



# NOAA ARL Monthly Activity Report



December 2003

**Bruce B. Hicks, Director**  
**Air Resources Laboratory**

## Contents

1. **HIGHLIGHT – Homeland Security**
2. **HIGHLIGHT – Urban Atmospheric Observatory – New York**
3. **HIGHLIGHT – Mercury in the Gulf**
4. **The Effect of Future Mercury Emissions on North American Ecosystems**
5. **HYSPLIT Homeland Security Update**
6. **Changes to HYSPLIT via READY**
7. **Addition of South Polar Stratospheric Temperature Data to the ARL Web**
8. **NRC Feedbacks Report Released**
9. **HYSPLIT at NCEP**
10. **SURFRAD/ISIS**
11. **ARM Aerosol Working Group Meeting, Sonoma, CA.**
12. **Urban Dispersion**
13. **Tampa Bay studies – Bay Regional Atmospheric Chemistry Experiment (BRACE)**
14. **Canaan Valley**
15. **GEWEX/GCIP**
16. **Small Aircraft.**
17. **U.S. Climate Reference Network**
18. **Community Multiscale Air Quality (CMAQ) Modeling System**
19. **Community Modeling and Analysis System Center**
20. **Multimedia Integrated Modeling System Framework Developments**
21. **Air-Quality Forecasting Initiative**
22. **Exposure to Manganese From the Use of MMT as an Additive to Unleaded Gasoline**
23. **Community Scale Modeling of Air Toxics and Homeland Security**
24. **MultiLevel BioChemical Model**
25. **Climate Impacts for Regional Air Quality Model Analysis**
26. **Fugitive Dust Emissions**
27. **Spatial Modeling**
28. **Smart Balloon Research**
29. **New York City Tracer Experiment**
30. **INEEL Mesoscale Modeling**
31. **HARM III Installation**
32. **NOAA Cooperative Institute for Atmospheric and Terrestrial Applications (CIASTA)**

## Highlights

**1. Homeland Security.** Ray Hosker (Oak Ridge), Walt Schalk (Las Vegas), John Irwin (Research Triangle Park), and Bruce Hicks (Silver Spring) are serving as members on the Office of the Federal Coordinator for Meteorology (OFCM)'s Joint Action Group for Atmospheric Transport and Diffusion, to help develop a research

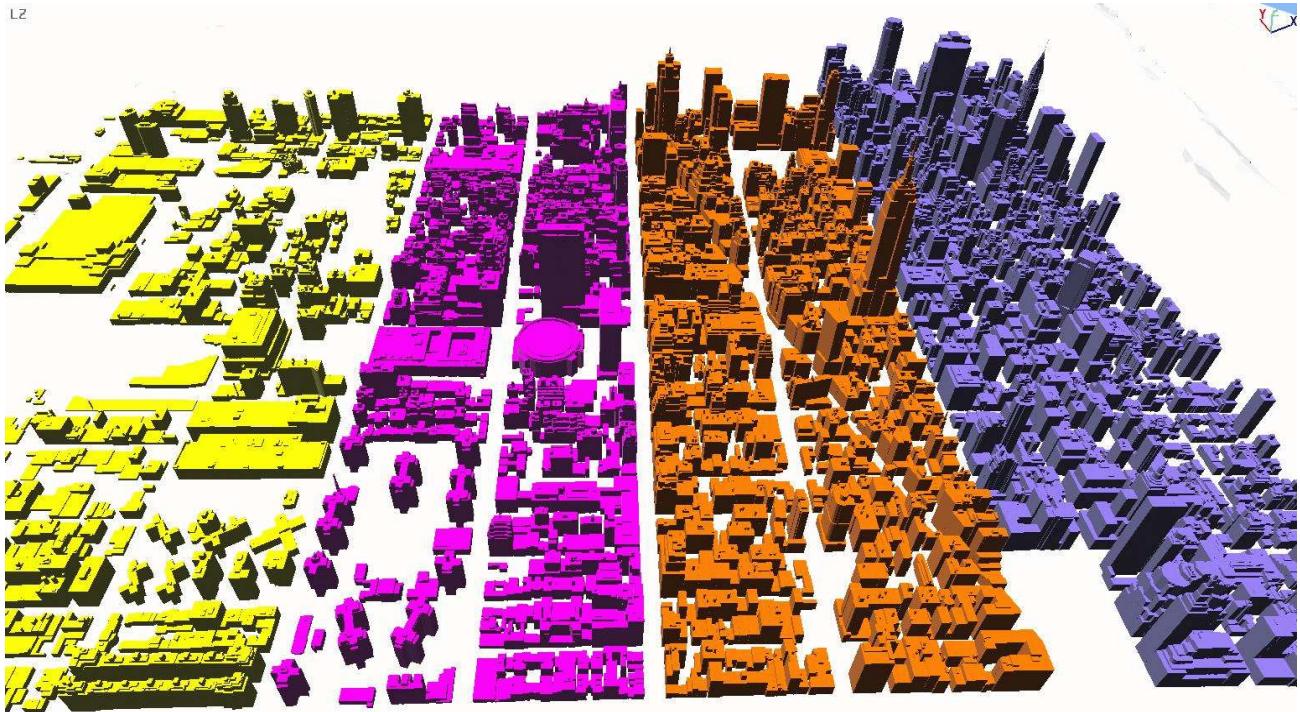
and development plan for Federal agencies. Frequent meetings and teleconferences are scheduled, to ensure a draft report is completed by April. Kirk Clawson (Idaho Falls) participated in a recent meeting of the group.

