



NOAA ARL Monthly Activity Report



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1. *Highlight – NOAA 2006 Awards Announced.* A 2006 Bronze Medal has been awarded to Melissa Free, Dian Seidel, (OAR/ARL), John Lanzante, Imke Durre, Jay Lawrimore, and Thomas Peterson (NESDIS) “For developing research-quality radiosonde atmospheric temperature datasets for reliably monitoring climate variations and change.”

Carmen Nappo, Jr, (OAR/ARL/ATDD) has received a Distinguished Career Award “For continued improvements of scientific understanding and predictions of atmospheric transport and dispersion, especially in the nocturnal boundary layer, throughout thirty-seven years of service to NOAA.”

The awards will be presented at a formal ceremony in the Washington Metropolitan area (details to be announced at a later date). Congratulations to each of these scientists for their sustained top quality research contributions. richard.artz@noaa.gov

2. *Highlight – AMS Council.* Dian Seidel has been elected a Councilor of the American Meteorological Society (AMS) for a three-year term beginning January 2007. The Council is the principal governing body of the AMS and meets twice annually to conduct its business. She

welcomes input from colleagues with ideas, suggestions, complaints, and general perspectives on the AMS and its governance. richard.artz@noaa.gov

Air Resources Laboratory Headquarters, Silver Spring

3. GCOS Reference Upper-Air Network. Under the auspices of the Global Climate Observing System (GCOS) Atmospheric Observing Panel for Climate (AOPC), efforts continue to design and implement a GCOS Reference Upper-Air Network (GRUAN). At the AMS Annual Meeting in San Antonio in January, two sessions on “Improving Climate Data Records Using Reference-Quality In Situ Upper-Air Observations” were held. In conjunction with the conference, a subset of the AOPC Working Group on Reference Observations met to plan next steps for furthering the network goals. dian.seidel@noaa.gov

4. Forest Fire System with Expanded HYSPLIT-Chemistry Modeling. A series of new approaches have been explored to improve HYSPLIT’s computational efficiency. The results of this work have been implemented in the dust forecasting system to increase its efficiency.

The HYSPLIT-CMAQ coupling system has been installed at NCEP’s computer system. A partial statistical analysis comparing the results from the series of coupled HYSPLIT-CMAQ runs with measurements has been performed for the Alaskan forest fires of 2004. Domain average, bias and absolute bias have been calculated. This analysis shows that the best statistical performance for the days of the concentration peak (July 21 and 22, 2004) corresponds to the HYSPLIT run using NASA emissions estimates, EDAS and GFS meteorological fields, and adding CMAQ’s PM_{2.5} fields without coupling between the models. All models underestimate measured concentrations. ariel.stein@noaa.gov

Atmospheric Turbulence & Diffusion Division (ATDD), Oak Ridge

5. U.S. Climate Reference Network. As the U.S. Climate Reference Network (USCRN) continues to expand, annual maintenance visits (AMV) have become a significant activity of the Oak Ridge Associated Universities crew associated with ATDD, ensuring reliably high precision of data. Maintenance is scheduled in regional groups. January’s group included Monroe and Lafayette, Louisiana; Palestine and Edinburg, Texas; and Newton, Mississippi. During AMV next year, USCRN sites will be acquiring relative humidity sensors. A newly acquired humidity calibration system will ensure their data quality. A bench system, traceable to the National Institute of Standards and Technology, calibrates several transfer-standard units used to check the instruments in the field. Several improvements to the equipment and procedures used to assess the health of the CR23x dataloggers have been identified and are being implemented. The metadata, fundamental to interpreting the measurements, are mostly up to date. Multiple new sites make this an ongoing task. tilden.meyers@noaa.gov, mark.e.hall@noaa.gov, d.l.senn@noaa.gov

6. UrbaNet. A web site has been established for UrbaNet at <http://urbanet.noaa.gov/>. It describes ARL’s various research initiatives, provides direct access to testbed data for Washington DC, and connects to the full UrbaNet mesonet through NOAA’s MADIS program. Negotiations are in final stages for at least 9, maybe up to 15, new UrbaNet sites and a significant upgrade to the site at the National Arboretum. The associated dense network of sites developed by AWS Convergence

