



NOAA ARL Monthly Activity Report



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1. Highlight – READY/HYSPLIT Registrations. On 24 September 2001, ARL began requiring all users except those with @noaa.gov computer domains to register before being permitted to run the HYSPLIT transport and dispersion model on the ARL READY (<http://www.arl.noaa.gov/ready.html>) website. At the end of October, over 300 requests for registration have been processed from more than 40 countries. This is an excellent demonstration of the widespread community reliance on the HYSPLIT products. However, the flood of requests has caused an increase in workload that is substantially more than was anticipated. To become a registered user of the HYSPLIT model on the web, an international the applicant must have an institutional affiliation with one of the following types of organizations: government, commercial,

educational, or non-profit. A registration form is available on the web site that must be filled out, printed on official letterhead, and faxed back to ARL. (glenn.rolph@noaa.gov)

2. *Highlight – Urban Dispersion Study.* A meeting of the international (US-UK-Canada-Australia) Urban Dispersion Modeling Working Group (UDMWG) was held on October 1-2 at the U.S. Army Dugway Proving Ground Conference Center in Salt Lake City, Utah. Progress on numerical modeling of flow and dispersion around, over, and within urban regions was described by several groups. Dr. R. Hosker presented suggestions for initial organization and planning for a major urban dispersion study to be held in Oklahoma City in July 2003. Events during September have added additional emphasis to the need for providing high-quality meteorological and tracer concentrations data to test and refine urban dispersion models. Such models are needed to help plan for and mitigate the results of a potential terrorist release of toxic or otherwise hazardous airborne materials in a major city. One action item from the meeting was a request for several UDMWG members to visit Oklahoma City as soon as possible, to look for potential instrument, tracer release, and tracer sampling sites. (hosker@atdd.noaa.gov)

C. Biltoft (Dugway Proving Ground), R. Hosker (NOAA-ATDD), and Jeff Basara of the Oklahoma Mesonet and Oklahoma University (OU) traveled throughout Oklahoma City (OKC) to find good locations for meteorological equipment (both temporary and permanent), surface energy balance stations, tracer sources, and tracer samplers (both mobile and fixed). Good possible locations for sodars were located in a line across the south (upwind) side of the city, and to the north (downwind). A good possible lidar site was located to the SSE, and permission was obtained verbally from the site manager. Several possible energy balance sites were located. OU plans to install instruments on a 1500 ft radio tower N of the city, which would give an excellent vertical profile. Candidate E-W tracer sampler routes were located and driven. Local small airports were visited to evaluate them as potential flight operations sites for instrumented aircraft, and one just S of the city seems especially well suited; the owner-manager seemed very hospitable. The OU Health Sciences Center to the east of the city has offered numerous sites for meteorological and tracer sampling; all of these were visited with the chief of facilities for the Health Sciences Center. The State Fair Ground to the west of the city offers many sites, including a “space needle” that could be instrumented for data well above ground level. Some of the E-W streets within the central business district (CBD) offer good locations for sonic anemometry and fixed tracer samplers, and the –S streets within the CBD will provide fixed tracer sampler sites as well. There are plenty of rooftop sites (especially parking garages) for samplers located above street level. Two large downtown hotels allegedly offer government rates, and would provide convenient lodging for measurement personnel; another cluster of hotels to the NW of the CBD would provide housing that is close to a lot of service businesses (Home Depot, Radio Shack, Staples, Office Depot, WalMart, etc. etc.), and might therefore be convenient for the experimental teams. The biggest anticipated difficulty is providing good meteorological data – especially turbulence measurements – within the CBD, and particularly along the –S street canyons. Vertical profiles of these variables would be very desirable, but will be difficult to implement. Meetings were also held in Norman OK with OU staff, to discuss initial plans, including the need to conduct a thorough public education program in OKC to allay any worries about the tracer releases. Given the expected large number of participating organizations in the 2003 study, there will have to be a lot of coordination among a large number of PR groups, and education of the PR departments should begin early. (hosker@atdd.noaa.gov)

