



NOAA ARL Monthly Activity Report



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Highlights

1. *HIGHLIGHT -- EPA/NOAA Meeting, Boulder.* The second of the scientist-to-scientist meetings set up under the air quality Memorandum of Understanding between EPA and NOAA took place in Boulder, on 27 and 28 October. The meeting was hosted by the Aeronomy Laboratory, and was attended by about 50 scientists from various EPA centers, from several ARL Divisions, and from many other NOAA laboratories. The purpose was to explore linkages between air quality and climate change issues. The meeting proved to be an excellent venue to compare notes on such activities as NOAA's (and EPA's) Community Multiscale Air Quality (CMAQ) development and the Climate Impacts on Regional Air Quality (CIRAQ) project. Initiatives were proposed in numerous areas to take advantage of collaborative research in the two agencies. These included: Linkage of Global and Regional models, real time observations of fire and dust events, vertical profiling, carbon

measurements, emission inventory presentation and uncertainty analysis, nighttime chemistry, and regional/urban measurement programs. (Alice Gilliland, 919 541 0347; David Mobley, 919 541 4676)

A proposed aerosol optical depth network for the U.S. was discussed, that would include the current seven SURFRAD sites and the 32 USDA/UVB sites operated by Colorado State University. The sites would use visible multi-filter rotating shadowband radiometers (MFRSRs) to retrieve total column aerosol optical depths. The data could be used for aerosol model development and testing. Additional UV data from instruments already operating could be used to estimate actinic flux for air quality model validation. joseph.michalsky@noaa.gov

Special interest surrounded the downscaling of regional climate models. Results obtained by ARL at Research Triangle Park paralleled results reported by NCAR scientists participating in the meeting. In general, the downscaling models do not yet reproduce the vegetation distributions found in nature. ellen.cooter@noaa.gov, and tom.pierce@noaa.gov

2. HIGHLIGHT -- HYSPLIT Training Workshops. During October, two HYSPLIT training workshops were held. Twenty-one participants, 17 from Spain, 3 from Finland, and 1 from the UK attended the 3-day course in Valencia, Spain. About 10 participants attended the subsequent 2-day course at Research Triangle Park. User feedback from both sessions has resulted in numerous small changes to HYSPLIT and its graphical user interface. These improvements will be incorporated into the next version, to be released before the end of this year. One new feature is an automated link to NCEP's 12 km ETA tiles, which minimizes the amount of data transferred per forecast time step. The next training workshop will be held in the spring of 2005. The location and date have not yet been determined. roland.draxler@noaa.gov

Silver Spring

3. Expansion of READY – Access to Meteograms. To make it easier to retrieve multiple meteograms (time-series of meteorological data) for the same location but using different forecast meteorology, a new program has been added to READY that will allow the user to choose up to 6 different forecast meteorological datasets and create a webpage with thumbnail versions of all 6 meteograms. The user can then click on a thumbnail image to retrieve the already calculated full-size meteogram. This application is very computer intensive, and therefore the use of it will be monitored and may need to be further restricted if the product proves too popular. glenn.rolph@noaa.gov

4. Update of Global Temperatures Through Last Summer. Radiosonde-derived global tropospheric and stratospheric temperatures have been updated through the middle of 2004. The most interesting feature is the global warming of the summer low-stratospheric (100-50 mb) layer since 2000, resulting in a temperature about 1K below the 1961-1990 average in 2004 compared to about 1.5K below this average during 1993-2000, thus reversing the long-term tendency for stratospheric cooling. The global 100-50 mb temperature in June, July and August of 2004 was the warmest since the Pinatubo-induced warmth of 1992. This recent JJA warming is apparent in all climate zones except the south temperate zone where, strangely, there is indicated to be record coolness of the low stratosphere and 300-100 mb tropopause layer, and record warmth at the surface and in the tropospheric 850-300 mb layer, in 2004. The increasing low-stratospheric JJA temperature occurs at a time of decreasing sunspot number, and thus runs counter to the usual

tendency for a decrease in sunspot number to be accompanied by a decrease in stratospheric ozone and hence stratospheric temperature. It seems unlikely that this low-stratospheric JJA warming trend will continue, but if it does it has ramifications for the global warming issue. (Jim Angell, 301 713 0295, x127)

