NOAA ARL Monthly Activity Report

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Highlights

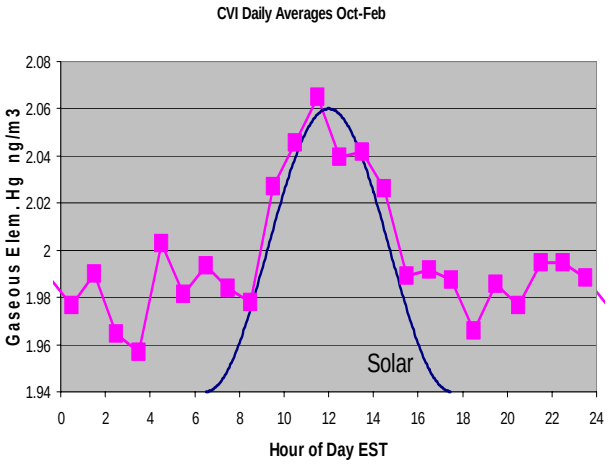
1. Interim and Operational Smoke Forecasting. For the last few years, NOAA ARL has been developing a smoke forecasting tool in collaboration with NOAA NESDIS and making the results available via the READY website at http://www.arl.noaa.gov/smoke/index.html. Smoke forecasts are produced with the ARL HYSPLIT model, which is preconfigured to run over the entire country once-a-day to produce a 72-hour forecast using the NOAA NCEP NAM 12 km meteorological forecast data. The smoke forecasts are now being produced daily by NCEP and verification statistics are being created on the ARL website. Within the next few weeks these experimental forecasts will be made available by the NWS to air quality forecasters in order to get feedback on the usefulness of the product. In addition, NESDIS continues to work on using a GOES aerosol optical depth product as a possible verification tool for the HYSPLIT forecasts. glenn.rolph@noaa.gov

2. Atmospheric Mercury Activities. It is well known that some forms of atmospheric mercury deposit to ecosystems, where the mercury can bioaccumulate to potentially dangerous levels. The process is of most concern in coastal areas, where deposited mercury ends up in the tissue of fish that can then be consumed by people. Consumption of mercury-tainted fish can be dangerous, particularly for children, before and after birth. There are known to be mercury hot spots in the coastal waters of the Gulf of Mexico, and much of the national research effort is focused there. Three ARL Divisions are working with several NOAA line offices and with other federal and state agencies on establishing a NOAA-wide mercury research program that links with a larger federal effort. This program will combine monitoring, process research, and modeling, to start in FY 2008.

As a first experimental step, and in recognition that relevant data are urgently needed by the modelers working on the problem, ARL is currently establishing at least one mercury monitoring site in the Gulf of Mexico region, to measure speciated atmospheric mercury (i.e., to measure both mercury levels and their

chemical composition). A number of potential sites have been examined, including several pre-existing local, state and federal monitoring sites (for collocation possibilities). An ideal site (or sites) would provide information on regional background conditions as well as on source-impacted conditions. Winston Luke, Mark Cohen, and Steve Brooks are the primary ARL scientists working on establishing this monitoring program, which is evolving as a partnership between the ARL Silver Spring and Oak Ridge Divisions. winston.luke@noaa.gov and mark.cohen@noaa.gov

It is suspected that local coal-fired power plants contribute significantly to local mercury deposition, but this is rather contentious because of the large background levels of mercury in air arising from distant emissions (as far away as Asia). The experimental site operated by ARL in collaboration with the Canaan Valley Institute is now being expanded to provide speciated mercury data, and data on mercury deposition. This site is located in the area of direct influence of emissions from the coal-fired power plants along the Ohio River. In late December surface snow at this location was found to have rather high mercury concentrations, from 6 ng L^{-1} to 8 ng L^{-1} due, presumably, to the dry deposition of soluble reactive gaseous mercury from regional sources. Oxidized mercury in surface snow undergoes photoreduction to gaseous elemental mercury, which passes into the near-surface air. This is evident in the figure, where the average atmospheric concentration is clearly correlated to the incident solar radiation. steve.brooks@noaa.gov and chris.vogel@noaa.gov



