NOAA ARL Monthly Activity Report

June 2006

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Contents

1. Highlight -- ARL HYSPLIT Trajectories Added to AIRNow- Web Site. EPA, NOAA, National Park Service, tribal, state, and local agencies developed the AIRNow-Tech Web site to provide the public with easy access to national air quality information. The Web site offers daily air quality index forecasts as well as real-time air quality index conditions for over 300 cities across the United States, and provides links to more detailed state and local air quality Web sites. Since 2002, state and local government agencies have been relying on the AIRNow-Tech Web site (http://www.airnowtech.org -- hosted by the EPA). At the end of June, a new feature was added to AIRNow-Tech's Navigator section that enables users to add ARL HYSPLIT model forward or backward trajectories to assist with forecasting or to analyze past air quality events. Trajectories, run by the user by clicking on any starting location, can be plotted on a map along with other air quality measurements and forecasts. NOAA National Weather Service NAM (40 km resolution)

model data are used to drive the HYSPLIT trajectory calculations. Archived events can be run from the year 2000 to the present. glenn.rolph@noaa.gov

2. Highlight -- AMS Council Nomination. Dian Seidel has been nominated to run for a position on the Council of the American Meteorological Society. Four councilors will be elected from a slate of eight candidates in elections to be held this fall. dian.seidel@noaa.gov

Silver Spring

3. Krypton-85 in the Global Atmosphere. A methodology for determining krypton-85 background concentrations in air has been refined. Kr-85 is a radioactive noble gas generated by nuclear fission and released into the atmosphere in fuel rod reprocessing. Concentrations of Kr-85 have steadily increased through the nuclear era, sometimes causing concern about long-term environmental impacts (e.g. related to atmospheric electrical conductivity). In the past, Kr-85 data have been used extensively to verify plume model predictions. Subtracting background from measured concentrations is required before these data can be used for such a purpose. Background concentrations can vary by as much as 5% with air mass changes over a sampler. This is not an issue for samplers near the emission source where concentrations are high but can be critical at more distant samplers. A manuscript on this topic has been submitted. roland.draxler@noaa.gov

4. HYSPLIT Version 4.8 Finalized. The new version 4.8 of HYSPLIT now supports the staggered meteorological data grids of the WRF (Weather Research and Forecasting) model as well as the use of the time averaged fields from the AER (Atmospheric and Environmental Research, Inc.) version of WRF. Data conversion routines are available to make use of output from other models, e.g. LAPS. The temporal emissions input file was modified to handle more complex release scenarios, including the heat released by the emission to compute a dynamic plume rise option. Additional options were added to many of the GUI menus. The trajectory and concentration examples were reduced to 12 hour duration simulations to illustrate shorter-range applications. The help files and User's Guide were updated to reflect the changes in the new version. roland.draxler@noaa.gov

5. Problems with Radiosonde Datasets. A recent paper by W. Randel and F. Wu examines the time series of differences between radiosonde and satellite data in the stratosphere and finds evidence of uncorrected inhomogeneities in the radiosonde data due to changes in instruments and procedures. The dataset used was similar to, although not identical to, the recently-released RATPAC (Radiosonde Atmospheric Temperature Products for Assessing Climate) dataset, which attempts to adjust for such problems. ARL is a central player in the RATPAC program. Randel and Wu claim that these remaining problems extend into the troposphere and suggest that despite recent efforts to remove inhomogeneities, existing radiosonde datasets like RATPAC are not suited for analysis of long-term changes in vertical temperature profiles.

In response, we have submitted a "Comment" on the Randel and Wu paper to the Journal of Climate. Using the RATPAC dataset, we confirm that remaining problems are likely in the stratosphere and examine the reasons for failure of our method to adjust for them. However, we find insufficient evidence that these problems have a significant effect on trends in the middle and lower troposphere, where trends are the subject of recent controversy. We also show that similar problems may exist in another adjusted sonde dataset, recently produced by the UK Met.Office. The conclusion is that

more work will be necessary to determine the effect of remaining inhomogeneities on tropospheric trends from radiosondes. melissa.free@noaa.gov

