



NOAA ARL Monthly Activity Report



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1. Highlight -- Air Quality Forecast Model Development and Analysis. The development of a nationwide forecast model using the Community Multiscale Air Quality (CMAQ) model driven with the Weather Research and Forecasting-Non-Hydrostatic Mesoscale Model (WRF-NMM) model is proceeding at the National Weather Service (NWS), in collaboration with ARL. The air quality forecast model is currently deployed in two streams: (1) to provide prototype operational forecasts for the eastern United States, and (2) for experimental forecast simulations over the continental United States. Both simulations employ a 12-km horizontal grid resolution. The operational North American Mesoscale (NAM) model, currently Eta, is expected to be replaced by the WRF-NMM in June 2006. Both the horizontal and vertical grid and coordinate structures employed by WRF-NMM are different from those traditionally employed in CMAQ applications. To reduce errors associated with the interpolation of meteorological data from the coordinate and grid structure of WRF-NMM to that of CMAQ, efforts are underway to improve the interactions and consistent use of data between the two models. The first step in this effort, namely improving coupling in the vertical

direction such that the CMAQ calculations are performed with the same hybrid sigma-P vertical coordinate system that is utilized in the WRF-NMM, was completed. Initial tests for a retrospective case indicated the model updates were performing satisfactorily. The system is being further tested through deployment in the experimental forecast runs. rohit.mathur@noaa.gov, Tanya Otte, and Jonathan Pleim

2. Highlight -- UrbaNet. All ARL Divisions are working on the UrbaNet program. The program is designed to test the hypothesis that data from local (and comparatively dense) urban meteorological networks can be used to improve dispersion forecasting for cities and their surroundings. The local (surface) data are mainly provided by commercial networks. The exposure of these sites is such that their data cannot be readily used for conventional weather models, since the observations are made well within the part of the atmosphere that is directly affected by local obstacles. However, this same “problem” means that the observations are indeed indicative of the atmospheric behavior that will affect people within the urban canopy. The challenge is to work out how to capitalize on the data that are available, given that conventional synoptic wisdom is largely inapplicable. Silver Spring and Research Triangle Park scientists are testing this, by exploring the benefits of assimilating surface data into a modified mesoscale model. Oak Ridge and Idaho Falls are addressing dispersion within the urban canopy, seeking ways to exploit the relevant data from local networks. Las Vegas is soon to become a testbed somewhat similar to that already set up for Washington, DC, and the National Capital Region. The ARL group in Las Vegas is taking the lead in this activity. Collaboration with the University of Nevada, Las Vegas and with the local emergency management community is anticipated.

A tracer study in Las Vegas is being planned. ARL’s Field Research Division (FRD Idaho Falls) has contacted the local utility company in Las Vegas to locate possible fugitive sources of SF₆ in the area. If there are leaking substations that are conveniently located, then a survey of tracer concentrations using a mobile sampler could be exceedingly informative. Moreover, locating fugitive SF₆ sources will save time and money in preparing for a full scale atmospheric tracer study in the future. jason.rich@noaa.gov

Silver Spring

3. WMO Emergency Response Program. NOAA provides the WMO Regional Specialized Meteorology Center (RSMC) capability for the USA, through collaboration between NCEP and ARL. The Center is the internationally-recognized WMO source for dispersion guidance for the USA. Roland Draxler attended the recent WMO Emergency Response meeting, at which it was agreed that all of the Centers have the technical capability to provide "backward dispersion" products that could be used for source attribution. For instance a country may measure high radiation levels and want to know the origin of offending material. Currently this is not part of the RSMC program, but the operational version of HYSPLIT has the capability to run in the backwards mode. At this point there is nothing we need to do. But the issue will come before WMO in November and if all countries agree that RSMCs should provide such a capability, then WMO will formally ask each of the RSMCs if they want to provide that additional service. The request will come from the WMO to the Permanent Representative. Similar to the standard accident scenario, where International Atomic Energy Agency (IAEA) provides the international coordination, the

CTBTO (Comprehensive Test Ban Treaty Organization) would provide the coordination for the source-attribution simulations. roland.draxler@noaa.gov