Silver Spring

3. *HYSPLIT Upgrades.* Due to increased interest in various operational dispersion model products by NWS and others, a variety of long-planned improvements to the code were completed as quickly as possible. These include the ability to compute plume transport and dispersion simultaneously on multiple meteorological grids; the long overdue fix to permit computations to be started at a time that falls between two meteorological data files; the ability to output selected meteorological conditions along a trajectory for post-processing display and evaluation; modifications to the meteorological data packing and input routines to

handle data grids of greater than 999 grid points, a requirement to use the model with the new NCEP 12 km CONUS grids; simplification of the model configuration for “backward” dispersion calculations consistent with the backward trajectory calculation, now only a negative runtime is now required; new GRIB decoders were installed at NCEP to process ETA fields as well as MM5 fields from AFWA that NCEP uses for backup purposes; the ensemble dispersion options were reconfigured to simplify operational applications; and the various code changes were incorporated into the READY web version, the PC code, and installed on NCEP’s SP system for operational implementation. The graphics programs for trajectories and air concentrations have also been revised to be consistent with display requirements for the Web, PC, NCEP, and RSMC applications, thereby permitting us to drop support of NCAR graphics and now use the same graphical programs on all platforms. (roland.draxler@noaa.gov)

4. HYSPLIT Linkage with NCEP’s 12 km Eta Model Output. ARL and NCEP are currently working to link the operational HYSPLIT model at NCEP with the soon to be released Eta 12 km output. This will provide the Senior Duty Meteorologist (SDM) at NCEP with higher resolution meteorological forecast data as input to the operational HYSPLIT model run at NCEP. The 12 km Eta model is planned to become operational and replace the 22 km Eta model on 27 November 2001. (glenn.rolph@noaa.gov)

5. Study of Cyclone Intensities Starting. A project to examine trends in the potential intensity of tropical cyclones has begun, in collaboration with Kerry Emanuel of MIT. The potential intensity, measured in terms of maximum winds and minimum central pressure, is calculated from the sea surface temperature and the vertical profile of temperature and humidity and represents the theoretical maximum intensity of a storm under the given atmospheric conditions. The CARDS radiosonde archive at NOAA’s National Climatic Data Center will be used to determine the atmospheric profiles, with consideration of possible changes in instrumentation that could affect long-term trends in these data. (melissa.free@noaa.gov and dian.seidel@noaa.gov)

6. RATPAC Meeting. The ARL-GFDL-NCDC team developing Radiosonde Atmospheric Temperature Products for Assessing Climate (RATPAC) met October 18 to discuss results to date and determine next steps. Plans were set in place to continue working with first-difference methods to expand the radiosonde station network for which data adjustments have already been made, and to explore the possibility of automating aspects of the ‘expert committee’ approach used to make those adjustments. (melissa.free@noaa.gov and dian.seidel@noaa.gov)

7. NOAA Water Cycle Workshop. The US Global Change Research Program has put forward a plan for a new science initiative on the water cycle. To determine NOAA’s role in this interagency effort, Rick Lawford and Jin Huang (OGP) and John Bates (ETL) organized a NOAA workshop, which was held October 10-11 in Silver Spring. Dian Seidel and Tilden Meyers presented information on current ARL research activities that relate to the water cycle. Workshop organizers will be preparing a draft initiative based on recommendations of the participants and input from NOAA management and advisory groups. (dian.seidel@noaa.gov)

8. The Atmospheric Transport and Deposition of Mercury. Work continues on atmospheric mercury simulations using HYSPLIT. Mercury-specific modifications made to an earlier version of HYSPLIT are being incorporated into a more recent version, to allow new HYSPLIT features to be utilized in the simulations. When this is accomplished, global simulations will be run, to allow estimation of the impact of mercury sources worldwide on selected receptors (e.g., the Great Lakes and the Gulf of Maine). A global emissions inventory for 1995 has been obtained from Jozef Pacyna (NILU, Norway) and AMAP. Initial processing of this inventory is being conducted to allow its inclusion in the analysis.

