NOAA ARL Monthly Activity Report

August 2002

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Air Resources Laboratory

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Highlights

1. ARL Scientist Recognized for Ground Zero Work. The EPA Administrator Governor Whitman presented Alan Huber with a special Agency commemorative medallion and a letter of appreciation for excellence in response to September 11, 2001, events. Alan provided meteorological measurements/modeling support and initial modeling of the plume from "ground zero". (ST Rao, 919 541 4542)

2. Forest Fire Smoke Forecasting Now Being Demonstrated. A smoke forecasting demonstration project in collaboration with NESDIS and their Hazard Mapping System has been initiated (see http://www.arl.noaa.gov/smoke/). Smoke forecasts are produced using HYSPLIT; the model is pre-configured to run from selected regions using the daily ETA meteorological forecast. Hourly average output maps of soot concentrations are produced. Fire locations for the dispersion simulation are obtained daily at the end of the day from the NESDIS Hazard Mapping System. A preprocessor reads the fire position data file representing individual pixel hot-spots that correspond to visible smoke and aggregates the locations on a 20 km resolution grid. The model is run over seven regions covering the CONUS. A website has been developed (http://www.arl.noaa.gov/smoke/) to provide access to smoke forecasts via a clickable map of the United States. User's can also view the last 31 days of forecasts online. roland.draxler@noaa.gov; glenn.rolph@noaa.gov,

Silver Spring

3. Smoke Forecasting Interface to use TOMS and AVHRR. A Graphical User Interface (GUI) to link the HYSPLIT smoke plume position file with satellite images from TOMS of aerosol index and AVHRR optical depth has been completed for the PARTS project. The smoke GUI permits the display of the HYSPLIT model predicted smoke plume on the same projection as the satellite images. The GUI permits the model positions to be adjusted to improve the match with the observations. The new adjusted positions can then be used to continue the calculation using analysis meteorological data or become the smoke initialization field for the next forecast calculation. Unlike the previous "Windows Only" version, the new GUI is portable to most Unix and Linux platforms. The new smoke GUI addition was designed to fit seamlessly into the existing HYSPLIT GUI with minor modifications. albion.taylor@noaa.gov

4. HYSPLIT Developments. In the process of evaluating the HYSPLIT ozone forecast results, certain persistent features in the concentration patterns suggested some problems in the mixing algorithms. It was discovered that the existing particle dispersion permitted a well mixed layer to become less well mixed when the vertical mixing profile had a substantial slope. This was corrected by using the auto-correlation ratio of the Lagrangian turbulent velocity to the Eulerian velocity variance rather than just the auto-correlation of the velocity variance in the computation of the new turbulent velocity. This approach was originally suggested by Wilson et al. (1983) and applied more recently by Chock and Winker. ariel.stein@noaa.gov and roland.draxler@noaa.gov

A paper describing the evaluation of the HYSPLIT ensemble dispersion scheme was accepted for publication in the *Journal of Applied Meteorology*. HYSPLIT was modified to generate multiple simulations from a single meteorological data set. Each member of the simulation was computed assuming a ± one grid point shift in the horizontal and a ±250 m shift in the vertical of the particle position with respect to the meteorological data. The configuration resulted in 27 ensemble members. Each member was assumed to have an equal probability. The model was tested by creating an ensemble of daily average air concentrations for three months at 75

measurement locations over the eastern half of the United States during the Across North America Tracer Experiment (ANATEX). Two generic graphical displays were developed to summarize the ensemble prediction and the resulting concentration probabilities for a specific event: a "probability exceed" (PE) plot and a "concentration probability" (CP) plot. Although a cumulative distribution of the ensemble probabilities compared with the measurement data was favorable, the resulting distribution was not uniform. This was attributed to release height sensitivity. The trajectory ensemble approach accounts for about 41% to 47% of the variance in the measurement data. This residual uncertainty is caused by other model and data errors not included in the ensemble design. roland.draxler@noaa.gov

5. Trajectory Optimization Scheme for Balloon Flight Planning. There is an ensemble version of the HYSPLIT trajectory model on the READY web site: http://www.arl.noaa.gov/ready/sec/ensemble.html However, this is not an ensemble in the traditional way but is instead based on an approach used to support balloon flight planning. Every 12 hours new trajectories are started at each of three starting heights from the end of each previous trajectory. Therefore the total number of trajectories will grow by 3^n, where n is the number of times the trajectories split (n = run duration in hours divided by 12). The balloon trajectory optimization program was re-coded and introduced into the existing version of HYSPLIT and trajectory plotting program. It will be a standard part of future HYSPLIT distributions. roland.draxler@noaa.gov

6. READY Developments. Data from the AVN 111 km Northern Hemispheric grid have been replaced by ~95 km resolution AVN northern and southern polar stereographic grids (AVN Short Range) on READY. These grids are 3-hourly and are available four times per day for a forecast of 84 hours. Two more AVN datasets will soon be added to READY. Although reduced in horizontal and temporal resolution, they will extend the forecast out to 180 hours at 6 hour intervals, and to 288 hours at 12 hour intervals. The latter will replace the current MRF forecast dataset that NOAA NCEP plans to remove later this year. glenn.rolph@noaa.gov

