



# NOAA ARL Monthly Activity Report



July 2003

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## Highlights

**1. Mercury in the Southeast.** Mercury measurements in the Gulf of Mexico 40 km - 100 km off the Alabama coast continued an on-going collaboration with the University of Alabama. Measurements showed negligible diurnal variation. Gaseous elemental mercury averaged  $2.16 \text{ ng m}^{-3}$ ; reactive gaseous mercury averaged  $1.8 \text{ pg m}^{-3}$ ; and fine particulate mercury averaged  $14.2 \text{ pg m}^{-3}$ , with no correlation between reactive gaseous mercury and fine particulate mercury (reactive gaseous mercury was consistently near the 1.0 detection limit). By comparison, last summer's remote monitoring at Cove Mountain TN (1243 m MSL) gave averages of gaseous elemental mercury, reactive gaseous mercury and particulate mercury of  $2.41 \text{ ng m}^{-3}$ ,  $11.1 \text{ pg m}^{-3}$ , and  $9.3 \text{ pg m}^{-3}$ , respectively, with reactive gaseous mercury and fine particulate mercury significantly correlated. Typical estimates of background values in the Northern Hemisphere for elemental gaseous mercury, reactive gaseous mercury and fine particulate mercury are  $1.8 \text{ ng m}^{-3}$ ,  $1.0 \text{ pg m}^{-3}$ , and  $1.0 \text{ pg m}^{-3}$ , respectively.

Back trajectory calculations (HYSPLIT) for the Gulf of Mexico study area show that the sampled air mass had remained over the Gulf waters for the previous five days or so and may have traversed southern Florida just before entering the gulf. The differences between Cove Mountain and the Gulf marine boundary layer are

therefore especially intriguing. It appears that, in the total absence of local sources, reactive gaseous mercury and fine particulate mercury levels are decoupled. Reactive gaseous mercury either deposits or converts to fine particulate mercury. The remaining fine particulate mercury has a substantial lifetime ( $> 1$  week) in marine air.

Notably absent from the Gulf measurements was any hint of halogen-based chemical conversion of elemental gaseous mercury to Hg(II). The minimum observed gaseous elemental mercury concentration for the study period was  $1.78 \text{ ng m}^{-3}$ , very close to the estimated  $1.8 \text{ ng m}^{-3}$  background level. No local or regional production of reactive gaseous mercury was evident. (Brooks)

**2. Joint Urban 2003.** Field measurements for the Joint Urban 2003 Tracer Study continued during the month of July. In addition to FRD, ARL's Atmospheric Turbulence and Diffusion Division, Argonne National Laboratory, Pacific Northwest National Laboratory, Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, Los Alamos National Laboratory, U. S. Army Dugway Proving Ground, Aberdeen Proving Ground, Army Research Laboratory, the University of Oklahoma, the University of Utah, Arizona State University, and others participated, making this a truly multi agency effort.

Ten Intensive Operation Periods (IOPs) were conducted during the month of July in the downtown region of Oklahoma City. Sulfur hexafluoride was released both in puffs and with a continuous release system mounted in a U-Haul van. These mobile release systems made it possible to conduct IOPs utilizing four different release points for winds coming from the southwest, south, and southeast.

Immediately following an IOP, the sample cartridges were collected for analysis. The Automated Tracer Gas Analysis System (ATGAS) functioned almost flawlessly during the laboratory analysis of the cartridges filled using the PIGS. One ATGAS needed column replacements due to a timing error for the back flush of the oxygen peak. This error was corrected about halfway through the project and the instrument had no other issues. Another ATGAS had intermittent baseline noise at certain voltage outputs. The problem was not able to be fixed in the field due to time constraints, but the ATGAS was still fully functional for lower concentration levels where most of the sample concentrations fell.

For each IOP, 195 sample cartridges containing 12 bags each were analyzed for a total sample number of 2,340. This number does not include the calibration and laboratory quality control (QC) that is also associated with each IOP. The total number of data points for the project is well over 23,000. Due to many months of pre-planning, we were able to analyze all samples and their associated QC, have the data verified by a second analyst, rerun any samples that were inadvertently missed or had QC issues, re-clean all 195 cartridges, analyze every 6<sup>th</sup> cleaned cartridge and move the cartridges back to the staging area for future use, all in approximately 3-4 days time, an amazing accomplishment considering the sheer number of data points. (debbie@noaa.inel.gov)

In addition to the PIGS, ten continuous SF<sub>6</sub> analyzers were operated during each intensive observation period, more than FRD has ever operated in the past. Nine of the analyzers were stationary during the releases and one was mobile. Because of the short range nature of the experiment, the analyzers were tuned for their maximum dynamic range of 0 to 20,000 ppt SF<sub>6</sub>. This made it difficult for some of the analyzers to make reliable measurements at very low concentrations (0 to 100 ppt). However, most of the plume observations peaked at several thousand ppt so lack of sensitivity at the low concentrations should not be a problem.

