NOAA ARL Monthly Activity Report

September 2005

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1. Highlight -- 2007 AMS Annual Meeting. Dian Seidel has agreed to serve as co-chair of the 2007 AMS Annual Meeting, to be held in San Antonio, Texas in January. Current AMS President-Elect Franco Einaudi (Director of the Earth-Sun Exploration Division, NASA GSFC) will preside over the meeting and has chosen the meeting theme "Bridging Weather and Climate Studies". Mary Cairns (Office of the Federal Coordinator for Meteorological Services and Supporting Research) will be the other meeting co-chair. Co-chair responsibilities are to ensure an interesting and logically-planned program, coordinating among all the specialty conferences, forums, and symposia. (dian.seidel@noaa.gov)

2. Highlight -- Forecasting Smoke Dispersion. The smoke dispersion forecast model developed in collaboration with NESDIS has been transferred to NCO (NCEP Central Operations) for development testing, prior to consideration for going operational. Some modifications were required to conform to NCO standards. (roland.draxler@noaa.gov)

3. Highlight – Helping Protect the Pentagon. ARL is joining forces with NCAR and with the Force Protection group at the Pentagon, to conduct the research necessary to improve dispersion forecasting as it might affect the Pentagon itself. From the perspective of the research programs of NCAR and ARL, this

provides an opportunity to collaborate on improving the capability to forecast the probability of experiencing high concentrations of hazardous materials following a release into the air upwind. From the Force Protection perspective, the collaboration will ensure access to the most recent dispersion developments in a quasi-operational setting. (will.pendergrass@noaa.gov; bruce.hicks@noaa.gov)

Silver Spring

4. A Warm Summer. Data from the ARL 54-station radiosonde network reveal that the tropospheric temperatures of last summer were the second warmest of the 48 year record (about 1K above the 1961-1990 average) in the Northern Hemisphere, and the fourth warmest globally. The warmest temperatures were in JJA of 1998, 2-3 seasons after the maximum in SST associated with the powerful 1997-98 El Niño. Taking into account the impact of such a strong El Niño on tropospheric temperature, JJA of 2005 could be considered the warmest summer of record. (Jim Angell, 301 713 0295, x127)

5. WMO Expert Team on Dispersion Meeting. The World Meteorological Organization is establishing approaches to help national meteorological services to respond to non-nuclear emergencies such as chemical accidents and wildfires. At a recent meeting, it was concluded that response to such events was a local problem and that WMO should develop a web page listing available resources. ARL has played a leading role in the discussion, following its earlier role with the setting up of the Regional Specialized Meteorological Centers for dispersion. (roland.draxler@noaa.gov)

Boulder

6. Farewell to the Surface Radiation Research Branch. Many decades of ARL research on surface radiation and the surface energy budget has ended, with the transfer of the Surface Radiation Research Branch of ARL to the new Earth System Research Laboratory in Boulder. We look forward to continued collaboration between the radiation specialists at ESRL and the surface energy budget specialists in the ARL Divisions elsewhere. (bruce.hicks@noaa.gov)

7. Central UV Calibration Facility. An interagency agreement was signed with the Environmental Protection Agency for CUCF to operate a smaller, streamlined Brewer ultraviolet spectrometer network. The first Brewer network consisted of 21 sites that operated several years, but was terminated at the end of FY2004. The new network will consist of six sites operated with ancillary equipment to characterize the aerosol optical depth and cloud cover to better characterize those effects on ultraviolet radiation. (joseph.michalsky@noaa.gov)

Oak Ridge

8. East Tennessee Ozone Study (ETOS). The data collection phase of the 2005 East Tennessee Ozone study that began in June is now completed. The study was performed with cooperation from the Tennessee Division of Forestry, National Weather Service, Great Smoky Mountains National Park, Rockwood Airport, and the University of Tennessee-Knoxville. The final measurements were performed during the first part of the month. Afterwards, ozone analyzers were retrieved and are now going through a post-experiment calibration procedure. Data analysis will continue. (Pendergrass, White, Brooks, Meyer, Klemenz, and Myles)

9. Twin Otter Scientific Power Upgrade. LCDR Philip Hall spent two weeks in Sidney, Canada to manage a Twin Otter modification contract, awarded to Viking Air Limited. This modification will increase the scientific power available on the NOAA Twin Otter N48RF to 4 KVA at 115 VAC and 120 amps at 28VDC. Additionally, the scientific power will now switch from ground power unit to aircraft power with no interruption. These modifications have been requested by ARL for future Twin Otter projects. (P. Hall)