6. Tropopause Study. The tropopause is the nominal boundary between the troposphere and stratosphere. Recent studies have suggested that the tropopause might be a sensitive indicator of climate change, responding to greenhouse gas-induced tropospheric warming and stratospheric cooling. A paper on "Variability and Trends in the Global Tropopause Estimated from Radiosonde Data" by Dian J. Seidel and William J. Randel (NCAR) has been accepted for publication in the *Journal of Geophysical Research*. The study examines global tropopause variability on synoptic, monthly, seasonal, and multi-decadal time scales using 1980-2004 radiosonde data. On shorter time scales, tropopause height variations are anticorrelated with stratospheric temperature variations and positively correlated with tropospheric temperature variations. Tropopause height is more sensitive to stratospheric temperature change than tropospheric, rising 2-3 km per degree cooling of the lower stratosphere. Tropopause height trends over 1980-2004 are upward at almost all the stations analyzed, yielding an estimated global trend of 64 ± 21 m/decade. The tropopause trends are spatially correlated with stratospheric temperature trends but are uncorrelated with tropospheric temperature trends. This suggests that different processes control tropopause variability at longer time scales, when the tropopause is primarily coupled with stratospheric temperatures. Therefore, as an indicator of climate change, long-term changes in the tropopause may carry less information about changes throughout the vertical temperature profile than has been suggested by previous studies using reanalyses and global climate models. dian.seidel@noaa.gov

Oak Ridge

7. Interpretation of Aircraft Flux Records. The "flux fragment" conditional sampling technique for airborne flux measurements has been tested extensively, using the recent data set obtained over central Illinois in collaborative studies with the University of Alabama. This work has shown the ability to differentiate between corn and soybeans in the airplane's measurements even though individual fields have only 500 m typical width. The results promise a couple of important applications. We can to some extent discern the origin of a given 1-s airborne sample based on the measurements alone, a potentially useful tool to test footprint models in natural conditions. We can fly below the local blending height and determine the height above which the signal of the surface's horizontal heterogeneity has been obliterated by the turbulent mixing. ron.dobosy@noaa.gov

A key requirement in deriving flux data from aircraft observations is to quantify the attitude and velocity of the aircraft in detail. A relatively inexpensive small inertial navigation system (C-MIGITS) was tested on the University of Alabama's Sky Arrow aircraft this month during the first part of this year's Midwest (Illinois) Intensive Campaign. Unfortunately, the C-MIGITS's attitude reports (roll, pitch, and heading) have so far been unacceptable for measuring turbulent fluxes. ATDD and the University of Alabama are working with the manufacturer, Systron-Donner, to resolve the problems. Meanwhile the Sky Arrow will continue as before to use a more complex system to derive attitude information. ed.dumas@noaa.gov, ron.dobosy@noaa.gov

8. UrbaNet – Sensor Data Fusion (SDF). There are a number of SDF models now available for application in urban areas. Specialized field studies are needed to test these models. A SDF Working Group meeting was held in Boulder, CO on June 12 – 13, to design a tracer field study

suitable for testing various SDF models. A draft overview of the study plan was prepared and will be presented for comment at the George Mason University workshop in early August. A tentative date for the field study is Fall, 2007. ray.hosker@noaa.gov

The next meeting of the Sensor Data Fusion Working Group will be held on July 31, in conjunction with the annual George Mason University Transport and Dispersion workshop. shankar.rao@noaa.gov

9. East Tennessee Ozone Study (ETOS). Eight ATDD-designed fast response ozone sensors have been constructed, to permit ozone dry deposition rates to be quantified as part of the ETOS program. This is the first time (to our knowledge) that a network of ozone dry deposition instruments has been set up in North America (or elsewhere, for that matter -- similar activities have been contemplated in Europe, but it is not known that the work has actually been done.) d.l.senn@noaa.gov, philip.g.hall@noaa.gov

10. Dispersion from Roadways. Several years ago, ARL developed the ROADWAY-2 model, in collaboration with the Federal Highways Administration. At this time, the model is being used for updating the original EPA ROADWAY model. shankar.rao@noaa.gov

11. Progress with the U.S. Climate Reference Network. ARL continues to develop improved methodologies for use in the US Climate Research Network. Now that data are starting to be accumulated, studies of the spatial differences across the network and correlations among the stations are commencing. In June, a new USCRN site was installed in Mendenhall, PA. keith.bryant@noaa.gov, denny.dunn@noaa.gov