Analyzer operators included FRD employees, retirees from FRD, the INEEL, and DoD, and college students. All operators worked very well together and operated the analyzers very professionally. They performed double duty as both continuous analyzer operators and PIGS servicers. They deserve much of the credit for making this a successful experiment.

About 30 percent of the continuous analyzer data has been reviewed. Completion of the data review process should take several more weeks. We are confident that the continuous analyzers will provide a quality data set that will complement the PIGS data and will be used for many years by many researchers. (roger@noaa.inel.gov)

On July 16<sup>th</sup>, FOX News interviewed several project participants and filmed much of the equipment for a television special on bioterrorism that will air in September. (debbie@noaa.inel.gov)

## Silver Spring

**3. Improvements to HYSPLIT.** NCEP has begun work on the updated HYSPLIT package submitted to them by ARL. Pre-processor scripts that convert NCEP regional (Eta model 12-km resolution CONUS) and global (GFS model, one-degree resolution) model output into a format suitable for HYSPLIT have been set up to run four times a day in a mode parallel to operations. Hence a current forecast will always be available should an incident occur that requires a dispersion forecast (i.e., volcano eruption, radiological release from nuclear power plant, etc.). The higher resolution one-degree global file will replace the currently operational 191 km files after HYSPLIT is declared operational and replaces VAFTAD for volcanic ash forecasting. [barbara.stunder@noaa.gov](mailto:barbara.stunder@noaa.gov)

After the installation of several new disk drives on our web server and the testing of a new faster procedure to push the data directly from NCEP's computer to our web server, we are now routinely getting the 12 km ETA forecasts 4x per day. In addition, an extraction procedure was implemented to concatenate the initial field and +3 h forecast for each cycle into daily files that can be accessed as a pseudo analysis archive. The last 30 days are saved. Total disk usage is a modest 15 Gb. Policies for public access of these data from the Web is still undecided.

New procedures that were initiated two years ago requiring registration to run Hysplit on the web or to download the PC code have proved to be an increasingly time consuming task. To simplify the process, registration will only be required when using forecast meteorological data (researchers primarily use the archive data). However, this also requires two different PC versions, one supporting all data types and one supporting only archive meteorological data (the code change was trivial). To simplify the PC support a new installation program is now in place, which makes it easier to create different installation variations and requires prior agreement with our usage restrictions. [roland.draxler@noaa.gov](mailto:roland.draxler@noaa.gov)

Users familiar with HYSPLIT but not sure if it is right for their needs can now download a trial version of PC HYSPLIT from READY that has the same functionality as the full version, except that it cannot be run using forecast meteorology. Users still need to read and agree to the HYSPLIT Use Agreement before downloading the code. Registration and download of the HYSPLIT model now requires users to abide by a new HYSPLIT Use Agreement. The agreement makes clear the permitted uses of the model and the redistribution of its results. In particular, results computed using **forecast** data from NOAA ARL may not be redistributed outside the user's organization without permission from NOAA ARL, and any results created by the user shall not be presented as official government material. [glenn.rolph@noaa.gov](mailto:glenn.rolph@noaa.gov)

**4. READY System Registrations – 1650.** Since 24 September 2001, NOAA ARL has been requiring all users except those with **.noaa.gov** computer domains to register before being permitted to run the HYSPLIT transport and dispersion model on the NOAA ARL READY (<http://www.arl.noaa.gov/ready.html>) website. At the end of July 2003 over 1650 users have been registered. [glenn.rolph@noaa.gov](mailto:glenn.rolph@noaa.gov)

**5. Potomac Dispersion Experiments.** The NWS had decided to participate in a series of Navy sponsored short-range (~ 5 km) tracer experiments from July 21 through August 4 by providing Hysplit forecasts. However, the default configuration for the NWS operational version of Hysplit only produces output more suitable for mesoscale and regional dispersion simulations. Therefore, in the event our products are requested (real-time forecasts were not required in support of the experiment), we (ARL) decided to save hourly ETA 12 km fields and the RAMS 4 km forecasts for each experimental day. Future participation is undecided. [roland.draxler@noaa.gov](mailto:roland.draxler@noaa.gov)