Research Triangle Park

10. NOAA/EPA Golden Jubilee Symposium. The American Meteorological Society sponsored the highly successful Symposium on Air Quality Modeling and Its Application, September 20–21, 2005, Research Triangle Park, North Carolina. The symposium celebrated the 50-year partnership between NOAA and the EPA, and their predecessor agencies. The 216 attendees participated in six sessions of oral presentations, two luncheons with distinguished keynote speakers, and an evening poster session and ceremony celebrating the occasion. The American Meteorological Society will publish a special issue of the *Journal of Applied Meteorology* (*JAM*) containing 20 papers presented at the symposium. Papers not accepted for the special issue will be considered for another issue of *JAM*. (ST.Rao@noaa.gov)

11. Community Multiscale Air Quality (CMAQ) Model. The 2005 version of the Community Multiscale Air Quality (CMAQ) model (v4.5) was delivered to the Community Modeling and Analysis System (CMAS) Center for public distribution during September 2005. New features in this version of the model include the addition of sea salt aerosols in the particulate matter modules, addition of 20 air toxics species for optional modeling of their gas phase chemistry, and new diagnostic modeling tools, including a carbonaceous aerosol source apportionment method and a sulfate tracking method. The CMAQ modeling system is characterized as a "one-atmosphere" system, meaning that it incorporates multiple pollutant regimes that interact with each other. This capability allows the study of potential impacts from targeted emissions mitigation strategies for one pollutant (such as ozone) on other pollutants (such as $PM_{2.5}$).

Significant challenges for model development over the past several years have included incorporating new scientific developments in the chemical and physical modeling of $PM_{2.5}$ and the need to model ever larger spatial domains at finer resolution over longer time periods for retrospective analyses. Aerosol modeling science, including the simulation of $PM_{2.5}$ size distribution and chemical components, has made progress in recent years in the areas of the phase partitioning between gases and aerosols, in understanding the pathways to secondary inorganic and organic aerosol production from gas-phase precursors, and in the characterization of significant intermittent primary sources such as forest fires. Modeling domains have grown in size to encompass the entire continental United States and the duration of model simulations has grown to one-year analyses to comply with the requirements of the latest NAAQS for ozone and $PM_{2.5}$. Incorporating these scientific and technological advancements and meeting the new modeling requirements have spurred new developments for the CMAQ modeling system. (shawn.roselle@noaa.gov, kenneth.schere@noaa.gov, jon.pleim@noaa.gov)

12. Fourth Annual CMAS Models-3 Users' Conference. 205 people attended the Fourth Annual CMAS Users' Conference at the University of North Carolina at Chapel Hill. There were 80 presentations, and 29 posters. The central theme was model development, highlighting the contributions of the community to the Community Multiscale Air Quality (CMAQ) model. Special sessions included Urban and Regional Modeling Applications, International Modeling Applications, Emission Modeling and Analysis, Integrated Systems for Air Quality Management, Analysis Tools, and Regulatory Modeling. Papers will considered for a special issue of the *Journal of Applied Meteorology*, along with air quality modeling papers from the NOAA/EPA Golden Jubilee Symposium, which was held the preceding week (see http://cf.cmascenter.org/html/2005_conference/conf_agenda.cfm. (william.benjey@noaa.gov)

13. Regional Climate Scenario Exploration for Air Quality Assessment. An extensive report entitled "*An Examination of Downscaled Regional Climate Model (RCM) Scenarios for Assessing Air Quality Response to Climate Variability and Change*" has been completed and submitted as an EPA Annual Performance Measure product. Several papers on various aspects of the report are in preparation for journal publication. The report addresses questions raised by the U.S. Climate Change Science Program (CCSP) Research Strategy related to

the effects of global climate and chemical change on regional air quality and ways in which predictions of climate variability and projections of climate change can be improved for air quality assessments, with direct relevance to issues relating to human health and welfare. (ellen.cooter@noaa.gov, robert.gilliam@noaa.gov, alice.gilliland@noaa.gov)

