



NOAA ARL Monthly Activity Report



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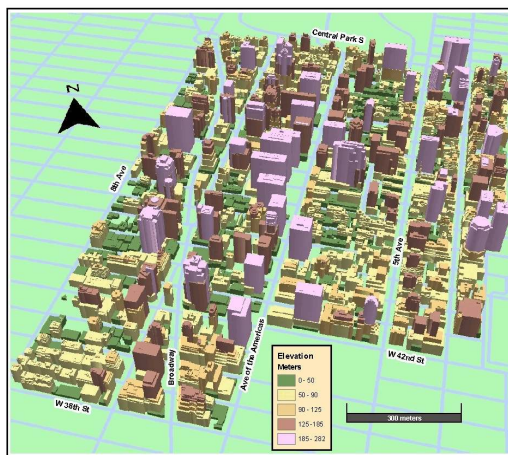
Highlights

1. *HIGHLIGHT – Urban Dispersion, New York and Washington.* During 2004, there will be a pilot study addressing rapid vertical dispersion induced by buildings in Midtown New York City. 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). The Environmental Protection Agency's sponsored wind tunnel and human exposure measurement studies are being anticipated. During January, the DHS expressed preferred

interest in conducting a study in the Times Square area of New York City during 2004. ASMD provided initial building geometry data to the program modeling group per request from DHS. The diagram below shows the area between 42nd Street and Central Park South being considered for the study. (Alan Huber, 919 541 1338)

Procedures to automatically blend DCNet tower data into the 12-km ETA archive & forecast data files have been implemented on the ARL web server for testing. The script runs hourly to update the most recent ETA forecast cycle with the previous hours tower observations and once-a-day to update the monthly ETA archive. A special extract program is also run daily that will create a special ETA archive file in a text format at the grid points corresponding with the tower locations. These data will be used for long-term evaluation studies. roland.draxler@noaa.gov

A survey of potential fugitive sources of SF₆ and interferants was conducted in New York City, New York on January 20-23. The survey consisted of driving a van instrumented with an SF₆ real-time analyzer along the streets of midtown Manhattan. The survey was conducted on several days together with one nocturnal surveillance study. Two major sources of SF₆ were discovered, both of which were large electrical substations. To ensure that the real-time analyzer had, indeed, measured SF₆ and not some other SF₆ interferant, several bag samples were acquired from the plume immediately downwind of the substations. These bag samples were later analyzed in the FRD Tracer Analysis Facility, where it was determined conclusively that the compound being emitted from the substations was SF₆. No other sources of SF₆ or SF₆ interferants were measured in NYC.



The proposed study site for the Urban Study 2004.

A similar survey was conducted in Washington, D.C. on January 26-28. Three sources of SF₆ were identified in the area of the White House and the U.S. Capitol. None were discovered in the area of the Pentagon.

The results indicate the potential of using existing sources of SF₆ as a source of opportunity when conducting an atmospheric tracer study. In fact, had a full tracer experiment been conducted with a fully deployed complement of bag samplers and real-time analyzers on the night of the nocturnal survey in NYC, the test would have mimicked the intentional tracer releases in Oklahoma City from the summer of 2003. The results also indicate that the SF₆ sources can be sufficiently managed to permit successful intentional releases of SF₆ without the fear of ambiguous tracer sources convoluting the concentration data. kirk.clawson@noaa.gov

The February 2004 issue of the *EM* magazine, a publication of the Air & Waste Management Association, featured the work of ARL and EPA scientists in assessing the extent of pollution and potential health risks following the terrorists attacks on the World Trade Center towers on September 11, 2001. Several articles summarizing the air quality monitoring, modeling, and risk assessment conducted near ground were published in this issue of *EM*. (S.T. Rao, 919 541 4541)

Silver Spring

2. *Global Temperatures Updated Through 2003.* Based on a 54-station global radiosonde network, global surface, tropospheric and tropopause-layer temperatures were slightly cooler in 2003 than in 2002, but low-stratospheric temperatures were the same. None of the changes between the two years was significant. In 2003 the global tropospheric temperatures were the 5th warmest of the 46-year record and the surface temperatures the 7th warmest of this record. The global surface and tropospheric cooling between 2002 and 2003 was mostly due to a cooling of the north temperate zone. The year 2003 was a record year only in the case of tropical surface temperature, reflecting an inexorable increase in this temperature during the last 30 years. Except for the record tropospheric warmth in 1998 associated with the strong 1997-98 El Nino, there has been little change in global surface, tropospheric, tropopause-layer or low-stratospheric temperature during the last decade. (Jim Angell, 301 713 0295, x127)