Two ARL Divisions are actively involved in the development of mercury deposition models. The group at Research Triangle Park is focusing on Eulerian methods for assessing regional deposition rates. The group at Silver Spring is developing Lagrangian methods for identifying the origins of mercury being deposited at specific locations. Both groups have been involved in a number of formal mercury modeling intercomparison exercises. The intercomparison activities started with an extensive international comparison of mercury models. A summary of this project can be found at: *http://www.arl.noaa.gov/ss/transport/cohen.html#item36*. Second, the HYPSLIT-Hg (Lagrangian) deposition results have been compared against CMAQ-Hg (Eulerian) predictions for the Great Lakes, with emphasis on the role of U.S. coal-fired power plants. Other intercomparisons among models have been conducted, and are summarized in a recent presentation, available at: *http://www.arl.noaa.gov/ss/transport/cohen.html#item40*. The model intercomparsions generate a feeling of security and confidence that is likely somewhat misleading, since there are very few actual data against which to compare. The NOAA program that is now evolving and the data from the ARL Gulf Coast and Canaan Valley sites will provide the some relevant data. mark.cohen@noaa.gov

The open question is whether local deposition of mercury can be attributed to nearby power plants or to the consequences of long range transport. There is strong interest in this issue. Early work by ARL, funded by the EPA and in collaboration with Canadian researchers associated with the International Joint Commission on the Great Lakes, has drawn Congressional interest. In response to a direct Congressional mandate, ARL has prepared a Report to Congress on mercury contamination in the Great Lakes. The report is undergoing intra- and inter-agency review. The EPA-NOAA review and consultation process is nearing completion, and it is expected that the report will soon be submitted to the Office of Management and Budget. Mark Cohen, Roland Draxler and Richard Artz are the primary authors of the report. However, the models are still being improved. Work continues on both the Lagrangian and Eulerian models. The goal is to be able to conduct

comprehensive source-attribution studies for key receptors (e.g., Gulf of Mexico, Great Lakes, etc.), including estimates of the relative importance of global sources to mercury deposition. mark.cohen@noaa.gov

3. *Memorandum of Agreement with DOE, Idaho Falls.* An initial meeting was held with DOE personnel in February to discuss the NOAA-DOE interagency agreement (IAG) covering INL activities, which is up for renewal in FY 2007. One of the items discussed was the possibility of developing a Memorandum of Agreement (MOA) between the two agencies in addition to the IAG. The MOA would describe the benefits to each agency of the partnership activities in Idaho Falls, and would help to address some of the misunderstandings that have sometimes arisen at higher levels within each agency. Also under discussion is the need to ensure that the new IAG provides sufficient resources to continue FRD's applied research activities related to dispersion modeling. A recent transformation of priorities at INL has created several new potential areas of collaboration. kirk.clawson@noaa.gov and Richard Eckman

Silver Spring

4. PC HYSPLIT Training. HYSPLIT is among the most widely used atmospheric dispersion models, having been adopted by the National Weather Service (NWS) and by the meteorological services of several other countries as their operational dispersion code. Training classes have been offered several times within the last 3 years and have been quite popular, but attendance is intentionally kept small. On May 9-11, another training workshop will be held at the NOAA facility in Silver Spring.

The coming class will be made up of PC HYSPLIT users from the NWS, state governments, private companies, and several foreign institutes. Past workshops have involved a similar mix of attendees.

The class is developed and offered by Roland Draxler, Glenn Rolph and Barbara Stunder from ARL Silver Spring, MD. glenn.rolph@noaa.gov

5. National Volcano Early Warning System (NVEWS). Forecasting ash plumes from volcanoes is necessarily a multi-agency activity, currently involving the US Geological Survey (USGS) and the Federal Aviation Administration (FAA) as well as NOAA. Recently, the USGS sponsored a workshop to present preliminary plans for NVEWS to local emergency managers, aviation concerns, and other stakeholders, and to receive feedback before developing an implementation plan. The USGS has rated 169 geologically active volcanoes in the US in terms of possible hazard and exposure. The volcanoes in the "very high threat" category are in Washington, Oregon, California, Alaska and Hawaii. The idea is to set up monitoring, fund research, etc. before volcanic unrest so that early warnings would be possible. Presentations at the workshop illustrated the importance attributed to the operational HYSPLIT product, that is supported by ARL. In particular, the ARL trajectory and NWS (ARL-developed) dispersion products were used by air traffic controllers in the Augustine, Alaska, eruption response. barbara.stunder@noaa.gov