7. Stratospheric Temperature Trends Study. As an outgrowth of the WMO/UNEP 2002 Scientific Assessment of Ozone Depletion, a detailed study of modeled and observed stratospheric temperature change is being organized by Prof. Keith Shine (Univ. of Reading, UK) to determine how well we understand the cause of the recent pronounced cooling of the stratosphere. Radiosonde-derived temperature trends were provided to this analysis to complement the satellite data that had already been incorporated. The better vertical resolution of the radiosonde data, especially in the lower stratosphere and upper troposphere, as well as some differences between the satellite and radiosonde results, allow a more detailed assessment of the model simulations. The models vary in their complexity and are from a variety of international research groups. A manuscript is in preparation for submission to the Quarterly Journal of the Royal Meteorological Society. dian.seidel@noaa.gov

8. Global Temperatures Updated Through Spring of 2002. Analysis of data from the 63-station radiosonde network, the global surface temperature last spring is the warmest of the 45-year record, both Northern and Southern Hemispheres showing 1K above the 1961-1990 average. However, the global troposphere is only the third warmest of record (0.5K above this average), though record warmth is indicated for the tropospheres of north and south polar zones. In the tropics (30S-30N), the surface temperature during the past spring is again the warmest of record, and the tropospheric temperature the second warmest of record, both related in part to the weak-moderate El Nino now in progress. (Jim Angell, 301 713-0295, x127)

Boulder

9. SURFRAD/ISIS. The thermal offset of thermopile-based pyranometers is being investigated using overlap data collected at SURFRAD stations over the past year. During the 2001 instrument exchanges, shaded Eppley 8-48 pyranometers were installed as the diffuse solar instrument, replacing shaded traditional pyranometers that have been known to have an erroneous signal due to infrared cooling of the thermopile sensor. Because of the way that the 8-48 operates, it does not have this problem. At the 2001 instrument exchanges, the old diffuse

pyranometer was left running at each station to overlap with the new 8-48 for a year. In the meantime, we found that the Spectrosun pyranometers that we use at SURFRAD stations do not behave as the Eppley pyranometers with regard to the erroneous cooling. Eppley pyranometers nighttime offsets exhibit a linear relationship with the degree of cooling (as determined from a collocated infrared radiometer). We found that the Spectrosun exhibits more of a constant offset at night. In other words, the Spectrosun thermopile's cooling reaches a quasi-equilibrium. With the collocated 8-48 and regular pyranometer diffuse solar data set, we can now investigate the nature of the true offset in the nighttime, as well as the daytime, which was not possible before. (John Augustine, 303 497 6415)

10. TCCR Issues. Chris Cornwall attended a TCCR Teleconference on August 7 to discuss the formation of an IT Security subcommittee. This committee keeps tabs on recent attacks experienced by OAR labs, and provides feedback to people responsible for computer security in the field. The NOAA Computer Incident Response Team (–CIRT) collects data on security incidents, from hostile probes to system compromises, but there is currently little feedback to the people in the field. The new subcommittee will work on detecting trends in attacks, so we can focus our limited IT personnel and resources on prevention of the most common and most damaging attacks. –CIRT data will be made available to the subcommittee, but victim information will be kept in strictest confidence. We can all help this effort by using the online form 47-43, Incident Reporting Form at https://www.csp.noaa.gov/noaa/form47-43/index.html to report probes, virus infections, and successful intrusions. It is extremely important to log unsuccessful intrusion attempts using this form, because otherwise OAR's intrusion statistics are skewed, and it looks like we have one intrusion for every foiled attempt. If you have any suggestions or requests of TCCR or this new subcommittee, please contact your TCCR representative, Chris Cornwall, at christopher.r.cornwall@noaa.gov

11. Environmental Communication Issues with NOAA. Betsy Weatherhead and Amy Stevermer met with Kathryn Parker and Kevin Rosseel of the U.S. Environmental Protection Agency, who were visiting Boulder to discuss environmental communication issues with NOAA, NCAR, and university scientists involved in climate change and ozone science. The EPA has already established itself as a clearinghouse for information to the public, as demonstrated by its successful SunWise school program, which educates people about UV and its effects. Extending these efforts to climate change information is now a major goal, but there are many hurdles to be conquered, and much support to be garnered from the scientific community. Betsy and Amy also introduced Kathryn and Kevin to members of the Boulder Outreach Coordinating Committee, many of whom are on the forefront of science communication and outreach issues for NOAA research. (Amy Stevermer, 303 497 6417; Betsy Weatherhead, 303 497 6653)

12. CUCF. Major progress has been made in developing algorithms to process data from the U111 UV Precision Spectroradiometer developed by ASRC/Suny and located at the Table Mountain Test Facility (TMTF), 8 km north of Boulder. This instrument is used for UV research, ground based validation, and by the Central UV Calibration Facility (CUCF) for UV calibration of other instruments. This is the CUCF's primary reference instrument. Previous algorithms were written to process the external calibration measurements into finalized responsivity files. Recent improvements include generating corrections to the UV solar measurements to account for degradation of the instrument between external calibrations. The corrections to the UV solar scans are based on daily and weekly scans of two internal lamps. These corrections are determined as a function of wavelength for each day, are then archived into files and plotted for QA/QC checks. These corrections are used to account for drift and in part the temperature dependence of the instrument. Currently, the algorithms are designed to generate corrections files that are used to correct the solar data. These are processed on a monthly basis. kathy.o.lantz@noaa.gov and patrick.disterhoft@noaa.gov

