NOAA Air Resources Laboratory
Monthly Activity Report

September 2007

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1. Highlight - ARL Science Presented at Annual National Atmospheric Deposition Program (NADP) Symposium. ARL scientists from Headquarters and the Atmospheric Sciences Modeling Division provided oral presentations of their work during the 29th Annual NADP Symposium, 10-13 September in Boulder, Colorado. The theme of the Symposium was Wet & Dry Deposition Measurements: Do We Have the Total Picture? Presentations were made by Robin Dennis, Alice Gilliland, and Rob Pinder focusing on CMAQ modeling analyses for nitrogen deposition. These modeling analyses will help direct NADP monitoring in the future. Presentations on mercury measurements and modeling were made by Winston Luke and Jesse Bash. Quantifying atmospheric mercury concentrations and deposition is a critical component of understanding the complex processes controlling the movement of mercury through the environment and how emissions controls will reduce concentrations in fish. NADP holds a scientific symposium each year in order to provide presentation and discussion of the latest information on deposition monitoring and research. margaret.kerchner@noaa.gov, Robin Dennis, Alice Gilliland, Rob Pinder, Winston Luke, and Jesse Bash

2. Highlight - Tampa Bay Assessment of the Atmospheric Deposition of Nitrogen. The Tampa Bay assessment of atmospheric nitrogen deposition has been completed and the results delivered to the Tampa Bay Estuary Program (TBEP). Estimates of annual wet and dry atmospheric deposition of nitrogen (N), both oxidized- and reduced-N, to the Tampa bay and its watershed sub-basins were developed using the CMAQ-UCD model for use in the TBEP Total Maximum Daily Load (TMDL) implementation planning process. The focus of the assessment was on the annual deposition of oxidized nitrogen from nitrogen oxide (NO_X) emissions. To facilitate the TBEP TMDL planning process, CMAQ-UCD was run for a 2002 base case and a variety of future projections and sensitivity scenarios to provide answers to questions that were asked of ASMD by the Tampa Bay Estuary Program. These answers are applicable to development of an improved understanding of the atmospheric deposition of N to Tampa Bay and its watershed. In response, estimates were provided of the relative influence of all of the local NO_X sources within the watershed on N deposition to the watershed and bay, supplemented by the break down of the full local influence into the components of local mobile, utility and other NO_X sources. In addition, estimates were provided of the effectiveness of local and national emission reductions that have been mandated (e.g., EPA's 2010 Clean Air Interstate Rule). CMAQ-UCD was nested to a 2-km grid size, which is smaller than typical, to provide spatially detailed deposition estimates for the Tampa watershed sub-basins and bay waters. The CMAQ-UCD model includes the effect of sea salt on oxidized nitrogen deposition, using nine different particle size sections. Ten months were simulated by the model to develop the annual average estimates. Because models with this many sections are slow, the Tampa assessment required 15 months of coordinated computing on two separate supercomputer systems. This assessment is also a U.S. Environmental Protection Agency, National Exposure Research Laboratory Annual Performance Measure. robin.dennis@noaa.gov

Air Resources Laboratory Headquarters, Silver Spring

3. Review Panel for IPCC Synthesis Report The Intergovernmental Panel on Climate Change will be issuing the final Synthesis Report (covering all three Working Group reports of the IPCC Fourth Assessment) in November 2007. The synthesis report is currently out for final governmental review. Dian Seidel is serving on the US Government Review panel, which will meet in late October to prepare the U.S. review in advance of the plenary meeting in November. dian.seidel@noaa.gov

4. AMS Green Meetings. The Council of the American Meteorological Society is considering ways in which its conferences and meetings can be conducted in a more environmentally-responsible way. Dian Seidel is serving on an ad hoc committee on green meetings that is developing recommendations for the Council's consideration and for implementation at the 2008 AMS Annual Meeting in New Orleans in January. dian.seidel@noaa.gov

Atmospheric Turbulence & Diffusion Division (ATDD), Oak Ridge

5. Climate. The U.S. Climate Reference Network increased by six sites in August and September. The total is now 116 sites in all sections of the country.

The ability to provide spatial averages of measured atmosphere-surface exchange segregated by surface type is valuable to the development and testing of ecosystem models. Apportioning of CO_2 flux was successfully demonstrated with airborne measurements over two differing crops planted in

kilometer-scale patches, too small for the usual analysis. The approach, combining remote sensing, footprint analysis, and conditional sampling, will appear in Agricultural and Forest Meteorology. ron.dobosy@noaa.gov and Mark Hall

6. Air Quality. Dry deposition (i.e., not by rainfall) of several sulfur- and nitrogen-based atmospheric contaminants near Tampa, Florida, was sampled by relaxed eddy accumulation, the findings reported in Environmental Research Letters.

