



NOAA ARL Monthly Activity Report



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1. Highlight – New York City, Urban Dispersion Program. The new Department of Homeland Security's New York City - Urban Dispersion Program had its first organizational meeting for collaborators during June 29-30. Current plans envision a real-time-reporting meteorological and other sensors network operating continuously, and a series of tracer dispersion studies in Manhattan, spread over several sensors. Numerical and wind tunnel studies will also be conducted. Four ARL groups are involved – Idaho Falls, Oak Ridge, Research Triangle Park, and Silver Spring. This meeting served as a general overview of the program with more details to be presented and discussed at the next meeting during Fall 2004. This new program replaces elements of planning that were ongoing by the earlier proposed Urban Atmospheric Observatory (UAO). A two-week pilot study near Madison Square Garden based on an early plan completed by the UAO group is expected to take place during the late Fall 2004. The first major insensitive field study will be planned for Spring 2005, but the site has not been determined. Deployment of an urban area network of meteorological instruments is already underway.

The program is organized around five tasks, with PIs for each task. These tasks are:

- Developing and implementing a permanent NYC meteorological network.

- Developing and implementing a permanent radiation monitoring network.
- Field Programs: Designing and implementing field programs consisting of tracer studies, including SF₆ and perfluorocarbons.
- Applying urban models to assist in the design of the field programs and to help in understanding the data from field programs.
- Getting the results of the program into the operations of the NYC EOM.

The field programs will investigate the seasonal variation of dispersion in the NYC region with four different study periods planned in all four quarter of the year, beginning in March 2005. The results of the Midtown Manhattan fugitive SF₆ survey that was conducted in January 2004 by Kirk Clawson were published in June and presented to the NYC planning Group. Conclusions of this study were:

- Electrical substations in the city release SF₆ that impact the target test area around Times Square.
- There were no significant SF₆ sources other than the substations.
- The impacts of the East 13th Street and Central Park substations would be negligible under most wind conditions.
- Two types of dispersion tests can be conducted using SF₆.
- The SF₆ emissions of West 49th Street substation can be used as a source when winds are from the west and northwest.
- Under other wind conditions SF₆ can be intentionally released.

Based on these results, the area of the city where the field program is focused may be changed because of concerns about fugitive sources. ARL emphasized that the spatial domain of the field programs must be determined soon, since changing the test area will require another survey of fugitive sources. thomas.watson@noaa.gov, Kirk Clawson, Alan Huber, Ray Hosker.

2. Highlight Mercury and the Chesapeake Bay. Mercury contamination in the Chesapeake Bay is an ongoing concern with a potential for serious effects to public health and to the region's economy. At least 50% of the Bay's mercury loading may come directly from the atmosphere. To further elucidate this process ARL began monitoring atmospheric mercury species at Wye and Oxford, MD. Measurements of mercury in air and precipitation began at Oxford and Wye, two sites on the Eastern Shore of the Chesapeake Bay. Additionally at Oxford, SO₂, CO, and O₃ are being measured. Wye is an AirMon and NADP site with additional co-located measurements of interest. The project is a joint operation with the NOS Cooperative Oxford Laboratory, and the NOAA Chesapeake Bay Office. Measurements will be made until mid-August 2004. The data will be used to evaluate and/or improve atmospheric mercury modeling. Studies so far suggest that the Chesapeake Bay is receiving much more than average Hg deposition -- with a flux significantly higher than any other receptor in our experience (including the Great Lakes, etc.). One of the world's largest medical waste incinerators is in Baltimore, and there are a lot of incinerators and coal fired power plants in the local and extended region. The study may help to shed some light on critical scientific questions regarding the fate of mercury in power plant plumes (see below).

Three forms of atmospheric mercury are being measured – gaseous elemental mercury (GEM); reactive gaseous mercury (RGM); and fine particulate mercury (FPM). Each of these three mercury forms has its own dramatically different characteristic behavior in both wet and dry deposition. For ecosystem loading, RGM is the big actor. RGM concentration is up to three times as high at Oxford as at other locations recently measured. This identification of high RGM concentration underscores the impact

of atmospheric mercury on the Chesapeake Bay Ecosystem. steve.brooks@noaa.gov, Mark Cohen, Winston Luke, and Paul Kelly

3. Highlight Air Quality Forecast System - Start of 2004 Operational Season. Air quality forecasting over the eastern United States domain started on June 1, 2004; forecasting on the northeast United States domain had started a month earlier on May 1, 2004. Comparisons of model performance for surface ozone for the month of June, between the eastern United States and Northeast simulations show similar model performance for maximum 1-hour and maximum 8-hour statistical metrics. Comparison of hourly ozone performance statistics show improved performance in the eastern United States simulation due to improved representation of nighttime ozone titration resulting from changes in the minimum Kz specification algorithm. The new Kz specification algorithm is now being incorporated into the Northeast configuration.