In June the National Climate Data Center (NCDC) retrieved 30 data files from USCRN sites through the server ftp.atdd.noaa.gov/. Data are passed to NCDC by this path when retrieved episodically by ATDD from individual sites to fill data gaps. A table containing the number of missing hours of retrievable data for the last 12 months has been created and is being maintained. The database, CRNSites, on NCDC's server was updated and checked for consistency and accuracy. It contains instrumentation characteristics for each site along with a record of events which affect data quality. New events are identified from several sources, including ATDD's field crews and NCDC's data-quality checks. The maintenance of ATDD's equipment database is continuing. This database includes all equipment, past and current locations, repair history, and current status. lynne.satterfield@noaa.gov

Research Triangle Park

12. Urban Dispersion -- New York City Program. Computational Fluid Dynamics (CFD) numerical model simulations have been ongoing in support of the Madison Square Garden Spring 2005 (MSG05) field study and the Midtown Summer 2005 (Mid05) field study in New York City. The Division is providing the building geometry database for the Manhattan neighborhoods. This is an extension of the building model generated by Vexcel Corporation in 2001, as was used to support earlier ARL modeling of the plume from the World Trade Center on 9/11/2001. A need was recognized to update the building model to conditions relevant to the 2005 field studies. The Division has reviewed and rechecked assessments of available photographs and information of the

Manhattan neighborhoods to identify modification needed to update the building database. The resulting building database is being used to support UDP field reports, CFD modeling simulations, and the Division's physical model for the wind tunnel model study.

Completed CFD model simulations were presented at the recent Urban Dispersion Program meeting in Salt Lake City, Utah. Plans for participation in a model intercomparison using Midtown 2005 field measurements were preliminarily discussed. The goal is to have a round of model intercomparisons completed by December 2006. alan.huber@noaa.gov

13. Air Quality Forecast Model Development and Analysis. Forecast model runs with the Community Multiscale Air Quality (CMAQ) model driven with the Weather Research and Forecasting-Non-Hydrostatic Mesoscale Model (WRF-NMM) model are underway at the National Weather Service. The air quality forecast model is currently deployed in two streams: (1) the operational forecast runs over the eastern United States based on a loose coupling paradigm, and (2) experimental forecast simulations over the continental United States based on a tight coupling paradigm wherein CMAQ calculations are performed with the same hybrid sigma-P vertical coordinate system that is utilized in the WRF-NMM. Both simulations employ a 12-km horizontal grid resolution. Comparisons of forecasts results from both streams against observations from the AIRNow network are underway. rohit.mathur@noaa.gov .

14. Linking Air Quality Models to Water Models for Chesapeake Bay. Community Multiscale Air Quality (CMAQ) model runs for the 2020 Clean Air Interstate Rule (CAIR) futures scenario were completed during May and delivered during June to the Chesapeake Bay Program for input to the Bay watershed model. These model results are considered preliminary because the 2001 Base Case has not yet been run. robin.dennis@noaa.gov

15. Modeling Particulate Matter Concentrations. ARL/ASMD scientists were leading participants in two NARSTO Particulate Matter Modeling workshops, June 27-30, 2006, in Boulder, Colorado. The first Workshop discussed particulate matter (PM) model simulation and process evaluation, and the second Workshop discussed the applications of PM models for source apportionment and air quality management. At the second Workshop on Air Quality Model Evaluation-Forecasting and Retrospectives, Ken Schere provided a plenary lecture entitled “Air quality model evaluation-forecasting and retrospectives." He also chaired a breakout session on the role of air quality forecasting in model evaluation. At the first Workshop on PM Modeling, Rohit Mathur gave an invited talk entitled “Status and progress in particulate matter forecasting: Initial applications of the Eta-CMAQ forecast model.” A workshop report is being prepared by NARSTO. kenneth.schere@noaa.gov and rohit.mathur@noaa.gov