4. Developing Protocols for Reference Upper-Air Observations. A consensus is building regarding the need for, philosophy behind, and reasonable design of a Global Climate Observing System (GCOS) Reference Upper-Air Network. Dian Seidel was a member of the organizing committee for two recent workshops and will be involved in follow-on activities. The first workshop in the series was the "NOAA/GCOS Workshop to Define Climate Requirements for Upper-Air Observations", held in Boulder, February 2005. The second was on "Reference Upper Air Observations for the Global Climate Observing System: Potential Technologies and Networks," held at the Applied Physics Lab, University of Washington, Seattle, 22-24 May 2006. This meeting was sponsored by NOAA and the GCOS program. For more information, see http://www.oco.noaa.gov/index.jsp?show_page=page_meetings_gcoss.jsp&nav=universal dian.seidel@noaa.gov

In parallel with this activity, there is growing attention to the need for improved calibration for satellite instrumentation. A workshop on "Achieving Satellite Instrument Calibration for Climate Change (ASIC3)" was held on 16-18 May 2006 in Lansdowne, VA. This was a follow-on workshop to the meeting on "Satellite Instrument Calibration for Measuring Global Climate Change" held November 2002 in College Park, MD. The main goal of this activity is to try to ensure that satellite data will be useful for climate change monitoring and research, and thus has considerable common interest with the reference upper-air activity described above. More information is available at the workshop website <http://www.sdl.usu.edu/conferences/asic3/>. dian.seidel@noaa.gov

5. Forest Fire Forecasting with HYSPLIT-Chemistry. A postprocessor has been developed to calculate Aerosol Optical Depth (AOD) from the CMAQ model, to permit comparison of the model results with satellite measurements. HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) and CMAQ model results were subsequently compared with MODIS (MODERate Resolution Imaging Spectroradiometer) AOD measurements. Both models under-predict the satellite AOD. However, they capture the spatial evolution of the smoke plume. ariel.stein@noaa.gov

6. HYSPLIT Training. A training workshop was conducted May 3-5 for 12 participants. An updated version of HYSPLIT based upon issues that came up during the training will be released next month. Members of the class were from other ARL divisions, the Earth System Research Laboratory's Global Systems Division (formerly the Forecast Systems Laboratory), NWS, National Ocean Service, National Institutes of Health, state health and air quality agencies and one foreign radiological organization. The class covered operation of and applications using the PC version of HYSPLIT. roland.draxler@noaa.gov, Barbara Stunder, Glenn Rolph

The educational package which trains users on the operations of HYSPLIT is currently being reviewed externally. Recommendations for improvement have been prepared, and will be presented to ARL in June 2006. These recommendations follow from the guidance generated in earlier studies conducted for NASA on "Defining Best-In-Class Processes at NASA" (American Society for Quality (ASQ) World Conference on Quality and Improvement, 2005, with NASA HQ permission). A 3-tier approach (beginner, intermediate, advanced) will be very useful for future editions, and will

improve readability and utility. A HYSPLIT training course in Europe is being discussed. ariel.stein@noaa.gov

Oak Ridge

7. *East Tennessee Ozone Study (ETOS)*. The East Tennessee Ozone Study (ETOS) 2006 Science Workshop was held on May 17-18 at the Pollard Technology Conference Center in Oak Ridge. The opening session of the workshop featured remarks by Carolyn Carter Jensen and Jonathan Griswold from the Offices of Senator Bill Frist and Congressman John J. Duncan, respectively, as well as by Dr. Richard Spinrad, Assistant Administrator, NOAA/Office of Oceanic and Atmospheric Research, and Mr. Richard Artz, Acting Director, Air Resources Laboratory. Both Dr. Spinrad and Mr. Artz stressed the significance of NOAA's partnering with other federal entities, state and local agencies, and academia to address key societal issues such as air quality.