The new data analysis and multiple-model system is being referred to as HARM-3. One of these systems was installed at NOAA/SORD in Las Vegas. Modifications to ingest the 4-km model output of RAMS from UNLV will allow more detailed dispersion modeling around the Nevada Test Site. (Dumas, Pendergrass)

**2. Urban Atmospheric Observatory – New York.** The Urban Atmospheric Observatory (UAO) program is a developing long-term effort between the Department of Energy’s (DOE’s) Brookhaven National Laboratory (BNL), the National Oceanic and Atmospheric Administration’s (NOAA) Air Resources Laboratory (ARL), the Department of Homeland Security’s (DHS) Environmental Measurements Laboratory (EML), and the New York City Office of Emergency Management (OEM). A study of the dispersion (transport and diffusion) of airborne material in the deep urban canyons of New York City is being planned for Spring 2004 in the area around the Madison Square Garden, Pennsylvania Train Station, and Empire State Building. The figure below shows the Madison Square Garden near the center and the Empire State Building several blocks to its right side. This area has one of the largest commuter populations in the world. The 2004 study is expected to provide useful information on rapid vertical dispersion and will assist in planning for a more extensive study in the summer of 2005. Alan Huber has been part of the core planning group for the developing UAO. Dr. Huber anticipates a role in developing the digital model of buildings and Computational Fluid Dynamics simulations supporting this program. Support for the UAO follows the EPA’s World Trade Center assessment studies. (Alan H Huber, 919 541 1338)

**3. Mercury in the Gulf.** Because of recent concerns about the levels of mercury in the tissues of fish in the Gulf of Mexico, a group of interested NOAA researchers met in Biloxi, MS on December 10-12 to discuss the problem, and how increased measurements of atmospheric deposition of airborne mercury and better

L2



*The study site of dispersion of airborne material in the deep urban canyons of New York City area around the Madison Square Garden, Pennsylvania Train Station, and Empire State Building.*

understanding of mercury chemistry in the Gulf area might contribute to remedial decision making. Representatives from three ARL groups (Research Triangle Park, Oak Ridge, and Silver Spring), NMFS, the University of Alabama, and the Mississippi-Alabama Sea Grant Consortium were present; ORNL staff plan to participate but were unable to attend the meeting. It was agreed that the group has the necessary range of capabilities to work on the problem, and that a joint proposal should be developed in the next few months. (Cohen, Hosker, Brooks, Hicks, Bullock, Lindberg (ORNL)).

## Silver Spring

**4. *The Effect of Future Mercury Emissions on North American Ecosystems.*** An analysis was completed of the effect of future emissions scenarios on ecosystems in the U.S. and Canada. Simulations were made of atmospheric deposition of mercury to the five Great Lakes, Chesapeake Bay, Lake Champlain, and eight Canadian lakes (Lakes Winnipeg, Winnipegosis, Manitoba, Southern Indian, Cedar, La Ronge, Reindeer, and Churchill). A presentation was given at the meeting *Mercury in the Great Lakes Region*, sponsored by the Commission for Environmental Cooperation's Environment, Economy and Trade and Pollutants and Health Programs and the Binational Toxics Strategy, Chicago, Dec 17, 2003. A final report *Atmospheric Mercury Deposition Impacts of Future Electric Power Generation*, co-authored by Paul Miller of the CEC, was recently prepared.

The receptors studied appear to fall into two different groups. For the first group – the Great Lakes, Lake Champlain and the Chesapeake Bay – the deposition was relatively high and was dominated by U.S. emissions (even on a *per-capita* basis). For the second group (the eight Canadian lakes), the deposition was somewhat lower, and both Canadian and U.S. emissions sources contributed significantly. On a *per capita* basis, Canadian sources generally contributed significantly more than U.S. sources for this second group. [mark.cohen@noaa.gov](mailto:mark.cohen@noaa.gov)

**5. *HYSPLIT Homeland Security Update.*** Further enhancements have been incorporated into Hysplit to improve the model's performance for 1-20 km simulations. As noted in last month's report, the code was restructured to use the velocity variance for dispersion calculations. This month, new equations were added to compute the turbulence directly from boundary layer stability functions. Either equation set (diffusivity or turbulence) can be selected. However, simulations using the new turbulence equations require considerably more CPU time than the diffusivity based calculation. In addition, the plotting programs were revised to improve the clarity of the graphics at smaller distances.