14. Air Quality Forecasting. The Air Quality Forecasting Focus Group Workshop was held in Silver Spring, Maryland, on September 7-8, 2005, to gather feedback on the forecast model performance during the summer of 2005. The focus group is comprised of public, state, and local air quality forecasters who use the forecast guidance products from the Eta-CMAQ modeling system. Presentations from the Division included an overview of the Community Multiscale Air Quality (CMAQ) model configuration and enhancements for the 2005 forecast applications, and detailed analyses and evaluations of surface O_3 predictions from the 2005 operational and developmental forecast runs. Overall, the feedback on model performance from the focus group members was positive. Suggestions on improvement of model processes, forecast guidance products, and their availability are being incorporated into planned upgrades and development for FY-2006. (rohit.mathur@noaa.gov)

15. Global Energy and Water Cycle Experiment Atmospheric Boundary Layer Study (GABLS). In 1999, ARL was a major participant in the Cooperative Atmosphere-Surface Exchange Study (CASES) experiment. The data obtained are now being used as a basis for developing improved models of the Planetary Boundary Layer. The second intercomparison project from the GEWEX Atmospheric Boundary Layer Study (GABLS) aims to study the representation of the CASES-99 diurnal cycle over land in both 1D column models and large eddy simulations (LES). Simulations have now been completed, using the newly developed second version of the Asymmetric Convective Model (ACM2). Time series of vertical profiles of mean quantities and vertical fluxes were generated and submitted to the study coordinator. (jonathon.pleim@noaa.gov)

16. North American Mercury Model Intercomparison Study. Two Community Multiscale Air Quality (CMAQ) mercury model simulations of the year 2001 were completed for the North American Mercury Model Intercomparion Study (NAMMIS) using initial condition/boundary condition (IC/BC) files developed from two separate global mercury model simulations. One set of IC/BC files was based on a simulation of the Chemical Transport Model (CTM) applied by Atmospheric and Environmental Research, Inc.,(AER) and the other from the Global-Regional Atmospheric Heavy Metal (GRAHM) model applied by Environment Canada. A third global model simulation for NAMMIS was also completed by Harvard University using their GEOS-CHEM model. The results from the various systems are significantly different, for reasons that have yet to be determined. (russell.bullock@noaa.gov)

Idaho Falls

17. Urban Dispersion Program (New York City Study). All samples collected in the Urban Dispersion Program have been analyzed and verified. The project entailed the inclusion of extra quality controls. Field blanks, field controls and field duplicates were implemented as usual, but in addition samplers were programmed to collect samples after the end of each study period to gauge the possible existence of a higher than usual background SF_6 concentration level. Also, during the first three intensive study periods, most samplers were programmed to collect a background bag before the first release, during the hour between releases and again after the end of each study. The collection of these extra QC samples will increase the confidence of the SF_6 data in such a diverse, urban environment as New York City.

A quick-look summary of the UDP deployment has been prepared. In all, a total of 16 SF_6 tracer release periods were conducted in 6 Intensive Observation Periods (IOPs). Release rates ranged from 3 to 5 g s^{-1} in 30-minute release periods, which resulted in a total release of about 105 kg of SF_6. More than 3,500 field samples were analyzed for the 6 IOPs. Of these, 93% of the data are reliable. (kirk.clawson@noaa.gov, Roger Carter, Debbie Lacroix, Jason Rich)

18. Smart Balloon. Two NOAA smart balloons were launched from Puerto Rico in an effort to place the balloons into a hurricane during the RAINEX experiment. Balloon 1 was launched at about 0120 hours (GMT) on September 8th, 2005. It tracked to the northwest in the direction of Hurricane Ophelia. After tracking the balloon for nearly a day and half, the solar radiation increased but the solar panel charging current remained at zero. This was monitored for a few hours and when it was determined for sure that the batteries were not going to charge, the balloon flight was terminated while battery power was good and we could ensure the balloon did drop into the ocean.

Figure1. Paths of the two NOAA smart balloons launched from Puerto Rico during the RAINEX experiment. The path of balloon 1 is shown in red dots, while the path of balloon 2 is shown in blue dots.