An international mercury modeling intercomparison project is being organized by EMEP's Meteorological Synthesizing Centre – East, located in Moscow, Russia. A number of scientists from around the world are participating in this project. ARL scientists will figure prominently. (mark.cohen@noaa.gov)

Boulder

9. Optical Depth Computation. A paper has been prepared, describing the development of a method whereby the automated Long and Ackerman clear-sky analysis methodology can be applied to solar component observations to identify clear-sky periods for use in calibrating a Multi Filter Rotating Shadow Band radiometer. The periods identified are used to mask MFRSR data to obtain a calibration data subset representing the clearest and cleanest skies during a several week calibration period. Langley plots of these data are used to calculate a mean extraterrestrial signal (a calibration value), that is valid for the calibration period for the particular MFRSR that was used. After the calibration extraterrestrial signal is calculated, it may be applied to other data, from the MFRSR that was calibrated, and within the calibration period, to construct time series of aerosol optical depth. The method is tested on an Asian dust event that affected the Front Range of Colorado in April 2001. (John Augustine 303 497 6415)

10. Surface UV Observations and TOMS Determinations. A multi-authored manuscript entitled On the Correspondence Between Surface UV Observations and TOMS Determinations of Surface UV: A Potential Method for Quality Checking World UV Observing Stations, was completed. The results for five U.S. ISIS stations for clear sky conditions, revealed a bias ranging from 15%-18% between the two observational methods, TOMS being higher. However, the standard deviation for clear sky conditions is only 4% suggesting that the method might be suitable for world wide checking of surface UV observations.(J. DeLuisi, 303 499 6824)

Oak Ridge

11. Terrestrial Carbon Program. Assessment of energy-balance closure, an outline of systematic bias errors in eddy-covariance measurements, and results of hyperspectral reflectance measurements were presented at Argonne National Laboratory, during two DOE-sponsored meetings. Both the Carbon Cycle Science Team and the AmeriFlux Investigators met there 29 October - 1 November. The ATDD presentations featured data from the Walker Branch Site and other AmeriFlux and FLUXNET sites. (wilson@atdd.noaa.gov)

Structural damage to the Walker Branch tower during a windstorm affected measurements for about 10 days in late October. Temporary relocation lower on the tower insured continued flux measurements, but some other meteorological instrumentation remains out of service. The tower manufacturer and several contractors have been consulted about repairs, which will probably be completed during November. (wilson@atdd.noaa.gov, White, Hall, Matt, Hosker)

12. Canaan Valley. The energy-balance suite of instruments is being installed at the Canaan Valley National Wildlife Refuge, while monitoring of dry and wet deposition continues. The HYSPLIT modeling project to identify source regions affecting air quality in the Canaan Valley area is progressing. Nitrogen deposition to Canaan Valley is also being assessed. Dissemination of data and analyses from these studies is to be facilitated by a web page under construction. (vogel@atdd.noaa.gov, Meyers, Pendergrass, Hall)

13. Climate Reference Network. A problem with moisture affecting the temperature measurement was diagnosed and fixed. The two Asheville sites were retrofitted with newly calibrated sensors and the temperature fix was incorporated into the sites. Data for intercomparisons of thermistor sensors and PRT's began to be collected and the ATDD test site in Oak Ridge. A draft of the CRN documentation manual was compiled. Staff continued preparing for site setups at New Hampshire, Rhode Island, Nebraska, and Montana, which are expected to take place in late November and early December. (hosker@atdd.noaa.gov, Meyers, Hall, Black, French, Brewer, Randolph, Shifflett, Conger, Ridenour)

14. Dynamical/Photochemical Modeling. Development work continued on increasing the complexity of the dynamics-only LESchem simulations. Large-eddy simulation (LES) sensitivity studies examined the effects of the update frequency of the shortwave and longwave radiation parameterization on the convective boundary layer (CBL) dynamics. Now that the coupled LESchem model has the ability to utilize time-dependent photolysis rates calculated by the TUV model, new two-hour midday coupled LESchem simulations were generated in order to study how updated photochemistry affects the trace gas mixing ratios and distributions. Two simulations were conducted using photolysis update frequencies of 900 s and 60 s. Trace gas analysis of these results is currently under way. (decker@atdd.noaa.gov, Herwehe)

15. GEWEX/GCIP. A Linux-based computer system was installed at the Black Hills, SD, GEWEX site this month. A digital camera was added to the instrument suite, and site maintenance was performed. Subsequent data have shown the Linux system to be reliable and robust. A Kermit communications protocol provides fast and accurate transfer of flux data and digital images. (dumas@atdd.noaa.gov, Meyers)