An important aspect of introducing a new calculation scheme is to show that the model's performance has actually improved. The computations have been tested against tracer data collected during METREX. The Metropolitan Tracer Experiment (METREX) consisted of simultaneous 6-h duration perfluorocarbon releases from two locations every 36-h in the Washington D.C. suburbs for one year (1984), with a large number of measurement sites spread across DC and its surroundings. For the present purposes, the 2.5 deg 6-h NCAR/NCEP reanalysis data were interpolated to a 5 km resolution 30-min interval grid covering a 1 deg square domain centered over Washington D.C. Meteorological tower observations at five locations, collected during METREX, were blended into the gridded data using the interpolation procedure discussed last month. The model was run for 1984 for each release location. The PMCH tracer was released from Rockville from January through May and from Lorton, VA the rest of the year, while the PDCH was released from Mt. Vernon over the entire year. Absolute PDCH numbers are higher because its release rate was six times that of the PMCH release rate. Concentration units are in picograms ( $\text{pg}/\text{m}^3$ ). The diffusivity approach is the original Hysplit mixing scheme and the turbulent velocity method is the new approach for short-range dispersion discussed above.

Statistic	Reanalysis Data Diffusivity		Reanalysis Data Turbulent Velocity		+ Tower Data Diffusivity		+ Tower Data Turbulent Velocity	
	pmch	pdch	pmch	pdch	pmch	pdch	pmch	pdch
Correlation	0.90	0.65	0.88	0.59	0.91	0.55	0.86	0.80
Mean Calculated	132	297	130	282	23	70	116	296
Mean Measured	72	385	72	385	72	385	72	385
Percent x2	40	55	42	54	21	9	48	64
Percent x5	94	98	92	92	73	38	93	98

The last two rows show the percentages of predictions that fall within a factor of 2 or 5 of the observations. In general the use of the turbulent velocity variance method provides slightly better results than the diffusivity method only when the finer resolution tower data are introduced into the calculation. [roland.draxler@noaa.gov](mailto:roland.draxler@noaa.gov)

**6. Changes to HYSPLIT via READY.** In December the ancient web server used to support the READY website was replaced. At the same time, the READY and HYSPLIT login methodology was changed. For historic applications using archived data, HYSPLIT access is now available to everyone, without a password. Secondly, there is now only one username and password required for access to HYSPLIT when using forecast data; registration is necessary. After registration approval, we email the single account name and password to the user. We plan to change the single username and/or password every 1-3 months. New information will be distributed by e-mail. If the user's email address is no longer valid, the account will be terminated. Finally, we continue to have a third area of the READY/HYSPLIT website that provides a limited set of users access to the "special" or "emergency response" section of READY, which includes the use of the 12km Eta forecast data with HYSPLIT and a version of HYSPLIT with more options. [glenn.rolph@noaa.gov](mailto:glenn.rolph@noaa.gov)

The archived meteorology section of READY has been changed; it now has the familiar global and North American map. All of the READY model products that are currently available under the forecast section are now available under the archived meteorology section. [glenn.rolph@noaa.gov](mailto:glenn.rolph@noaa.gov)

**7. Addition of South Polar Stratospheric Temperature Data to the ARL Web.** Based on data from the eight Antarctic radiosonde stations consistently reporting in the NOAA publication "Climate Data for the World", seasonal and annual temperature deviations from the mean on 100, 50 and 30 mb surfaces have been computed and placed on the ARL website (<http://www.arl.noaa.gov/data/web/climate/Index.html>) to form a south polar stratospheric dataset. The record extends through the summer of 2003, and begins in 1958 at 100 mb, 1964 at 50 mb, and 1968 at 30 mb. (Jim Angell, 301 713 0295, x127)

**8. NRC Feedbacks Report Released.** A report on "Understanding Climate Change Feedbacks" was released recently by the National Academies. The report characterizes the uncertainty associated with feedbacks in the natural climate system that are important for projecting the evolution of Earth's climate over the next 100 years, and defines a research strategy to reduce the uncertainty associated with these feedbacks. The report is online at <http://www7.nationalacademies.org/basc/publications.html> [dian.seidel@noaa.gov](mailto:dian.seidel@noaa.gov). Dian Seidel was a member of the authoring panel. [dian.seidel@noaa.gov](mailto:dian.seidel@noaa.gov)

**9. HYSPLIT at NCEP.** A HYSPLIT training document was written and given to the NCEP SDM. The document describes the features of the integrated modeling system and gives examples of the features for radiological, volcanic ash, or other applications. The document is intended to assist the SDM staff during



the pre-implementation testing of the system. The matter is operationally important - VAFTAD (volcanic ash) forecasts were issued 96 times by NCEP in 2003, a slightly higher number than the previous two years. [barbara.stunder@noaa.gov](mailto:barbara.stunder@noaa.gov)