Over 70 attendees, representing academia, government, local interest groups, and private industry, participated in the two-day workshop. Opening remarks and some technical presentations are available at

http://www.atdd.noaa.gov/Research_Page_Additions/ETOS_additions/etosworkshop.htm.
latoya.myles@noaa.gov, Pendergrass, and Ridenour)

8. *Multiagency Urban Dispersion Study*. A meeting of the Urban Dispersion Program (UDP) participants in the August 2005 study in New York City was held in Salt Lake City May 3 – 4. Summaries of data collected and preliminary analyses were presented. The main topic, however, was the unavailability of funding from the Dept. of Homeland Security for both data analysis and a second field study. Perhaps additional funding will be available in future years, but for now the UDP is almost at a standstill. This leaves NOAA as the only civilian agency addressing the issue of how to forecast dispersion in cities and urban areas. ray.hosker@noaa.gov

9. *WP-3D Turbulence Probe System*. Software modifications and changes were made to the Best Available Turbulence (BAT) Probe system after numerous test trials on the bench. Environmental testing was conducted by rigging the Probe on a test fixture attached to a car. The probe demonstrated flawless operation of the new sensors and data system for turbulence measurement from NOAA's P-3 aircraft and other applications. Unfortunately, installation is unlikely this year because of higher priority for other hurricane instruments on the P-3. A second probe is being constructed and calibrated. ed.dumas@noaa.gov, P. Hall, and Senn

Research Triangle Park

10. *Climate Impact on Regional Air Quality (CIRAQ)*. As part of the CIRAQ project, outputs from a global circulation model are being used to provide boundary conditions for the CMAQ model in simulations of two five-year periods representing current (1999-2003) and anticipated future (2048-2052) air quality. For these simulations, anthropogenic emissions were held constant at 2001 levels to isolate the effect of climate change from the effect of changing emissions. Ten years of air quality simulations are now complete and analysis is in progress. Preliminary results indicate (1) an increase in the frequency and duration of ozone episodes (8-h maximum > 80 ppb), particularly in

the West and Southeast; and (2) a 1-2 ppb decrease in PM_{2.5} throughout most of the United States. chris.nolte@noaa.gov

11. *Linking Air Quality and Human Exposure Models.* To illustrate how air quality models can be used to provide inputs to human exposure models, an integrated air quality-exposure model has been developed for application in Philadelphia, Pennsylvania. In this example, results from the CMAQ simulations (4-km grid) over Philadelphia were used as an input to the Stochastic Human Exposure and Dose Simulation (SHEDS) model for benzene. To provide sufficient detail in air quality inputs for exposure modeling, CMAQ was used to provide regional background concentration values and contributions from chemically-reactive pollutants. SHEDS was applied to provide annual exposures for the population by accounting for the actual demographic characteristics of the region and by simulating human activities using the hourly ambient concentrations from the CMAQ simulation. A related paper is now in ARL review. vlad.isakov@noaa.gov

12. *Modeling Atmospheric Deposition of Nitrogen to the Chesapeake Bay.* An approach has been developed to link the CMAQ modeling system with the Bay Watershed Model by using dry deposition estimates directly from CMAQ for the watershed model input. With this link, the uncertainty in dry deposition has become an important issue. This topic is of major concern to ARL as a whole. There are chemical complexities as well as issues related to terrain complexity. At a recent meeting of the Chesapeake Bay Modeling Subcommittee, it was noted that as we do not really know where truth is at this time, and any bias adjustment would be a judgment call. It is expected that CMAQ will be run as is for regulatory applications and it may be important to have the Chesapeake Bay applications remain consistent with the regulatory applications. The decision made at the meeting was to recognize the possibility of bias in deposition estimates but to continue to use CMAQ deposition estimates as is. If necessary, sensitivity studies to understand the effects of these potential biases on calculated nitrogen loads may be performed at a later date. robin.dennis@noaa.gov

Idaho Falls

13. *Joint Urban 2003 – Oklahoma City Dispersion.* Analysis of two daytime experiments at Oklahoma City in 2003 and two nighttime experiments has now been completed. Many of the results can be described in terms of “near” (less than a city block) and “far” (distances greater than a city block) fields. A key aspect of this research is the peak-to-mean ratio. It has been found that the peak-to-mean ratios in the near field are usually much greater than the far field both day and night. The daytime far field is characterized by higher peak-to-mean ratios than for the nighttime.