**6. Updated IER Ozone Module for HYSPLIT.** The IER (Integrated Empirical Rate - Graham Johnson) model for ozone formation (a simple 3 equation scheme) was tested many years ago with an earlier version of Hysplit 4. The code was resurrected and restructured to fit into the most recent Hysplit version (4.6). The idea was to test some new code structures that permit the meteorological data fields to be linked more closely with the chemistry module. In previous Hysplit versions the meteorological data were only defined at the Lagrangian particle positions. Defining the meteorological data at the chemistry grid points required a considerable amount of convoluted coding. The new Hysplit code revision considerably simplifies that linkage. [roland.draxler@noaa.gov](mailto:roland.draxler@noaa.gov)

**7. Layer-mean Temperatures are on the Web.** Layer-mean temperatures for both 63-station and 54-station radiosonde networks are now on the web for the period 1958 through the winter of 2003

(<http://www.arl.noaa.gov/data/climate/Index.html>). Data are presented both by height for each region and region for each height, and in text and Excel format. The spring 2003 data have been reduced and will be placed on the web shortly, along with tropical stratospheric data up to 10 mb and Antarctic stratospheric data up to 30 mb for the 46-year period. The spring 2003 data are anomalous, the Northern Hemisphere troposphere indicated to be the second coldest of record (with record cold in north polar and north temperate zones), the Southern Hemisphere troposphere the second warmest of record, a hemispheric difference not seen before. This follows on the anomalous warmth of the Antarctic stratosphere and disappearance of the Antarctic ozone hole last year. (Jim Angell, 301 713 0295, x127)

## **Boulder**

8. *SURFRAD/ISIS*. Lightning damage at the Goodwin Creek station has been repaired. Total damage that SRRB will have to recover amounts to about \$8,000. It is planned to install the lightning protection system in October. On July 30-31, the annual instrument exchange took place at the Penn State SURFRAD station. The original hardware had deteriorated to a point that much of the non-stainless hardware, including all of the guy wires, had to be replaced. (John Augustine, 303 497 6415)

An instrument exchange and hardware improvements were performed at the Salt Lake City, UT Integrated Surface Irradiance (ISIS) site 30 June - 2 July. The site was upgraded with new equipment that included Eppley ventilators and an updated Campbell Scientific modem. General site improvements were made including the rerouting of signal and AC cables, and the removal of non-functioning and unused equipment. SRRB is working with National Weather personnel in Salt Lake to make some site alterations that will improve the field of view of the ISIS instruments. (Gary Hodges, 303 497 6460)

9. *Dobson Spectroradiometer Intercomparison*. Dr. Irina Petropavlovskikh took part in intercomparisons of Dobson spectroradiometers. The campaign was sponsored by MeteoSwiss and was held at Arosa, Switzerland from July 20 through August 1, 2003. The primary objective of intercomparisons was to assess accuracy of radiation measurements as well as compare products, such as total ozone column and ozone profile. Among six countries participated in the campaign were France, Italy, Germany, Switzerland, Czech Republic, and USA. The European standard instrument was used as reference for intercomparison of total ozone product. However, for Umkehr ozone profile comparisons the mean average of all profiles was chosen as a reference. The profiles from most Dobsons had agreed within 4 percent. However, two instrument were off as much as 10 percent. The campaign also compared products from collocated Brewer instrument, such as total ozone column and ozone profile. The goal of the intercomparisons is to homogenize the Arosa ozone profile and total ozone series using Brewer and Dobson instruments. To be able to achieve the goal one needs to understand the observed differences between Brewer and Dobson Umkehr profiles and, if possible, to improve/adjust the inversion algorithms. The analysis of differences/similarities of Umkehr measurements taken at the last two Arosa Intercomparisons (in 1995 and 1999) will be used to understand differences between Umkehr profiles retrieved from collocated instruments as well as to assess errors of the measurements. (Irina Petropavlovskikh, 303 497 6279)

10. *Total Sky Imager*. This past spring a Total Sky Imager (TSI) was installed at Eglin Air Force Base, in northwest Florida. This is a temporary installation that is expected to last through the year. The TSI is a relatively new instrument (initially an ARL development) being manufactured by Yankee Environmental Systems, Inc. that is capable of determining fractional cloud cover of the daytime sky. The installation at Eglin is a joint operation being carried out by ARL's Surface Radiation Research Branch and Eglin personnel in the 46th Weather Squadron. The purpose of this experiment is twofold. The main goal of SRRB is to compare the TSI with weather personnel observations. This will compliment research currently being conducted at SRRB that is comparing data from a TSI installed at SRRB's SURFRAD site in Nevada with observations made by NWS employees in Las Vegas.