## **Boulder**

**10. SURFRAD/ISIS.** A great deal of time has been spent on correcting historical SURFRAD diffuse solar measurements that were made prior to the deployment of Eppley model 8-48 pyranometers in 2001. Before 2001, ordinary pyranometers were shaded to make the diffuse solar measurement. However, it was discovered that these instruments' receiving surface, a thermopile, cools by thermal infrared emission, thus offsetting what would be the true reading. This results in a diffuse solar value that is too low. A method to correct this offset has been developed by Ellsworth Dutton (CMDL) and his colleagues. To apply this technique instrument pairs used at SURFRAD stations have been documented, and the necessary data have been downloaded. Correction formulae are now being developed. After these are developed, they will be applied to all historical SURFRAD data. Corrected SURFRAD data will then be resubmitted to the BSRN. [john.a.augustine@noaa.gov](mailto:john.a.augustine@noaa.gov)

**11. ARM Aerosol Working Group Meeting, Sonoma, CA.** Joe Michalsky continues his involvement with the ARM Aerosol Working Group, attending a meeting in Sonoma, California, to chart progress in analyzing data from the May 2003 Aerosol Intensive Observation Period (IOP) held at the ARM central facility near Ponca City, Oklahoma. The data included extensive airborne and ground-based measurements of physical, optical, and chemical properties to attempt to resolve some outstanding issues with regard to radiative closure issues concerning aerosols. Dr. Michalsky reported on surface albedo, aerosol column, and spectral plus broadband radiation measurements acquired during the IOP. [joseph.michalsky@noaa.gov](mailto:joseph.michalsky@noaa.gov).

## **Oak Ridge**

**12. Urban Dispersion.** A major issue in studying the interaction between gravity waves and turbulence is to determine what is turbulence and what is wavelike. There are no certain dividing criteria in the boundary layer, where waves are often nonlinear and short-lived. One promising scheme uses wavelet decomposition of time series of atmospheric pressure at the surface. The scheme in effect finds features which over a limited time have shapes suggesting oscillatory motion. Like a Fourier decomposition it identifies oscillatory motion on multiple scales, but with the further advantage of locating them in time, thus identifying features of finite duration. With multiple microbarographs at known locations, the rate and direction of propagation of coherent features of this type can be estimated. A MATLAB script has been completed which automates much of the process, requiring only that features' centers be manually identified at three or more sensors. (Dobosy)

**13. Tampa Bay studies – Bay Regional Atmospheric Chemistry Experiment (BRACE).** Analysis shows that continental air transported over the region is found in layers bounded by medium to strong inversions. The presence and persistence of these layers is caused by the temperature differential between the warm continental air and the ocean surface. The stability of the atmosphere constrains vertical mixing and tends to preserve the structure of the layers as they existed at the land/ocean interface. (Gunter).

**14. Canaan Valley.** A new headquarters facility for the Canaan Valley Institute (CVI) is planned. Design of laboratory and office space includes representation from NOAA/ARL in the interest of facilitating future atmospheric research collaborations. A long-term ecological research area is also being planned by NOAA/ARL, CVI, and West Virginia University on the land donated to CVI adjacent to the Canaan Valley. Atmospheric studies are to be an integral part of the long-term science goals. A NOAA Climate Reference Network CRN site was installed at the Canaan Valley Resort State Park near the existing Canaan Valley Air

Quality Research and Monitoring Station (part of NOAA/ARL's AIRMoN Network) on the Canaan Valley National Wildlife Refuge. (Vogel, Meyers, Hall, Boice, Bryant).

**15. GEWEX/GCIP.** Research work is centered on the NOAA GEWEX program that monitors the exchange of energy and trace gases between the land surface and the atmosphere at several different vegetation sites in the US. Computer programs are being developed to use in evaluating measurements of energy and carbon fluxes at these sites, with the goal of gap-filling lost data that at times result from instrument failures. The program selected to do the gap-filling is called the Atmosphere-Land Exchange (ALEX) surface energy balance model, developed in 2000 by Dr. Martha Anderson et al. in the Department of Soil Science, University of Wisconsin at Madison. ALEX was selected over other such programs that have been reported in the literature because it is robust and relatively simple to use. ALEX seems to provide a fast and simple way of using real-time measurements of radiation, wind momentum and speed to specify the leaf area and canopy height at each of ATDD's GEWEX network sites. (Wilson)