3. *High Resolution Eta Archive Available to HYSPLIT via READY.* A 31-day rotating “archive” of 12 km Eta meteorological data was added to the list of archived meteorological datasets that registered users of HYSPLIT can access via the READY website. In addition, NOAA ARL HYSPLIT users (others upon request) can access a special higher resolution archive that blends the DCNet tower data with the 12 km Eta archive through a link on the READY site. This unique dataset allows users to run HYSPLIT with possibly a better initial wind field than possible with just the 12 km Eta data. glenn.rolph@noaa.gov

4. *Java Animation Applet added to READY Applications.* A Java-based animation routine was added to a number of READY products to give users more control over meteorological model forecasts and HYSPLIT concentration loops. The Java applet, called AniS, was derived mainly from work done for the VISIT projects’ VISITview collaboration and distance learning tool. VISIT is a joint effort involving NOAA-NESDIS Cooperative Institutes, the National Environmental Satellite Data and Information Service (NESDIS), and the National Weather Service (NWS). The primary mission of VISIT is to accelerate the transfer of research results based on atmospheric remote sensing data into NWS operations using distance education techniques. glenn.rolph@noaa.gov

Boulder

5. *SURFRAD/ISIS.* The refined documentation of historical diffuse solar radiation has been completed. A number of other changes were also made to the data set. First, the UVB processing was improved with regard to how the UVB standards’ calibrations are applied to the field UVB instruments. The SURFRAD processing code now accesses several annual UVB standards’ calibrations that have been made since the network began in 1995. Because the change in the standards’ calibrations has been found to be linear, the relevant calibrations are linearly interpolated to the day being processed. Before this change, just the latest standards’ composite calibration was applied. In addition, the net solar and total net surface radiation calculation for SURFRAD data has been improved, especially around sunrise and sunset. In the coming month, the entire SURFRAD data set will be reprocessed to incorporate these improvements and to apply the diffuse corrections to the data set before 2001. john.a.augustine@noaa.gov

6. Collaboration with CMDL and NASA. NASA has agreed to help sponsor the effort (with CMDL) to continue providing EOS validation data. However, NASA has proposed that they (NASA) should support only 50% of the effort, with NOAA supporting the rest. They also stated that the funding level that was identified was not perceived to be exorbitant. The sole reason given for the partial support by NASA was that they believe that NOAA should be supporting the SURFRAD and CMDL surface radiation networks more than they are. NASA officials stated that they would soon talk to NOAA administrators about this. john.a.augustine@noaa.gov

7. “Umkehr Ozone Retrieval” Web Page. A new “Umkehr Ozone Retrieval” web page was created and linked from the NOAA/ARL/SRRB group home page <http://www.srrb.noaa.gov/research/umkehr>. The web page provides users with information on the updated Umkehr retrieval ozone profile algorithm (UMKV8). The anonymous ftp download of the algorithm and look-up tables are available. The time-series of Umkehr ozone profiles retrieved using the UMKV8 (new) and the UMK92 (currently operational) algorithms are available for three stations (Arosa, Switzerland; Boulder, CO, USA; and Tateno, Japan). irina.petro@noaa.gov.

Research Triangle Park

8. Air-Quality Forecasting. The pre-processor to the Community Multiscale Air Quality model for air-quality forecasting (PREMAQ) was set up to satisfy the requirement at the National Centers for Environmental Prediction (NCEP) that data must be in the format of the operational forecast systems. Several minor changes were made to PREMAQ to accommodate this need. Initial tests were successful. This update to PREMAQ will be included for the Summer 2004 test period. (Tanya Otte, 919 541 7533)

An analysis of emissions from SMOKE/MOBILE6 for August 2003 is underway. Because estimated emissions from evaporative sources in MOBILE6 depend on temperature, time of day, and day of week, a nonlinear (quadratic) least squares approximation was created to simplify and to accelerate the emissions processing. A similar methodology was developed for the mobile exhaust processes. These two sets of approximations will be used in the 2004 version of NOAA’s real-time air quality model forecasting system. (George Pouliot, 919 541 5475)

In a parallel activity, computer scientists at the Department of Energy’s Sandia National Laboratory are optimizing CMAQ and developing some enhancements, with emphasis on the assessment applications of the fully expanded code. Test data sets and code have been identified for a 2-week scenario, in which the goal is to be able to run CMAQ for this scenario in not more than 12 hours. The latest public release version of CMAQ takes considerably longer to run a typical 2-week scenario - as much as 60 hours or more. The code contains the most recent model enhancements made by the Division and is the version delivered to the Environmental Protection Agency’s Office of Air Quality and Planning Standards for their annual runs. This code has already been significantly optimized for run times by our Division, nearly meeting the model speed up goal. (Jeffrey O. Young, 919 541 3929)