Balloon 2 was launched approximately 4 hours after the termination of balloon 1 at about 1838 hours (GMT) on September 9, 2005. After flying for a little over three days the elevation of the balloon was changed from 2600 meters to around 700 meters. Communications failed after a few more hours. (randy.johnson@noaa.gov, Brad Reese, and Shane Beard)

19. Mesoscale Modeling. Data from the ARL mesonet in Idaho are being used extensively to test regional and local forecasts. The most obvious biases in MM5 forecasts are related to the 2 m AGL temperature. In the predawn hours the model has a strong positive bias of several degrees Celsius. This suggests a problem with either the surface characterization (e.g., soil moisture) or the PBL parameterization in stable conditions. The wind-speed forecasts were on average fairly accurate, with the median bias near zero and the interquartile range of the bias generally spanning less than 5 m/s during most hours of the day. For the wind direction, the best performance was during the afternoon, when the median bias was less than 20 deg and the interquartile range was near 50 deg. At night with light winds, the interquartile range for the direction bias was closer to 120 deg. (richard.eckman@noaa.gov)

Las Vegas

20. Summaries of Arid-Area Stability Data. A climatology of Pasquill-Gifford stabilities (A-F) has been created, using data from the ARL Nevada mesonet (MEDA). Stability frequency tables for Desert Rock for the years 1978 through 2004 were also constructed. The data will be used for the dispersion applications central to SORD programs, and also for studies of the influences of terrain complexity and aridity on atmospheric turbulence. (douglas.soule@noaa.gov)

21. Urban Air Quality Study. Data from the ARL ozone sensors at the Desert Rock Meteorological Observatory have been melded with data from the Clark County Air Quality District. The figure below is presented as an example of the dramatic difference between the diurnal evolution of surface-level ozone in the center of a large urban, desert environment and that at a pristine site upwind. The red curve represents the diurnal ozone variation in ppm at the Desert Rock Meteorological Observatory (DRA) and the black curve is for Las Vegas, NV, city center. Notice that ozone concentrations remain elevated at night in the pristine air at DRA due to the lack of reactive pollutants available to the ozone. In addition, the afternoon ozone concentrations in the city exceed those at DRA by a factor of approximately 1.5 due to increased opportunities for reactions in the polluted air over the city. (marc.pitchford@noaa.gov, Darryl Randerson, Raymond Dennis, James Wood, and Ricky Lantrip)

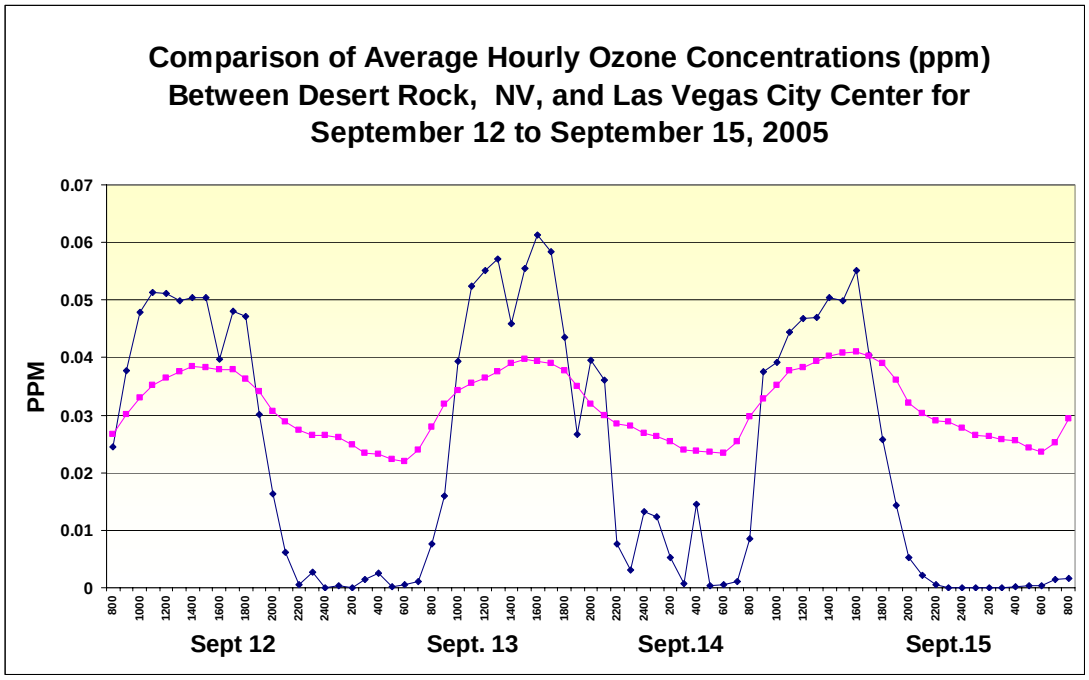

Figure 2.