Technologies, Inc. makes extensive use of R.M. Young Junior Propeller Anemometers. The dynamic characteristics of these devices are being evaluated; they appear to work poorly in light winds. Model Output Statistics (MOS) are in development as a promising approach to short-term forecasts of transport and dispersion on the urban scale. Standard forecasts from, for example, the Rapid Update Cycle of the National Weather Service provide vital forecasts of regional conditions, but are too coarse for the street scale. Model Output Statistics are the traditional and effective approach to extending model forecasts to local scales. will.pendergrass@noaa.gov, ed.dumas@noaa.gov, ron.dobosy@noaa.gov

7. Eddy Fluxes Over Heterogeneous Surfaces. The Flux Fragment Method (FFM), an integrated approach to analyzing airborne measurements of air-surface-exchange fluxes over heterogeneous landscapes, was successfully demonstrated using data taken over Illinois farmland in 2005. The method integrates airborne turbulence measurements with remote sensing and footprint modeling using a geographical information system. It can partition the fluxes of momentum, heat, moisture, and carbon into their components according to the type of underlying surface to help test and develop ecosystem models, which estimate air-surface exchange based on remote sensing. A paper describing ATDD's demonstration of FFM has been submitted to the journal *Agricultural and Forest Meteorology*. ron.dobosy@noaa.gov

8. East Tennessee Ozone Study (ETOS). In anticipation of continued support for the East Tennessee Ozone Study (ETOS) preparations are underway for a summer 2007 measurement program. Previous studies have identified three ozone regimes associated with different elevations within East Tennessee's ridge/valley structure -- valley floors, ridge tops, and higher terrain. Each regime has a significantly different diurnal ozone pattern. Prior years' measurements have concentrated on real-time ozone ambient concentration levels. The effort this year will focus on ozone deposition within the three zones. Fast-response ozone instrumentation has been developed and will be coupled with existing flux measurement systems for this activity. Measurements are anticipated to begin in July and to extend through September, 2008. will.pendergrass@noaa.gov

Atmospheric Sciences Modeling Division (ASMD), Research Triangle Park

9. Peer Review of Community Multi-Scale Air Quality (CMAQ) Modeling. The Community Modeling and Analysis System (CMAS) Center is coordinating a review of recent developments in air quality modeling by ASMD. The particular emphases of the review are the modeling and interaction of meteorological, physical, and chemical processes of the Community Multi-Scale Air Quality (CMAQ) modeling program, as well as their applications and evaluations. Seven reviewers were charged with examining the quality, productivity, scientific relevance, and strengths and weaknesses of the components of the modeling program. The review took place in Research Triangle Park, North Carolina, during December 18-20, 2006. A draft report has been received for review in January, and a technical response to the points raised by the reviewers is being prepared. It is anticipated that the final report of the review committee will be submitted by April 30, 2007. The final report and the technical response will be posted on the CMAS website <http://www.cmascenter.org> at that time. william.benjey@noaa.gov

10. CMAQ Model – Bi-directional Surface Fluxes. Chemical surface fluxes have been represented in the CMAQ model as products of pre-computed dry deposition velocities and ground level

concentrations. This method assumes zero concentration at the surface and thus precludes bi-directionality as well as surface saturation effects. A new surface exchange module has been developed to permit consideration of more complex algorithms including stomatal and ground compensation points and non-linear component fluxes. For chemical species that behave according to simple linear dry deposition, the new scheme simply moves the dry deposition velocity calculation from the pre-processor (MCIP) to a subroutine within CMAQ. However, for species such as ammonia and mercury, both deposition and evasion can be represented. For ammonia, the bi-directional flux model includes compensation concentration computed as a function of surface temperature for the stomatal and ground pathways, and cuticle resistance computed as a function of surface relative humidity and the ratio of in-canopy concentrations of ammonia to SO₂. This model has been tested in a “stand-alone” configuration against field data and appears to replicate the typical nighttime and morning deposition and midday emission patterns. In CMAQ, the magnitude of the compensation point is computed according to the fractional area of agricultural land use. The CMAQ with the new bidirectional module is being run for the summer of 2002 to compare to the currently-released version of CMAQ (without the bidirectional module) and to field measurement data. jonathan.pleim@noaa.gov

