NOAA ARL Monthly Activity Report

February 1999

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Air Resources Laboratory

Highlights

1. BAT/MFP packages becoming a research aircraft standard. The Best Available Technology - Mobile Flux Platform atmospheric turbulence package developed in the experimental development program at Oak Ridge is rapidly becoming a cornerstone of the international research aircraft community. The BAT system employs high-resolution GPS systems to derive wind field information, and carries temperature, humidity and CO_2 sensors as part of a routine package for eddy fluxes. All of the sensors were developed at ATDD, in Oak Ridge.

Studies of wave structure in coastal areas (being conducted with the US Navy, off Duck, NC) rely on the BAT system, flown using an experimental aircraft. The next Shoaling Wave Experiment (SHOWEX99) will be conducted in March. Both ATDD and FRD personnel will participate in the SHOWEX99 field experiment. (dumas@atdd.noaa.gov)

The BAT package is used as a part of the high-altitude research program of the USAF. The first experimental application has been in the study of electromagnetic radiation propagation near the tropopause. Electromagnetic radiation sent through the atmosphere can experience dispersion and loss of signal strength due to turbulent changes in the index of refraction. For example, objects viewed through air rising from a hot surface appear fluid and wavy. In sufficient strength in inconvenient places, such distortions interfere with a number of military activities. Their presence at high altitudes has not been well documented but is thought to be important in the strong velocity shears near the polar-front jet. ARL is testing this hypothesis with *in-situ* turbulence measurements near the tropopause. Over 40 hours of measurement were made during February over the waters near Japan, the normal location of the strongest northern-hemisphere jet cores. Three BAT probes were carried on a Grob EGRETT, a unique two-place airplane, designed for low-speed, high altitude reconnaissance. The operation went very smoothly, enabling preliminary processed data to be in our hands in the field. More detailed analysis is now in progress. (dobosy@atdd.noaa.gov)

A new research aircraft, the Sky Arrow, has been developed in Italy in association with the NSF and San Diego State University and is being equipped with BAT systems. During February, modifications and flight tests of the Sky Arrow 650 ERA (Environmental Research Aircraft), were completed at the Iniziative Industriali Italiano (3I) factory in Rome, Italy. E. J. Dumas visited 3I in early February. He assisted their engineers with the installation of the MFP data acquisition system and with power-on tests to satisfy U.S. FAA "no hazards" requirements. Interference between the aircraft's instruments and the MFP was insignificant. San Diego State University took delivery of the aircraft on March 4. (brooks, dumas@atdd.noaa.gov)

2. EPA Hierarchy Shown Models-3/CMAQ Capabilities. A tour of the supercomputing center and a Models-3/CMAQ demonstration in the scientific visualization lab were given to Dr. Norine Noonan, EPA

Assistant Administrator for Research and Development. On February 17, a similar tour and demonstration were given to Peter Robertson, Acting EPA Deputy Administrator, and to Romy Diaz, EPA Assistant Administrator for Administration and Resources Management, both of whom were accompanied by Norine Noonan. These two events provided excellent opportunities to acquaint the top EPA leadership with the NOAA/ARL/ASMD's capabilities and its recent noteworthy achievement in the form of Models-3/CMAQ. (Frank Schiermeier, 919 541 4542)

3. Development of AMS Instruments Short Course. A curriculum is currently being developed for an American Meteorological Society (AMS) one-day short course on meteorological instruments and observation techniques. The effort is being led by Jerry Crescenti who chairs the AMS Measurements Committee. This course will be taught in Albuquerque, New Mexico during the 81st Annual Meeting of the AMS in January 2001 and will coincide with the 11th Symposium on Meteorological Observations and Instrumentation (11th SMOI). The focus of the course is on the basics of *in situ* monitoring and will be oriented towards undergraduate and graduate students. This course is being organized in response to the lack of an instrument curriculum in most university meteorology programs. Topics to be taught during the short course include: measurement of wind, temperature, humidity, pressure, short/long wave radiation, and precipitation; data loggers; siting requirements; quality assurance and quality control. The instructors will include: Scott Richardson (University of Oklahoma), Tom Lockhart (Meteorological Standards Institute), and Bob Baxter (Parsons Engineering Science). Over the next several months, a course outline will be formalized. (jerry.crescenti@noaa.gov)

General

The topics that are presented are sorted according to their contribution to the NOAA Strategic Plan, as follows . . .

