



NOAA ARL Monthly Activity Report



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Highlights

1. NASA Partnership in the West. NASA has requested to work with the Regional Planning Organizations (the five RPOs are partnerships among western states and tribes, to implement the Regional Haze Rule) to explore the use of air quality relevant satellite remote sensing data. Marc Pitchford (SORD), co-chair of the Inter-RPO Data Analysis/Monitoring Workgroup, organized a conference call (February 22) to hear the suggestions by the NASA Applied Sciences Program Integrated Product Team for Air Quality (Stennis Space Center). Among the high spatial resolution remotely sensed data that can be provided is aerosol and gaseous concentration fields, surface temperature, cloud and snow cover, and precipitation types and amounts. As a result of the call, by mid-summer the RPOs will generate a wish list of desired data that could be supplied according to information provided by NASA. By mid-September NASA will assess this request and develop an implementation plan. At the same conference call where NASA made this proposal, the VIEWS Steering Committee agreed to begin planning for inclusion of aerosol speciation data from Canadian monitoring networks into the VIEWS to simplify assessment of spatial patterns across the international border.
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2. READY Used by Forecaster for the Successful Fossett Record-Setting Flight. As he did for the last successful around-the-world balloon flight for Aviator Steve Fossett, Belgian meteorologist David Dehenauw used NOAA's NCEP Global Forecast System (GFS) forecasts and NOAA ARL's READY website to

successfully guide Fossett to become the first person to fly solo, non-stop, around the world. Details on the flight can be found in the NOAA press release: <http://www.noaanews.noaa.gov/stories2005/s2401.htm>
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Silver Spring

3. Additions of Ozone and Temperature Data to the ARL Web Site. Global ozonesonde and total-ozone data have been updated through 2003, and for some total-ozone stations through 2004. It is planned to place these seasonal data (along with global Umkehr data through 2003) on the ARL Web in a format similar to radiosonde-derived global temperatures, now being placed on the ARL Web for years 2003 and 2004. As with temperature, the total-ozone record begins in 1958, but the ozonesonde and Umkehr record only in about 1968. (Jim Angell, 301 713 0295, x127)

4. NOAA/GCOS Workshop to Define Climate Requirements for Upper-Air Observations. About 80 scientists and managers met at NOAA's David Skaggs Research Center during 8-11 February 2005 to discuss scientific requirements for upper-air observations for climate. The workshop addressed a wide spectrum of climate activities that depend on upper-air data, including climate monitoring, climate prediction, climate process studies, climate model development and evaluation, and radiative transfer studies. Recommendations for observing system requirements will be summarized in a workshop report, which will be the basis for a second workshop that will address potential technologies to meet the stated requirements. This activity is integral to the NOAA Observing System Architecture program, and to the Global Climate Observing Systems Upper-Air Network planning activities. More information about the workshop is at <http://www.oco.noaa.gov/workshop>. dian.seidel@noaa.gov

Boulder

5. SURFRAD/ISIS. The Baseline Surface Radiation Network (of which SURFRAD is the continental US component) has been identified as a focal issue for Climate element 1 of the FY08 PBA. As a result, related materials are being prepared and plans made for subsequent years of operation. It has been suggested that Tilden Meyers' heat flux and CO₂ flux systems should be included in NOAA's climate observations plans.

The method of correction developed for a ventilated and shaded pyrgeometer with either a bad case or dome temperature measurement has been refined and is ready to be reported. The two temperature measurements are made in a pyrgeometer. If one of the temperature measurements is incorrect, the resulting error in the computed infrared irradiance could be significant, on the order of 5-10%. It was determined that the method developed for correcting a bad case or dome temperature contributes only a 0.1 Wm⁻² error at 95% confidence to the measured infrared irradiance.

