



# NOAA ARL Monthly Activity Report



**March 2007**

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Air Resources Laboratory**

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**1. Highlight – Stop-Press News. ARL has a new Director.** Dr. Steve Fine has been appointed to lead the Air Resources Laboratory. He returns to ARL after several years working with the Headquarters of the NOAA Office of Oceanic and Atmospheric Research. Steve will relieve Rick Artz, who has served as Acting Director since the departure of Bruce Hicks, some fifteen months ago. ARL is the oldest of NOAA's research laboratories, yet Steve is only its third Director. The first Director was Lester Machta. When Lester retired in 1990, Bruce Hicks took over. Now, it is Steve's turn to lead ARL. It is great to have him on board.

**2. Highlight – Urban Forecasting and UrbaNet.** ARL is collaborating with ESRL/GSD to set up a high resolution meteorological forecast for the Washington DC metropolitan area. The project is funded by the Department of Homeland Security. GSD will be providing initial conditions using LAPS, which will be assimilating all the MADIS data and running the WRF-NMM forecast out to

+12 hours four times per day. ARL will be working on the observational data nudging using WRF-NMM. [roland.draxler@noaa.gov](mailto:roland.draxler@noaa.gov)

### **Air Resources Laboratory Headquarters, Silver Spring**

**3. *Wildfire Smoke Dispersion.*** The ARL wildfire smoke forecast system has been restructured to match the NCEP operational environment. Daily testing is still in progress. [roland.draxler@noaa.gov](mailto:roland.draxler@noaa.gov)

**4. *Tropical Widening Study.*** Radiosonde measurements and NCEP/NCAR reanalysis data have been used to examine long-term changes in tropopause behavior in the subtropics, associated with the transition between the tropics and extratropics. Tropopause heights in the subtropics exhibit a bimodal distribution, with maxima in occurrence frequency near 16-17 km (characteristic of the tropical tropopause) and below 13 km (typical of the extratropical tropopause). Both the datasets show that the frequency of occurrence of high tropopause days in the subtropics of both hemispheres has systematically increased during the past few decades, consistent with a widening of the tropical belt. The data indicate an expansion of  $1.7 \pm 0.8$  degree latitude per decade during 1979-2005. [dian.seidel@noaa.gov](mailto:dian.seidel@noaa.gov)

### **Atmospheric Turbulence & Diffusion Division (ATDD), Oak Ridge**

**5. *Climate Reference Sites.*** The US Climate Reference Network (CRN) has four new sites -- Charlottesville, Virginia; Durham, North Carolina; Big Bend National Park, Texas; and Las Cruces, New Mexico. New sites were also installed for the Historical Climate Network (HCN) in Clanton, Livingston, Selma, and Birmingham, all in Alabama. Existing sites in Arizona and New Mexico received their annual maintenance. Following a lengthy development and demonstration program, Instruments are being prepared for deployment to USCRN sites to monitor soil moisture and temperature, two new parameters to support the National Integrated Drought Information System (NIDIS). [mark.e.hall@noaa.gov](mailto:mark.e.hall@noaa.gov)

**6. *Air Quality -- ETOS.*** The southern Appalachians have an especially unhappy synergy of natural and human sources of tropospheric ozone, suffering one of the highest summertime impacts in the country. The East Tennessee Ozone Study, seeking to understand the production, transport and removal of this ozone will this summer use a new self-contained, readily portable ozone monitor, the Hitchhiker. Developed at ATDD, the Hitchhiker is especially suited to airborne sampling, readily carried as baggage in any small rental airplane. It requires only a port to uncontaminated outside air such as any general-aviation craft would have. [d.l.senn@noaa.gov](mailto:d.l.senn@noaa.gov)