Sustain Health Coasts, 4, 22
Short-term Forecasting and Warnings, 1, 2, 5, 8, 9, 15, 16, 18, 20, 21, 23, 24, 26, 27, 28, 29, 30, 31
Seasonal to Interannual, 11, 12, 17, 19
Decadal to Centennial, 6, 7, 10, 13, 14, 25
Crosscutting, 3

Silver Spring

4. Transport and Deposition of Toxic Substances to the Great Lakes. The HYSPLIT model is being used to construct source-receptor relationships for deposition to the Great Lakes, in support of the IJC's International Air Quality Advisory Board (IAQAB). A meeting of project participants was recently hosted at ARL, in which ongoing emissions inventory and modeling activities were discussed. A report on the project is anticipated for June 1999. Base simulations for dioxin and atrazine are nearly completed, and a series of post-processing calculations are being conducted to combine emissions inventory data with the modeling information. The development of maps of source contributions for Great Lakes atmospheric deposition is underway. (mark.cohen@noaa.gov)

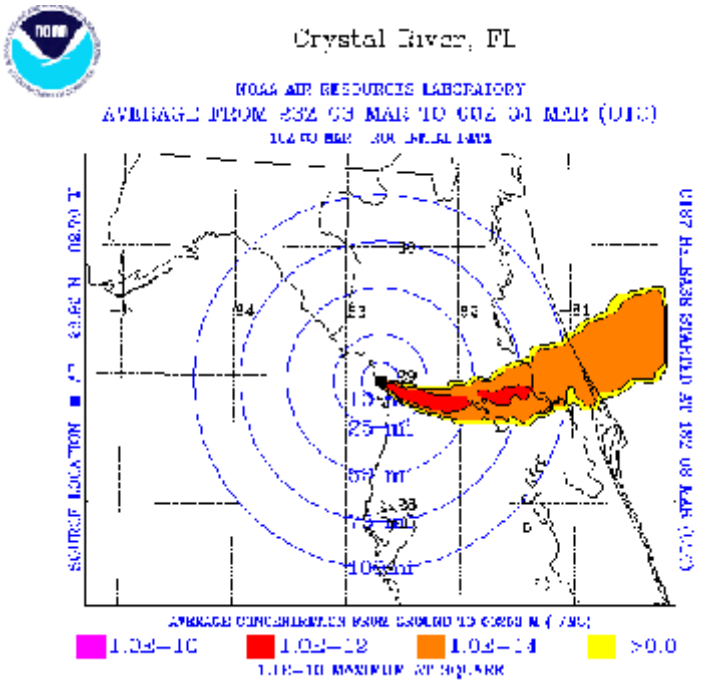
5. COAMPS/ECMWF Oil Fires Smoke Simulations. In two previous studies, HYSPLIT dispersion model results were used to estimate the ground level exposure to combustion products from the Kuwait Oil Fires. The first evaluation used meteorological fields from NOAA's global model final analysis (FNL) as a basis

for the calculation. Although in general the model results were satisfactory, there were still many days in which the model and satellite smoke plumes were not in agreement. The disagreement in plume positions was attributed in part to the coarse resolution of the meteorological data. Subsequently, higher resolution data were obtained from the European Center for Medium Range Weather Forecasting (ECMWF). In the second evaluation, recalculation of the smoke plume positions reduced the number of days of disagreement by more than half from the initial FNL based calculation. The third evaluation of the smoke plume calculation has just been completed for a two-day period (March 11 and 12 of 1991) using meteorological data from the Navy's COAMPS model (Version 7) at horizontal resolutions of 45 and 15 km. The March 11 COAMPS smoke plume was comparable to ECMWF calculation, both not indicating any early plume curvature to the west. The results for March 12 are mixed with the 45 km COAMPS plume showing less agreement with the observed plume than the ECMWF calculation and the 15 km COAMPS results showing perhaps a little better agreement with the satellite plume than the ECMWF calculation. The results of the smoke plume calculations for the two-day test period do not indicate any dramatic improvement in predictions using COAMPS versus ECMWF data. (roland.draxler@noaa.gov)