Idaho Falls

16. UrbaNet/Joint Urban 2003. Analysis of the tracer data collected in the Oklahoma City dispersion study in 2003 set continued in June. The analysis of four daytime intensive observational periods (IOPs 3-6) and four nighttime IOPs (7-10) has now been completed. Some of the recent key findings, particularly for the daytime-nighttime differences, are shown in the accompanying graphs. Figure 1 plots the peak-to-mean ratio (P:M) and concentration fluctuation intensity (CFI - standard deviation divided by the mean) by the edge vortex (ev), midblock roof sampler locations (mbr),

midblock street sampler locations (mbs), and open sampler locations (op). Figure 2 plots (1) the exponential tracer decay time (Tau), (2) the fraction of the total integrated concentration measured after the tracer release is shutdown (TIF), (3) the total time the tracer was detected (Time), and (4) the plume arrival speed (receptor site distance from the release point divided by the plume arrival time) divided by the mean wind speed aloft (AS/WS) by IOP. These graphs show that daytime periods are characterized by higher P:M and CFI than nighttime periods, the decay of the tracer plume is slower during the night than day, and the tracer plumes at night tend to arrive more slowly and depart more slowly than during the daytime relative to the ambient wind speed aloft. The implications of these observations and the physical causes underlying them are being worked out for inclusion in a journal article presently in development. dennis.finn@noaa.gov

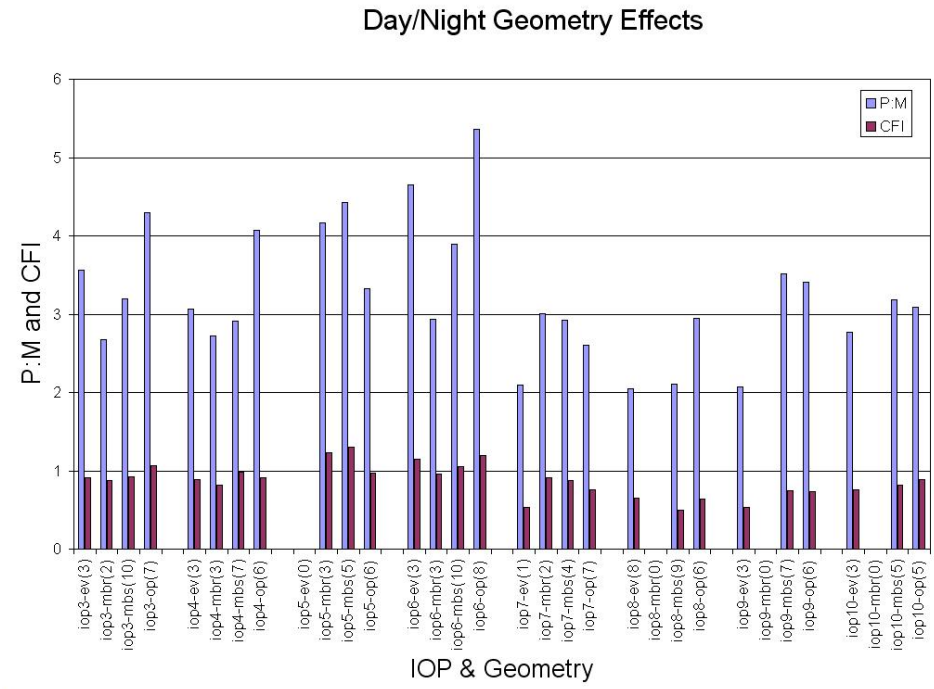

Figure 1. Peak to mean (P:M) and concentration fluctuation intensity (CFI) plotted by the edge vortex (ev), midblock roof (mbr), midblock street (mbs), and open (op) sampler locations.