Oak Ridge

6. Collaboration with the Indian Institute for Technology. Dr. K. S. Rao was an invited participant in the International Conference on Mesoscale Processes in Atmosphere, Ocean and Environmental Systems (IMPA 2006), organized in connection with the Silver Jubilee celebrations of the Center for Atmospheric Sciences (CAS) at the Indian Institute of Technology (IIT). He presented an invited talk titled "Source estimation methods for atmospheric dispersion". He also co-chaired two sessions and led panel discussions to make recommendations at the end of the conference. Discussions with several well-known scientists from France, Russia, UK, USA, as well as India, focused on adjoint methods, variational data assimilation techniques, etc. shankar.rao@noaa.gov

7. Dispersion – Collaboration with DTRA. The annual meeting of the DOD's TTCP Technical Panel 9 was held in Salt Lake City February 13 – 16, with invited attendees from Australia, Canada, New Zealand, the

UK, and the U.S. The status of research related to urban dispersion was extensively reviewed. R. P. Hosker presented a brief overview of planned NOAA/DTRA work on coastal dispersion, expected to begin this spring. ray.hosker@noaa.gov

8. Visit from the Government Accounting Office. A three-person GAO team visited ATDD on February 23 to discuss the status of present and needed research on sensor data fusion. They will provide a report to a House Subcommittee that requested the GAO research. ray.hosker@noaa.gov and Will Pendergrass

Research Triangle Park

9. CMAQ and HYSPLIT Models Used to Investigate Maximum 8-hr Ozone. Various analyses have been underway using the capabilities of the Community Multiscale Air Quality (CMAQ) and HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) modeling systems and the tools linking them to assess the impact of recent NO_x point-source emission reductions on maximum 8-hr ozone concentrations in the eastern United States. CMAQ model simulations have been performed for the summer periods (*i.e*, June, July, and August) of 2002 and 2004 on a regional domain encompassing the entire eastern half of the United States with a 12-km grid-cell size. The four model simulation scenarios defined a complete 2 x 2 matrix of meteorology (Met) and emission (Emis) combinations: (1-1) 2002 Met + 2002 Emis, (2-2) 2004 Met + 2004 Emis, (1-2) 2002 Met + 2004 Emis, and (2-1) 2004 Met + 2002 Emis. The emission data sets consisted of base case 2002 emissions and the 2004 emissions reflected notable NO_x reductions at numerous major point-sources in the modeling domain. The design of these model simulations permitted an investigation of the separate effects of meteorology *(i.e.*, summer 2002 versus 2004) and emissions (*i.e*., base 2002 emissions versus reduced NO_x emissions in 2004) on maximum ozone concentrations in the region. Model results indicated that the meteorological differences between the two summers periods *(i.e.*, warmer, drier conditions in 2002 versus predominately cooler, wetter periods in 2004) had a much greater effect on maximum ozone levels than the emission differences from model simulations. The effort underway involves detailed analysis of pollutant transport with the HYSPLIT model to help identify a subset of cases with similar airflow originating from the Ohio Valley region, where numerous point sources experiencing large emission changes exist. Back trajectories from particular CASTNet (Clean Air Status and Trends Network) monitoring sites were generated by HYSPLIT, which utilized the same wind fields applied in the CMAQ simulations. Modeled ozone concentrations from this set of cases with airflow from the Ohio River Valley area into the northeastern/mid-Atlantic states will be examined between the base case and emission reduction simulations to assess the impact on maximum ozone levels. Forward trajectory calculations from selected major point-source locations are being performed with the HYSPLIT trajectory model so that CMAQ concentrations can be extracted along the trajectories to also investigate concentration differences between the base case and emission reduction runs.
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10. Weather Research and Forecasting Model (WRF) Workgroup. The Division's Weather Research and Forecasting Model (WRF) Workgroup held its kickoff meeting on February 3, 2006. The WRF Workgroup is challenged with the task of transitioning internal meteorological modeling activities from the Penn State/National Center for Atmospheric Research Mesoscale Model (MM5) to WRF. The WRF Workgroup is a subsidiary of the Division's Model Development Group, and it will have synergies with other internal workgroups such as the Two-Way Coupling Workgroup and various evaluation workgroups. The WRF Workgroup is comprised of Division staff and contractors, and it will meet once per month. tanya.otte@noaa.gov