**16. Small Aircraft.** A Sky Arrow Environmental Research Aircraft (ERA) has been ordered by the University of Alabama, for delivery in January 2004. The University of Alabama (UA) has awarded a five year aircraft operations contract to Dixie Air Services which will provide maintenance, transport and piloting of the Sky Arrow. ATDD will collaborate with UA on instrumentation, research plans, and analyses of data, and the aircraft will be available for use in ATDD field studies. The aircraft is scheduled for FAA import inspection in Atlanta early in 2004. Mobile Flux Platform installation by ATDD is anticipated in March. Overflights of flux towers at Walker Branch TN, Duke Forest NC, and the Florida Slash Pine Site are scheduled by UA for spring, with DOE funding. This Sky Arrow will receive new smaller and lighter BAT-REM modules, otherwise functionally identical to the previous modules. In addition, a new positioning system is being evaluated; if this proves satisfactory, it will save about \$20K over the originally specified system. (Dumas, Brooks, Dobosy, Senn)

**17. U.S. Climate Reference Network.** The USCRN (Climate Reference Network) data inventory is checked daily to identify sites unable to transmit data directly to the National Climate Data Center (NCDC) in the normal way. Operators at those sites with problems are sent Palm PDA's onto which they can download their locally stored data that failed transmission. These data, along with any data retrieved during annual site visits, are placed on ATDD's FTP site (<ftp.atdd.noaa.gov/>) for NCDC to pick up. In December, PDAs were sent to five sites. NCDC uploaded data from ATDD for eleven sites in all. The station database, CRNSITES, on NCDC's server is being updated and checked. (Satterfield)

## **Research Triangle Park**

**18. Community Multiscale Air Quality (CMAQ) Modeling System.** The annual simulation of air toxic concentrations with the Community Multiscale Air Quality (CMAQ) model was completed in December. CMAQ can now provide spatially and temporally-resolved concentrations of 20 hazardous air pollutants as well as criteria pollutants and volatile organic compounds (VOCs) over the entire United States. These model results will be particularly valuable for helping us understand the risks associated with exposure to atmospheric formaldehyde, acetaldehyde, and acrolein. Initial analyses show that societal emissions of formaldehyde account for only about 10 percent of the total formaldehyde concentrations on an annual basis, with biogenic emissions and reactions in the air explaining the rest. Emissions of acrolein, on the other hand, account for over 70 percent of the total acrolein concentration on an annual average. Our next step is to analyze and interpret these results and compare them with the available observations of toxic air pollutants. The results will be used to assess the implications for risk assessments and the National Air Toxics Assessment, as well as for developing strategies for the control of hazardous air pollutants. (Deborah Luecken, 919 541 0244)

An investigation of the numerical method used to solve aqueous chemistry in the CMAQ mercury model was begun in hopes that the large amount of CPU time presently used might be reduced. Some significant improvements are anticipated. An update of the CMAQ mercury model to use the August 2003 release of the standard CMAQ codes was performed and the resulting model tested to assure that new mercury simulation results differ from previous results only as expected and that the implementation of the mercury codes into the standard form of the model did not change model performance with respect to criteria pollutants and particulate matter. (Russ Bullock, 919 541 1349)

Trial simulations have been performed with the updated Plume-in-Grid (PinG) approach, which treats both gaseous pollutants and aerosol species in subgrid-scale major point source plumes within the Community Multiscale Air Quality (CMAQ) grid model. Results have been generated for the eastern United States domain with a 36-km grid cell size from a summer period to investigate the impact on concentrations from model runs with and without the PinG treatment applied to a set of the 77 largest NO<sub>x</sub> and SO<sub>2</sub> point sources. Comparisons between the modeled results show relatively lower concentrations for oxidants and aerosol species in the CMAQ /PinG simulations. An evaluation of the two sets of model results against various measurement network data sets is also underway. (James Godowitch, 919 541 4802)

One component of CMAQ determines the gas-particle phase partitioning of semivolatile organic compounds (SVOCs). This secondary organic aerosol module interactively solves a coupled system of equations by using a Newton-Raphson numerical method. By changing the initial guess passed to this solver, the partitioning calculation can reach convergence in fewer iterations. For the model conditions studied, these modifications resulted in a 50 percent reduction of the time required by the aerosol component and a 2.3 percent reduction in overall runtime. (Chris Nolte, 919 541 2652)

Scientists at the University of California-Davis have incorporated a 9-section module, that includes the chemistry of sea salt reactions with nitrate in the coarse mode, into the 2003 pre-release version of CMAQ. This version is termed CMAQ-AIM. Scientists at University of California-Riverside provided computational support. Preliminary results show that there can be high concentrations of coarse particle nitrate in the Gulf of Mexico and especially over the strong NO<sub>x</sub> sources on Tampa Bay. Coarse particle nitrate concentrations can also be high over the coastal ocean off the U.S. east coast and constitute a significant fraction of total nitrate, more than 90 percent of total nitrate in some locations. CMAQ-AIM made its debut at the Fall 2003 AGU Conference in the BRACE (Tampa Bay Study) session. CMAQ-AIM, based on the official 2003 release version of CMAQ, is to be brought in-house for further testing, using identical inputs, and for use in the BRACE evaluation. We anticipate it will be released to the public through CMAS sometime in late spring or early summer 2004. (Robin Dennis, 919 541 2870)