Oak Ridge

13. Terrestrial Carbon Program. There has been progress on the proposed site that will be replicated under the new Sustained Neuron Source program. The location of the new tower has been modified slightly to ease

logistical problems related to the guy wire footprint. A detailed topographic map of the site and surrounding area is being prepared. This map will be forwarded to ORO/DOE realty personnel involved in final approval of the project, informing them of the final site selection. This approval will allow other phases of the project planning and installation to commence/continue. Installation of power to the site, and the clearing of pine trees coordinated through ORNL Forestry, will both be expedited once the map is delivered. Documentation for the procurement of the tower and support building, as well as services to install both, is being finalized. meyer@atdd.noaa.gov Lew, Dumas, Heuer

14. Air Quality Chemistry Laboratory. Over the past several months, Simone Klemenz has set up an Air Quality Chemistry Laboratory at ATDD. It is used to analyze gas and aerosol sulfur and nitrogen compounds including ammonia, nitric acid, sulfate, and sulfur dioxide. Much of Ms. Klemenz's duties is preparation and extraction of filter packs and denuders that are used to collect compounds, including filter packs from the AIRMON Dry Network as well as filter packs and denuders from intensive field campaigns. Current campaigns to date include Deposition Studies conducted at the Tampa Bay Watershed, Chesapeake Bay Watershed, and the Canaan Valley Institute in West Virginia. klemenz@atdd.noaa.gov

15. Canaan Valley. An instrument suite for relaxed eddy accumulation (REA) was deployed at the Canaan Valley Air Quality Research and Monitoring site. It will help determine air-surface exchange rates of nitrogen species in the Canaan Valley region. vogel@atdd.noaa.gov, Meyers, Dumas, Heuer, Klemenz

16. Atmospheric Mercury. Mercury measurement continues atop Cove Mountain (1243m) in Great Smoky Mountains National Park. In recent weeks, concentrations of reactive gaseous mercury and particulate mercury have regularly built up during the day and depleted at night to below detectable limits.

At Barrow, the peak atmospheric concentration of GEM was 4.2 ng $^{-3}$ this year. The peak occurred, as usual, during the time of most rapid snow melt in May, and has predictably decreased to N. Hemisphere background levels (~1.5 ng $^{-3}$) since. A modified Bowen-ratio flux system for GEM and ozone will be re-installed in Barrow this fall. It will measure episodic production of GEM by photoreduction from contaminated snowpack. This has been seen at both Barrow and Alert. We also will test two theories for the production of oxidized mercury. One theory (Brooks; Lindberg, and Skov) postulates a process in the boundary-layer air through the following reactions.

$$Br_2 + h\nu \Rightarrow 2Br$$
$$Br + O_3 \Rightarrow BrO + O_2$$
$$BrO + BrO \Rightarrow 2Br + O_2$$
$$Br + Hg^o \Rightarrow HgBr\bullet$$

An alternative theory, presented at the recent "Atmospheric Mercury in the Arctic" workshop in Toronto, postulates heterogeneous chemistry at the snowpack interface in which ozone is destroyed and mercury oxidized. We hope to sort out the role of these two mechanisms using the flux data soon to be collected. brooks@atdd.noaa.gov, Meyers; Lindberg, ORNL; and Skov, NERI Denmark)

17. University of Wales Aberystwyth High-Altitude Turbulence. The EGRETT high-altitude reconnaissance airplane, fitted for atmospheric turbulence measurement by Airborne Research Australia in collaboration with ATDD and FRD, flew up to the lower stratosphere above the 1000-m Cambrian Mountains of Wales. The study, led by Dr. James Whiteway of the University of Wales, Aberystwyth, identified a particularly well-defined episode on 2000 May 11. A vertically-propagating gravity wave, observed at multiple altitudes, broke at 11.4 km MSL. dobosy@atdd.noaa.gov

18. U.S. Climate Reference Network. Automatic calibration of platinum resistance thermometers (PRTs) for the US Climate Reference Network (CRN) is now available. New Linux-based software written this month has performed flawlessly in initial testing. dumas@atdd.noaa.gov, Black, French

New CRN sites were installed in Alaska (2), Georgia (2), and South Carolina (1). hall@atdd.noaa.gov , Black, French, Bryant, Brewer, Randolph, Lew

Research Triangle Park

19. Community Multiscale Air Quality Modeling System. The optimization of the CMAQ modeling system was a focus this month. The current version of CMAQ is designed to be a highly flexible community modeling system, capable of running on various computer architectures including parallel processors. Thus, CMAQ's main design objective was not speed of execution. To use CMAQ in a near real-time mode will require significant performance improvements. To add to the complexity of this challenge, some meteorology and emissions processing will need to be integrated into the operator-splitting set of science processing currently performed in the chemistry-transport model. To achieve the necessary speedup in CMAQ from a structural point of view, two major changes are planned: (1) the model architecture will be structured for a single specific parallel platform, IBM/SP2; and (2) the code will be modified to optimize use of specific hardware features, such as memory access (cache) and floating point units. In addition to structural modifications. Division scientists are reviewing algorithms and data organization changes to try to achieve further performance gains. (Jeffrey Young, 919 541 3929)

Benchmark runs have been completed on several microprocessor hardware platforms (Intel PIII-933MHz, Intel PIII-1.4GHz, Intel P4-2.4GHz, and AMD Athlon 1900-1.6GHz running Linux) and on a parallel supercomputer (IBM-SP2). Different versions of CMAQ (previous versions and the latest release of the model) were included in the tests. Runtimes for the latest CMAQ release, using single-processor runs, were as follows: Intel PIII-933 (20.05h), Intel PIII-1.4 (12.08h), Intel P4-2.4 (13.77h), AMD Athlon 1900+ (14.91h), and IBM-SP2 (single processor: 22.28h). The new release of the model was 25%-66% slower than the previous. Also tested were different Fortran 90 compilers (Portland Group and Intel); the Intel compiler was 13%-24% faster than the Portland Group compiler. (Shawn J. Roselle, 919 541 7699; Jeff Young, 919 541 3929)