Idaho Falls

11. Urban Dispersion Program in New York City. A NOAA Technical Memorandum documenting FRD's participation in the MID05 Urban Dispersion Program is in preparation. This report will focus on the data obtained. Research based on these data is now commencing. Our partners in this endeavor were the U.S. Depts. of Homeland Security and Defense. An internal draft has been completed, and the document should be ready for ARL review by March 31. The results of this project should make a valuable contribution to our understanding of atmospheric dispersion processes in urban environments and deep street canyons. roger.carter@noaa.gov, Debbie Lacroix, Jason Rich

12. TexAQSII -- Smart Balloon. Several groups are planning on using the ARL/FRD "Smart Balloon" system in the Texas Air Quality study to take place later this year. Smart balloon communications testing between the balloon and a ground tracking station were completed during February. Satellite telephone communications were markedly improved after a dial-out routine was added to the balloon package. This routine was mandated by General Dynamics (operator of the Iridium satellite system) to insure continuous communications. Circuit board layout is now complete for the interface board that connects all devices together. Instrument and communications testing continues for implementation before the balloons are deployed in the upcoming TexAQSII air quality study to be held during August and September, 2006 in Houston, TX. randy.johnson@noaa.gov and Shane Beard

Las Vegas

13. A Moving Mesonet. It is well known that different network configurations are required for different applications. Refining the design of local networks and the models to make use of their data is a focus of the group at Las Vegas. The data acquisition and model adjustments go hand in hand, in order to meet the demands of the operational components of the program. In line with previous experiences, the "Divine Strake" test series now being planned has called for a reconfiguration of the ARL mesonet in Nevada. An assessment of the test-specific meteorological data needs for this experiment has now been completed and a plan for the installation of new remote sensors has been formulated. Due to predicted blast over pressures, the ground-zero (GZ) weather tower (MEDA 21) will be moved one mile east of its' present location. Two additional MEDA stations will be installed, one on a hill top (5500 ft MSL) approximately two miles south of the GZ and the other on top of Tippipah Peak (6500 ft MSL), approximately two miles southwest of the GZ. These data, when melded with 15-min data from the other mesonet stations, will provide a refined basis for forecasting dispersion regimes as required to support the test operations.

In parallel with the data acquisition changes, research is under way on how best to forecast for the test series, and especially on how to display the predictions. During test operations, all required meteorological data and dispersion calculations will be displayed to test management in real time on wide screens in the test operations center (CP-1) on the NTS. An additional safety focus will be on the prediction, detection, and warning of cloud-to-ground lightning within 10 miles of the GZ. darryl.randerson@noaa.gov and Gerry Fleming

14. USDA Agriculture Air Quality Task Force. ARL is contributing strongly to the evolving USDA plans for a new Air Quality Program. As specified by the Federal Agriculture Improvement and Reform Act of 1996, the USDA commissioned an Agriculture Air Quality Task Force to oversee and review research in agricultural air quality issues in order to ensure intergovernmental cooperation in research activities and to advise the Secretary of Agriculture regarding the scientific basis of the impact of agriculture on air quality. At the most recent meeting of this Task Force, members were thanked for their efforts, by the Secretary of Agriculture and by the Administrator of the Environmental Protection Agency. Due in large part to the urging of the Task Force, over the last year several USDA agencies have been adding air quality expertise to their staff (9 at Agricultural Research Service and 6 at Natural Resource Conservation Service) and substantially increasing their budgets for air quality-related activities ($10M in assistance from Cooperative

State Research Education and Extension Service and $44M from Natural Resource Conservation Service). All of the presentations made at the meeting are available at http://www.airquality.nrcs.usda.gov/AAQTF/index.html. marc.pitchford@noaa.gov