



NOAA ARL Monthly Activity Report



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Highlights

1. *Extreme Turbulence Probe.* A new Extreme Turbulence Probe being developed by FRD and ATDD is to provide measures of turbulence nearly in real time in the violent atmospheric boundary layer during hurricane landfall. The link between the probe's sensors and the processing software comes through an advanced analogue-to-digital(A/D) converter. This connects with the outside world physically through a US

port. The link is currently being formed to make the output from more than 30 sensors in the sphere available to the processing software at 50 samples per second.

During hurricane landfall deployments, the ET probe will experience both high wind and frequently heavy rain. To explore the response to rain, a rain accelerator was built to simulate the impact of high velocity rain drops on the surface of the ET Probe sphere. The system accelerates well formed droplets in a laminar flow of air. This allows the drops to be consistent in size, velocity and impact position. Several design changes have been made as a result of initial experiments using this system. (randy.johnson@noaa.gov, Tim Crawford, Eric Egan, Jerry Crescenti, dobosy@atdd.noaa.gov)

Silver Spring

2. *Climate Research Committee Report.* The National Research Council's Climate Research Committee (CRC) is reviewing U.S. participation in the World Climate Research Programme (WCRP). In December, the CRC prepared a letter report to relevant federal agencies discussing the U.S. contributions to each element of the WCRP and recommending ways to enhance their effectiveness. Dian Seidel serves as a member of the CRC. (dian.gaffen@noaa.gov)

3. *Global Ozonesonde Data Updated Through 1999.* Following on the update of total ozone through 1999, global ozonesonde data have also been updated. In the north temperate zone, where the data are best (12 regularly reporting ozonesonde stations), the ozone in the 16-24 km layer of the low stratosphere decreased by about 15% between 1968 and 1999, the generally uniform decrease interrupted by ozone decreases of about 10% for 1-2 year intervals following El Chichon and Pinatubo eruptions. In the 8-16 km layer the ozone decrease following these eruptions is again about 10%, but in this layer bracketing the tropopause there is no long-term change in ozone. In the 24-32 km layer there is essentially no change in ozone from 1968 until the Pinatubo eruption in 1991, but then the ozone decreased by about 5% and has remained 5% below the average through 1999. In the tropospheric 2-8 km layer the ozone increased by about 20% between 1968 and 1988, but since then has decreased by a few percent. During the 32 years of record, the ozone decrease in the low stratosphere has been greatest (about 40%) in the south polar zone in connection with formation of the well-known Antarctic ozone hole, but it should be noted that in the low stratosphere of the north polar zone, the ozone has decreased by up to 30% during this period! (Jim Angell, 301 713 0295, x127)

4. *University of Hawaii/NASA Volcanic Ash Ensemble Forecasting Project.* The HYSPLIT model is now up and running on the computers of the Maui High Performance Computing Center (MHPCC). All of the elements of the ensemble dispersion forecasting project have been completed and can be viewed on a special web page:

<http://www.arl.noaa.gov/ready/mhpcc0.html>

The ensemble forecast system is comprised of two components, meteorological prediction and plume dispersion forecast. In the current configuration, only one meteorological forecast is used to create an ensemble of dispersion forecasts. The meteorological component is comprised of the 10 km output fields from the non-hydrostatic Mesoscale version of the Regional Spectral Model (MSM). The dispersion calculations are from the HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. Both HYSPLIT and the MSM are run at the MHPCC.

The assumption behind the dispersion ensemble is that errors in the downwind plume position are primarily a function of the accumulation of initial errors in the particle trajectories. Each ensemble member of the dispersion forecast is computed from the same pollutant source location, but for the calculation the meteorological grid is offset by \pm two meteorological grid points in X,Y,Z, thereby resulting in 27 members of the ensemble. The ensemble is run simultaneously on 28 processors.

The following products are produced: 1) A time series of air concentrations for the base case of the ensemble prediction; 2) a probability that a concentration value will be exceeded; 3) the concentration contours at three different standard probability levels: the 50th, 75th, and 90th percentiles where each contour shows the area where the concentration will NOT be exceeded, and 4) the number of ensemble members at each grid location that have a concentration value greater than the concentration of the base member. (roland.draxler@noaa.gov)

5. Data Archive – Tracer Experiments and Meteorology. The availability of meteorological re-analysis projects at several international meteorological centers, provides an opportunity to link high quality modern meteorological data with many of the older long-range tracer (perfluorocarbon and Kr-85) experimental data sets, many of which were funded by the US government. The concept is to create a set of CD ROMs, containing the experimental data, relevant reports, meteorological data, and statistical analysis and display software, all in a common non-proprietary form. This common data base would permit the modeling community to conduct sensitivity and verification studies with considerable less preparation and effort than is now required. A demonstration project has been funded for us to put together the experimental data that have been coordinated at ARL headquarters over the past 25 years. The first phase of the project is in progress in which we have extracted the meteorological data (on sigma surfaces from the spectral coefficients) for the ACURATE, CAPTEX, and ANATEX experiments. The data are now in the process of being converted to a standard gridded format. (roland.draxler@noaa.gov)