Diagnostic simulations to assess the influence of ozone boundary conditions derived from the Global Forecast System (GFS) model on model simulations were continued. These involved limiting the use of the GFS-derived profiles to the upper layers of CMAQ. Based on results from these simulations and analyses of model forecast results, modifications to use of the GFS ozone profiles and incorporation of the minimum Kz specification algorithm for the Northeast domain have been recommended. Additional simulations testing the role of clouds in downward mixing of the GFS-specified ozone and subsequent impact on surface ozone concentrations are underway. (Rohit Mathur, 919 541 1483)

Silver Spring

4. Reactions of Reactive Gaseous Mercury in Plumes. At the recent 7th International Conference on Mercury as Global Pollutant, a number of important scientific issues were discussed, including a controversial matter regarding the fate of mercury emitted from coal fired power plants. In brief, coal-fired power plants are likely the largest source of mercury in the U.S. A portion of the Hg emissions from coal-fired power plants (~50%) is in the form of soluble, ionic mercury (sometimes called reactive gaseous mercury or RGM). RGM can deposit locally and regionally -- much more so than elemental mercury -- and so if the RGM remains as RGM in the plume, then there will be local and regional impacts from the coal-fired power plant. Some researchers at the meeting claimed that there is a very rapid reduction of much of the RGM to elemental mercury in power plant plumes.

If their claim is true, then emissions trading would not have the problem of creating "hotspots". Emissions trading for mercury is controversial; it's favored by industry and the EPA but opposed by many States and environmental groups. Also, if the reduction hypothesis is true, then the whole rationale of regulating power plants is called into question. The industry argues that they only emit 1-5% of total global emissions. If all of their emissions are functionally emitted as elemental mercury (due to rapid reduction of RGM), and all of this goes essentially into the global background pool, then they can argue that they are only 1-5% of the problem in any given area. mark.cohen@noaa.gov

5. Urban Dispersion – Revisiting METREX. The one-year MM5 calculation for 108/36/12/4 km grids centered about Washington, D.C. has been completed. The analysis is designed to yield detailed meteorological information to assist in re-analysis of tracer data obtained in the extensive METropolitan Experiment (METREX) of 1984. roland.draxler@noaa.gov

6. *Diurnal Cycles in the Free Atmosphere.* Radiosonde data have been used to scrutinize the amplitude and phase of the climatological diurnal cycle of temperature, from the surface to 10 hPa. The results are in general qualitative agreement with earlier studies, with some quantitative differences, but provide more detail about vertical, seasonal, and geographic variations. The radiosonde data have also been used to simulate the deep-layer mean temperatures that would be observed by the satellite-borne microwave sounding unit (MSU). Estimates of the amplitude and phase of their diurnal cycles are needed to improve corrections to MSU data to remove spurious trends associated with the orbital drift of the polar-orbiting satellites. A manuscript on “The Diurnal Cycle of Temperature in the Free Atmosphere Estimated from Radiosondes” by Dian Seidel, Melissa Free (ARL), and Junhong Wang (NCAR) has been prepared for JGR and submitted for internal review. dian.seidel@noaa.gov

Boulder

7. *SURFRAD/ISIS.* Instruments at two stations were exchanged during June. At Madison, WI, scientists from the Mechanical Engineering Department have submitted a paper for formal publication that uses data from the Madison ISIS site. They requested that a pyranometer that is presently mounted on an inclined solar panel (just north of the ISIS station) connect to our data logger.