The opportunity to install the TSI at Eglin is fortunate since routine human sky observations have all but disappeared with the advent of Automated Surface Observing Stations (ASOS) at NWS offices. Eglin, while interested in the results of the SRRB research, are primarily motivated by the possibility of improving short-term weather forecasts. The current structure of Air Force weather forecasting is such that meteorologists located in Virginia are responsible for forecasts in the southeastern United States. With access to current images of the sky conditions at Eglin available to the Virginia meteorologists, the Air Force believes short-term weather forecasts will be improved. A main function of Eglin Air Force Base is the development and testing of weapons systems. For example, earlier this year Eglin tested the largest non-nuclear bomb ever built; the 21,000 pound Massive Ordnance Air Blast (MOAB). With testing such as this taking place on the Eglin reservation, any improvement to short term weather forecasts is beneficial. (Gary Hodges, 303 497 6460)

## Oak Ridge

**11. Terrestrial Carbon Program.** Data collection at the Walker Branch Site has been mostly consistent through July, with only minor data loss due to power outages. Development continues at the CHESS site, which will assume many duties of the Walker-Branch Site, soon to be influenced by proximity to DOE's new Spallation Neutron Source (SNS) facility. The power line to the CHESS site is installed. Specifications for power-quality equipment have been finalized. A meeting with the SNS representative was held on July 21 to discuss completion of SNS's role in the project. Bids on the support building were received, but will require modification to come within available funding. (Meyers)

A request for assistance with the installation of an AMERIFLUX tower in Missouri was met. A meeting with Steve Pallardy, University of Missouri, will be held in early August to discuss logistics and further assistance in that effort. (Meyers)

**12. East Tennessee Ozone Study (ETOS).** During July, several tests were performed to insure instrument accuracy during preparation for the upcoming ETOS study. In addition, calibrations and analyzer sequential runs were conducted to compare results between the new Metrohm 790 IC's and the new Dionex 90 IC's. Analysis of the filter packs for the AIRMON Dry Network Program was performed, which includes the preparation, extraction, and reloading of filter packs. After the analysis of filter packs are complete, the data are converted and recorded. (Klemenz, Satterfield)

The Twin Otter was scheduled to fly approximately 16 hours in support of ETOS, after completing the Joint Urban 2003 Experiment. These flights were also going to compare ozone measurements from the standard TECO ozone instrument with a newly developed smaller ozone instrument manufactured by 2B Technologies. However bad weather conditions and clean air dominated, and there were no flights. Equipment removal will occur on August 6, and then the aircraft departs. (Gunter)

**13. Italian National Research Council Sky Arrow.** Three MFP systems are being built for Enzo Magliulo of ISAFoM-CNR (Italian National Research Council, Institute for Agricultural and Forest Meteorology). All three systems will be shipped in August. (Auble, Brooks, Dumas, Ludwig, Mayhew)

**14. Extreme Turbulence Probe.** The pressure-sphere design of the extreme turbulence probe presents no moving parts to the wind. It does, however, have 30 open ports each of 1 mm diameter distributed over its surface and leading to pressure sensors. To keep these from being clogged with rain, we are designing a back flush system which maintains a continuous stream of air outward from all ports. The back flow will be tuned such that the differential pressure sensors report zero pressure difference for all pairs of ports when the sphere is in calm wind. (Dobosy, Auble)

**15. Urban Dispersion Study.** The Joint Urban 2003 dispersion study continued in Oklahoma City. After considerable efforts by many people including NOAA legal staff, a good location for ATDD's second 100 ft tower was found, and the tower was placed in operation. Two 100 ft towers (four levels each of temperature and sonic anemometry), three surface energy budget stations, and a three-station microbarography array were operational. Data collection ended on July 31. (Hosker, White, Meyer, Heuer, Gunter, McMillen, Nappo, Auble, Stachowiak)