9. Air Quality Assessment – CMAQ.

Air Toxics Modeling. Several CMAQ model simulations were run to assess how biogenic emissions contribute to the air concentrations of formaldehyde and acetaldehyde. The series covers periods for winter and summer days during 2001. The model domain covers the continental United States with

36-kilometer grid resolution. For winter concentrations averaged over a 24-hour period, biogenic emissions contribute up to 1 $\mu\text{g}/\text{m}^3$ for both acetaldehyde and formaldehyde concentrations. Primary emissions and secondary production have equal contribution. Biogenic olefins as represented in the Carbon Bond IV mechanism account for secondary production. During summer, biogenic emissions contribute up to 6 and 9 $\mu\text{g}/\text{m}^3$ for acetaldehyde and formaldehyde, respectively. Secondary production accounts for most of these contributions but the dominant source depends on the toxic compound and location. For acetaldehyde, secondary production comes from olefins as in winter conditions. For formaldehyde, secondary production comes from the emissions of both isoprene and olefins. Isoprene emissions produce more formaldehyde over the southeastern and Gulf coast states than olefins. Olefins emissions lead to higher secondary production over states in the Pacific Northwest than isoprenes. (William T. Hutzell, 919 541 3425).

Aerosol Module Development. Several enhancements to the CMAQ aerosol module were made in preparation for the year-long air quality model simulations. Module developments were focused on improving computational efficiency so that the CMAQ simulations may be completed in a time span comparable to those of other commercially-available air quality models. A new method for calculating aerosol coagulation coefficients was incorporated into the CMAQ aerosol module and tested extensively for efficiency and accuracy. The method of calculating the gas-aerosol partitioning of semi-volatile organic compounds was modified to reduce the computational burden. In combination, the coagulation and organic partitioning code changes reduce the aerosol module run time by 57%, which decreased the overall CMAQ model run time by 25% without affecting modeled concentrations. (Prakash Bhawe, 919 541 2194)

A project to improve the treatment of aerosol-phase inorganic equilibria is underway. Work will initially proceed by analyzing the approach used by scientists at the University of California-Davis in developing the Community Multiscale Air Quality Aerosol Inorganic Module (CMAQ-AIM). CMAQ-AIM is a model in which CMAQ is coupled to a 9-section aerosol module that includes sea salt reactions with nitrate in coarse particles. Future work will also include a comparison of the modal approach currently used in CMAQ with the sectional approach used in CMAQ-AIM. (Chris Nolte, 919 541 2652)

10. Fugitive Dust Emissions. A prototype for a new module that estimates the emission factors of fugitive dust sources from unpaved roads has been developed. The module, which is being developed for the Sparse Matrix Operational Kernel Emissions (SMOKE) system, will incorporate meteorological variables (temperature, surface pressure, mixing ratio, rainfall) to create hourly estimates of moisture for the surfaces of unpaved roads. This new module is intended to replace monthly averaged emissions that are currently used in the National Emissions Inventory (NEI). Testing and comparisons of the emissions generated by the new module to the NEI is underway. (George Pouliot, 919 541 5475)

11. Meteorological Model Evaluation Tool. Hourly surface observations and corresponding estimations (space and time) from an MM5 2001 year-long simulation have been loaded into the evaluation database. A series of statistical plots and tables has been generated for several subsets of data. The figures include scatter plots, histograms, a breakdown of the statistics as function of data range and a variety of spatial plots. The current results indicate that MM5 has a rather large cold bias during the winter, especially at night. During the daytime in winter, the model underestimates temperature but to a lesser degree. In summer, the model has a slight cold bias; this is greatest just after sunrise and sunset, indicating that the model may not accurately simulate the growth and collapse the

boundary layer. The data also show that the diurnal bias pattern in the summer and fall are reversed. The model was cool during the night in the spring and nearly unbiased during the day, and vice-versa during the fall. This may be a result of errors in the response of modeled deep soil temperature to the change of season. We will be experimenting with a time factor constant that would allow the deep soil temperature to be more responsive to surface air temperature. (Robert Gilliam, 919 553 4593)

12. Air Quality Information Technology Pilots (Center of Excellence). EPA has embarked on an effort to create a Center of Excellence (COE) for Environmental Scientific Computing. The goal is to create a centralized location for obtaining or sharing computational environmental data, products, or services, particularly where that science relates to the mission of protecting the environment and human health. An action plan has been developed to facilitate the design of the COE, where pilot projects are being developed as test cases. Three pilot projects have been initiated in support of the Air Quality COE. ASMD will work with several collaborating stakeholders to share air quality data, model inputs such as emissions or meteorology, and model outputs enabling both mutually beneficial collaborations and a demonstration of Information Technologies facilitated by the COE. (Gary Walter, 919 541 0573; Alice Gilliland, 919 541 0347)