8. *Errors in Radiation Instrumentation.* The SURFRAD group met with CMDL staff and staff from the National Renewable Energy Laboratory and the Pacific Northwest National Laboratory to discuss the problem of offset in pyranometers that measure global, or total, solar radiation. This second meeting of the group more narrowly defined the magnitude of the problem as about the same as that for the shaded pyranometer used to measure the diffuse-only solar radiation. Several steps were outlined to confirm or deny this conclusion through more experiments and analyses. The conclusions thus far reached will be presented to the BSRN group at this year’s meeting in Exeter, UK. joseph.michalsky@noaa.gov

9. *ARL Umkehr Developments Adopted.* Update for the Umkehr ozone profile retrieval algorithm were presented at the recent ozone symposium (Kos, Greece). Considerable discussion concerning the value of Umkehr observations took place at an Umkehr sub-committee meeting, called by the International Ozone Committee (IOC). A decision was made that the sub-committee on Umkehr algorithm and data analysis should make recommendations and report them directly to both the World Meteorological Organization (WMO, SAG Ozone), and IOC. The sub-committee also recommended that the current “best” algorithm, based on the outcome of new work by Dr. Irina Petropavlovskikh (NOAA/ARL/SRRB), and P.K. Bhartia (NASA/Goddard), be adopted for use in the World Ozone and UV Data Center (WOUDC, Canada), and that the existing Dobson Umkehr data be reprocessed. Both the existing and reprocessed data will be made available to the community. An agreement has been made to pursue a better algorithm for analyzing Brewer Umkehr data as well. irina.petro@noaa.gov

10. *Automatic Computation of Aerosol Optical Thickness.* A code is being finalized will lead to an aerosol optical thickness product for SURFRAD. The intent is to permit use of all channels of the spectral instrument (MFRSR) deployed at SURFRAD stations. The system will automatically screen cloud interference from aerosol optical thickness time series using an algorithm developed at SRRB. The work is being done by Carlos Medina, a fifth year Civil Engineering student at the Colorado School of Mines. Carlos is a SOARS summer student. SOARS is an EEO program

sponsored by the University Corporation for Atmospheric Research. Part of SOARS' funding comes from NOAA's Office of Global Programs. john.augustine@noaa.gov

Oak Ridge

11. Urban Dispersion – NOAA Rapid Response Tool (RRT). A NOAA Rapid Response Tool (RRT) system, using ArcGIS, was built for use by the Department of Homeland Security in Washington, D.C. The system uses two 20-inch LCD flat-panel screens to display a user interface significantly re-organized from past versions. An upgrade of the NOAA RRT system was also installed for Bill Peterson and John Irwin at the NOAA/EPA facilities in RTP, NC. ed.dumas@noaa.gov and Will Pendergrass

Idaho Falls

12. Smart Balloon. The Smart Balloon and electronic payload was tested on the ground over the course of several weeks to ensure the proper operation of the balloon controls and reliable satellite communication. The Smart Balloon with the newly improved electronic payload was launched in the early afternoon of June 19th and tracked for about four and a half hours. Communications and balloon controls worked flawlessly. The balloon cut-down worked as planned when high winds associated with a local afternoon storm started blowing the balloon into the mountains east of Idaho Falls. The balloon was recovered from its landing point about 20 meters from an access road. There was no damage to the balloon or the transponder payload. The balloon is ready for deployment to the AIRMAP/Targeted Winds Project in July. randy.johnson@noaa.gov and Shane Beard

13. Pentagon Shield. The initial analysis of the data from the continuous SF analyzers has been completed. Work is now focusing on resolving a number of problems with the data files. These include incorrect times, data sets split into multiple files, incorrect limit of detection calculations, etc. The problems should be resolved within a couple weeks and work will begin on attempting to estimate baseline from zero-air calibrations during extended periods of high concentrations of SF₆. roger.carter@noaa.gov

The analysis of the programmable integrating gas samplers (PIGS) was finished this month, including all re-analysis of samples that did not meet quality control acceptance limits. All the QC average results were calculated and graphed to look for trends. These results were compared to the QC target limits that we have determined for this project. All the time history plots have been printed and have been reviewed. Efforts to track the reasons for bag or cartridge results that do not appear to be valid are ongoing. Multiple download problems have resulted in several pages of changes to be made to the final data output.

The method limit of detection (MLOD) and the method limit of quantitation (MLOQ) were also calculated. The final MLOD and MLOQ have not been chosen, however, due to a positive bias on the low end up until about 40 pptv. We are attempting to determine what caused this bias in the controls, and how it correlates to the sample results. In choosing the MLOD and MLOQ, we consider many different indicators including the recovery percentages, signal to noise ratios, and the percent relative standard deviation (RSD). For this project the recoveries on the low end (<44.9 pptv) are greater than acceptable. This is an indication of some kind of low level contamination.