The CMAQ modeling system is being augmented to explicitly model 18 gaseous toxics compounds. These compounds are among the more than 30 compounds that have been identified as high priority in the National Air Toxic Assessments because of their adverse health impacts (e.g. formaldehyde, acetaldehyde, and benzene). All of the 18 toxic compounds degrade in the atmosphere, and several are products of atmospheric photochemical reactions. Because of the disparate nature of their atmospheric interactions and the need to minimize computational requirements, different approaches for simulating their atmospheric chemistry are being evaluated. Thus far, three methods have been formulated, varying from a detailed mechanistic approach to a less refined, but more computationally efficient, chemical approximation approach. Modifications to the existing CMAQ chemical mechanisms and chemistry solvers necessary to implement these approaches have been completed. (Gerald L. Gipson, 919 541 4181)

A CMAQ study is underway with available meteorological inputs for a 36-km eastern United States domain to examine the effects of the Phase 1/1.5 NO_x point source emission control program. Major point-source emissions of NO_x and SO_x from 1990, prior to the control program, are being applied in CMAQ model simulations for comparison with model runs using 1995 base case emissions for a July 1995 period. The model simulation results will be examined in light of changes found in various species (*e.g.*, sulfate, nitrate) between 1990 and 1995. (Jim Godowitch, 919 541 4802)

A sensitivity analysis is being conducted of the differences in CMAQ ozone predictions and differences in the predicted change in ozone due to a control strategy response associated with alternate CMAQ science

formulations and with uncertainties in model inputs. The base case is for 1999 emissions and the control case assumes the combination of a uniform 75% reduction in anthropogenic nitrogen oxide emissions with a uniform 25% reduction in anthropogenic volatile organic emissions (labeled as 75/25). The simulation period is July 3 - 14, 1999, for the 32-km continental domain and July 3 - 9, 1999, for the 8-km domain over the southeastern United States. First-look results suggest that differences in the type of vertical mixing (meteorology) create the largest differences in the predicted daily peak 8-hour ozone, but that differences in chemical mechanism (chemistry) cause the largest difference in control strategy response. (Robin Dennis 919 541 2870)

The prototype of CMAQ/Dioxins was evaluated. The evaluation showed that CMAQ under-predicted gas fractions, but within observational and modeling uncertainties. (Bill Hutzell, 919 541 3425)

20. Community Modeling and Analysis System (CMAS) Center. The Community Modeling and Analysis System (CMAS) Center is evolving into an operational entity. On August 28, MCNC's staff introduced ASMD staff to the new online CMAS support system for Models-3/CMAQ, including CMAQ, SMOKE, and the IOAPI. Support of the MIMS framework for air quality applications and the new Spatial Allocator for gridding of data will be added in the next few months. The new online user support system, which is now operational at http://www.cmascenter.org, includes documentation, frequently asked questions (FAQs), bulletin boards, and support e-mail capabilities linked with bug tracking. CMAS will establish a listserv for Models-3/CMAQ in the next two months. Support requests to ASMD staff are now being directed through the new system. In addition, Bill Benjey continued to collaborate with CMAS and OAQPS in the planning of a Models-3/CMAQ User's Workshop, scheduled for October 21-23, 2002, in Research Triangle Park, North Carolina. A draft agenda is available on the CMAS web site. Training sessions for CMAQ, SMOKE, and MIMS will be offered. At the end of August the CMAQ training was oversubscribed, and twenty people had registered for the MIMS training. The User's Workshop will be an annual event as a part of CMAS' outreach function. Presentation proposal titles were due by September 3, 2002. Extended abstracts are due by September 23, 2002. (Bill Benjey, 919 541 0821)

21. Sea Salt Emissions. Research continued into re-configuring a stand-alone computer model for determining sea-salt emissions in coastal grid cells. Eventually, this model will be included in the CMAQ model. In particular, the output from a box model that investigates the dependence of sea spray generation on various values of friction velocity u_* was examined. The examination indicates the model's algorithm is producing reasonable results. The objective is to treat the sea-salt particles as a separate entity throughout the model, rather than lumping them into a catchall "coarse mode" category. (Michelle Mebust, 919 541 0833)

22. Fire Emissions Modeling. A project is underway to develop a prototype stand-alone emissions processor that will introduce smoke from fires (prescribed and wildfires) into the Models-3/CMAQ modeling system based on state-of science algorithms developed by the U.S. Forest Service (USFS). Efforts continued in preparing a case study to demonstrate the linkages between the various smoke preprocessors. A presentation of preliminary results of this limited modeling study is now being scheduled for early October in Research Triangle Park, North Carolina. This study is being performed by CIRA (Cooperative Institute for Research in the Atmosphere) and administered by the U.S. Park Service. Through bi-monthly conference calls, the Division and collaborators monitored the implementation and testing of the processor that will be incorporated into the generalized Sparse Matrix Operator Kernel Emissions (SMOKE) processor. Planning continues to establish the requirements and sources for the activity databases and for the optimization of the emissions model for both regional and national assessments, including a mid-winter workshop. (Jason Ching, 919 541 4801; Bill Benjey, 919 541 0821)