13. Ammonia Exchange. A Quality Assurance Project Plan was prepared and approved for the project “High Resolution Modeling of Land-Atmosphere Ammonia Exchanges”, which is an Interagency Agreement between National Aeronautics and Space Administration (NASA) Goddard and the Division. The project involves development of modeling techniques for predicting the bi-directional surface exchange of ammonia. This project will also couple the ammonia model with NASA’s Land Information System (LIS), a global, high-resolution (1 km) high performance extension of the NASA Land Data Assimilation System (LDAS). (Donna Schwede, 919 541 3235)

14. Atmospheric Mercury. In February 2004, Russ Bullock will be attending a Steering Group Meeting of the Arctic Council Action Plan (ACAP) to reduce mercury contamination in the Arctic countries in Moscow, Russia. This meeting will deal with the development of air emission inventories for mercury by the Arctic Council member nations and a proposed mercury emission control study on a large industrial source of atmospheric mercury in or around the Moscow area. (Russell Bullock, 919 541 1349)

15. Spatial Modeling. Spatially correlated data sets collected on differing scales (point wise measurements vs. areal averages) is being developed and tested. The current implementation is appropriate for use with processes possessing a known, simple stationary covariance structure. This preliminary version contains parameters to incorporate model error, bias, and observational error. Work with spatially correlated data supports efforts in model evaluation, the NO_x initiative, and other projects. (Jenise Swall, 919 541 7655)

16. Calibration of the ATI-V Sonic Anemometer. In the field study of sub-canopy deposition conducted this past summer, we used a ATI-V style sonic anemometer to measure the flow and turbulence in the thickest part of a coneflower canopy. This anemometer was chosen for this application because it is very small, and can be inserted into the canopy without disturbing the surrounding vegetation. Unfortunately, the manufacturer had no calibration data on the instrument. We have completed a calibration of the instrument in the Fluid Modeling Facility (FMF), comparing turbulence measurements to those provided by the FMF’s Laser Doppler Velocimeter (LDV). Speed corrections were found to be a function of both azimuth and elevation angle. Correction equations have

been developed, and applied to the raw data collected this past summer. Corrected raw data have been processed into turbulence statistics, which will now be used in the evaluation of the Meyers-Paw U higher order closure model for sub-canopy deposition. (Pete Finkelstein, 919 541 4553)

17. Preparations for Upcoming Community Multiscale Air Quality Model Evaluation. The Division set up postprocessing codes and observational data to be used by ASMD and OAQPS scientists to evaluate the outputs from CMAQ model runs. These codes have been applied successfully to CMAQ test runs done for January and July 2001. The 2001 annual simulation should be completed during February, and the full ASMD evaluation plans can then proceed. (Alfreida Torian, 919 541 4803; Steve Howard, 919 541 3660; Alice Gilliland, 919 541 0347)

18. Resuspension of Extremely Hazardous Substances. ASMD is involved in deliberations of the resuspension of “Extremely Hazardous Substances”. The fraction of particulate material resuspended from the time of the spill until the time when no additional material could be resuspended ranges from ~0.1 % to 10 % . In addition, resuspension fractions at the time of a spill may be small enough that other processes (for example, combustion aerosolization) may dominate. However, for a long time following a spill, resuspension of extremely hazardous substances may be a very important mechanism. (Dale Gillette, 919 541 1883)

Idaho Falls

19. CBLAST-High. The Best Available Technology (BAT) turbulence probe and data system were removed from the P-3 and returned to FRD in early January. The system is currently “on the bench” and will undergo some upgrades to both the hardware and software before the upcoming hurricane season.

A meeting of CBLAST PIs is scheduled to take place in Miami in mid-February. The meeting will focus on analysis of data collected last summer and plans to publish data in reviewed literature. Discussions will also focus on upcoming field campaigns, which need to include additional funding for the BAT (currently our funding only includes data analysis in 2004). Further discussion will evolve around possible follow-on to CBLAST. jeff.french@noaa.gov