The software used to interpolate the NWS national network of soundings to the locations of the SURFRAD stations was improved. It now limits the extent over which a vertical interpolation will be allowed when normalizing individual soundings to a 25-mb vertical resolution. The way in which the sounding data are stored and accessed was also improved. john.a.augustine@noaa.gov

6. Aura Satellite Validation Campaign. The Aura Satellite Validation Campaign took place during the Polar Aura Validation Experiments (AVE) mission between January 24 and February 9, 2005. The campaign was designed to provide support for the recently launched Aura satellite that is taking measurements in the polar region. Measurements were taken on board the DC-8 aircraft under the satellite path. Ozone column data were produced to validate the ozone column measurements as part of the AURA mission. There were a total of six science flights with some flights taking measurements in the unusually strong polar vortex along the AURA underpasses. The preliminary results were presented at the AURA science team meeting, March 1-3, 2005 in Pasadena, CA. irina.petro@noaa.gov

Oak Ridge

7. *Urban Dispersion Study.* The Annual Meeting of the international Technical Panel 9 on urban dispersion issues was held in Melbourne, Australia, Jan. 31-Feb. 3. It was followed by a meeting (Feb. 3-4) on sensor data fusion. A status report on NOAA's Urban Test Beds was presented for Bruce Hicks by Ray Hosker. ray.hosker@noaa.gov

Research Triangle Park

8. *CMAQ Model-Meteorology-Chemistry Interface Processor (MCIP).* The Meteorology-Chemistry Interface Processor (MCIP) has been modified to output dry deposition velocities for six chlorine and two mercury species to support versions of the Community Multiscale Air Quality (CMAQ) model that will simulate chlorine and mercury. These modifications will affect the "M3Dry" (Pleim) dry deposition routine. Both chlorine and mercury will be user options. Testing is required for both the chlorine and mercury dry deposition velocities for both the Penn State/National Center for Atmospheric Research Mesoscale Model (MM5) and the Weather Research and Forecast Model (WRF) models. It is anticipated that the new MCIP with the option for additional dry deposition species will be released to the CMAQ community with the August 2005 CMAQ release. (Tanya Otte, 919 541 7533; Golam Sarwar, 919 541 2669; Russell Bullock, 919 541 1349)

Modification of the Meteorology-Chemistry Interface Processor (MCIP) of the Community Multiscale Air Quality (CMAQ) Chemical Transport Model (CTM) for the simulation of atmospheric mercury in the next public release of all CMAQ model codes was begun. In MCIP, Henry's constants for elemental mercury and reactive gaseous mercury (RGM) were added, with the value for RGM based on those for mercury chloride. RGM is an operational term for the gaseous forms of mercury that are easily collected in air samples separately from elemental mercury. While the actual compounds of mercury that comprise RGM are uncertain, it is believed to be primarily mercuric chloride. MCIP also requires specification of molecular diffusivity and reactivity for all simulated substances to estimate dry deposition velocity. The diffusivity value for elemental mercury was obtained from recent scientific literature. The value for RGM was derived from the elemental mercury value and a published adjustment factor based on the relative molecular weights to the $-2/3$ power. Again, mercuric chloride was used as a surrogate for RGM. The reactivity value for RGM was set to that already prescribed for nitric acid since past modeling practice has been to use nitric acid as a surrogate for RGM when calculating dry deposition velocity. The reactivity value for elemental mercury was set to 1/20th of that already used for NO and NO₂ based on the very long atmospheric lifetime of elemental mercury. The effect of these parametric settings will be investigated in test applications of MCIP and CMAQ CTM and adjusted if necessary to produce reasonable dry deposition velocities and air/cloud partitioning of the new mercury species. (Russell Bullock, 919 541 1349)