**7. *Airborne Mercury.*** Atmospheric mercury released from a forest fire was sampled during a prescribed burn in the Grand Bay National Estuarine Research Reserve in Mississippi. ATDD's mercury sampler downwind reported increased concentration in all three atmospheric forms, reactive gaseous mercury (RGM), fine particulate mercury (FPM), and gaseous elemental mercury (GEM). The extra mercury was 90% GEM or more, as expected, but RGM was unexpectedly found in readily detectable quantities. This form quickly redeposits suggesting local deposition "hotspots" downwind of forest fires. [steve.brooks@noaa.gov](mailto:steve.brooks@noaa.gov)

**8. *UrbaNet – Collocation with Weatherbug Installations.*** Six sites for collocation of UrbaNet's sonic anemometers with Weatherbug's® standard weather stations have been tentatively identified in the National Capital Region. The proprietors of these sites have responded favorably, and implementation agreements are being finalized. Installation is scheduled to begin upon receipt of FY 2007 funds. [chris.vogel@noaa.gov](mailto:chris.vogel@noaa.gov)

### **Atmospheric Sciences Modeling Division (ASMD), Research Triangle Park**

**9. *Implementation of Pleim-Xiu Land Surface Model in WRF.*** We are nearing the implementation of the Pleim-Xiu Land Surface Model, the Asymmetric Convective Model version 2 (ACM2) boundary layer model and surface layer scheme into the new WRF 2.2 version. In particular, progress was made on passing the 2-m temperature and moisture analyses from the driving model to the Pleim-Xiu Land Surface Model using the four-dimensional data assimilation (FDDA) package. This information is necessary for the soil moisture-nudging scheme of the Pleim-Xiu Land Surface Model, and as of late March this has gone through the initial testing stage including a comparison with the Mesoscale Meteorological Model Version 5 (MM5), as well as other physics options within the WRF model framework.

The WRF model was executed for the months of January and July 2002 using four dimensional data assimilation (FDDA) with three sets of physics options. The first simulation is with the Pleim-Xiu Land Surface Model, the Asymmetric Convective Model version 2 (ACM2) boundary layer model and Pleim-Xiu surface layer scheme; the second simulation tests the NOAA Land Surface Model, Yonsei University boundary layer scheme, and Monin-Obukhov surface layer scheme. The third simulation is similar to the second except the Mellor-Yamada-Janjic boundary layer scheme is utilized. We are currently testing a few improvements to the Pleim-Xiu scheme, but as of early April, the Pleim-Xiu is testing as well, and in many cases better than the other physics options. Furthermore, other than 10-m wind, the Pleim-Xiu implementation in WRF is performing better than MM5. [robert.gilliam@noaa.gov](mailto:robert.gilliam@noaa.gov); [jonathon.pleim@noaa.gov](mailto:jonathon.pleim@noaa.gov)

**10. *Peer Review Report on CMAQ Modeling.*** The Community Modeling and Analysis System (CMAS) Center coordinated an expert peer review of recent developments in air quality modeling by ASMD. The final peer review panel report was delivered in early March, following the panel meeting December 18-20, 2006, in Research Triangle Park, NC. Seven expert reviewers were charged with examining the quality, productivity, scientific relevance, and strengths and weaknesses of the components of the modeling program. The panel's assessment of the Community Multiscale Air Quality (CMAQ) modeling program was highly complimentary. The overall quality of the program was deemed state-of-science. The panel endorsed the Division's work on transitioning to the use of WRF to drive air quality modeling, the implementation of analysis and observation nudging and the ACM2 planetary boundary parameterizations in WRF, and the development of a new Carbon Bond (CB05) chemical mechanism. The panel agreed with ASMD staff that high priority should be given to the addition of the RACM2 chemical mechanism to CMAQ, inclusion of surface heterogeneous HONO chemistry, combining gas and aqueous phase chemistry modules, and implementing source apportionment for particulate matter (PM) trace elements. The panel also indicated that high priorities should be given to nitrogen chemistry, secondary organic aerosol formation, evaluation of the performance of chemical mechanisms, and improvement of cloud chemistry and physics in CMAQ. The panel supported continued development of the Atmospheric