6. NRC Emergency Response. The Nuclear Regulatory Commission has expressed renewed interest in NOAA support for nuclear accidents and exercises. NRC representatives met with ARL HQ in December to discuss the current status of meteorological and dispersion model products available to the NRC from NOAA. NRC was very interested in the plant specific meteorology and dispersion forecast pages within READY and would like ARL to train it's dispersion modelers in the use of READY. Following the meeting the READY web pages were updated to reflect new meteorological products now available from the NWS, including free 5-minute NEXRAD radar images near each nuclear power plant. (glenn.rolph@noaa.gov)

Boulder

7. SURFRAD. All SURFRAD interpolated rawinsonde-type soundings were reprocessed with the new and improved interpolation code that checks and corrects for hydrostatic stability. This improvement especially affects the interpolation of the surface parameters. A new code has been added to interpolate soundings to the proposed Canaan Valley, WV SURFRAD station. The reprocessed information is available via the SURFRAD web site. (John Augustine, 303 497 6415)

8. Central UV Calibration Facility (CUCF). In December the CUCF completed the year 2000 EPA/NPS UV Radiation Monitoring Network audits. The EPA/NPS network consists of 21 sites, each of which has a Brewer spectrophotometer. The CUCF audit consists of an independent verification of the absolute

spectral responsivity of each instrument. The CUCF visits seven sites each year to verify the instrument's calibration and operational characteristics.

The CUCF completed the construction and initial characterization of its new angular measurement system for Yankee Multi-Filter Rotating Shadowband Radiometers (MFRSR). The system can accommodate both the UV and visible models of the shadowband instrument. The system incorporates a new method for making this measurement by simultaneously sampling all seven instrumental channels and a normalizing channel.

Researchers at the CUCF are attempting to change the measurement system of the Irradiance Scale Transfer system from photon counting to current measurement. It is a formidable task due to the low light levels at short wavelengths that are trying to be measured. The advantage to this system will allow 100's of measurements (or more) to be made at each wavelength instead of just a few with the photon counting system. This will effectively reduce the statistical variation in the measurement process and thereby reduce the measurement uncertainty. (Patrick Disterhoft, 303 497 6355).

Kathleen Lantz of the CUCF attended the World Meteorological Organization (WMO) UV Instrument Sub-group Meeting from November 15-18, 2000 in Lauder, New Zealand at the NIWA Lauder Station. The committee was organized to write several documents on "Instruments that measure solar ultraviolet radiation." The committee convened to work specifically on two documents of the series. These included "Broadband instruments measuring erythemally weighted solar radiation" and "Multi-channel moderate-bandwidth filter instruments." The documents are intended to provide users of the different instrument types with a set of criteria for assessing performance and stability of the instrument, and typical applications of the instruments for research and monitoring. The first WMO document in the series "Spectral Instruments" is in the final stages and is due out early this year. (Kathleen Lantz, 303 497 7280)

9. EPA UV Network Brewer Spectral Radiometers. Preliminary examination of EPA UV Network Brewers has been completed. This effort is aimed at using the existing information in the EPA UV network database to arrive at temperature corrections to be applied to the irradiance data. The Brewers are meant to undergo field checks with externally mounted 50 W lamps on a bi-weekly basis, but most sites perform the tests on a less frequent timetable. These data are used to examine the effect of temperature on response functions. This correction can eventually be replaced with a more accurate correction when or if such becomes available. Of the 20 sites examined, 12 seem to have similar behavior and are promising candidates for immediate correction. The other 8 show a temperature dependence that is either much different from the others, has too few data for a reliable fit, or have other problems that raise questions about the interpretation of the data. (Dave Theisen, 303 497 6620)

Oak Ridge

10. Canaan Valley. Several planned projects will extend the activities at the Canaan Valley air quality and measurement site beyond the current NOAA AIRMoN efforts. The NOAA SURFRAD instrumentation and full energy-balance suite have been mentioned previously. Two water quality stations are now also being planned, along with an intensive field study of the dry deposition of nitrogen, sulfur, and ozone to Canaan Valley watersheds. A presentation to the Board of Directors and staff of the Canaan Valley Institute explained the need for these studies and the time frame of their implementation. Cases of acidic precipitation in the Canaan Valley also continue to be analyzed using NOAA/ARL's HYSPLIT model. This work seeks to identify source regions for the acid precipitation events. (vogel@atdd.noaa.gov, Meyers)