Comparative measurement of the dry deposition of (reactive gaseous) mercury and nitric acid is progressing in mid-Atlantic highlands of West Virginia, along with high accuracy measurement of atmospheric CO2 concentration.

A synthesis of the chemistry of atmospheric mercury depletion events involving the atmosphere, snow, and water has been published in Atmospheric Chemistry and Physics Discussions. latoya.myles@noaa.gov and Steve Brooks

Atmospheric Sciences Modeling Division (ASMD), Research Triangle Park

7. Air Quality Forecast Model Development. An aerosol version of the air quality forecasting Community Multiscale Air Quality model (CMAQ-F) has been developed and tested in September 2007. This update of CMAQ-F also incorporates the latest improvements to the mass-conserving horizontal advection scheme, specifically the speed up obtained by moving the message passing of data out of the part of the kernel solver that is called most often. An evaluation of the performance of the experimental air quality forecast system, based on NOAA's Weather Research and Forecast Model and EPA's Community Multiscale Air Quality (CMAQ) Modeling System revealed very good performance during the summer of 2007. jeff.young@noaa.gov, brian.eder@noaa.gov

8. Expansion of Operational Air Quality Forecasts for the Continental United States. The operational forecast guidance was expanded to include ozone forecasts for the contiguous United States on September 18, 2007. This expansion was supported by improvements implemented in the North American Meso-scale model (NAM) CMAQ air quality forecast modeling system, extensive testing of the resultant experimental surface-level O_3 forecast guidance, and collaboration with scientists at EPA and NOAA. rohit.mathur@noaa.gov

9. Public Release of the Community Multiscale Air Quality (CMAQ) Modeling System's Meteorology-Chemistry Interface Processor (MCIP) Version 3. In preparation for the next release of the Community Multiscale Air Quality (CMAQ) modeling system, the Meteorology-Chemistry Interface Processor (MCIP) has been updated. Several scientific improvements were made in the "M3Dry" dry deposition routine. MCIP has been modified to accommodate some changes that were introduced into the December 2006 release of the Weather Research and Forecasting (WRF) model, as well as additional output fields that are available with the local implementation of the Asymmetric Convective Model version 2 (ACM2) planetary boundary layer scheme, the Pleim-Xiu land-surface model (LSM), and the accompanying surface layer model. In addition, some output fields were added to support the inline calculation of dry deposition velocities and the bidirectional fluxes for some species in CMAQ. MCIP has been made more flexible with regard to near-surface fields so that LSMs in addition to the Pleim-Xiu LSM (such as the "NOAH" LSM) can be better

accommodated. MCIPv3.3 was released to the CMAQ community by the Community Modeling and Analysis System (CMAS) Center on 14 August 2007. tanya.otte@noaa.gov

Field Research Division (FRD), Idaho Falls

10. Perfluorocarbon Tracer Analysis Development. Steps taken during the month of September appear to have culminated in a successful resolution of the recent problems experienced with the PFT method. These included rapid baseline drift, rapid changes in response, low sensitivity, and peak interferences. The final resolution required replacing the electron capture detector, the installation of additional pressure regulators and flow controllers, and adjustments to the settings for flows, voltage, and peak integration parameters. Tests have shown that the voltage baseline and response are now much more stable and some peak interferences were eliminated. Furthermore, it was found that the response and baseline are stabilizing much more quickly, and at lower voltages, than when the modified configuration was first tested. This breakthrough has enabled us to complete the sample aging tests. These tests concluded that sample concentrations in the bags (250, 4000, and 100,000 pptv) remained stable for at least 7-8 months, within the uncertainty in the measurement. We also continued development of software that will allow overlapping peaks to be automatically separated which may improve the handling of interferences in the future. Preparations have begun for final testing to ensure that all sampling and analytical artifacts have been identified and all necessary quality control protocols have been established. dennis.finn@noaa.gov and Roger Carter

11. Radar Wind Profiler. To improve confidence in INL wind measurements, we are beginning a comparison of the INL boundary layer wind profiler measurements with wind measurements from the NOAA INL Mesonet. This requires finding examples where the meteorological conditions would be expected to make the tower measurements comparable to some of the profiler measurements. We are also looking for other ways to make wind measurements that would be more directly comparable to profiler measurements. We hope to have some results in the next few months. roger.carter@noaa.gov