Model Evaluation Tool (AMET), and the improvement of the observational data base need to better evaluate CMAQ-Hg (mercury). Overall, the panel concluded that ASMD does an excellent job in balancing the inclusion of new science, and program and model user needs. The final report will be posted on the CMAS website ([www.cmascenter.org](http://www.cmascenter.org)) by May 2007. [william.benjey@noaa.gov](mailto:william.benjey@noaa.gov)

**11. Air Quality Forecast Model Development and Testing.** In support of experimental O<sub>3</sub> forecasting for the continental U.S. during 2007, investigation of model enhancements to address performance issues in the western U.S. were continued. Sensitivity simulations with differing physical parameterizations and emission estimations were conducted for the extended time period of July 20-August 4, 2006 and involved: (1) the ACM2 mixing scheme to represent turbulent transport, (2) O<sub>3</sub> predictions from NCEP's Global Forecast System (GFS) to specify lateral boundary conditions at the top CMAQ model level to represent possible impacts of stratospheric O<sub>3</sub>, and (3) emission estimated for the non-road mobile sector in California from the recently available 2002 National Emissions Inventory (NEI). Use of ACM2 resulted in systematic increase in O<sub>3</sub> in regions of high-observed O<sub>3</sub>. Though the approach in part helped address under-predictions in California, it resulted in a high model-bias relative to measurements for several other regions of the continental U.S. An additional simulation with the ACM2 incorporating an alternate estimation of the planetary boundary layer (PBL) height is planned. The use of the GFS also resulted in systematic increase in surface level O<sub>3</sub> as a result of increase in simulated background O<sub>3</sub> over the analysis period. Analysis of CMAQ predictions using the non-road mobile emission estimates for California from the 2002 NEI resulted in improved performance for peak O<sub>3</sub> both downwind of Los Angeles as well as in California's Central Valley. Efforts were also devoted towards preparation of emission files for the forecast modeling system for 2007. These data are currently undergoing quality assurance. Configurations of the PREMAQ and CMAQ model code for deployment in the 2007 version of the air quality forecast system are currently being finalized for delivery to the National Weather Service. [rohit.mathur@noaa.gov](mailto:rohit.mathur@noaa.gov), [george.pouliot@noaa.gov](mailto:george.pouliot@noaa.gov), [jonathan.pleim@noaa.gov](mailto:jonathan.pleim@noaa.gov)

#### **Field Research Division (FRD), Idaho Falls**

**12. UrbaNet – Model Output Statistics Appear Promising.** Some preliminary work related to developing urban Model Output Statistics (urban MOS) was completed in March. The intention is to provide improved wind forecasts in urban areas by combining model outputs and local observations in a MOS regression approach. The NCEP Rapid Update Cycle (RUC) appears most suitable for this effort, because it is reinitialized every hour based on the latest observations. Archived RUC output is available from the NOAA National Operational Model Archive & Distribution System (NOMADS). It is hoped that the model output can be combined with urban observations (including private network data) to significantly enhance the skill of short-range urban forecasts. [richard.eckman@noaa.gov](mailto:richard.eckman@noaa.gov), and Ron Dobosy, ATDD

**13. Extreme Turbulence (ET) Probe.** The ARL ET probe is a key component of work proposed by John Gaynor (OAR) and Emil Simiu (NIST) in a recent submission to the NIST-NOAA Resilient Communities Cooperative Initiative. This initiative includes research related to wind damage caused by hurricanes. [richard.eckman@noaa.gov](mailto:richard.eckman@noaa.gov)

**14. Perfluorocarbon Tracer Analysis Development.** The long-term Perfluorocarbon (PFC) sample stability (aging) tests for low (250 pptv), middle (4,000 pptv), and high (100,000 pptv)

concentrations are still in progress. All of the test sample cartridges have been analyzed over periods of several weeks and indications are that the stored samples are maintaining their original concentrations. The samples will continue to be analyzed intermittently over the next several months. [dennis.finn@noaa.gov](mailto:dennis.finn@noaa.gov) and Roger Carter