11. Climate Reference Network. Planning and discussions continued on the Climate Reference Network. The new temperature calibration system was placed in operation and automated; performance is generally satisfactory. Development of improved calibration and documentation protocols is underway. (meyers@atdd.noaa.gov, Hosker, Hall, McMillen, Auble, Matt, Baker - NCDC)

12. Dispersion Studies in Washington, DC. Software was developed and tested to support a new DOD-DTRA study in Washington, D.C. for the 2001 Presidential Inauguration. The Linux-based software will log data received via wireless serial connections from two separate sonic anemometers. Fifteen-minute averages of wind speed, wind direction, and associated standard deviations will be logged and made available on ATDD's FTP site during the experiment period. (meyers@atdd.noaa.gov, Dumas, gunter@atdd.noaa.gov)

DTRA also expressed strong interest in installing ATDD's Remtech PA1-LR sodar at a site in Washington (probably at Ft. Myer) to provide wind data aloft. ATDD agreed to do this, but expressed strong reservations because of the high ambient noise levels in the Washington area that are expected to interfere with the sodar's data acquisition. (pendergrass@atdd.noaa.gov, White, Hosker)

13. Dynamical/Photochemical Modeling. Statistical analysis of the trace gas distributions from the coupled LES-photochemical simulations continued in December. To eliminate the effects of the domain grid on the autocorrelation and spectral analyses, an array element shuffling routine was written to randomize the "observations" for each trace gas in each horizontal cross section.

Due to the skewness of many of the trace gas distributions, horizontally-averaged mixing ratio profiles with \pm standard deviation "error bars" appear to be an unsatisfactory, though simple, way to show the variation of each species within each horizontal plane. (herwehe@atdd.noaa.gov)

14. Italian National Research Council Sky Arrow. Final assembly and initial testing of the new MFP system for the Italian National Research Council's Sky Arrow aircraft was completed this month. Delivery to the Sky Arrow factory in Rome, Italy is expected during January. (brooks@atdd.noaa.gov, Dumas).

15. Enhanced Emergency Response Forecasting. ATDD participated in a meeting with several scientist and engineers from various ORNL divisions, to discuss collaboration on a new emergency response capability for nuclear facilities. This would involve both real-time modeling with ingestion of local data and NWS-forecast wind fields, as well as the use of instrumented "smart balloons" (a la FRD) and/or remotely piloted aircraft. A draft proposal is being prepared. (hosker@atdd.noaa.gov)

Research Triangle Park

16. Land-Surface, Dry Deposition, and Boundary Layer Models for Models-3/CMAQ. New land-surface, dry deposition, and planetary boundary layer (PBL) models for M-3/ CMAQ have been under development for several years. The land-surface model (LSM) has been added to MM5 and has been evaluated through comparison to surface flux measurements over a variety of vegetation. The latest release of MM5 (version 3.4) from NCAR includes the new LSM, which is known as the PX LSM (after Jonathan Pleim of ASMD/ARL and Aijun Xiu of MCNC), as one of two LSMs now available to the MM5 community. A new dry deposition model (M3dry) has been developed to use the stomatal and aerodynamic resistance directly from the PX LSM. The main advantage of is that the stomatal pathway for dry deposition is more responsive to soil moisture and vegetation conditions. Recent surface flux studies, which include measurements of heat, moisture and chemical surface fluxes, were used for combined evaluation of LSM and dry deposition components. Results from soybeans near Nashville during the SOS-95 experiment, from mixed

forest in upstate NY, and from soybeans and grass near Nashville during the SOS-99 experiment were presented at the Fall AGU meeting in December 2000.

An option in MM5 includes the asymmetric convective model (ACM) which is a simple non-local closure scheme for convective conditions. Recently, the ACM has been modified to improve its treatment of the surface layer. During convective conditions, vertical mixing in the surface layer, defined by the magnitude of the Obukhov length, is modeled by eddy diffusion where diffusivity is defined by surface layer similarity theory. Above the surface layer, upward non-local transport from the surface layer directly to all layers in the CBL is combined with local compensatory downward transport. The ACM2 has been implemented in MM5 and is soon to be implemented in CMAQ. It will be suggested that the three model components, PX LSM, M3dry, and ACM2, be used together as a consistent surface-PBL package when available in the Fall 2001 M-3/CMAQ release. (Jonathan Pleim, 919 541 1336)