**19. Community Modeling and Analysis System Center.** Work continued on the Community Modeling and Analysis System (CMAS) center located at the University of North Carolina at Chapel Hill, Carolina Environmental Program, for advancement of the Models-3/Community Multiscale Air Quality (CMAQ) user community and collaboration in model improvements, training, and support. It is expected that the first offerings of the community will be the MADRID version of CMAQ, featuring the discrete size bin approach to aerosols. Developers will be able to check code in and out of the site to make and test improvements. The code on the shared development site will be unofficial and will not affect the approved code version issued through CMAS. During December, CMAS also conducted an independent peer review of the science within the Models-3/CMAQ system. Division staff answered questions and presented material describing their work, supplementing written information provided to the reviewers earlier. The reviewers provided a briefing of their initial conclusions at the end of the two-day session, and will provide a written report within the next few weeks. (Bill Benjey, 919 541 0821)

**20. Multimedia Integrated Modeling System Framework Developments.** Work also continued on the Multimedia Integrated Modeling System (MIMS) framework development. This work consisted of adding

new features and fixing software bugs. A recently developed feature is a multiple nested looping iterator used for executing over ranges of data parameters. This feature gives the framework more capabilities and provides more support for modeling applications. In addition to the work on MIMS, Steve developed some I/O API data utility programs used for analyzing data and model evaluation. (Steve Howard, 919 541 3660)

Development of a more detailed research plan for anticipated FY-2004 multimedia mercury modeling tasks and accomplishments continued. The primary FY-2004 technical activity is the update and implementation of Community Multiscale Air Quality/Mercury (CMAQ/Hg) for both mainframe and Linux computing platforms. In December, it was determined that several changes in the September 2003 CMAQ public release require re-implementation of the mercury version. Re-implementation requires additional resources for which estimates of additional resource needs were obtained and resources identified. Meteorological test periods for model implementation were identified. Appropriate Hg emission inventories have been identified and implementation issues resolved. (Ellen Cooter, 919 541 1334)

**21. Air-Quality Forecasting Initiative.** The pre-processor to the Community Multiscale Air Quality (CMAQ) model for air-quality forecasting (PREMAQ) was modified to process hourly precipitation increments allowing for the Eta accumulation “bucket” to periodically empty, as is typically done during the Eta model operational forecasts. This change to PREMAQ will have a positive impact on the wet deposition calculations in CMAQ and the precipitation-based soil moisture calculations used in the biogenic emissions. This update to PREMAQ will be included for the Summer 2004 test period. (Tanya Otte, 919 541 7533)

The ETA-CMAQ air quality forecast system has been upgraded to reflect the latest public release of CMAQ. Testing is underway to determine if we want to incorporate predicted ozone from the Global Forecast System (GFS) for boundary concentrations and/or if we want to incorporate eddy diffusivities based on the Eta model’s Turbulent Kinetic Energy (TKE) predictions. Initial testing shows that the eddy diffusivities from Eta are of considerably less magnitude in the daytime boundary layer than CMAQ’s current parameterizations. This leads to overpredictions of ozone in the southern cities (primarily Atlanta). (Jeff Young, 919 541 3929, and Jonathan Pleim, 919 541 1336)

Ozone concentrations in the GFS result from assimilation of SBUV satellite data and subsequent transport by the forecast system. There is no photochemistry in this system and the satellite data are most valid for upper troposphere and stratosphere. Thus, we use the GFS data only for the upper portions of the model profile. Therefore, the effects of incorporation of the GFS ozone data are sporadic at the surface when there is some mechanism for rapid transport from aloft such as deep convection or tropopause folding events. (Jonathan Pleim, 919 541 1336)

The analysis of emissions from Sparse Matrix Operations Kernel Emissions/MOBILE6 (SMOKE/MOBILE6) is underway. MOBILE6 incorporates assumptions about vehicular emission rates that are dependent on the time of the day. An analysis of a MOBILE6 run for the month of August is underway to determine if a relationship between the temperature and emission rates exists at each grid cell and for each hour of the week during the month. If such a relationship exists, then the same method used for MOBILE5B can be applied to MOBILE6 but at a much higher temporal detail. Revisions to the air quality forecast system will be made after an analysis of the new method is completed. (George Pouliot, 919 541 5475)

**22. Exposure to Manganese From the Use of MMT as an Additive to Unleaded Gasoline.** There is a history of using Methylcyclopentadienyl-Manganese-Tricarbonyl (MMT) in U.S. gasoline. MMT was banned as an additive in unleaded gasoline in 1977. The principal emission product of MMT combustion in catalyst-equipped vehicles is a fine particulate matter (0.1 - 0.8um diameter) consisting of a chemical mixture of manganese oxides, manganese sulfates, and manganese phosphates. In 1995, the ban was lifted and a court decision ordered EPA to register the product for use as a gasoline additive although testing for



health effects is yet incomplete. The producer of MMT (Ethyl Corporation) has conducted recent health related studies to support its interests in having MMT used in U.S. gasoline.