Airborne turbulence measurements supporting the Joint Urban 2003 Experiment were flown using the NOAA Twin Otter. The aircraft measured the turbulence and stability of the boundary layer, flying a total of 25.5 hr coordinated with ground-based releases of SF<sub>6</sub> tracer. A reliably southerly wind allowed use of two primary cross-wind flight tracks, one north and one south of the urban core. Flight as low as 150 m AGL was permitted, even in one series over the urban core itself. For nighttime releases of SF<sub>6</sub>, 150 m was too high for meaningful measurements of the nocturnal boundary layer. On those days, the flights sampled the morning transition, beginning about 0700 local time (LT). They continued until about 1030 LT, when the nocturnal inversion was eroded and the boundary became coupled with the free air. Instrumentation included the Mobile Flux Platform in the nose extension that also contained a fast temperature sensor, upward and downward PAR sensors, two net radiometers, two IRGAs for water vapor and CO<sub>2</sub>, and a surface temperature sensor. As always, state parameters were measured. A new GPS system (the Garmin 16) was on board to test against the Novatel system. (Gunter)

On July 10, the Joint Urban 2003 study hosted a "Visitors Day". About 25 city and state officials and interested scientists from around the country attended. Orientation lectures explained the background, rationale, and

expected benefits of the study, as well as the experimental plan and instrument arrays. These were followed by a tour of key sites. An ATDD scientist provided one of the two orientation presentations. (Hosker)

**16. U.S. Climate Reference Network.** USCRN sites were installed in Boise, Idaho; Burns, Oregon; and Idaho Falls, Idaho. Annual site maintenance was performed at Columbia, South Carolina, and Mt. Pleasant, South Carolina. (French, Black, Randolph, Bryant, Rutherford, Dunn)

### **Research Triangle Park**

**17. Community Multiscale Air Quality Modeling System.** As part of the CMAQ 2003 release, the model is being evaluated under winter 2002 (January-February) and summer 1999 (June-August) cases. The model results will be evaluated against several observational networks including data from the Aerometric Information Retrieval System (AIRS), Clean Air Status and Trends Network (CASTNet), Interagency Monitoring of Protected Visual Environments (IMPROVE), and Speciation Trends Network (STN). (Alice Gilliland, 919 541 0347)

An CMAQ analysis was performed using the mercury model's cloud chemistry module to see if simulated total-mercury concentrations in cloud water respond in a linear fashion to additions of elemental mercury, reactive gaseous mercury, and particulate mercury air concentrations. This analysis was performed to address an issue that Mark Cohen at NOAA ARL/HQ has raised regarding the validity of Lagrangian modeling for the assessment of source-receptor relationships for atmospheric mercury. For his HYSPLIT modeling analysis of mercury source-receptor relationships to be valid, total cloud water mercury content must respond in a linear fashion to additions of the various mercury species to the air in which clouds form. The CMAQ results indicate did confirm that the aqueous chemistry mechanism for mercury responds in a linear manner to additional air concentrations of mercury. However, the photochemistry products that act as reactants to mercury in the cloud water do not respond in a linear manner to additions of the various precursor emissions. Thus, the linear response demonstrated only pertains to conditions of constant photochemically-produced mercury reactant concentrations. Given that prescribed and unperturbed air concentration fields for these photochemical mercury reactants have been used in the HYSPLIT simulations, the source-receptor analysis method appears to be valid. (O. Russell Bullock, 919 541 1349)

A special version of CMAQ has been developed to allow the explicit tracking of primary carbonaceous particulate matter emitted from nine major source categories. The emission source categories separately tracked in this model formulation are diesel engine exhaust, gasoline engine exhaust, biomass combustion, coal combustion, oil combustion, natural gas combustion, food cooking, paved road dust, and crustal material other than paved road dust. In total, emissions from these source categories constitute more than 95% of the carbonaceous material emitted from the continental United States. In a parallel effort, emissions processing inputs to the Sparse Matrix Operator Kernel Emission model were modified to generate gridded inventories of source-segregated carbonaceous particulate emissions for the nine source categories listed above. Using a source-segregated inventory as input to the modified CMAQ model described above, air quality model simulations will be performed to calculate spatially and temporally resolved contributions from each major emission source category to the atmospheric carbonaceous particle concentrations across the United States during the summer of 1999. (Prakash Bhave, 919 541 2194; George Pouliot, 919 541 5475)

The saturation vapor pressures, molecular weights, and criteria for establishing gas/particle equilibria of selected semi-volatile organic compounds were modified in the Community Multiscale Air Quality (CMAQ) model, based on findings from a recent review of the existing secondary organic aerosol (SOA) module source code. The net effect of these changes is a pronounced decrease in the model predictions of anthropogenically-derived SOA. These changes will be implemented in the August 2003 release of the CMAQ model. (Prakash Bhave, 919 541 2194)