6. Contributions to the IPCC Third Assessment Report. Preparation of the Intergovernmental Panel on Climate Change, Third Assessment Report, has begun. Contributions are being made to the chapter on "Observed Variations and Changes in Climate." Material on temperature, water vapor, and extreme heat events was submitted to Convening Lead Authors Tom Karl (NOAA) and Chris Folland (UKMO). (dian.gaffen@noaa.gov, Jim Angell, 301 713 0295, x127, and rebecca.ross@noaa.gov)

7. Tropical Tropopause Study. Data processing has begun for a study of the climatology and long-term variability of the tropical tropopause. Algorithms were developed for calculating tropopause location (pressure, height) and characteristics (temperature, saturation vapor pressure, potential temperature), and tropospheric variables (lapse rates, layer-mean virtual temperatures). The sounding data are from NCDC's Comprehensive Aerological Research Data Set (CARDS). (dian.gaffen@noaa.gov)

8. Real-time Dispersion Predictions Available on READY for U.S. and Canadian Nuclear Power Plants. The HYSPLIT model has been configured to produce a highly detailed dispersion forecast for every operating commercial nuclear power plant in the U.S. and Canada four times each day. HYSPLIT uses the Rapid Update Cycle (RUC-2) meteorological data to produce a 6 hour forecast with output available on the READY web server of 1-hour averages. ARL will use these products to brief NRC in the event of a nuclear accident at one of it's regulated facilities. An example of the output is shown in the figure. The next step will be to produce a dose plot for each plant. Currently, the products are password protected on READY. (glenn.rolph@noaa.gov and roland.draxler@noaa.gov)



9. Volcanos: VAFTAD - New Feature at NCEP. Prompted by a volcano in Ecuador at 0.2E South last year, ARL has re-implemented a program on the ARL workstation (arlrisc) that makes a tropical (mercator projection) grid from the Northern and Southern Hemisphere AVN grids and VAFTAD was modified to use this new grid. Now, in preparation for turning over VAFTAD operations from arlrisc to NCEP's computers, the mercator file is created operationally 4 times a day at NCEP using an ARL-developed program which directly decodes the NCEP AVN output, rather than a 2nd level reprocessing from the hemispheric files as is done on arlrisc. VAFTAD will be run using this meteorology file for volcanos near the equator when the other grids available (Northern **or** Southern Hemisphere) would not be sufficient. (barbara.stunder@noaa.gov and roland.draxler@noaa.gov)

10. Decadal Variation of Polar Vortex. Using NCEP's 51-year reanalysis data, a study was initiated to review the decadal variation of polar vortex and its association with dominant mid-latitude and tropical climate signals, such as ENSO. Early results indicate that low-frequency variability (decadal to trend) of the polar vortex, including its size and intensity, is closely connected to the tropics. Further detailed analysis is ongoing. (julian.wang@noaa.gov)

Boulder

11. SURFRAD. A meeting was held on February 5 at SRRB on the treatment of UVB data from the ISIS levels 1 and 2 networks. Attending was Detlef Matt from ATDD, and Kathy Lantz and John Augustine from SRRB. The subject was to establish responsibilities for roles in the annual calibration of the UVB instruments, and to establish a protocol for applying calibration factors to the data from the monitoring instruments. It was tentatively decided that the CUCF would be responsible for maintaining the calibrations of the Solar Light and Yankee reference instrument triads at Table Mountain, and John Augustine would be responsible for running the monitoring instruments alongside the standards, and for analyzing that data to produce scale factors used as part of the formulation for converting output voltage to UVB-Diffey irradiance. A memo to the Director of ARL summarizing the meeting, suggesting responsibilities, and documenting unresolved issues was prepared by Detlef Matt.

12. Cooperation with Pennsylvania State University. Chuck Long's clear sky identifying software has been adapted to SURFRAD and successfully applied to the first four years of SURFRAD data. This was done as part of the three year contract that SRRB has with NASA to validate their new EOS satellites.

