climatological Support for Proposed INEEL Space Port. Efforts are continuing to develop various upper-air climatological products that will support the INEEL as well as the proposed space

port. Monthly and annual summary wind profiles were prepared from the 915-MHz profiler and RASS data. These data will be used by space port personnel to analyze areas where debris from potential explosions may fall. They will also be used to determine the impact of potential ducting of ground-based and airborne explosions, should such an event occur. (kirk.clawson@noaa.gov, Jerry Crescenti, Neil Hukari)

33. Sagebrush Steppe Ecosystem Reserve. On 17 July, DOE Secretary Bill Richardson and Idaho Governor Dirk Kempthorne created the Sagebrush Steppe Ecosystem Reserve on the INEEL DOE reservation. (See: http://www.inel.gov/cgi-bin/newsdesk.cgi?a=89&t=template.html.) The Reserve sets aside 74,000 acres of pristine sagebrush steppe for scientific research. The sagebrush steppe ecosystem covers approximately 94 million acres of the 11 western states. The creation of the Reserve comes at a very advantageous time because we are setting up a year-round carbon dioxide and water vapor flux monitoring site in this very ecosystem. We are collaborating with scientists from the USDA/ARS in this CO_2 monitoring effort. The sagebrush steppe ecosystem has largely been ignored by researchers trying to understand the carbon balance of the earth. (kirk.clawson@noaa.gov)

34. INEEL Wind Forecast System. The automatic wind forecast system for the INEEL mesonet has been reconfigured to generate a forecast every 30 minutes. Previously, it was running once per hour, but our experiences with the AFTAC project in April and May indicated that more frequent runs would be beneficial. The system uses an historical pattern matching technique and generates a two hour wind forecast with a typical run time of between two and three minutes. (roger.carter@noaa.gov)



INEELViz Display. INEELViz (shown using output from an MDIFF dispersion model calculation) has been modified to use the data from the wind forecast model described above. Using the data, operators can generate short term plume projections from 1 ½ to 2 ½ hours. In addition, a snapshot feature was added to the model output, showing the current plume location rather than the cumulative footprint.

An autorun feature was also added, allowing the plume projection to update automatically as new wind field data are received. Changes to FRD's web site are being made to supplement the information provided by INEELViz by including meteorological data from our 31 station mesonet. (brad.reese@noaa.gov)

35. Advanced Mixed Waste Treatment Plant. Plans are in place at the INEEL to install the Advanced Mixed Waste Treatment Plant (AMWTP). This plant will process mixed waste before it is moved from Idaho to a permanent storage site. Residents of the resort area of Jackson Hole, WY are expressing concern about the impact this plant may have on them. Wind roses from surface meteorological stations, monthly and annual summary wind profiles from the 915-MHZ profiler and RASS data, and the MDIFF modeling results have been provided for use to help alleviate the fears of the residents. Explanations of wind flow patterns

were also provided to Idaho State Oversight personnel for inclusion in a fact sheet on the AMWTP. (jerry.sagendorf@noaa.gov, Kirk Clawson)

36. Cluster Analysis. The identification of natural clusters in southeast Idaho wind fields has been completed for the years 1996, 1998, and a combined data set. 1996 and 1998 both showed the same 7 natural clusters that were present in the 1994 and 1997 data sets. The combined set used 32,630 data points from the 64 month period of Oct 1993 to Feb 1999. It showed eight natural clusters; the additional cluster was a division of the largest of the seven clusters occurring in the annual data sets. On the basis of the completed cluster analysis, several trial forecasting tools have been implemented for evaluation. (roger.carter@noaa.gov, Neil Hukari)

37. NRC Site Visit. Dr. Judith Nyquist, Deputy Director and Program Administrator Associateship Programs for the National Research Council (NRC), visited FRD on July 13. The agenda included detailed discussions presented by several members of FRD's staff. Tim Crawford presented an overview of FRD and its mission, while Kirk Clawson discussed the important role FRD fills for the INEEL. Tom Watson presented his research interests in tracer dispersion monitoring and modeling, as well as analytical chemistry techniques. Jerry Crescenti discussed the importance of ground-based remote sensor research for the acquisition of upper-air meteorological data to be used for air quality modeling Tim Crawford presented his research on airborne measurements from small aircraft. Dr. Nyquist has responded favorably to our request to be included in NRC's research program. Tim Crawford's NRC advisor status is being transferred from ATDD to FRD. Tom Watson and Jerry Crescenti have been approved as new NRC research advisors. (tim.crawford@noaa.gov)

38. Aircraft Programs. FRD staff (Tim Crawford, Jeff French and Jerry Crescenti) are working with ATDD personnel (Ed Dumas and Rick Eckman) on the preparation of the LongEZ for two upcoming experiments. The first experiment known as CASES, will be conducted in Kansas during October. This field study will examine the behavior of the nocturnal boundary layer. The second experiment, SHOWEX, will be conducted off the coast of Duck, North Carolina from November 10 to December 10. The primary objective of SHOWEX was to measure the spatial and temporal variation of the mean wind, surface stress, and spectral wave fields in the coastal shoaling zone and to develop new models for the drag coefficient and momentum transfer between waves and the atmosphere. The mobile flux platform (MFP) data acquisition system and sensors are being tested before installation of the LongEZ. We expect rigorous inflight tests in August to assure reliable operation of the MFP. (tim.crawford@noaa.gov, Jeff French, Jerry Crescenti)