9. *Model Evaluation: Aerosol Optical Depth Comparisons.* The Community Multiscale Air Quality Modeling System predicted PM_{2.5}, sulfate, nitrate, ammonium, organic carbon, and elemental carbon concentrations have been compared with those observed by the Interagency Monitoring of PROtected Visual Environments (IMPROVE) network and the Speciated Trends Network (STN). Comparison tables showing the Mean Bias, Normalized Mean Bias, Root Mean Square Error, and Normalized Mean Error have been generated for cases when the CMAQ was run using the standard emission inventory, and also when CMAQ was run using the satellite-reallocated emission files for May and August 2001. Aerosol Optical Depth (AOD) and Single Scattering Albedo (SSA) have been computed and inter-compared using three different published methods. Time series of CMAQ AOD values have been compared with satellite AOD products. A pseudo-scattering coefficient of particles is computed for August 2001, by dividing the difference between the CMAQ AOD, and satellite observed AOD values by the model derived meteorological mixing layer height during the daytime hours (15-20 UTC). The pseudo-scattering coefficient is being used to analyze if it has any relationship with other convective boundary layer parameters. A conference paper entitled, "A

comparison of aerosol optical depth simulated using CMAQ with satellite estimates,” was submitted for the forthcoming 98th Annual Conference of the Air & Waste Management Association to be held in Minneapolis, Minnesota, June 21-25, 2005. (Dev Roy, 919 541 5338; Rohit Mathur, 919 541 1483; Alice Gilliland, 919 541 0347)

10. Climate Impacts on Regional Air Quality (CIRAQ). Data from the future scenario climate simulation were received (8 of 10 years), and are currently being processed for analysis. A majority of time was spent analyzing the “current scenario” regional climate model (RCM) output for representativeness of the actual climate. Observed and simulated temperature, dewpoint temperature, pressure and wind speed/direction time series (10-years total) were extracted for 131 sites around the United States. The simulated distributions of these variables were compared with the observations using cumulative distribution function (CDF) plots. The interannual variability of observations and model were calculated as a function of variable range and compared using a separate plot. Wind speed and direction distributions were contrasted with wind rose plots. The variability of these distributions was examined as a function of wind speed and wind direction using a contour plot. These results were made accessible through an interactive web interface.

Initial results are mixed. The 2-m temperature distribution indicated by the regional climate model replicated the interannual variability of the temperature distribution for most locations around the United States. However, the distributions as a whole are biased cold, especially in the eastern and southern United States. The mid-western United States was best simulated in terms of 2-m temperature. Other distributions are consistent with the 2-m temperature. For example, the model is biased dry in the eastern United States as indicated by the observed and simulated 2-m dewpoint temperature distributions. This dry bias is consistent with the cold model bias. Across the mid-western United States the bias of dewpoint temperature is minimal, consistent with the non-biased 2-m temperature. Wind distributions over the eastern United States partially explain the cold temperature bias as northerly winds are more frequent. These results will be examined in more detail over the next few months. (Robert Gilliam, 919 541 4593; Ellen Cooter, 919 541 1334)

11. NARSTO Emission Inventory Assessment. NARSTO’s Emission Inventory Assessment has been reviewed by the NARSTO external scientific peer review panel. The comments were received in mid-February and the assessment authors are addressing the comments. While the comments were very favorable in general, two significant suggestions were made: (1) the document needs to be enhanced for relevance to audience of decision makers, and (2) the document needs additional material on the costs and next steps to implement the action plan for improvement of emission inventories.

The current schedule calls for the next version of the report to be presented to the NARSTO Executive Assembly on April 11 and to the EPA Emission Inventory Conference on April 12, 2005. The document should be finalized and distributed at the Air & Waste Management Association’s Annual Meeting in June. The current list of recommendations includes:

1. Address priority source category testing needs;
2. Improve speciation estimates;
3. Improve existing and develop new emission inventory tools;
4. Quantify and report uncertainty;
5. Increase inventory compatibility and comparability;
6. Improve user accessibility;
7. Improve timeliness; and,
8. Assess and improve emission projections.