16. Italian National Research Council Sky Arrow. ATDD will likely be instrumenting a Sky Arrow aircraft owned by the University of Trento in Northern Italy. They propose to use a Sky Arrow for pollution measurement on a regional scale, along with *in-situ* measurement of turbulence and flux. The system will include the ATDD turbulence probe and computer data acquisition system in addition to pollution measurement instruments, as yet undetermined. A relaxed eddy-accumulation (REA) flux measurement system is being considered for that purpose. (brooks@atdd.noaa.gov, Dumas)

17. Mercury in the Arctic. The mercury deposition model was improved by including nighttime atmospheric transport of photolyzable Bromine/Chlorine from open leads and polynyas within the annual sea ice area. Including this transport better simulates mercury deposition at distances far downwind of the open water sources. (brooks@atdd.noaa.gov, Lindberg-ORNL)

18. Extreme Turbulence Probe. Resilience and utility of the software for the Extreme Turbulence Probe have been further enhanced this month. There are currently three output streams. The Medium Frequency (MF) stream delivers input from all sensors: 32 channels, 50 times per second, for development only. The regular RAW stream forms a subset of these 32 channels. Processed Output Data (POD) contain meteorologically relevant quantities computed from RAW. Calculations and writing operations for these streams would occasionally interfere with fundamental data gathering. New code takes better advantage of the multi-thread capabilities of the Software Development Kit provided by the manufacturer of the analog-to-digital converters, allowing asynchronous data processing at lower priority to data gathering. A separate development will facilitate hardware engineering for the probe, providing an option to translate all MF files from binary to ASCII upon closing the program. (dobosy@atdd.noaa.gov)

Research Triangle Park

19. US Weather Research Program. Dr. Jonathan Pleim (ARL/ASMD) participated in a meeting of the US Weather Research Program Prospectus Development Team 11: Meteorological Research Needs for Air Quality Forecasting, at Palm Springs, CA, November 6-8, 2001. After presentations from all participants, working groups and discussions helped to define the need for air quality forecasting and recommended areas of research. A report, to be published in the Bulletin of the AMS, will define the problem in terms of temporal and spatial scales, urban and rural aspects, emergency response, and long term planning. The history and current state of air quality forecasting will be summarized along with a discussion of user and societal impacts. Research needs are presented in 3 categories: 1. Scientific understanding, 2. Improved tools for predictability and model evaluation, and 3. information transfer. There was some consensus that comprehensive 3-dimensional grid models are currently not up to the task of providing accurate air quality forecasts. Most groups currently forecasting air quality use combinations of statistical models, meteorology products, and experience, with a few groups adding comprehensive models. Much of the discussions focused

on identifying areas in most need of further research and development such as PBL and land surface modeling, model representation of clouds and aqueous processes, and local circulations (e.g. complex terrain and land-sea breeze). There was also much discussion of verification metrics, uncertainty analysis, and observations. (Jonathan Pleim, 919 541 1336)

20. AERMOD Model-Training Workshop. A four-day AERMOD model-training workshop was developed and conducted by three members (including an AMD Division scientist) of the AMS/EPA Regulatory Model Improvement Committee for the air quality modelers from the ten EPA Regional Offices. The focus was the AERMOD regulatory dispersion model that has been proposed by EPA for estimating potential exposures from air emissions from industrial and urban sources. The workshop participants were exposed to a thorough description of the model formulation with preliminary discussions of the planetary boundary layer and similarity theory and were given a number of specific applications of the model in which they were challenged to interpret the state of the boundary layer as it related to the AERMOD-predicted concentration distributions. The Regional modelers will be conducting their own training for state and local air pollution modelers in their respective regions over the next year, so the workshop was also constructed to provide significant time for each participant to develop and perform some of their own short lectures on aspects of the workshop material. (Steven G. Perry, 919 541 1896)

Idaho Falls

21. Urban Diffusion. The focus on URBAN/VTMX 2000 and URBAN 2003 has returned. A final report is in preparation for the 2000 field study. The current effort for this month centered on the mobile SF₆ analyzer data. More than 825 traverses of SF₆ plumes were made by the 6 mobile analyzers during the six regular and one shake-down intensive observation periods (IOP). An additional 130 null traverses were made by the analyzers to verify the lack of SF₆. These data have been plotted and prepared for inclusion in a data appendix. Planning for URBAN 2003 is also moving ahead. Coordination has begun between FRD and the two funding agencies, the Chemical and Biological Non-proliferation Program (CBNP) of the U.S. Department of Energy, and the Defense Threat Reduction Agency (DTRA). Future visits to Oklahoma City, Oklahoma, to begin logistical and public relations work is in the planning stages. (kirk.clawson@noaa.gov)