The lab controls do not show this bias, and this problem did not occur with the Joint Urban 2003 study. debbie.lacroix@noaa.gov

14. Aircraft Eddy Fluxes – the P-3. Test and calibration flights were conducted with the NOAA P-3 on the 28th and 30th of June. One five-hour mission was flown on each of the two days. The main goals of the flights were (1) to provide calibration data for the ARL turbulence probe and verify proper operation of the probe, and (2) to test new flight patterns for the upcoming hurricane season. For the both objectives, the test/cal flights were a success, although two of the sensors on the BAT were not operating properly during the first flight. On the down day between flights, it was determined that there were several suspect electrical connections on the new sensor board. These connections were fixed and the subsequent flight proceeded without any problems.

In an attempt to maximize the utility of flight time spent below 1200 meters for the upcoming hurricane season, new flight strategies were developed and tested. Fewer flight levels will be used, but there will be longer runs at a given flight level. The new patterns were tested and deemed successful. jeff.french@noaa.gov

15. Extreme Turbulence Probe. The modified “big port” ET probe has now been tested several times in the rain. In each case, it has performed well. The Gill sonic anemometer that is operated with the ET probe in these tests generally has severe problems with rain spikes. In contrast, the ET probe has continued to operate without any noticeable spikes. The only sensors that have shown some rain effects are the temperature sensors in the “mushroom” housing on top of the probe. In some cases, water appears to have coated these sensors. This is difficult to eliminate without totally redesigning the mushroom housing. Based on the success of the design, a second ET probe is being modified. The plan is to deploy two of these “big-port” ET probes during the upcoming hurricane season. ATDD is working on a separate design that uses an air pump to flush the ports. If this design works out, total of three ET probes may wind up being deployed this season. richard.eckman@noaa.gov and Tom Strong

16. Proteus Aircraft. The manufacture of the BAT cone and hemisphere were completed this month. The electronics were tested and calibrated. The final assembly will be completed in July in anticipation of an installation on the Proteus aircraft sometime in August. jeff.french@noaa.gov

17. INEEL Emergency Operations Center (EOC). There were several exercises at the EOC during June. The Annual Training Exercise took place on June 16. The scenario involved a traffic accident between two trucks that resulted in a wildfire. Meteorological support was provided by Rick Eckman and Debbie Lacroix. They provided current weather conditions and forecasts with emphasis on the shifting wind conditions and plume projections using MDIFF. On June 24 the EOC was activated for a hydrogen fluoride release at the INTEC facility. A small leak was detected in a gas cask which was quickly stopped. The last EOC exercise was the Quarterly Assessment Specialist Drill on June 29. This was a training exercise for the people manning the EOC Planning Room. richard.eckman@noaa.gov.

18. State of Idaho and INEEL Support. As a result of a request from the State of Idaho’s INEEL Oversight Program, FRD is looking to various methods for estimating the depth of the planetary boundary layer (PBL). This is a standard input variable required by most dispersion models. A climatological database of PBL depths is available for INEEL based on soundings taken many years ago, but FRD currently has no standard procedures for estimating this depth. Three approaches are

being considered. One is to manually estimate the depth using the data from the radar-profiler system operated at the site. This system provides both wind and temperature profiles, and would be useful for locating the capping inversion at the top of the PBL in convective conditions. A second approach is to use data from the surface-flux tower operated at INEEL by FRD. This tower provides both energy and momentum fluxes. Various algorithms have been proposed in the literature for estimating PBL depth using such surface data. This approach has the advantage of being more automated, and may be particularly suited for stable conditions. A third approach is to use the forecast PBL depths generated by the MM5 model runs at FRD. This would be most useful when one is trying to project a contaminant release several hours out into the future. richard.eckman@noaa.gov

Las Vegas

19. The Las Vegas Urban Test Bed. Initial steps have been taken to bring together the many organizations starting to collect data for the Las Vegas area. The program now evolving is being led by the Cooperative Institute for Atmospheric Sciences and Terrestrial Applications (CIASTA), which works closely with ARL in Las Vegas. Funding for the Las Vegas activity is being provided by Clark County, in which Las Vegas resides. A meeting is being planned for 3 August, to initiate discussion among the various players. In essence, the Las Vegas activity is an extension of the ARL Nevada mesonet into the urban area. darryl.randerson@noaa.gov, Walt Schalk