A method that uses these clear-sky identification data to infer cloud fraction from solar data alone in the hemisphere viewed by the ground station has also been developed by Chuck. To do this he related cloud fraction as measured by his hemispheric sky imager to statistics generated by the clear-sky identification algorithm. This method appears to isolate the hemispheric sky fraction to within 10%. It was tested using all surface radiation stations at the ARM-CART SGP site. John Augustine helped Chuck with this effort by writing software to analyze the inferred cloud fractions from the twenty-plus stations to a half-degree latitude/longitude grid encompassing the SGP site, so that the results could be contoured and directly compared to satellite imagery. (John Augustine, 303 497 6415)

Oak Ridge

13. Mercury in the Arctic. As predicted, episodic depletions in mercury concentration continued sporadically through early February after Arctic sunrise. There was a single unpredicted episode of elevated concentration, persisting for about 12 hours in light and variable winds. Such low wind speeds are very

unusual for the Barrow region. Given the light winds, it is probable that the source of this mercury is local to the Barrow area, although nothing specific has been identified. (brooks, meyers@atdd.noaa.gov)

14. Dynamical/Photochemical Modeling. The first "successful" coupled large-eddy dynamics and photochemistry boundary layer simulation using the LESchem model was completed at the beginning of February. The output appears realistic and considerable excitement has been generated among the team of collaborators. As far as is known, this simulation represents the first time that isoprene photochemistry has been directly coupled to a turbulent convective boundary layer in a numerical model. Plus, all of the computations were performed "for free" on a desktop personal computer instead of paying for the usual supercomputer time. A number of additional simulations have since been completed. (herwehe@atdd.noaa.gov)

15. East Tennessee Ozone Study (ETOS). Final site selection for new towers in the East Tennessee Ozone Study has been made. Equipment is being rounded up for installation of sites in April. Permission was obtained from the Tennessee Forestry Service and National Park Service for installation of these sites. (birdwell@atdd.noaa.gov)

A relatively dense network of surface ozone monitors is planned. Initial instrument calibrations (on five ATDD-owned ozone instruments) and site hardware preparation has begun. The University of Tennessee will be loaning us about eight of their instruments, and these will also be prepared for deployment by ATDD. Plans have been made for an airborne ozone instrument. (hall, brewer, mayhew, gunter@atdd.noaa.gov)

ETOS will be taking place while the Southern Oxidants Study is under way in central Tennessee. ATDD is also involved in the SOS program. In preparation for the SOS '99 study, several energy balance/ozone flux systems are being assembled. Tests are being carried out to fully evaluate the response and behavior of ATDD-built fast response ozone analyzers. (meyers, hall@atdd.noaa.gov)

16. Highway and urban dispersion. After systematic debugging over the past few months, the Roadway-2 model developed at ATDD has started giving reasonable results. Completion of the work, however, faces two problems: (1) comparing the results to an acceptable benchmark, and (2) correcting for the computational instability at successive time steps. The first problem will eventually be addressed by evaluating the model against a data set obtained from General Motors. The second problem is possibly due to a new (logarithmic) vertical grid used in the model to replace the coarse grid used in earlier versions of he model. (rao@atdd.noaa.gov)

The study shows a serious need for properly placed observations to estimate winds in the centers of moderate-size cities. Airport and rural-site winds were found to provide unacceptable estimates for Knoxville and Nashville on all days for which central-city winds were directly measured (4 days in Nashville, 7 days in Knoxville). Dispersion modelers concerned with air-quality regulation, urban planning, toxic spills, and terrorist attacks should find this situation of interest. Analysis continues with our limited data set, which will be augmented by two additional days' data at each site. (gunter@atdd.noaa.gov)

Analysis of wind pattern correlations between individually studied sites in the Idaho Falls meteorological tower network are under way. The primary goal is the determination of how the six analyzed sites correlate to one another and how upper level winds affect wind pattern. Due to the higher overall altitude of the area, upper level winds at the 700 mb level are being used instead of 850 mb (as was used in the study over Eastern Tennessee). Ultimately, this analysis will help determine the correspondence of upper level winds with surface winds that affect traffic in areas of complex terrain. (birdwell@atdd.noaa.gov)

17. GEWEX/GCIP. A visit was made to the NOAA/GEWEX site in the Little Washita Watershed in Oklahoma. Several new tower systems and buildings (including gravel roads) were recently installed in the flux footprint of the NOAA system. Due to this site "improvement," the area is no longer suitable for flux studies. Recommendations were made to the NOAA Office of Global Programs to move the equipment to another location within the watershed or to another location altogether. Several sites are currently under consideration with a decision to be made sometime in March. (meyers@atdd.noaa.gov)