The Ethyl Corporation's reported human exposure estimates are being examined, for a 12-15 month period in 1995-1996 in Toronto, Canada, where MMT was being used in its fuel. Estimated 24 hourly values of meteorological factors and estimated emissions densities are being examined for seven Canadian and five U.S. cities to estimate potential human exposures to MMT combustion products relative to what was observed in Toronto. The resulting comparative estimates are believed to provide reasonable comparative values since mobile source emissions are ubiquitous for major cities. Conclusions from the present assessment will be used as one element to support the EPA's recommendations on potential MMT use in U.S. gasoline. (Alan Huber, 919 541 1338)

**23. Community Scale Modeling of Air Toxics and Homeland Security.** The Community Scale Modeling of Air Toxics and Homeland Security (CMATHS) team has developed an implementation plan for FY-2004 organized around the activities of five working groups (WGs): WG1 is involved in implementing the Prototype Philadelphia study. For this effort, annual runs of air toxics using the Community Multiscale Air Quality (CMAQ) model at 12- and 4-km grid resolutions will be performed for a domain including the Philadelphia area and the State of Delaware. These runs will be based upon the National Air Toxics Assessment (NATA) CMAQ simulations at 36-km grid resolution, which has already been completed. Collaborations with EPA Region 3 and with the State of Delaware are underway; they have agreed to contribute and provide information on concentration distributions at finer than 4 km scales. WG2 is involved in further model development and testing of the neighborhood scale concept for the Houston area. In this effort, MM5 and CMAQ will be modified to simulate air quality including air toxics at 1-km grid resolution. Unique to this effort are the specialized urban canopy parameterizations (UCPs) gridded at 1- km resolutions. The meteorology of this effort will be the advanced DA-SM2-U(3d) in MM5. This UCP database will need to be incorporated into all aspects of the simulations. WG3 is tasked to investigate and develop models and means for predicting concentration distribution from within the CMAQ grid variability. In this effort, methods for providing within-grid concentration fields for their sources and for subgrid chemical transformations are investigated. Studies include the use of dispersion models, wind tunnel studies, CFD modeling, and a linked chemistry with turbulence model (LESChem). Means to derived distributions and formats that aptly characterize the distribution are being investigated. WG4 is tasked with adapting an existing operational exposure model (HAPEM4 to HAPEM5) to be driven by the outputs of fine scale CMAQ and their complimentary subgrid distributions developed by WG1 for the Philadelphia/Delaware areas. Finally, WG5 is tasked to develop and test model linkage between the neighborhood scale air quality modeling with the National Exposure Research Laboratory's Stochastic Human Exposure to Doses (SHED) model. (Jason Ching, 919 541 4801)

**24. MultiLevel BioChemical Model.** A quality assurance project plan was prepared and approved for the project "*Adaptation of the MultiLevel BioChemical (MLBC) dry deposition approach for area-weighted canopies*". In the original design, the MultiLevel BioChemical model treats all canopies as a mixture of the plant species. Alternatively, the deposition velocity may be determined from area weighting the deposition velocities for each of the local species. MLBC (v1.0) is being modified to allow for this latter approach to develop a new version of the model that will be referred to as MLBC-AW to denote the area weighting algorithm. The Clean Air Status and Trends Network (CASTNet) currently uses the area-weighted approach with the Multi-Layer Model (MLM) for calculating deposition velocities at sites in the network. Development of the MLBC-AW model will offer the EPA Clean Air Markets Division an alternative model for use in CASTNet. (Donna Schwede, 919 541 3255)

**25. Climate Impacts for Regional Air Quality.** Download and pre-processing of regional climate EDAS data arrays for the period 1997 through 2002 has been completed. 1800 hour GMT 700 millibar u-v wind component data were divided into four seasons and arranged to support national domain spatial cluster

analysis similar to that described in Cohn *et al.* (2001) of similar National Center for Environmental Prediction (NCEP) data spanning the period 1984 through 1992. Cluster frequencies and visual displays of mean cluster values were developed for the 1987 through 2002 period for comparison with similar information presented in Cohn *et al.* (2001). Not unexpectedly, preliminary analysis suggests potentially significant differences between the 700mb spatial patterns for the two time periods. Further study will be performed to determine the degree to which these differences are significant and/or informative with regard to further evaluation of the regional climate scenarios produced for the Climate Impacts for Regional Air Quality (CIRAQ) assessment. (Ellen Cooter, 919 541 1334)