17. *Relating Field-Scale Wind Blown Fugitive Dust to Larger Scale Vertical Dust Flux.* Work has been completed on reconciling micro-scale emission rates for fugitive dust sources like dust emissions from unpaved roads with measured concentrations of PM10 from further upwind. Regional scale model concentrations based on field-scale fugitive dust emission rates typically are much higher than observed fugitive dust concentrations. Gillette's model was developed to reconcile the observations and the emission rates. The work was presented at the Western Governors Regional Air Partnership Research and Development Forum during December at Las Vegas, NV. A box model was developed to calculate regional scale vertical fluxes of dust from field-scale vertical fluxes of road dust. (Dale Gillette, 919 541 1883)

Idaho Falls

18. *Central California Ozone Study (CCOS).* The data acquired during the Central California Ozone Study (CCOS) have been put through quality control screens. This includes data from nine meteorological towers and wind profiles acquired by a 915-MHZ radar wind profiler and Doppler sodar. The final data sets was released to the California Air Resources Board (CARB) early this month. In addition, a data report was recently published. (jerry.crescenti@noaa.gov, Neil Hukari)

19. *Wave Profile Experiment (WAPLEX).* Efforts are underway to enhance the aircraft data collected during the Wave Profile Experiment (WAPLEX) in November 1998. This includes using an improved differential GPS correction algorithm (*flykin*) which has reduced the noise (i.e., variance) in the wind velocity by about 20%. In addition, new calibration offsets are being determined to correct a bias in the mean wind speed and direction. (jerry.crescenti@noaa.gov, Jeff French)

20. *Salt Lake City Dispersion Study, 2000.* The extraction of SF₆ plume crossing data from records of van-mounted continuous monitoring systems has been completed. In addition, over 700 cartridges from whole air samplers have been analyzed. Data analysis became a longer than expected process due to the extremely wide range of concentrations from one sample bag to the next. All data is now in the QA/QC process. Every analytical run is being reviewed and verified. Some modifications have been made to the raw data software to make it more efficient and "user-friendly," as well as fix some information downloading glitches. (roger.carter@noaa.gov, debbie.lacroix@noaa.gov)

21. *INEEL Mesoscale Meteorological Network.* FRD is collaborating with the US Forest Service and Bureau of Land Management in augmenting the NOAA/DOE INEEL Mesoscale Meteorological Network. The data are provided through the Boise National Weather Service office. Due to computer system changes

at Boise, the automated data collection software had to be modified. The changes were implemented Dec. 4 and have been operating successfully since then. (roger.carter@noaa.gov)

22. INEEL Mesoscale Modeling. During the past two months, there have been numerous problems with downloading the Eta model GRIB files that are used to initialize the MM5 mesoscale model at FRD. On many days, the Eta files have either been missing or are corrupted in a way that causes the ftp download to fail. Modifications have been made to get around some of these problems. The system now attempts to download the files from an alternate ftp server if problems are encountered with the primary NWS server. Also, the program interpolates over missing files if Eta output from surrounding times is available. (richard.eckman@noaa.gov)

23. Underground Transport Feasibility Test. One of the FRD real-time continuous SF₆ analyzers was used to sample air from a test well and soil probes located on the INEEL. The intent of the experiment was to test the feasibility of using instrumentation similar to this sampler to monitor the movement of materials trapped underground. The analyzer responded to samples drawn from the test well to depths of 250 feet. However, the results cannot be quantified because the samples likely contained several different compounds that the TGA-4000 responds to. (roger.carter@noaa.gov, Debbie Lacroix)

Las Vegas

24. Cloud-to-Ground (CG) Lightning Study. A data file for the 2000 warm season was created and was added to the 1993-1999 data base. Using this expanded data base, a detailed analysis of cloud-to-ground flashes on the Nevada Test Site (NTS) was completed for the 1993 through 2000 warm seasons. The eight-year analysis was completed for 1 km² areas. Since the summer of 2000 was not an active thunderstorm season, little difference resulted from the addition of the 2000 data. The results of this analysis will be summarized in graphical form and added to the SORD web-site in January. (Darryl Randerson, 702 295 1231)

25. NOAA Cooperative Institute for Atmospheric and Terrestrial Applications (CIASTA). A collaborative program between SORD and CIASTA is focusing on the provision of forecasts (presently for weather but eventually for air quality) in the arid west, with emphasis on southern Nevada. Model outputs are presently being archived for later scrutiny. (Walt Schalk, 702 295 1262)

26. Nuclear Emergency Support Team (NEST) and Accident Response Group (ARG). ARL, through SORD, provides expertise to the major US weapons-related nuclear response activities – NEST and ARG. The work is in accord with the provisions and operations of the Federal Radiological Monitoring and Assessment Center (FRMAC). During December, the replacement systems for the SORD mobile, Global Positioning System (GPS) upper-air sounding system were received. The new equipment was unpacked, set-up, and tested. All of the systems were certified as acceptable. (Ray Dennis, 702 295 1263)