Work continued on revising and testing the algorithms for simulating the formation of secondary organic aerosols (SOA) in the Community Multiscale Air Quality (CMAQ) model. First, the implementation of the reversible equilibrium model necessitated revising the treatment of dry deposition since speciated SOA and the gaseous precursors are now lumped into a single model species. Previously, total SOA and speciated gaseous precursors were modeled as separate species, and deposition velocities for each were computed independently. With the new approach, a deposition velocity is now computed for the lumped species as a weighted average of the deposition velocities used for SOA and for condensable gas precursors. Without this change, the tests revealed that SOA concentrations would be underestimated by about 20-30%. Second, a series of tests was conducted with the SAPRC99 chemical mechanism to elucidate the contribution to SOA formation from anthropogenically

generated alkanes and olefins. The results indicate that the contribution from olefins is almost negligible (usually less than 5% of anthropogenic SOA), whereas the production from alkanes is more significant (on the order of 25-50% of anthropogenic SOA). Based on these results, SOA production from olefins will be eliminated in CMAQ, but production from alkanes will be retained with SAPRC99. Because the amount of chemical information is more limited with the Carbon Bond (CB-IV) mechanism, the production of SOA from alkanes can only be properly accounted for by making numerous other changes to the CMAQ model, including the emissions processing. Because the model predictions of anthropogenic SOA are about an order of magnitude lower than biogenic SOA, to maintain backward compatibility, the production of SOA from alkanes will continue to be omitted when the CB-IV mechanism is used. These revisions will be included in the CMAQ system scheduled for release in August. (Gerald Gipson, 919 541 4181)

**18. Community Modeling and Analysis System Center.** Operated by the Carolina Environmental Program at the University of North Carolina at Chapel Hill, CMAS fosters collaboration on improvements to Models-3/Community Multiscale Air Quality (CMAQ) modeling system and provides training and support. CMAS has announced that the second annual CMAS User's Workshop will be held October 27-29, 2003, at the Holiday Inn-Airport, Research Triangle Park, North Carolina. A call for papers and instructions for extended abstracts has been posted on the CMAS website, [www.cmascenter.org](http://www.cmascenter.org). Training classes on the use of CMAQ and the new version 1.5 of the Sparse Matrix Operator Kernel Emission (SMOKE) model system will be offered before and after the workshop. (Bill Benjey, 919 541 0821)

**19. Air Quality Forecasting Progress.** Work is continuing on porting the optimizations realized in the Air Quality Forecasting (AQF) version of the Community Multiscale Air Quality (CMAQ) model to our local Linux clusters. This should enable better production turnaround for the model applications in use at Research Triangle Park, however benchmark tests seem to indicate no significant improvement with the limited number of processors available in this particular Linux cluster. (Jeffrey O. Young, 919 541 3929)

Emission processing for Community Multiscale Air Quality Model (CMAQ) with Plume in Grid (PinG) capability is underway for a winter 2002 test period. Version 1.5 of Sparse Matrix Operation Kernel Emission (SMOKE) with patches has been used to create emission input files for CMAQ (with PinG). Further evaluation and testing of SMOKE for the generation of emission files for use with CMAQ (with PinG) is underway. We are continuing to monitor and analyze the emission input files used in the Air Quality Forecast model. During July, very few problems were experienced with these emission data files.

Version 1.5 of the Sparse Matrix Operational Kernel Emissions (SMOKE) system is being tested with EPA's integrated toxic and criteria emission inventories. Emissions for a January 2002 test period have been successfully generated using 15-layer MCIP files and the CB-IV toxics speciation profile. Once these tests are complete, emissions will be available to test a toxic-chemical version of CMAQ. (George Pouliot, 919 541 5475)

**20. Shenandoah National Park Air Quality and Effects Assessment.** The Shenandoah National Park (SHEN) Assessment Report is being released in August 2003. Robin Dennis participated in the assessment, applying the Extended RADM model to create regional air quality analyses. The Extended RADM treats only inorganic particles and does it in a simplified manner compared to the Community Multiscale Air Quality (CMAQ) model. The SHEN Assessment is a unique study in that the National Park Service (NPS) Natural Resource Protection Program funds were allocated to a state-of-the-science assessment for a national park. This was in part due to the loss of a fish species in SHEN during the 1990's, which was documented, indicating the current reductions in S and N deposition are inadequate. The SHEN Assessment addresses Air Quality Related Values (AQRVs) and key air pollutants that threaten: 1) aquatic resources (primarily from S and N deposition), 2) terrestrial resources (primarily from O<sub>3</sub> exposure and N and S deposition), and 3) visibility (primarily from sulfate fine particles). The Extended RADM was used to characterize the sources of air pollution affecting SHEN for 1990 emission conditions and to estimate changes at the park in S and N deposition and sulfate and ozone air concentration stemming from potential future reductions in SO<sub>2</sub> and NO<sub>x</sub> emissions. To assess current contributions, airsheds were developed to indicate the principal source regions responsible for the majority of acidic deposition and sulfate haze affecting the park. Also, the relative contribution of airshed states to the acidic deposition and sulfate haze were defined, and the top-ranked source hot spots contributing to air pollution were identified. To estimate future conditions, emission projections that were developed by the EPA Clean Air Markets Division and combined with heavy duty diesel rule projections from the EPA Office of Air Quality Planning and Standards were run through the Extended RADM. Relative changes from the Extended RADM were provided to ecological models for calculations of changes to visibility and aquatic and forest resources from 1990 to 2020. The SHEN assessment is several hundred pages long and arrives at an extensive set of conclusions