39. FRD Education Outreach. FRD is coordinating with the State of Idaho INEEL Oversight Program and the Shoshone-Bannock Indian Tribes on a meteorological educational outreach effort. This committee is focusing on the dissemination and use of meteorological and radiation data from the four Idaho Environmental Monitoring kiosks in southeast Idaho. The data are available both in person at each kiosk and over the Internet (see http://oversite.inel.gov), helping to make visitors aware of the meteorological support FRD provides to the INEEL and the general public. A public relations officer (Alana Jensen) has been hired by the State of Idaho. Her responsibility will be to finish the workbook for middle and high school teachers. The workbook will acquaint students with meteorology derived in real-time (with input from the committee). She will publicize the outreach efforts of the three groups in the local media and at state-wide teacher inservice seminars. In addition, the Idaho Environmental Monitoring Workbook is near completion. A critical review of the document was provided by several FRD scientists. This workbook will be distributed to the

various schools in southeastern Idaho as part of the continuing outreach effort. (kirk.clawson@noaa.gov, Jerry Crescenti)

40. Robert Leviton Award. The AMS Measurements Committee, chaired by Jerry Crescenti, has recently provided a critical review of four *Journal of Atmospheric and Oceanic Technology* papers written by students. The titles and authors of these papers are: *Improved installation procedures for deep layer soil moisture measurements* by J. B. Basara and T. M. Crawford; *Convective boundary layer height measurement with wind profilers and comparison to cloud base* by A. W. Grimsdell and W. M. Angevine; *Optimized operation and calibration procedures for radical amplifier type detectors* by C. M. Mihele and D. R. Hastie; and *Gravity wave spectra from GPS/MET occultation observations* by A. K. Steiner and G. Kirchengast. The committee has made a recommendation to the AMS Awards Committee to bestow the Robert Leviton Award to one of these students. Unfortunately, the name of the winner can not be disclosed at this time until the AMS Awards Committee has formally approved the Measurements Committee's recommendation. It should also be pointed out that the Robert Leviton Award was not granted last year because of a lack of student papers dealing with meteorological instrumentation and/or observation techniques. (jerry.crescenti@noaa.gov)

Las Vegas

41. Cloud-to-Ground (CG) Lightning Project. Intense thunderstorms occurred on and near the Nevada Test Site (NTS) during July. One of these occurred on the 9th in Area 19 and was accompanied with a flash density 24 fl/5km^2. Two thunderstorms occurred near Shoshone Mountain, one on the 9th and another on the 13th, producing a total flash density of 24 fl/5km^2. On July 10th and 13th, another set of intense thunderstorms struck just south of Mercury, over the foothills of the Spring Mountains, where a flash density of 98 fl/5km^2 occurred. Although cloud-to-ground lightning was detected over most of the NTS, little activity was measured in Areas 1, 4, and 2, along the western edge of Yucca Flat. (Darryl Randerson, 702 295 1231)

Precipitation for days with intense lightning activity was reviewed. Unfortunately there were no rain gages located near the areas of peak flash density. A gage located 6 miles southwest of the Area 19 storm reported 0.98 inch for July 9. For the July 13th storm near Shoshone Mountain, a gage located 8 miles north of the peak flash density center contained 1.08 inches. These totals are large; however, they were not within the area of peak flash densities. (Darryl Randerson, 702 295 1231)

42. NOAA Cooperative Institute for Atmospheric and Terrestrial Applications (CIASTA). Several planning and scoping meetings have been held with the University of Nevada-Las Vegas (UNLV), Department of Mechanical Engineering and the UNLV National Supercomputing Center staff to prepare for the installation of the RAMS model at UNLV. Tentatively, the plan is to run the model at UNLV and transmit graphical products to SORD. UNLV has received funding to install the FTP T-1 communications link between UNLV and the A-1 Building in the DOE Nevada Operations Office (DOE/NV) complex. From this node, the data will be transmitted to the SORD Meteorological Operations and Research Center in the DOE Nevada Support Facility.

ARL/HQ staff will work with the UNLV Supercomputing staff to install the RAMS model on the Origin 2000 parallel processor at UNLV. Access to the NOAA National Center for Environmental Prediction, ETA model data base, has been arranged through ARL/HQ and MPI software is available at UNLV for compiling the RAMS model. RAMS model installation is planned for the week of August 23, under the direction of J.

McQueen. (Darryl Randerson, 702 295 1231, Walt Schalk, 702 295 1262, Doug Soule', 702 295 1266, and Jim Sanders, 702 295 2348)

43. NTS Space Shuttle Project. Surface meteorological data continue to be collected in Area 18 to support future potential space shuttle launch programs on the NTS. These data are being collected to provide baseline climatological data for this part of the NTS. (Doug Soule', 702 295 1266)