23. Fugitive Dust Modeling. Division scientists are collaborating on the development of algorithms for modeling of wind-blown and fugitive dust (from on, off roads) from industrial and agricultural tillage practices model, which ultimately will produce hourly dust emission estimates in conjunction with SMOKE.. The first results were evaluated of a multi-day simulation of gridded wind-blown coarse-mode particles concentration

fields from CMAQ at 36-km resolution based upon the prototype dust-emissions algorithms. This prototype incorporates the BELD (Biogenic Emission Land Use) database; it is scheduled to be done as a proof of concept in September 2002. The preliminary results were in qualitative agreement with the values obtained from the NPS IMPROVE network. Examining methods for introducing agriculture tillage practice into the emissions processing continues. However, operational use will depend on converting the dust module to a form that runs in conjunction with SMOKE. This will require compilation of GIS-based surrogate data on agricultural operations, roads (especially rural unpaved roads), and construction activity. The benefits and requirements of introducing a new database containing information on vegetation fraction derived from satellite observations is under investigation. This information will provide an improved methodology for estimating the gridded percentage of exposed land area for dust production. (Jason Ching, 919 541 4801; Bill Benjey, 919 541 0821)

24. Neighborhood Scale Modeling. The objective is to develop a capability for modeling air toxics and particle concentrations at neighborhood scale grid resolutions to provide the air pathway links to human exposure assessment models An important component of this effort is to address the concentration variability from both chemical variability due to turbulent motions and from sub-grid concentration variability arising from individual sources. Evaluation simulations are underway of the prototype air quality simulation model for the Philadelphia Metropolitan Area and surrounding vicinity for a preliminary set of results for 36-, 12-, 4-, and 1.33- km horizontal grid sizes. Testing has begun of an important new mixing length parameterization to the basic urban canopy parameterizations (UCP) already in our neighborhood scale version of MM5, CMAQ's meteorological driver model. This approach provides a means for eliminating what appears to be spurious wave-like features in the meteorological fields at 1.33 km grid size. Also, work has begun to process gridded, high resolution building and tree canopy data for Harris County and the Houston Ship Channel area to produce gridded UCPs for the Houston, Texas, area. Subsequently, these UCPs will be implemented into the MM5/CMAQ as part of the overall modeling study of the southeast Texas (Houston) area using the Models-3/CMAQ modeling system. The formulation of a methodology to produce the sub-grid concentration distributions as Probability Density Functions is under investigation. (Jason Ching, 919 541 4801)

Simulations with the MM5 1.33-km domain (both with and without the urban canopy parameterization) showed a tendency to generate undulations in the physical fields similar to horizontal convective rolls. The undulations increased in intensity and amplitude throughout the day and were at their maximum amplitude in the late afternoon prior to sundown (approximately 6:00 p.m). Although horizontal convective rolls have been observed in other studies of urban environments, they were too strong in this case to be realistic. To minimize the impact of the undulations, the parameterization of the turbulent length scale of Bougeault and LacarrËre (1989) was implemented, including a non-local feature in K-coefficient turbulence schemes, in the Gayno-Seaman PBL scheme (GSPBL) only for convective conditions. This modification was tested to the GSPBL with the urban canopy parameterization in MM5. The signal of the undulations was removed, the mixing within the PBL increased, and the mixing heights over the core urban area also increased. (Tanya Otte, 919 541 7533)

25. NOAA's Air Quality Forecasting Pilot Program. A major component of NOAA's Air Quality Forecasting Pilot Program involves the evaluation of the suite of regional-scale air quality models that have been used to forecast ozone concentrations across the eastern United States during the summers of 2001 and 2002. These models include, but are not limited to, ARL's HYSPLIT Lagrangian model, FSL's MM5-chem model, and MCNC's MAQSIP model. The performance of these models is being evaluated using hourly O_3 concentration data obtained from the U.S. EPA's Aerometric Information Retrieval System (AIRS) network. A suite of statistical metrics is being used for both *discrete forecasts* (observed versus modeled concentrations) and *categorical forecasts* (observed versus modeled exceedances/non-exceedances of both the maximum1-hr and 8-hr standards). For the *discrete forecast*, examinations are underway of summary statistics, numerous measures of bias (mean bias, mean normalized bias, mean fractional bias, normalized mean bias) and error (root mean square error, normalized mean error, mean absolute gross error and mean normalized gross error). For the *categorical forecast*, examinations are underway of accuracy, bias, probability of detection, false alarm

rates, and critical success indices. The spatial and temporal characteristics of these metrics for each of the models are also being evaluated. (Brian Eder, 919 541 3994)

NOAA (OAR and NWS) will be entering into a Memorandum of Agreement with EPA (Office of Air and Radiation) to collaborate on developing models, emissions inventories, and air quality data for short range (1-3 day) forecasts of regional/national scale air quality. NOAA/NWS is expected to begin operational use of these tools to issue daily ozone forecasts for the northeast United States in 2004 with spatial coverage expanding to the continental United States over the following several years. Forecasts of particulate matter are also expected to go on-line in 2006. An Air Quality Forecast Oversight Board, composed of NOAA and EPA members, has been formed to provide executive guidance to the project. As an initial step, EPA's CMAQ air quality model will be linked to NOAA's ETA meteorological model to provide an initial operational capability for forecasting. (Ken Schere, 919 541 3795)