regarding air quality, terrestrial and aquatic ecosystem status, and trends, and the prognosis for recovery. The SHEN assessment is posted on the web site for the Shenandoah National Park ([www.nps.gov/shen](http://www.nps.gov/shen)) and at the web site for the NPS Air Resources Division ([www2.nature.nps.gov/ard](http://www2.nature.nps.gov/ard)). (Robin Dennis, 919 541 2870)

**21. Meteorological Model Evaluation Tool.** Over the last month, a great deal of progress was made on meteorological model evaluation, which will expedite the task of preparing observations and extracting model data for evaluation purposes. Currently, the tool has the capability of automatically retrieving all available surface, upper-air, wind profiler, aircraft, mesonet, and marine observation for the time period of a model simulation. Once all observations are gathered, surface (in the near future all observations) observations are matched with the corresponding model predictions to be stored in a database file. Once the observations are matched with model output, a series of model evaluation products will be executed. These products will include a standard statistical report, a number of routine statistical plots, and an interactive explorative interface. This is where the focus of the current development. The tool has been extended to work with the Penn State/National Center for Atmospheric Research 5th generation Mesoscale Model (MM5), the Weather, Research and Forecasting Model (WRF model), and the National Center for Environmental Prediction (NCEP) Eta model. (Robert Gilliam, 919 541 4593; Jonathan Pleim, 919 541 1336)

**22. Climate Impacts on Air Quality.** The Global Climate Impacts on Air Quality (CIRAQ) project team has constructed and documented a comprehensive analysis plan for the regional climate modeling (RCM) simulations. The analyses will include an evaluation of the RCM results against a variety of observations and analyzed wind fields, as well as time and space analysis of the results. In addition to a write-up of these RCM analysis plans, the task updates also include documentation of progress during FY03 and revisions to existing plans based on recent activities.

Tests are ongoing at Pacific Northwest National Laboratory to link GISS GCM output as boundary conditions for the MM5 Regional Climate Model (RCM) simulations. While these tests are performed, ASMD will analyze MM5 RCM simulations using NCEP fields as boundary conditions for the MM5 RCM. These simulations are considered the benchmark for comparing the MM5-GISS results.

A report is being prepared on international and intercontinental transport research issues. This report will cover monitoring, modeling, assessment, and policy. Alice Gilliland and the lead for the OAQPS InterContinental transport and Air Pollution project (ICAP) Dr. Carey Jang have proposed a list of model developments for the recommendations report. The list includes research issues identified under the ASMD CIRAQ, toxics, and mercury programs and the OAQPS ICAP project. (Alice Gilliland, 919 541 -347)

The Economic Growth and Analysis System (EGAS) will be updated to allow projection of emission data through 2050 for use in global climate change air quality modeling. EGAS is driven by the Regional Economic Models, Inc. (REMI) economic forecast model, which currently projects through 2035. Alternatively, EGAS may be driven by the Wharton Economic Model. The economic sector forecasts are mapped to the emission source classification codes (SCCs) in EGAS. The evaluation group is considering a range of improvements to EGAS, including projections through 2050, making EGAS input more flexible to allow users to do alternative “what if” evaluations, and expanding the geographic area to include Canada and Mexico (these countries are usually within the United States national air quality modeling domains). Decisions on changes to EGAS should be made by the end of September 2003. (Bill Benjey, 919 541 0821)