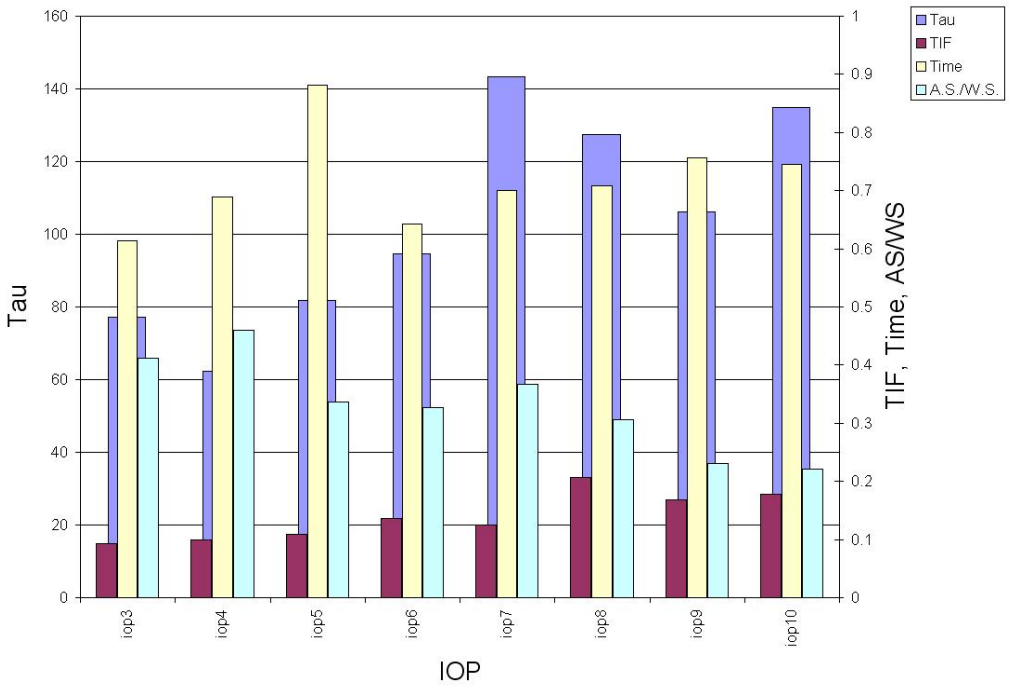

Figure 2. Exponential tracer decay time (Tau), fraction of the total integrated concentration (TIF), total time tracer was detected, and the plume arrival speed (Time), and plume arrival speed divided by the plume arrival time (ASWS) plotted by IOP.

17. Extreme Turbulence Probe. The ET probe has been included as part of a draft NOAA-NIST partnership on hazard resilient communities. The goal of the program is to carry out research and development that will reduce the vulnerability of U.S. communities to both natural and man-made hazards. One of the elements in the plan is to obtain high-quality observations of winds and turbulence in hurricanes and other high-wind events so that structures can be designed to better resist wind damage. The ET probe is clearly well suited for such applications. richard.eckman@noaa.gov

18. TexAQS II Preparations -- Smart Balloon. All six of the smart balloon transponders for the Texas Air Quality Study II (TexAQS II) in August have been constructed and tested in the lab. They are currently being tested in outdoor conditions. Communications are currently working well and final connections and leak testing of the fiberglass transponder housing is in progress. The battery packs and solar panels remain to be constructed.

Because of problems with the NOAA P-3, which currently has a planned arrival date of August 25 or later, we have delayed our arrival to be ready for deployment on August 22, 2006. randy.johnson@noaa.gov

Las Vegas

19. DIVINE STRAKE. In preparation for test support, all SORD mobile meteorological equipment, computer assets, and communications systems have been evaluated for dispersion forecasting. Some

minor problems have been identified and corrected. SORD is ready to support the experiment, but it has recently been announced that the experiment has been delayed until further notice.

The Open Burn/Open Detonation Dispersion Model (OBODM) has been. OBODM, the NOAA HYSPLIT model, and Google Earth have been installed for operational use by program managers to support Divine Strake and other future operations at the Nevada Test Site. kip.smith@noa.gov

20. Urban Air Quality Study (UrbaNet). Plans are being made for a next-stage focus on Las Vegas, as a part of the UrbaNet program. Collaboration with workers at the University of Nevada at Las Vegas will enable direct interaction with first responders there (especially fire fighters and police), streamlining the effort to get user guidance. Tracer studies are being planned. darryl.randerson@noaa.gov

21. IMPROVE Network Plans for Downsizing. Marc Pitchford (ARL-SORD) is chairing a committee tasked with identifying and priority ranking the least important 35 sites of the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. One hundred eighteen of the more than 150 IMPROVE sites are funded by EPA's resources that may be reduced by up to 15% in FY2007, requiring up to a 30% reduction in the number of monitoring sites. The just-released presentation/report of the committee describes the process used to select monitoring sites whose data are well correlated with data from neighboring sites, and shows the resulting priority-ordered list of