12. Transport and Dispersion Modeling. Several tests of the WRF-Var data assimilation system have been conducted at FRD using the NOAA MADIS database as the source of field observations. In these tests, 12 hour WRF forecasts for Southeast Idaho were first generated in the normal manner using output from the NCEP RUC model to initialize WRF. The model was then run a second time after using WRF-Var to assimilate all available data from MADIS (including surface observations, rawinsonde soundings, and aircraft observations) into the model initial conditions. Rather surprisingly, the WRF forecasts that included data assimilation often appeared to have less skill than those that used only the RUC output. Further investigation suggested that the cause of this behavior may be the rather poor representation of stable boundary layers in numerical models. Typically, these models exhibit a warm bias associated with the morning minimum temperatures because of problems in the boundary-layer parameterization. Most of the assimilation tests were conducted on 1200 UTC (0600 local time) runs of the WRF model, when the boundary layer is stable. By forcing the surface temperatures closer to the observations, the data assimilation appears to retard the development of the daytime boundary layer, causing unexpected forecast errors later in the day. richard.eckman@noaa.gov

13. Coordination with BEA Emergency Management Group. A meeting to inform the BEA Emergency Management Group of upgrades and improvements instituted at FRD this calendar year was held at the Willow Creek Building on 19 September. We discussed and demonstrated the forecasting and data dissemination improvements made through NIWC, the NOAA INL Weather Center web page (http://niwc.noaa.inel.gov/). The most notable improvements include weather notices and advisories that are now issued from our office, and access to the newly acquired real-time lightning data on and around the site. Other site specific weather forecasts and reports are available through this one stop clearing house for the INL. We also discussed the progress made to-date on transitioning our dispersion model from MDIFF to HySPLIT. We agreed to develop a transition plan and milestones and to incorporate improvements and suggestions made by BEA. We also agreed to jointly formulate criteria for weather notices and advisories made by our office on the NIWC web page. kirk.clawson@noaa.gov

Special Operations and Research Division (SORD), Las Vegas

14. SORD Review. Walt Schalk participated in a 3-day review of ARL/SORD functions and capabilities. The review was conducted by a private contractor hired by NSTec, the NNSA/Nevada Site Office Managing and Operating Contractor. The preliminary report was reviewed. walter.w.schalk@noaa.gov

15. WRF Model. The main WRF forecast system script was altered to include running the 3D variational data assimilation system (WRFVAR) which assimilates MADIS data. The WRF forecast system begins with a cold start at 00 UTC every Sunday and then cycles every 6 hours using the previous 6-hour forecast for initial conditions.

Meteorological Data Acquisition stations with valid pressure data are now assimilated by WRFVAR.

Several bugs were fixed in WRFVAR and various scripts that run the WRF forecast system. kip.smith@noaa.gov

16. Mesoscale Modeling. NV-RAMS ran on the UNLV computer system. Data are continuing to be renamed and saved daily, and backed up to CD monthly (4 CDs).

The 12Z model problems are currently being researched. kip.smith@noaa.gov

17. Air Quality Meetings. Marc Pitchford presided at the IMPROVE (Interagency Monitoring of Protected Visual Environments) Steering Committee meeting in Durango, Colorado September 5-7. Presentations were made on the status of the ~160 site rural aerosol speciation monitoring network, laboratory analysis, data processing and quality control activities. Sample recovery for 2006 was at 94% with only 4 of the monitoring sites failing to meet strict annual data completeness criteria. The current total annual budget for the network plus associated special studies is ~$8.1M plus an in-house contribution ~$1M. The meeting included a half-day field trip to a nearby IMPROVE monitoring site established a few years ago to monitor the air quality impacts on federal lands by the expected doubling of the extensive oil and gas extraction in the San Juan Basin. marc.pitchford@noaa.gov

Dr. Pitchford also participated in the Columbia River Gorge Air Quality Study Science Day Workshop at Hood River, OR on September 25. This workshop was designed to present a summary of six years of air quality assessment activities to regional policy makers, the public and peer reviewers. The Columbia River Gorge has the worst haze levels of any non-urban area in the Western U.S. The worst Gorge haze levels are during the winter, when multiple-day stagnations combined with persistent fogs throughout the river basin generate high concentrations of ammonium sulfate and ammonium nitrate particulate matter from principally man-made precursor gases emitted throughout the region. Winter haze is highest at the eastern end of the Gorge and is due to sources to the east of the Gorge, while on the western end of the Gorge the Portland metropolitan areas is responsible for a large share of the haze. Summer high haze episodes generally include smoke from wildfires as well as secondary organic particulate largely from natural biogenic organic emissions, Portland metropolitan area pollutants, plus transport from sources outside of the U.S. Regional air quality simulation modeling applied to projected future emission levels indicate that haze will improve by 2018, but the change will not likely be noticeable during the summer and will be relatively small though likely noticeable during the winter. For more information contact Marc Pitchford (702-862-5432 or marc.pitchford@noaa.gov) or go to the Southwest Clean Air Agency website at http://www.swcleanair.org/gorgereports.html for a copy of the draft summary report and other information.