An effort is underway to combine the ground-based tower and remote sensor (radar wind profiler and Doppler sodar) observations acquired at the Raging Waters in October 2000 with the LongEZ aircraft data during VTMX/URBAN 2000. (jerry.crescenti@noaa.gov)

22. CBLAST-Low. Final post-processing of the CBLAST-Low LongEZ aircraft data set was completed. The post processing algorithms were used to create the final data set which are now being disseminated to project PI's. Key elements of the processing routines include replacing the raw GPS data with differentially corrected velocities and positions, blending low frequency velocities and attitudes (from GPS) with higher frequency components from accelerometers, correcting temperature measurements for dynamic heating of the element, calculating winds based on the raw pressure measurements, and careful quality control checks. With the upgrades to the LongEZ data system hardware and software, this data set does not contain many of the timing errors and missing data points that plagued the system in previous experiments. Likewise, much of the post processing effort is being spent on careful calibrations to remove residuals in the wind calculations resulting from dynamic aircraft maneuvers. While this has little effect on the resultant mean wind, it is critical in determining the flux in gusty conditions. (jeff.french@noaa.gov, Jerry Crescenti, Timothy Crawford)

23. Wind Calculations from a Small Aircraft. Central to the use of the LongEZ as a platform to investigate Boundary-Layer phenomena is the ability to determine, very accurately, the three-dimensional wind vector. Considerable effort at ATDD and, more recently, FRD over the last 15 years has focused on reducing errors in the determination of aircraft velocity which may lead to rather large errors (percentage-wise) in wind calculations. Recent projects, such as CBLAST-Low that focus on boundary layers under extreme light wind

conditions have forced us to re-visit some of the earlier work in determining precisely the relationship between our measurements and the winds calculated from those measurements. The process relies on performing various maneuvers (such as pitch up/downs and 360 degree steady-state turns) and from wind calculations during those maneuvers, adjusting sensitivity and offset calibration factors to force the wind to match certain basic assumptions (*i.e.* minimize variance of wind during a turn). Previously, we have been able to reduce the variance in computed vertical air velocity to within 5% of the vertical velocity of the aircraft, much better than the typical value of 10% cited by many investigators as being the level to achieve. Further refinement, and careful calibration of the instruments has allowed us to achieve a 3% level with the current CBLAST-Low data set. By reducing variance of the horizontal winds during turns through the adjustment of airspeed sensitivity measurements and heading misalignment, we have been able to remove nearly all of the variation in wind speed and direction during turns. But turns in different directions typically lead to different solutions. Note, however, that our method of calculating the wind allows us to achieve what most other aircraft groups are not able to achieve, specifically usable winds during turns.

In addition, we find that under our current method of wind calculation, there exists a bias in vertical air velocity that is fairly well correlated with airspeed. Both of these findings suggest that our model of airspeed sensitivity errors likely needs to be refined, and that with such refinements, we may be able to further reduce errors in our wind calculations. (jeff.french@noaa.gov)

24. *Tracer Technology.* The prototype for the updated Automated Tracer Gas Analysis System (ATGAS) underwent significant design changes based on comments from the instrument operators. The controls were rearranged to be more convenient and the components were reorganized to simplify maintenance of the system. Software support for the new instrument is now operational and the system has been undergoing testing this month. It is consistent in its operation and easy to work with. Once testing is complete, a total of four systems will be built for use in future atmospheric tracer experiments. (roger.carter@noaa.gov, Debbie Lacroix, Shane Beard)

25. *INEEL Annual Dispersion Modeling.* In October, FRD completed a series of dispersion modeling runs that will be used in the INEEL Site Environmental Report for calendar year 2000. These runs were performed with the MDIFFH puff model, which is similar to the MDIFF model routinely used by FRD except that it uses hourly meteorological data rather than 5-minute data. The hourly meteorological data were provided by another program that reads in the raw data from the INEEL Mesonet and computes hourly averages.