**23. Spatial and Time Series Analyses.** Investigations into possible modeling methodologies for both temporally and spatially correlated data are ongoing. Several teams within the division are exploring, generating, or analyzing data sets that contain measurements of atmospheric or meteorological quantities collected over time and/or space. By their very nature, such data tend to be strongly correlated measurements made at neighboring points in space or time, and more complex statistical procedures are needed to appropriately evaluate these data sets. These methods include (but are not limited to) linear filters and spectral analysis techniques for time series, and data melding techniques, which combine spatially correlated information from differing monitoring networks or simulations. The Kolmogorov-Zurbenko filter has been implemented in the R programming language and successfully used with a idealized test data set. Work with spatially and temporally correlated data supports efforts in model evaluation, the Climate Impacts on Regional Air Quality (CIRAQ) project, and other projects. (Jenise Swall, 919 541 7655)

**24. Characterizing Unaccounted for Natural Variability.** A long-term investigation was initiated to characterize how much natural variability is not captured by traditional plume models of transport and diffusion. Data from 26 field experiments used in 1982 to investigate performance of dispersion parameter estimation



schemes were reconstructed. Preliminary analyses are being shared with a collection of investigators interested in this problem. It appears that there is natural variability from one site to the next (“site-to-site”) and natural variability “within-site” that are unaddressed by traditional dispersion estimation schemes. Results from these investigations provide guidance for setting uncertainty limits on model predictions and have implications to the comparisons of modeling results against observations in model evaluation studies. (John S. Irwin, 919 541 5682)

**25. Multilayer Biochemical Model.** Work continued on a version of the Multilayer Biochemical Model (MLBC) developed by Yihua Wu and Bart Brashers. MLBC is being placed in the Multimedia Integrated Modeling System (MIMS) framework and will be used for the Clean Air Status and Trends Network (CASTNet) modeling program. While the original design of MLBC treated the forest canopy simply as a mix of two tree species, we are redesigning the code to allow calculation of area-weighted deposition velocities for up to 50 tree species. (Donna Schwede, 919 541 3255)

## **Idaho Falls**

**26. CBLAST-High.** Final preparations were made for the upcoming field experiment. Test flights are scheduled for early August of the BAT system on the NOAA P-3. Continuing preparations for this years experiment include being able to provide data to other CBLAST investigators within hours of the end of the flight. This requires a good deal of coordination between various investigators, as much of the processing of data from the various systems (the BAT included) requires measurements from other instruments on the aircraft. The CBLAST-hurricane website that provides information about various experiments and will serve as the repository for the data collected this year is located at: <http://cblast.ecs.unmass.edu>. (Jeff.French@noaa.gov)

**27. Smart Balloon Research.** Efforts are under way to find a high energy to weight ratio solar cell to charge the lithium ion batteries used in the smart balloon transponder package. A possible source for this type of solar cell is Iowa Thin Film and their thin flexible solar cells. The solar cell is only 5.75 in. long, by 3.75 in. wide, 0.008 in. thick with a weight of only 4.5 grams. One of these units has been purchased and is being tested with the rechargeable Sony Energytec lithium ion batteries used in the smart balloon transponder. (Randy.Johnson@noaa.gov)

## **Las Vegas**

**28. DIVINE INVADER (DI).** The DI test series was conducted over a two-week period, July 7-21, at the HSC. The test objectives of DI 03-05 were to (1) detect the presence and release of Chemical Warfare agents in post-strike plumes, (2) identify the agents (constituents) in the plume, and (3) track the path and dispersion of the released agents over time and characterize the plume in terms of amount of agent present or released. Weather support provided to HSC included a climate and weather briefing by the Meteorological Advisor at the Safety Evaluation Panel held July 10, 2003, several upper-air soundings, a meteorological watch for the HSC area, customized weather forecasts, and twice-daily weather briefings. (Jim Sanders, 702 295 2348, and Phil Abbott, 702 295 1490)

**29. NOAA Cooperative Institute for Atmospheric and Terrestrial Applications (CIATA).** NV-RAMS ran to completion on the University of Nevada-Las Vegas computer system 30 of 31 days (a 97% completion factor). Data are continuing to be renamed and saved daily, and backed up to CD monthly (3 CDs).

The 12z model run is continuing to working well with a 94% completion factor. (Walt Schalk, 702 295 1262)

**30. Maximum Temperature Predictions.** The maximum temperature predictions via statistics from the morning radiosonde observation at Desert Rock Meteorological Observatory (DRA) for July showed a slight bias of -1.9°F and an absolute average error of 2.8°F. These differences are well within the normal forecasting range, and were better than might be expected for July. July was probably the hottest month on record for the NTS as a whole. Maximum temperatures averaged as much as 6°F above normal at some locations (the highest average maximum was about 106°F at station 34 in Frenchman Flat). (Doug Soule, 702 295 1266)