5. *Climate Change Science Program Assessment Report.* Work on the report on CCSP report on “Vertical Temperature Trends in the Lower Atmosphere - Steps for Understanding and Reconciling Differences” accelerated as draft chapters were written, critiqued, and revised, repeatedly. The report will be reviewed by the National Research Council beginning in mid-December. dian.seidel@noaa.gov

Boulder

6. *SURFRAD/ISIS.* Instruments have been readied for the last two ISIS instrument exchanges in Hanford and Salt Lake City. All plotting programs relating to SURFRAD and ISIS, including those used for the SRRB web page, have been improved. john.a.augustine@noaa.gov

7. *Cloud Fraction Data Compared.* ARL/SRRB’s long-term visitor from Germany, Ms Suzanne Benze, has begun to write code to compare Total Sky Imager (TSI) cloud fraction data and estimates of sky cover from trained observers at Eglin Air Force Base. These data are from a cooperative experiment between NOAA/ARL, the Air Force, and Yankee Environmental Systems, Inc. A one-year data record is being used to test the utility of the TSI as a replacement for observer sky cover fraction - an observation that has been missing since the implementation of ASOS by the National Weather Service. john.a.augustine@noaa.gov

8. *New Ozone Column Algorithm Developed.* Dr. Petropavlovskikh has developed a new algorithm to retrieve partial ozone column from actinic flux measurements. The algorithm will be applied to the measurements taken on board WB57 aircraft as part of the AURA/OMI validation campaign during the month of November, 2005. The product will provide validation for ozone column derived by OMI instruments. irina.petro@noaa.gov

Oak Ridge

9. *Terrestrial Carbon Program.* Planning for a Mid-Continent Intensive Study under the North American Carbon Program (NACP) continued with a workshop in early October in Boulder, CO. The scientific question is how much the North American continent sequesters carbon during a year. The intensive experiment's goal is to improve the methods of long-term monitoring of the atmosphere's carbon budget in terrestrial settings, where local sources and sinks obscure the long-term climate signal. A system of tall towers and routine vertical profiles by light airplanes is proposed, supported by land-surface characteristics obtained from satellites, agricultural statistics, and other routine data sources. The intensive experiment is to assess the accuracy and precision of such carbon-budget estimates and how to optimize them. (Dobosy)

10. *Airborne Measurements Collaboration – Italy and Alabama.* ARL is actively working on setting up a collaborative program with the University of Alabama, on aircraft measurement of air-surface exchange. The platform of choice is the Italian Sky Arrow aircraft, carrying ARL flux measuring equipment. Ed Dumas participated in the First Airborne-Flux-Measurement and Remote-Sensing Workshop in Rome Italy, October 25-29, 2004. The workshop's objective was to provide a

number of American and European Union students the opportunity to learn the techniques of airborne flux measurement and remote sensing on the Sky Arrow aircraft. During the workshop, several flights of the SkyArrow owned and operated by IBIMET/CNR (Firenze, Italy) provided data for reduction and analysis by the class participants.

Ed Dumas represented ATDD in the U.S.-Italy Joint Meeting on Climate Change Research & Technology in Venice Italy from October 20-22, 2004. The MFP instrumentation on the SkyArrow airplane highlighted in coordinated presentations between NOAA/ATDD and IBIMET/CNR (Institute for Biometeorology of the National Research Council, Firenze, Italy). (Dumas)

11. *Urban Dispersion Study.* Work continues on the design of the New York City Urban Dispersion Program (UDP). ATDD is coordinating the meteorological instrumentation, which will become part of a permanent network in NYC. The first tracer dispersion study will be a brief effort near Madison Square Garden, in early January. (Hosker)

Research Triangle Park

12. *Community Multiscale Air Quality (CMAQ) Model – Public Release.* The 2004 version of the Community Multiscale Air Quality (CMAQ) (v4.4) was delivered to the Community Modeling and Analysis System center (CMAS) for public distribution. The distribution included build and run scripts, a tutorial test case, reference data, and all associated documentation (release notes and instructions). (Shawn Roselle, 919 541 7699)