MDIFFH was run using all the available Mesonet data from calendar year 2000. Several changes were made in the model runs compared to previous years. In prior years, it was assumed that all the INEEL pollutant was released at a single location at the southern end of the site. For 2000, the pollutant was spread over six release locations. The model runs were also modified so that the total integrated concentration was directly computed at over 60 residential locations around INEEL. This will simplify the estimation of the dose received by the maximum exposed individual. (richard.eckman@noaa.gov)

26. *INEEL Mesoscale Modeling.* The Alpha workstation used for MM5 modeling at FRD was brought back online in October, and is again producing high-resolution forecasts for INEEL. The execution time of the model was significantly reduced by taking better advantage of the parallel-processing directives that have been put into the newer versions of MM5. These directives are based on a standard called OpenMP, which is platform independent. The Fortran compiler available on the FRD Alpha workstation understands the OpenMP directives, so the machine can better utilize its two processors. With the three grids currently in use, the MM5 runs require about 7-8 minutes to complete an hour of simulated time. The MM5 runs are also being used to provide forecast trajectories from INEEL. (richard.eckman@noaa.gov)

27. *Community Monitoring Stations.* Datalogger software has been completed that operates the large community monitoring display that allow the public to view current meteorological conditions as they walk or drive by the two schools. The sign displays wind direction, wind speed, temperature, wind chill

temperature, precipitation and background radiation. The display allows three seconds of display time each meteorological parameter before displaying the next. (randy.johnson@noaa.gov, Roger Carter, Tom Strong, Kirk Clawson)

Las Vegas

28. Mesoscale Modeling. NV-RAMS ran to completion and generated graphics 23 of 31 days (74%) in October. RAMS ran to completion on the University of Nevada-Las Vegas (UNLV) computer system 26 of 31 days (84%). Three days of automated graphics did not complete due to data transfer failures, but data was manually transferred and graphics generated. Three days of no data/incomplete RAMS run were due to initialization data download problems. The mode of initial data transfer from Air Resources Laboratory Headquarters (ARL/HQ) to UNLV had to be changed to speed the transfer rate. The issue was discussed with ARL/HQ people, identified, and fixed. The final two days of lost run data were due to computer problems at UNLV. Data are continuing to be saved daily, and backed up to CD weekly. (Walt Schalk, 702 295 1262)

29. Las Vegas Atmospheric Dispersion Display (LVADD). LVADD is a product that is very similar to the CADD project that runs for the NTS. LVADD uses the hourly NWS reports to generate one and two hour plume concentrations factors (c/Q). This is being developed for the Las Vegas Valley currently, but is easily transferable to any area. The wind data and plume calculation portions have been completed. A display with a basic background has been developed. A better topographic/geographic background will be added. (Walt Schalk, 702 295 1262)

30. Applications of Model Outputs. The ongoing project to predict maximum temperatures on the NTS at specific locations has progressed to utilizing overlapping months to smooth the transition from one month to the next. The technique seems to be fairly accurate in predicting maximum temperatures, but will have to be monitored as the seasons progress to see if any anomalies show up. A summary of the results will be produced after a couple of months of data collection. (Doug Soule, 702 295 1266)

31. Visibility Conference in Bend, OR. M. Pitchford participated in a conference titled "Regional Haze and Global Radiation Balance - Aerosol Measurements and Models: Closure, Reconciliation and Evaluation" in Bend, OR, October 2-5. This meeting, co-sponsored by the Air and Waste Management Association and the American Geophysical Union is a periodic event occurring every three or four years that brings together many from the atmospheric aerosol/optical community, especially those working in support of federal visibility protection regulations for national parks and wilderness areas. Dr. Pitchford presented one paper, co-authored a second paper, and was a technical session chair. The papers are "Perfluorocarbon Tracers Used to Study Transport and Dispersion during the BRAVO Study" by M.L. Pitchford, M. Green, H. Kuhns, V. Etyemezian, R. Dietz, T. Watson; and "A Ten-Year Spatial and Temporal Trend of Sulfate across the United States" by W.C. Malm, R.B. Ames, L.L. Ashbaugh, R.A. Eldred, M.L. Pitchford. (Marc Pitchford, 702 895 0432)