26. Satellite Data Assimilation. The solar insolation data derived from GOES satellite imagery was adapted for use in MM5 with the Pleim-Xiu land surface model (PX LSM). These techniques were developed at the University of Alabama in Huntsville (UAH) under a cooperative research agreement between ASMD and UAH in the mid-90's. Satellite data assimilation holds great promise for correcting inherent errors in modeled cloud cover in terms of timing, extent, and optical thickness. Initial testing, which is underway, has already shown significant improvements in model temperature predictions. The combination of the GOES satellite assimilation with the indirect soil moisture nudging technique that is part of the PX LSM should synergistically improve model simulations, since errors in modeled cloud cover pose the greatest difficulty for the soil moisture nudging scheme. The UAH group is also working on techniques for assimilation of GOES-derived skin temperature tendencies and cloud effects on photolysis rates. (Jon Pleim, 919 541 1336)

27. Improvements in Mobile Emissions Modeling. Division scientists continued to collaborate with of the Air Pollution, Prevention and Control Division (APPCD) of the EPA National Risk Management Laboratory on an implementation plan for the Mobile-Modal Model (MMM), based on a combination of features from the EPA Mobile 6 model and the data-intensive but spatially accurate MEASURE mobile source model. MMM is a precursor of the Multiscale Motor Vehicle and Equipment Emission System (MOVES) model expected from the EPA Office of Transportation and Air Quality in four to five years. The general plan is to implement and test the Mobile-Modal model during 2003. However, MOVES will eventually supercede MMM and is expected to be implemented for operation with SMOKE by FY-2006. The implementation plan, which will be part of a project Quality Assurance Project Plan, is expected to be completed during September 2002. Plans call for a PC version of Mobile-Modal to be complete by September 2003. Depending upon the parallel progress of MOVES, a version of Mobile-Modal may be installed SMOKE by September 2004. (Bill Benjey 919 541 0821)

28. Multimedia Integrated Modeling System. Development continued on the Multimedia Integration Modeling System (MIMS). The MIMS "framework" is software infrastructure or environment for constructing, composing, executing, and evaluating cross-media models. Steve Fine worked with collaborators at ASMD, the Office of Air Quality Planning and Standards, Argonne National Laboratory, MCNC Environmental Modeling Center, and North Carolina State University to plan and support several applications of the framework. Steve also worked with developers on addressing issues that arose in applications and designing plotting capabilities. Some recent development features include support for complex parameter types and parameter arrays. These features gives the framework more capabilities and provides more support for modeling applications. (Steven Fine, 919 541 0757; Steve Howard 919 541 3660)

The MIMS pilot has been downloaded and successfully installed on a remote system in CA. Test runs for Chlorobenzene suggest coding problems may be present (equilibrium cannot be attained) and further diagnostics are being run to isolate the problem. (Ellen Cooter, 919 541 1334; and Steve Howard, 919 541 3660).

The Mulitmedia Modeling Team has been asked to help develop an integrated multimedia model for Hg by 2006. ASMD's participation will focus on atmospheric processes and models, and surface coupling issues. Significant interaction with NERL/Athens with regard to characterization of hydrologic and ecological surface processes is anticipated. The goal is to address bi-directional flux and long-range transport issues for Hg. A brief task summary and resource strawman was submitted to the ASMD Multimedia Team Lead for inclusion in Division-wide resource discussions. (Ellen Cooter 919 541 1334)

29. Human Sun Exposure Model. Work continue on validation/debugging of Version 2.0 of the Human Sun Exposure Model. Major enhancements to Version 1.0 have included varied model postures, and even animated postures (walking, swimming, dancing). Clothing articles with variable transmittances are included with the model. Following validation, a comparison with measured exposures will be undertaken through collaboration with the University of South Queensland, Australia. (John Streicher 919 541 3521)

30. Sub-Canopy Deposition in the Great Smoky National Park. The field study to measure sub-canopy deposition has been completed, and the data analysis and model evaluation activities are starting. In the field study, O_3 was observed at four levels in a canopy of O_3 sensitive plants growing in the Great Smoky Mountains National Park. Meteorological and turbulence observations were also taken, along with measures of stomatal conductance, fluorescence, photosynthesis rate, and inter-leaf concentrations of anti-oxidants. The later observations were made on individual leaves, both damaged and undamaged, to compare the effects. The objective is to be able to evaluate a model that will estimate exposure to plants on the leaf level, enable scientists to deduce the exposure/damage relationship, and help understand the ways and levels at which O_3 damages plants. (Peter Finkelstein 919 541 4553)

31. Laboratory Experiments on Convective Plumes. The multi-year laboratory study of dispersion in convective boundary layers is continuing with the recent design of a second series of plume releases within the Fluid Modeling Facility's convection tank. During the past few years, an initial series of plume releases and two series of puff experiments were conducted in an effort to develop a better understanding of pollutant dispersion within and above the convective mixed layer. These data are essential to the development and evaluation of more physically realistic and reliable dispersion models. The initial plume experiments and their comparison to model estimates are described in Weil *et al*. (2002). This second series of plume experiments will be similar to the first in that they are focused on both dispersion within the mixed layer and the penetration and spread of plume material in elevated stable layers. These most recent experiments will expand upon the first plume studies by varying the strength of the stable layer, the heights of the release and the plume buoyancy. The experiments are scheduled to begin in October 2002. (Steve Perry 919 541 1896; Roger Thompson 919 541 1895)

Idaho Falls

32. CBLAST-High. Installation was completed of the BAT system on the NOAA P3 N43. Jeff French along with engineers at NOAA's Aircraft Operations Center (AOC) in Tampa, Florida completed the testing required for FAA certification of the BAT probe mounted on the P3. After assembling the BAT probe in Tampa earlier this month, the probe was put through a series of static load and vibrational tests (Fig. 1), followed by a "functional" test flight (Fig. 2) to demonstrate that the instrument would hold up under flight loads. After completing these series of tests, analysis from data taken from the accelerometers within the BAT itself showed that no unforseen vibrational modes were created within the probe/nose boom assembly. The data will be used by AOC engineers for a report to be submitted to the FAA for certification of the installation.