A meeting was held on November 12, 2003, with the EPA STAR cooperative agreement (coop) investigators at the National Aeronautics and Space Administration's Goddard Institute of Space Studies (NASA GISS). Alice Gilliland is participating in this group as an EPA collaborator, as it relates to the Atmospheric Sciences Modeling Division (ASMD) Climate Impacts on Regional Air Quality (CIRAQ) project. This STAR coop group will be providing CIRAQ global chemical transport model (CTM) and global climate model results as boundary conditions for regional air quality modeling needs. ASMD will perform comparisons of CTM results at both the global and regional scale over the United States, using a standard empirical orthogonal function methodology. The meeting represented a kickoff to the project, and was a successful start to collaboration. (Alice Gilliland, 919 541 0347)

**26. Fugitive Dust Emissions.** A prototype has been developed for a new module in the Sparse Matrix Operations Kernel Emissions (SMOKE) model that estimates the emission factors of fugitive dust sources from unpaved roads. The methodology currently used for the 1999 National Emissions Inventory (NEI) version 2 and later emission inventories has been incorporated into the module as part of SMOKE. Fugitive dust emissions from unpaved road sources were computed with the new module, treated as mobile sources, and compared to emissions computed as area sources. Both methods produced consistent results for a test day in January for all grid cells within the continental United States. The next phase is to incorporate rainfall and relative humidity into the module to estimate the amount of moisture at the road surface on an hourly basis. (George Pouliot, 919 541 5475)

**27. Spatial Modeling.** Software routines to aid in the implementation of data assimilation techniques for spatially correlated data sets collected on differing scales are being developed and tested. The method relies on a simple hierarchical statistical model that is appropriate for use with processes possessing a simple stationary covariance structure. The routines are being tested to determine their accuracy, numerical stability, and efficiency in dealing with the large volume of model output and monitoring data typically encountered in atmospheric research. (Jenise Swall, 919 541 7655)

## **Idaho Falls**

**28. Smart Balloon Research.** A new GPS and satellite communication technology has been adapted to improve the smart balloon instrument package. The size, weight and power requirements for GPS receivers have continued to decrease. An Iridium satellite data modem will be used for communication. It will provide communications over a much greater geographic area than the Globalstar satellite phone used in the previous version. The modem is intended primarily for data communications, however, it can be used for voice communications with an addition of a small voice interface box and a handset. Over 500 grams of weight are saved by removing the Iridium circuitry from the factory housing. The total weight of modern electronics is 150 g. Two marine antennas were purchased for operational testing with the satellite modem. We removed the antenna element and mounted it to the top plate of the transponder enclosure to reduce size and weight from 198 g 14 g. A new fiberglass enclosure will be used to house the instrument package. It has undergone testing and been fitted with the tubing necessary for filling and ballast adjustment. [randy.johnson@noaa.gov](mailto:randy.johnson@noaa.gov)

**29. New York City Tracer Experiment.** Planning discussions continued this month in preparation for a pilot transport and dispersion study to be conducted in New York City sometime in the summer of 2004. Preparation of an SF<sub>6</sub> mobile analyzer was begun so that a fugitive emissions study in New York City can be conducted next month. Additional planning meetings are on tap next month, as well. [kirk.clawson@noaa.gov](mailto:kirk.clawson@noaa.gov) & staff

**30. INEEL Mesoscale Modeling.** The new MM5 simulations initialized from the 12 km Eta model ran successfully during December on a test basis. This model configuration performs a cold start each day at 0300 UTC and then does a restart every three hours throughout the day. For both the cold start and the restarts, the model uses 4D data assimilation for both the INEEL Mesonet observations and any satellite-derived winds available within the model domain. Other sources of meteorological observations are also being considered for data assimilation. A search is also under way for better estimates of snow cover, since the snow cover included in the Eta model output is often inaccurate over Southeast Idaho. NOAA has an experimental National Snow Analysis (NSA) which appears to provide much better snow-cover estimates, but public access to these analyses is currently limited to graphical images rather than gridded files that could be ingested into a model. [richard.eckman@noaa.gov](mailto:richard.eckman@noaa.gov)

## **Las Vegas**

**31. HARM III Installation.** The NOAA HARM III/HYSPLIT/ARCMAP Emergency Response system was installed in the SORD Weather Forecast and Assessment Center. This advanced transport/dispersion model is ARL's Emergency Response Threat Model and Display tool. The model is capable of using local RAMS model runs to generate plume products and it draws forecast data from the NCEP models. (Walt Schalk, 702 295 1262, Jim Sanders, 702 295 2348, Ray Livsey, 702 295 1241, and Phil Abbott, 702 295 1490)

**32. NOAA Cooperative Institute for Atmospheric and Terrestrial Applications (CIASTA).** Mesoscale Modeling: NV-RAMS ran to completion on the University of Nevada-Las Vegas (UNLV) computer system for 26 of 31 days (an 84% completion factor). Data are continuing to be renamed and saved daily, and backed up to CD monthly (3 CDs). (Walt Schalk, 702 295 1262)