20. CBLAST-Low. A new method was developed to compute wave phase speed using wave height data obtained from three lasers mounted on an aircraft. The method does not require two flux legs in opposite directions, as was previously thought, to determine the true frequency. All wave parameters can be determined from one flux leg as long as time-series data from three lasers are available. The method is an extension of the work of Sun et al. (2003, in review) where they use two phase differences (the phase difference between lasers 1 and 2 and the phase difference between lasers 2 and 3) to compute the wave propagation direction and the true wave number (versus the encounter wave number) given the aircraft heading. Then knowing the aircraft heading, ground speed, and the peak encounter frequency, the wave phase speed can be computed. The wave age can then be computed from the wave phase speed and the friction velocity. Tami Grimmer, jeff.french@noaa.gov

21. JOINT URBAN-2003. The focus of activities for this month has been preparation of final data files that will be released to the project archive. The data from the Programmable Integrating Gas Samplers (PIGS) was converted into final output files, one file per IOP. Once the final files were generated, a time history plot of the SF₆ concentrations for each location was generated. These were

examined for inconsistencies or problems. The files are now ready for a final review before being sent to the data archive. A complete report on the QC procedures used during the project has been prepared and will be submitted with the data. An expanded description of the data and QC procedures is being prepared for inclusion in the project report.

The data from the real-time analyzers has also been converted to final output files. The generated files have been reviewed by plotting every column in the 390 data files and visually examining them for inconsistencies. The final step before the real-time analyzer data is complete is the insertion of pass numbers into the files for the mobile analyzer. The data will then be sent to the archive after a final review. A complete QC report has also been generated for these data and will be submitted with it. A description of the real-time analyzer data and QC is being generated for inclusion in the project report. roger@noaa.inel.gov, Debbie Lacroix, Neil Hukari

22. *BAT Probe Development.* Work was completed on the new all aluminum version of the BAT probe. The probe body is three separate pieces that are designed to be interchangeable from probe to probe. The interface piece (specific for a given install) and the hemisphere are machined from a solid rod of 2024 aircraft aluminum. The electronics cylinder, replacing the fiberglass cone, is machined from an extruded tube of 2024 aluminum. This version is designed to replace the standard fiberglass BAT for installations that require a more robust probe, such as for the P-3 install in CBLAST-High. The aluminum version increases the overall weight of the instrument from 6.6 lbs to 13.2 lbs., including electronics and wiring. The aluminum hemisphere is designed in such a way that it may still be mounted on a fiberglass cone for only a moderate increase in weight (roughly 1 lb) while still providing a significantly more robust sensor as the hemisphere is the portion most sensitive to damage. The probe was developed for the British Antarctic Survey. BAS will mount this particular probe on a Twin Otter. jeff.french@noaa.gov

23. *INEEL Mesoscale Modeling.* The new MM5 simulations continued to run reliably through January on a Linux workstation. Output from these simulations is currently limited to internal distribution within FRD. The public interface to FRD MM5 simulations is still coming from a different MM5 configuration on an older Alpha workstation. Given the reliability of the new simulations on the Linux computer, it is expected that the Alpha-workstation simulations will be deactivated in the near future, and the public interface will be shifted to the new simulations. The new simulations include many enhancements over the old ones, including initialization from higher resolution Eta-model output and more use of data assimilation. richard.eckman@noaa.gov

Las Vegas

24. *Cloud-to-Ground (CG) Lightning Study.* During January the spatial distribution of positive cloud-to-ground (CG) flashes was analyzed relative to topography. The analysis revealed that essentially no positive charge is deposited to the ground over the major mountain ranges in Southern Nevada. Consequently, in terms of the thunderstorm electric-field life cycle, thunderstorms develop over the mountain ranges and deposit negative charge to the ground in the early stage of storm development. As the storms move away from the mountains, they dissipate, and deposit positive charge to the ground.

Twenty-five years of thunderstorm and lightning data have been summarized for the Desert Rock Meteorological Observatory (DRA). These data are being used as baseline information to address

operational planning and personnel safety issues on the Nevada Test Site (NTS). The data base includes thunderstorm days, cumulonimbus (CB) days, and lightning days. CB days were used as the most general way of identifying those days when thunderstorm activity was likely to have occurred on the NTS. CB days are used because cloud observations are taken every hour and lightning is difficult to see during daytime. Initial analysis of the CB days data indicated little thunderstorm activity on the NTS between November 1 and March 1. (Darryl Randerson, 702 295 1231, Jim Sanders, 702 295 2348, and Doug Soule', 702 295 1266)

25. *MEDA Maximum Temperature Predictions Daily Charts.* A new map of the MEDA predicted maximum temperatures for the previous day, with verification, was programmed, and runs on a daily basis. The Forecaster now can easily see how well the statistical prediction of maximum temperatures for the MEDA sites is doing by looking at yesterday's predictions and verification. The link to the new map is on SORD's Web Page under "forecasts". (Doug Soule', 702 295 1266, and Jim Sanders, 702 295 2348)