A comparison of tracer concentrations measured by vertically collocated street level and rooftop samplers in the downtown area suggests that, in general, there is no readily predictable difference between street and rooftop tracer concentrations for either daytime or nighttime. While there were large differences between street and rooftop concentrations on some occasions, the concentrations tended to be comparable in most cases. Tracer concentration measurements made in the tunnel network under the city showed that the tracer was sometimes slower to arrive but it persisted at higher concentrations until well after it had already dissipated at the surface. There is no evidence to support the idea that a plume could be reliably avoided by fleeing upwards or downwards during the day or night. dennis.finn@noaa.gov

14. *Extreme Turbulence Probe.* Hurricane research using data collected by the ET probe is starting to pay off. There is accumulating theoretical and observational evidence indicating that coherent structures play a significant role within the hurricane boundary layer and may have a large effect on surface fluxes. A white paper entitled “The Non-gradient Contribution of Coherent Structures to Turbulent Fluxes in Tropical Cyclone Boundary Layers” was put together by a group of researchers who met during the Monterey, CA hurricane conference last April. Dr. Ralph Foster from the University of Washington took the lead. richard.eckman@noaa.gov

15. *Houston Air Quality Study.* The six smart balloon transponders are still in the process of being fabricated for the upcoming TexARQSII air quality study to be conducted in Houston this summer. Progress is still being made on the transponder fabrication despite not receiving the satellite modems. Delivery of the modems is expected in the first days of June. A more suitable location for balloon launches has been found in the La Porte area (east of Houston). The location is better suited for flying the balloon in the shipping channel where the NOAA ship Ronald H. Brown will be making measurements. This new launch site should allow placement of the balloons above or near the ship, if conditions allow. The new location is also located at the La Porte airport where space is available inside an aircraft hangar.

Departure for Houston will be on August 10th, 2006 with August 15th as the first possible date that a balloon flight will take place. randy.johnson@noaa.gov

16. *Atmospheric Tracer Chemical Analysis Upgrade.* Two recently-developed halogen detectors have been leased to permit testing with gas chromatographs (GCs) and as possible replacements for continuous tracer analyzers. The detectors were received the first week of May. They have been already been interfaced to two GCs. The detection limits initially observed appear to be too high for our use, but we will try to improve these over the next month. It is planned to test one detector in a continuous analyzer mode. roger.carter@noaa.gov and Debbie Lacroix

17. *Mesoscale Modeling for Dispersion Forecasting.* A new Linux workstation has been ordered for local testing of the Weather Research and Forecasting (WRF) mesoscale model. A high-resolution configuration of WRF will be tested for its ability to forecast atmospheric flows within the Eastern Snake River Plain and in the surrounding mountains. It will be compared with the current MM5 modeling system at FRD, which is run at 4 km horizontal grid spacing. Data from the Idaho turbulence mesonet will constitute a key component of the studies to be conducted. The goal is to improve local site-specific dispersion forecasting. The new workstation has two Intel dual-core processors, so it is expected to be considerably faster than the current MM5 workstation. richard.eckman@noaa.gov

Las Vegas

18. *Collaboration with DTRA.* SORD meteorologists are working with the Defense Threat Reduction Agency in preparation for a series of studies to be conducted at the Nevada Test Site.

19. *DIVINE STRAKE.* Dispersion forecasts are being prepared regularly, based on assimilation of data from the Nevada dispersion mesonet and in particular from the two new towers recently

installed. Data are transmitted every 15 min. The dispersion forecasts based on the data will also be updated every 15 minutes. These systems are ready to support the DIVINE STRAKE experiment, to be conducted soon at the Nevada Test Site. SORD meteorologists have developed most of the required software and graphics for displaying the products in a readily understandable form. 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

20. DOE Meteorological Coordinating Council (DMCC). The 13th technical meeting of the DMCC was convened on May 1. This meeting was held in conjunction with the Emergency Management Issues (EMI) Special Interest Group (SIG) meeting in Las Vegas, NV. A total of 17 individuals, from the public and private sectors, attended and actively participated in the meeting. The overarching purpose of the meeting was to provide a forum for DMCC members and for DMCC associates to review their accomplishments, products, and projects, and to plan for the future. darryl.randerson@noaa.gov