The document, "Improving Emission Inventories for Effective Air-Quality Management Across North America," can be downloaded from the NARSTO Web site at <http://www.cgenv.com/narsto/>. (David Mobley, 919 541 4676)

Idaho Falls

12. Tracer Analysis Facility (TAF) Adaptation for Perfluorocarbon Tracer Analysis. The development of an instrument for perfluorocarbon analysis shows promise for use in the upcoming Urban Dispersion Program field experiment planned for New York City in August. An initial test, using vapors of unknown concentration obtained directly from perfluorocarbon liquid aliquots of several candidate tracer gases were each analyzed on the modified system. There was very good separation of most of the peaks.

The liquid aliquots used for the initial test were taken from tracers that had been stored for years. Their purity is not known and even suspect. Pure standards are on order; a more quantitative investigation can then be completed. (Debbie Lacroix, 208 526 9997)

13. Extreme Turbulence Probe. Some early test data have been re-examined to better understand some of the probe's characteristics. One issue that has not been adequately explained is that the power spectrum for the cross-wind velocity component v usually rolls off faster than the $-5/3$ power law expected from inertial-subrange theory. It was discovered that this problem could be corrected by applying an empirical adjustment to the angle of sideslip computation. Such empirical adjustments are frequently required with pressure spheres, because the underlying equations used for the winds are based on inviscid flow theory. Generally, the adjustments become larger as the pressure ports get further from the flow stagnation point. The horizontal separation of the ports on the ET probe are twice the vertical separation, which may explain why an adjustment is required only for the v component. (Richard Eckman, 208 526 2740)

14. Smart Balloon. Three newly constructed transponders are being operated outside to 1) test the operation of the data acquisition software, 2) test the Iridium satellite modem operation and reliability, and 3) compare data between all three transponders. When side-by-side testing is complete, one of the transponders will be compared against standard meteorological instruments located at the Idaho Falls Mesonet station. In addition, real time mapping displays are being developed for tracking the balloon from the controlling computer and the web. Balloon data updates will be displayed every 15 minutes. (Randy Johnson 208 526 2129, Shane Beard, Vance Hawley, Brad Reese)

15. Tracer Sampler Software Upgrade. The software upgrade for the Programmable Integrating Gas Samplers (PIGS) has been completed and bench tested. The upgraded firmware is being loaded on a number of PIGS in preparation for a series of tests that will exercise the complete system in simulated field tests. The tests have been designed to check the operation of the new system and also document some of the capabilities of the PIGS. This upgrade greatly increases the capabilities of the PIGS but also increases the complexity of operating the samplers. Over 400 parameters must be specified by the operator every time a test is conducted with the PIGS. In order to avoid errors, a great deal of care must be exercised and sufficient time will need to be allowed for the operation. (Roger Carter, 208 526 2745)

16. Mesoscale Dispersion Modeling. As part of a planned update of the FRD web pages, a new link has been created to describe the general configuration of the mesoscale simulations performed at FRD. This link also shows some three-dimensional output from a HYSPLIT dispersion model. With the 3-D perspective view, one can see both the horizontal and vertical motion of the HYSPLIT particles relative to the terrain. This contrasts with the current modeling based on MDIFF, which is limited to a two-dimensional wind field. (Richard Eckman, 208 526 2740)

Las Vegas

17. MEDA Maximum Temperature Predictions. February weather on the NTS was wetter than normal at most locations, but the temperatures were near normal. The prediction of daily maximum temperatures showed negligible bias and an average absolute error of 1.9 C -- the system did a reasonably good job of predicting the daily maximum temperatures. douglas.soule@noaa.gov

18. MADIS to access DOE site data. ARL leads the Meteorological Coordinating Council (DMCC) of the Department of Energy. A draft memorandum was prepared, revised, and mailed to the DMCC membership, to elicit real-time meteorological data from each DOE/NNSA site. The data are to be made available for ingestion by the NOAA/FSL Meteorological Assimilation Data Ingest System (MADIS). Once in MADIS, the data can be input into NOAA weather forecast models run by the National Centers for Environmental Prediction. darryl.randerson@noaa.gov