13. *CMAQ — Mercury.* Test simulations of the CMAQ-Mercury model have revealed that the oxidation of gaseous elemental mercury (GEM) by reaction with OH produces surface-level air concentrations of particulate mercury about a factor of two higher than expected. The highest particulate mercury air concentrations predicted by the CMAQ-Mercury code occur in the Kansas/Oklahoma area and in desert areas of southern California where no observations exist for model verification. In response to these findings, two changes were made to the CMAQ-mercury model. First, and most importantly, the rate constant for the OH oxidation reaction was lowered. Second, the reaction product of GEM oxidation by hydrogen peroxide was changed to be reactive gaseous mercury (RGM) instead of particulate mercury. The 2001 simulation will be repeated using the updated version of the CMAQ-mercury model after some other possible modifications are investigated. (Russell Bullock, 919 541 1349)

14. *CMAQ Linkage with WRF model.* In anticipation of driving the air quality forecasting version of Community Multiscale Air Quality (CMAQ) with the Weather Research and Forecast (WRF) modeling system using the National Weather Service/National Centers for Environmental Prediction's Nonhydrostatic Mesoscale Model (NMM) core, which is targeted for operational use in FY-2005, work has begun on coupling CMAQ with WRF. In particular, we are analyzing the native-grid advection methods in WRF/NMM for the purpose of recasting CMAQ's transport processing for improved accuracy and mass conservation. (Jeffrey Young, 919 541 3929)

15. *Modeling Changes in Forest Fire Likelihood Following Climate Changes.* A joint program has started with the US Forest Service to explore the challenges and potential benefits of directly linking dynamic biogeochemical model output and Environmental Protection Agency's bioemission models (BEIS 3.12) to estimate the potential impact of changing distributions of natural vegetation and associated fire emissions under future climate conditions. USFS Pacific Northwest Research

Station (PNRS) scientists are performing equilibrium and dynamic vegetation model scenario studies driven by MM5-based regional climate scenarios. Preliminary results indicate the current models do not simulate current natural vegetation distributions well. These results have been provided to Pacific Northwest National Laboratory (PNNL) to guide future climate model downscaling research activities.

Work has been initiated to facilitate the cross-walk among various vegetation classes and the Biogenic Emissions Inventory System (BEIS) emission factors. A first step is to develop BEIS species assignments and distributions for each of the vegetation classes used by the USFS system. This has been completed; the next step is to develop estimates of mean emission factors for each vegetation class. (Ellen Cooter, 919 541 1334; Tom Pierce, 919 541 1375)

16. *Linking CMAQ to Human Exposure in an Urban Area.* In collaboration with the Environmental Protection Agency's Office of Air Quality Planning and Standards (EPA/OAQPS), EPA Region 3, and the state of Delaware, the Division has successfully demonstrated that the CMAQ chemical transport model can be an useful tool for simulating the air toxic concentration fields needed to drive a human exposure model. For this pilot study, air toxic concentrations generated by CMAQ for a 4-km grid mesh overlaying Philadelphia were successfully formatted for direct use in the Hazardous Air Pollutant Exposure Model (HAPEM5). Using a chemical transport model like CMAQ represents quite a departure from historic methods that have relied upon Gaussian plume models to compute ambient concentrations of air toxic pollutants. Gaussian models do not account for complex chemical reactions and do not properly address background concentrations. The next phase of this research effort will focus on extending the CMAQ modeling system for simulating air toxics with finer grid cell sizes (~1 km). Applications are planned for Houston, which is an excellent urban test bed for further development because it has a detailed building morphology database to test the urban parameterizations for meteorological modeling and it has detailed air toxic concentration data (from field studies such as the TexAQS 2000 air quality study) that can be used for extensive model evaluation. Based on the results of the pilot study, CMAQ is now being considered by EPA/OAQPS for application to the National Air Toxics Assessment (NATA) program. A copy of a briefing related to this research is located at www.epa.gov/asmdnerl/APM317.pdf. (Jason Ching, 919 541 4801; Thomas Pierce, 919 541 1375)

Idaho Falls

17. *Smart Balloon.* A miniature, single chip, digital temperature and relative humidity sensor has been integrated into a data acquisition system to compare its performance against the much larger and more expensive Vasaila HMP45 temperature and relative humidity sensor that has been used in past studies. Preliminary results indicate that the new system is typically within 0.2 C of a reference thermometer with 0.1 degree accuracy. Relative humidity under the same conditions show that the two systems track within 3% of each other. Further testing over a wider range of temperatures and relative humidity will take place at a later time. (Randy Johnson, 208 526 2129)