11. Using a Dense Surface Mesonet to Improve Mesoscale Forecasts. The focus of this work is to incorporate mesonet data from the Meteorological Assimilation Data Ingest System (MADIS) data portal and to use the Pennsylvania State University/National Center for Atmospheric Research Mesoscale Model (MM5) to generate short-term (~6-h) forecasts for the Washington, D.C. metropolitan area. This research is an extension of a broader collaboration within the NOAA Air Resources Laboratory as part of the UrbaNet research program. A Chesapeake Bay breeze case study was selected for the initial experiments, and 22 sensitivity experiments were conducted with various configurations of MM5 to ingest data from ~325 hourly surface mesonet sites for observation nudging during a 6-h pre-forecast dynamic initialization period followed by 6-h forecasts for a domain with 4-km horizontal grid spacing. The MM5 forecasts were then processed (using HYSPLIT) to generate forward trajectories. Differences in the predicted trajectories were shown to be due to the difference in initialization time (t=0 for static initialization vs. t=-6 for dynamic initialization), independent of the dynamic initialization and the observation selection and weighting techniques that were used. To a large extent, all MM5 forecasts that used the same physics options converged to effectively the same forecast solution shortly after the observation nudging was discontinued. The forecast near-surface time series of wind speed, wind direction, temperature, and humidity were shown to be more sensitive to the choice of the planetary boundary layer scheme in MM5 than to the observation nudging techniques. These results were presented at the American Meteorological Society’s 14th Symposium on Meteorological Observations and Instrumentation in San Antonio, Texas, on 17 January 2007. tanya.otte@noaa.gov, thomas.pierce@noaa.gov

Field Research Division (FRD), Idaho Falls

12. UrbaNet/Urban Dispersion Program. Analysis of data generated by ARL/FRD in the 2003 Oklahoma City dispersion study has been completed. Likewise, analysis of data from the 2000 Salt Lake City study has also been completed. Two separate manuscripts are being prepared. dennis.finn@noaa.gov

13. Smart Balloon. Development of the FRD Smart Balloon system continues. A new motor and gearbox are currently being tested. The new gearbox uses metal gears rather than plastic gears and appears to be capable of higher torque delivery without failure of the gears or the output shaft. The new parts should allow the balloon to perform more in-flight operations and allow the balloon to remain in the air for longer periods of time. randy.johnson@noaa.gov

14. Perfluorocarbon Tracer Analysis Development. The new ARL tracer gas analysis system continues to show considerable promise. In January, two chromatograph columns, approximately 12 and 18 m in length, were installed to replace the previous twin 30 m columns in an effort to shorten the sample run time. The effort succeeded. The analysis system can now analyze a sample about every 3 minutes and a complete cartridge of 12 samples in about 40 minutes including setup and pre-analysis purge steps. We are presently in the process of evaluating the stability of samples over time (i.e. sample holding time), cleaning tests, and tests measuring what carryover artifacts might be present in low concentration samples following high concentration samples. The results are preliminary but there is some evidence of carryover artifacts and a tendency for calibrations in the high concentration range to drift. The causes are being explored, as a first step towards developing procedures that will eliminate these phenomena. dennis.finn@noaa.gov

15. Dispersion Forecasting for the Idaho National Laboratory (INL). FRD is now planning significant improvements to the forecasts delivered in support of INL research programs. Rather than simply creating text forecasts, the upgraded system will follow the lead of the National Weather Service by creating digital forecast products. These digital forecasts will allow FRD to provide an expanded suite of products for use at the INL. In addition, they will enable a more flexible response to rapidly changing weather events. richard.eckman@noaa.gov, Kirk Clawson, Brad Reese, Neil Hukari, Jason Rich

16. Bayesian Research and Turbulence Data Analysis. Research continued on a Bayesian approach for estimating the uncertainty associated with turbulence statistics. Unlike more conventional approaches, the Bayesian method can generate a full probability density function (pdf) for parameters such as the signal variance and integral time scale. With these pdfs, it is easy to produce various uncertainty estimates such as a 95% probability interval. Because of the complexity of turbulence signals, the approach being investigated is based on a numerical procedure called Markov Chain Monte Carlo (MCMC) simulation. richard.eckman@noaa.gov

Special Operations and Research Division (SORD), Las Vegas

17. HYSPLIT Applications for Nevada Test Site Research. The Linux version of HYSPLIT has been installed on the SORD systems. So that support can be given automatically for research programs at the Nevada Test Site, scripts were written to calculate forward trajectories from five selected locations at 15, 17, 19, 21, 23, and 01Z, using the WRF forecast data and HYSPLIT model. The graphics are available on the SORD intranet along with the related graphics files designed to assist research program managers. kip.smith@noaa.gov