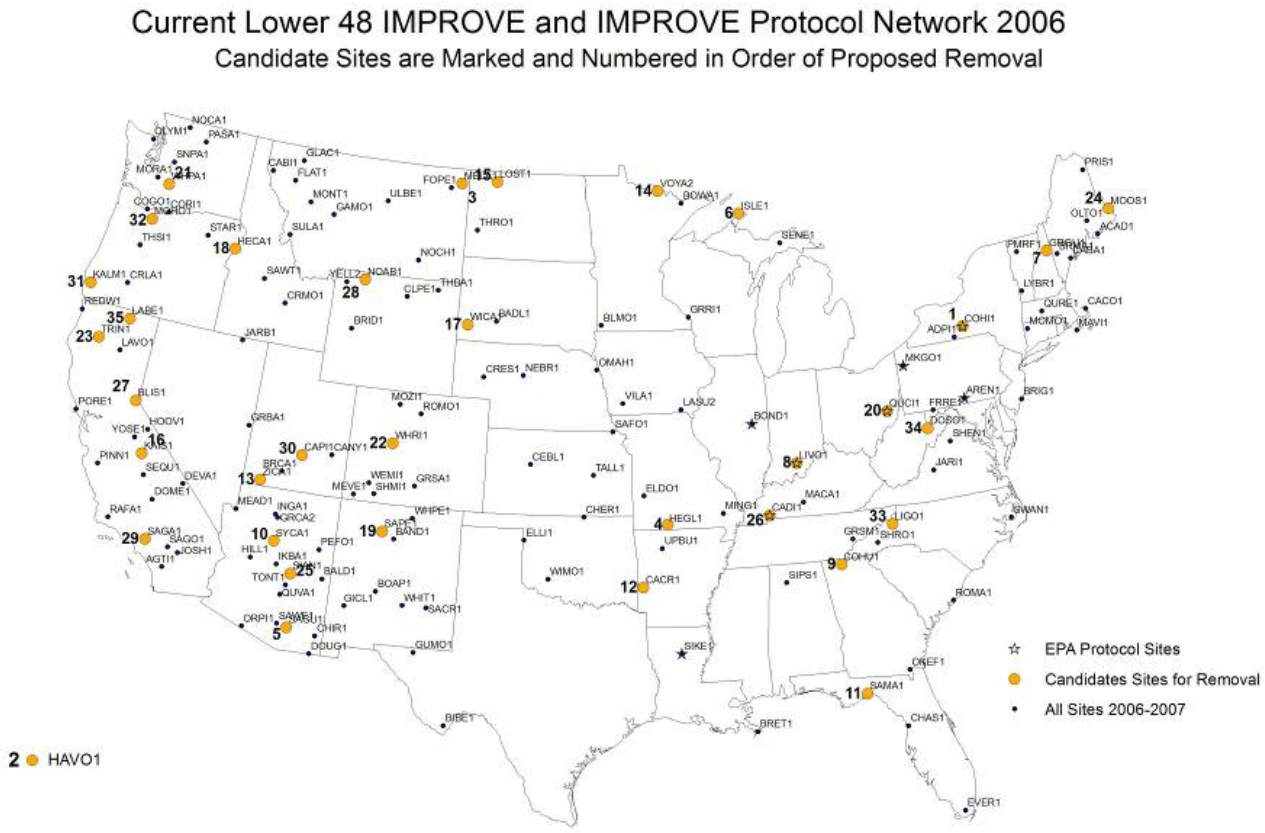

Figure 3. Sites suggested for removal from the IMPROVE network, numbered in order.

sites for possible decommissioning. Figure 3 (above) shows the locations of the sites selected for the list. The next step in the planning process involves solicitation of review comments, due August 15th, from those who have an interest in this monitoring program, including the air quality science community. NOAA and its cooperative research partners are encouraged to offer their comments. To access the PowerPoint presentation file (IMPROVEsiteReductionPlanPresentation1.ppt) and other information used in the assessment, see the FTP site identified below, with the username **cira\guest** and password **orion.** marc.pitchford@noaa.gov (ftp://vista.cira.colostate.edu/Public/IMPROVE/NetworkAssessment)