18. *Hurricane Surface-Level Turbulence Data.* A more thorough analysis of the hurricane data collected this season has started. This includes the use of quality-analysis procedures to flag bad or suspect data. The wind data analyzed so far (mainly from Hurricane Frances) appear to be of high quality, with very few points being flagged due to rain spikes or other problems. The temperature data tend to have more problems than the wind data. During some periods water intruded into the temperature sensors' electronics within the housing and caused voltage jumps that corrupted the

temperature data. Water drops could also collect on the temperature sensors and cause a temporary data spike. Fortunately, the wind calculations are only weakly sensitive to the absolute temperature, so the temperature problems have little bearing on the quality of the wind data. (Richard Eckman, 208 526 2740 and Tom Strong)

19. Preliminary Planning for 2005 Field Studies. Representatives of the Battelle Aerosol and Process Technologies Group visited the Field Research Division to learn about tracer sampling and analysis capabilities. This visit was in the context of proposed Spring 2005 DoD model validation studies. This project is the most recent in a series of FRD field programs in support of DoD and Homeland Security. (Tom Watson, 208 526 9397)

Laboratory preparations are already being made for the 2005 analysis year. Normal time for calibration gas delivery is usually two months from the initial request, but in times of high demand it has taken as long as four months to receive calibration gases from the vendor. Therefore, due to the upcoming holiday season, the quantity, and the concentration ranges needed, it was felt that the vendor should be given as much lead time as possible. (Debbie Lacroix, 208 526 9997, and Roger Carter)

Work is being done on each of the FRD automated tracer gas analyzers to determine the greatest concentration range that can be measured in the least amount of time for the upcoming studies. The possibility of an indoor study has meant that each instrument will need to be tuned for higher concentrations, but still allow for concentrations on the lower end. Sample loops, timing and attenuation issues will need to be determined ahead of time. The goal is to have a large enough concentration range so that each sample will need only one analysis rather than being re-analyzed using a different system calibrated using higher concentrations. (Debbie Lacroix, 208 526 9997)

In response to a request from a potential experiment sponsor, we are examining the possibility of modifying the Programmable Integrating Gas Sampler (PIGS) to allow for different sampling times on each bag and for delays between bags. The sampling and analysis system used by FRD is totally integrated and automatically matches information about the sampling and sample timing with each analysis done in the laboratory. Any change in the operation of the samplers requires changes in the hand-held downloaders, the analysis system, and all interface software. Consequently, this modification will be a significant effort. The firmware in one of the samplers has been modified to handle the new sample timing and is being tested. The software in the hand-held computers used to program the samplers is being analyzed to see if it can be modified to support the more complex timing. (Roger Carter, 208 526 2745)

20. Emergency Operations Center (EOC). Two FRD staff (Randy Johnson and Rick Eckman) have been requalified as emergency response operations staff. Other FRD EOC teams were requalified at the September sessions. The training covered a number of topics including event classification, notifications, log keeping, usage of communications equipment, and recovery operations. (Rick Eckman, 208 526 2740 and Randy Johnson)

21. Mercury from Mt. St. Helens Volcano. A new possible research project is being investigated with the Atmospheric and Surface Science Laboratory at INEEL. This involves an effort to monitor mercury emissions from the newly active Mt. St. Helens volcano. The INEEL team is planning to deploy mercury sensors downwind of the volcano. By combining the observations with dispersion modeling, it may be possible to estimate the mercury source term from the volcano. FRD may be

running the HYSPLIT dispersion model to provide estimates of the transport and dispersion of mercury from the volcano. Natural sources of mercury emissions are of considerable policy interest, since they must be known to properly assess the impact of anthropogenic emissions. (Richard Eckman, 208 526 2740 and Mike Abbott, INEEL)

22. *Disposal of Accumulated Hazardous Waste.* FRD has finally been able to dispose of our accumulated hazardous waste materials after having funding pulled by the NOAA Environmental Compliance and Safety (ECS) office twice in two years. The waste included a handful of chemicals, over 2,000 smoke grenades (M-18s, M-8s), 31- ½ hour floating smoke pots, one 400-foot fuse, 2,000 Squibs, and 2,000 fuses. Since the grenades were 20-50 years old, we chose to pay for the disposal cost of approximately \$56,000 using our own funds. Many of the grenades were rusting and deteriorating badly and provided a fire and safety hazard. (Debbie Lacroix, 208 526 9997)