**15. Tracer Sampling Upgrade.** As part of the continuing effort to improve the FRD tracer sampling and analysis capability, the firmware in the handheld computer used to program the tracer samplers was upgraded so it would properly record the field blank and field control samples. These samples are part of the field quality control program used in all our tracer experiments. The valve upgrade on the automated tracer analyzers was also completed and upgrades were installed on both the firmware in the analyzers and the software used to analyze the individual chromatograms. [roger.carter@noaa.gov](mailto:roger.carter@noaa.gov)

**16. Mesoscale Modeling for INL.** An automated system to generate WRF model forecasts for Southeast Idaho is nearing completion. The current setup uses a 20 km coarse grid and a 4 km nested grid for the region surrounding INL. WRF is being initialized with output from the NCEP Rapid Update Cycle (RUC) model. Every three hours, the FRD automated system will download the RUC 12-hour forecast and then run the higher resolution WRF model. At first, the intention was to run a WRF “cold start” only once per day. Later runs would be restarts based on the previous run. This limits the effect of spin-up issues during cold starts. However, the problem with this approach is that the only changes during the restarts are on the lateral boundary conditions of the coarse grid. Changes at these lateral boundaries can take quite a while to percolate into the grid interiors, so effectively the daily WRF runs are mostly determined by the RUC forecast used in the cold start. In the current configuration, every WRF run is a cold start. This takes maximum advantage of the RUC data assimilation. There may be more problems with spin-up, but so far this does not appear to be significant.

Graphics from the WRF runs are being generated using the NCAR Command Language (NCL). These are initially generated as high-quality Postscript images that are then converted into bitmap images for display over the web. An NCL add-on library (WRF\_NCL) has already been developed for WRF output, and this library provides many useful tools for accessing and displaying the model output. [richard.eckman@noaa.gov](mailto:richard.eckman@noaa.gov)

**17. One NOAA in Idaho.** FRD joined forces with the Pocatello National Weather Service (NWS) at the SE Idaho Spring Fair on 29 March to celebrate 200 years of NOAA scientific research and discovery. A public outreach booth was setup at the fair to provide safety tips on weather events and also to showcase weather instrumentation. The NWS utilizes data from the NOAA/INL Mesonet, operated by FRD, to position frontal boundaries, thunderstorm outflow boundaries, and for verification of their warnings. The cooperation between the two NOAA units has been ongoing for several years and is a connection that NOAA is increasingly fostering under its “One NOAA” slogan. [kirk.clawson@noaa.gov](mailto:kirk.clawson@noaa.gov)

### **Special Operations and Research Division (SORD), Las Vegas**

**18. DOE ISM and NOAA Safety Activity.** A complex NTS emergency response exercise, with Evaluators, was held on March 14. This exercise involved a severe weather episode at the Hazardous

Waste Storage Unit (HWSU) located in Frenchman Flat on the NTS. SORD Research Meteorologists played key roles in the design, development, and implementation of this exercise.

W. Schalk served as the Exercise Weather Controller, D. Bullard was the Weather Forecaster, and J. Sanders was the SORD representative to the Emergency Operations Center. Research Meteorologists were responsible for generating the weather scenario and providing exercise weather. The emergency response exercise involved severe thunderstorms and a tornado which were responsible for causing damage and relocating chemical drums. Severe weather notifications were generated and issued in real-time to simulate the thunderstorms and tornado time-line. A special webpage on the SORD site was developed for the emergency responders to present the weather data as it developed; wind barb charts, lightning charts, and severe weather notifications were available on the webpage. NOAA expertise played a key role in the success of this exercise. [walter.w.schalk@noaa.gov](mailto:walter.w.schalk@noaa.gov)

**19. Lightning Safety.** A lightning safety meeting is being planned for April. The objective of this meeting is to review NTS hazardous weather notification procedures, including lightning alerts, and to coordinate communications links. [darryl.randerson@noaa.gov](mailto:darryl.randerson@noaa.gov)