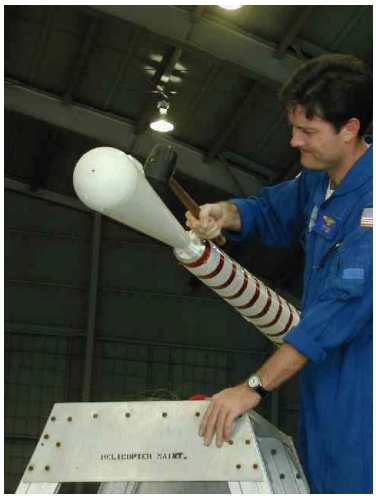

Figure 1. Vibrational testing of the BAT probe on the P3 boom.

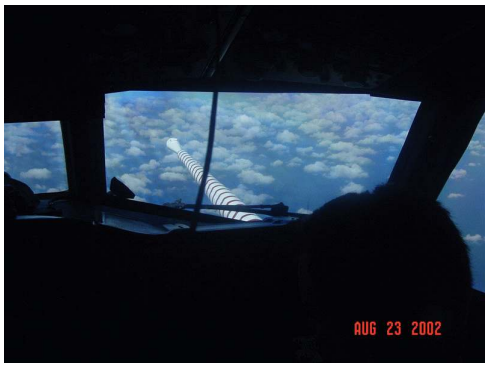

Figure 2. The BAT probe seen from the cockpit of the P3 during a test flight.

A series of data test flights were also conducted in August. Preliminary analysis of data collected during these flights indicated that the BAT probe, infrared gas analyzer and data acquisition system were operating properly. Initial results look encouraging and more rigorous analysis will be carried out in the upcoming months. The system has yet to fly through a hurricane, but flight plans call for a data (hurricane) flight in early September, as a number of systems in the Atlantic and Gulf of Mexico look promising. jeff.french@noaa.gov

33. Refractive Turbulence Study (RTS). Over half of the allotted flight hours have been flown in the first week of the Refractive Turbulence Study (RTS) being conducted in Adelaide, Australia in collaboration with the Air Force Research Laboratory (AFRL) and Airborne Research Australia (ARA). Conditions have been excellent, as a jet core with significant vertical shear has been relatively stationary just north of Adelaide, leading to moderate levels of clear-air turbulence. One of the goals of this year's study was to integrate FRD's Fast Ultra-Sensitive Temperature (FUST) sensor into the two BAT probes carried by ARA's Egret. Data from the FUST during these early flights has looked extremely promising. One of the problems with the original BAT temperature sensor was its inability to resolve temperature fluctuations at high frequencies when signals were weak. The FUST appears to be doing a much better job, both resolving weak signals and responding to rapid fluctuations. jeff.french@noaa.gov

34. CBLAST-Low. Participation in the Coupled Boundary Layers Air-Sea Transfer light-wind (CBLAST-Low) field study ceased when Dr. Timothy L. Crawford suffered a massive stroke while piloting the LongEZ research aircraft over the Atlantic Ocean on August 3, 2002. Tim was flying the second mission of the field study. Research is expected to continue for CBLAST-Low in FY-2003 and FY-2004 from data acquired by the LongEZ in a pilot field study from July and August 2001. jerry.crescenti@noaa.gov

35. Ion Mobility Spectrometer Development Project. The primary focus of the IMS Development project was to redesign the ion gate. The current ion gate uses a fiberglass/epoxy printed circuit board with a vacuum epoxy to insulate the wires that form the gate. Both the circuit board and the vacuum epoxy have been identified as primary contributors of interfering contaminates. We have ordered new printed circuit boards that will be constructed out of alumina ceramic that will not require any insulating compound. They are scheduled to arrive about September 10, 2002. We have also worked on improving the electronic amplifier and have a prototype that improves the signal to noise ratio several times over the current amplifier. roger.carter@noaa.gov, Randy Johnson, Shane Beard, Debbie Lacroix

36. Extreme Turbulence Probe. Three ET probes are expected to be ready for field deployment at the beginning of September. Dave Auble at ATDD has designed deployment kits that will be used with the probes. These include igloo enclosures (Fig. 3) for the notebook computers and batteries that will power the probes. Contacts have been made with staff at the AOML Hurricane Research Division for coordinating the ARL deployment with other groups involved in tropical cyclone research. Based partly on the pressure sensors that have been installed in the ET probes, it has been decided that the minimum sustained wind speeds that would be of interest are in the 25-30 m s^{-1} range. This corresponds to a strong tropical storm that is just under Category 1 hurricane strength. In theory, the probes may

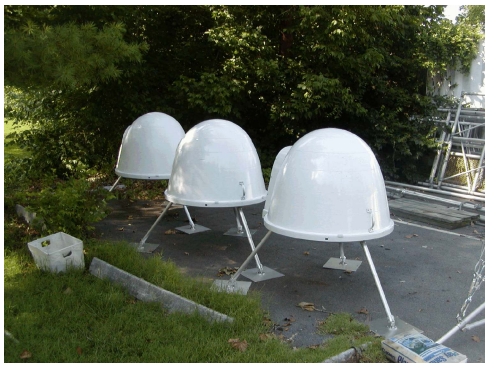

Figure 3. Enclosures that will contain the ET probe computers and batteries.

work down to 10-15 m s^{-1}, but such winds are not of scientific interest for tropical cyclone research. (richard.eckman@noaa.gov, Tom Strong, Ron Dobosy, and Dave Auble [ATDD]

37. INEEL Mesoscale Modeling. A new Dell workstation with dual Intel Xeon 2.4-GHz processors arrived in July. It will eventually run the daily MM5 forecasts for the INEEL region, replacing the current Alpha workstation. Most of the MM5 source code has been compiled on the new computer using the recently released Intel FORTRAN 90/95 compiler. There has not been a lot of experience compiling MM5 with this compiler (the Portland Group FORTRAN compilers have usually been used on Linux workstations), so it has taken some effort to get the code working. It has been particularly difficult getting the OpenMP directives, which are used to take advantage of multiple processors, to work properly. Some initial test runs of MM5 indicate that the dual processors are not providing as much of a performance boost as was originally hoped. In spite of this, the new machine still runs MM5 faster than the Alpha workstation it will replace. The main problem that remains is to get the RIP package, which produces graphics of the MM5 output, working on the new machine. This package keeps on producing run-time errors that appear to be associated with the FORTRAN BACKSPACE statement. It is not clear whether these errors are related to a compiler bug or something else, such as a stack overflow. richard.eckman@noaa.gov

Las Vegas

38. Test-Readiness/Sub-Critical Tests Mission. Full meteorological support was provided, for the recent MARIO experiment. The SORD director served as the Meteorological Advisor on the Test Controller's Scientific Advisory Panel. SORD personnel presented a comprehensive assessment of current and projected meteorological conditions in the vicinity of the MARIO experiment in Yucca Flat, making use of a wide variety of remote meteorological sensors, NOAA weather forecast models, and the RAMS model centered on the Nevada Test Site (NTS). Also provided test management with the predicted transport and dispersion pattern for the unlikely occurrence of release of toxic material into the atmosphere. (Darryl Randerson, 702 295 1231)

39. CIASTA - Mesoscale Modeling. NV-RAMS ran to completion on the University of Nevada-Las Vegas (UNLV) computer system 29 of 31 days (93%). The failures this month were due to the UNLV computers. One run only went to 22 hours. Data are continuing to be saved daily, and backed up to CD monthly (2 CDs). (Walt Schalk, 702 295 1262)

40. SORD Web. The SORD Web Site, http://www.sord.nv.doe.gov has undergone a significant transformation. The site now has a common ''look and feel'' for most of the web pages. The ''Home Page'' (arlsord-1.htm) is now ADA Section 508 compliant and meets Department of Commerce Web Site Standards. Additional modifications include easier navigation, using ''fly-out'' menus, on the Forecasts (fw.htm) and Weather Prediction Models (home_models.htm) main pages. Animation of the various RAMS model output graphics (winds vectors) is now available on the ''Weather Prediction Models'' page (home_models.htm). Future improvements planned include using the ''fly-out'' menu on the Weather Data page and other pages. (Jim Sanders, 702 295 2348)

41. Climatological Research – Nevada. The ongoing project to predict maximum temperatures for most locations on the NTS by utilizing the morning radiosonde observations from Desert Rock continued during August. The results indicated that the predictions were generally close, with a bias of about -1^0F and an absolute error of about 2.5^0F. August was exceptionally dry at the NTS with above normal temperatures being the general rule for most of the month. These hot, dry conditions helped to contribute to reasonable success of the statistical technique employed for the predictions. (Doug Soule', 702 295 1266)

42. HSC Tower Data Processing. The meteorological data collected from the HSC Tower in Frenchman Flat are uploaded each day via phone dial-up to a PC. These data are presently being stored in a single large file that contains approximately two years of data. The data file through July 10, 2002, was uploaded to the Sun

Development System (elnino) and processed to provide cleaned-up files by year. These new files are formatted for easy processing by computer programs. Also, the one-minute data that are collected during the evening hours are separated from the 15-minute data. Programs have been set up to process both the reformatted data files and to process the "raw" data files to produce individual graphics that depict the winds, temperatures, and relative humidity. An "automatic" version of the program is available that could be utilized to produce graphics either once a day or more frequently when the HSC Tower data can be brought "on-line" with the new networking being installed. (Ray Livsey, 702 295 1241, and Doug Soule', 702 295 1266)

43. HEFFTER Model Enhancement. The HEFFTER Model (for predicting the fallout from a nuclear explosion) has been modified to produce graphics that are of higher quality than those previously produced. Additionally, the labeling was modified for readability and the contouring was adjusted for clarity. Some test cases of HEFFTER predictions were run for the Washington D.C. area utilizing the nearby radiosonde observations. A writeup was produced for the model for the Office of Federal Coordinator for Meteorology. (Doug Soule', 702 295 1266, Rick Holmes, 702 295 1252, and Darryl Randerson, 702 295 1231)