18. Linear Wave-Theory Analysis of Stratified Flows. Work has begun on examining the surface pressure data obtained by the ATDD microbarographs during the 1990 FLAT experiment conducted in October near Cheyenne, Wyoming. At this time, data from several nights have been reduced and filtered, giving time series of pressure perturbations for four experimental nights. These pressure data will be compared with flux data taken by the NCAR ASTER system in order to see if there is a relationship between intermittent turbulence and coherent pressure disturbances. (nappo, eckman@atdd.noaa.gov)

19. SURFRAD and ISIS. Equipment was installed to perform comparison tests on the UVB broadband and other instrumentation deployed at the ISIS Level 1 site in Salt Lake City (SLC). Instruments included a PAR reference set and a replacement Solar Light Biometer. Additionally, it was determined that the data collected from SLC in the late afternoon have begun to be affected by a building recently erected on airport property directly west of the installation. The building primarily affects the direct beam component. (matt@atdd.noaa.gov)

20. Rocket Exhaust Dispersion Study. Most of the statistical comparisons have now been completed between the turbulence estimates computed by the REEDM model and the measurements taken by the Long-EZ at Cape Canaveral. Separate comparisons were performed over the various surface types (land, sea, inland waterways), and the data were also grouped according to whether they were within or above the boundary layer. Generally, it was observed that REEDM tends to underestimate the turbulence above the boundary layer by roughly 30-40%. (The turbulence above the boundary layer is of some interest at the Cape, because the buoyant rocket exhaust clouds can rise to considerable heights.) Within the boundary layer, the model performance varied greatly with surface type. The model did best inland towards Orlando, where the horizontal turbulence fluctuations were slightly overestimated by about 7% and the vertical fluctuations were underestimated by about 12%. Over the sea and the inland waterways, the model overestimated by 40-130%. Given the wide spatial variability of the turbulence, the use of a single turbulence estimate in REEDM is not really justified. (eckman@atdd.noaa.gov)

Research Triangle Park

21. Use of Special Observations in a Mesoscale Meteorology Model. Research at ASMD is underway with the observation nudging capability in the Fifth-Generation Penn State/NCAR Mesoscale Model (MM5). Observation nudging is a form of four-dimensional data assimilation that involves gently forcing the model solution toward individual observations whose influence is spread in space and time. The observation nudging technique in MM5 was developed at Penn State and was implemented in the predecessor of MM5 in the late 1980s. It is also used in the Regional Atmospheric Modeling System (RAMS). Research in the meteorology modeling community has shown the benefits of using observation nudging for air-quality modeling at fine scales.

Current work focuses on the high-ozone episodes in July 1995, particularly in the northeastern United States. Special data from the North American Research Strategy for Tropospheric Ozone ! Northeast (NARSTO-NE) study have been collected and processed for use in observation nudging. Preliminary results

show some subtle, but key improvements in the meteorology fields when observation nudging is used. Future directions include developing a strategy for using observation nudging, applying additional NARSTO-NE data in the nudging scheme (e.g., radar wind profiler and vertical azimuth display (VAD) winds), improving the methods of assimilation in coastal regions, and evaluating the impact of the changes in meteorology on the Community Multi-Scale Air Quality Model (CMAQ). (Tanya Otte, 919 541 7533)

22. Chesapeake Bay Program. A source attribution matrix translating annual NO_x emissions from within the Chesapeake Bay Airshed to annual oxidized nitrogen deposition (wet + dry) to major river basins of the Chesapeake Bay watershed has been developed for the Chesapeake Bay Program by ASMD The model used to develop the matrix is the Regional Acid Deposition Model (RADM). The attributions from 37 source regions are included in the matrix. The matrix is intended as a screening and learning tool for the Bay Program regarding atmospheric deposition of nitrogen to the Bay and its watershed. A version with 43 source regions will be used by Resources for the Future, in Washington, DC, for a policy analysis of the costs and emission reduction potential of different policies for reducing Bay nutrients from air sources, a study commissioned by the Bay Program. More than 3,000 Cray C-90 cpu-hours were required to develop the matrix and another 1,000 C-90 cpu-hours for testing the linear superposition assumptions inherent in the matrix. At the 80-km resolution of RADM the oxidized deposition from different NOx source regions was found to superpose quite linearly except at the center of very large urban areas. (Robin Dennis, 919 541 2870)

23. Using ASOS Data in Air Dispersion Modeling. ASOS data have several well-known limitations, including a lack of good cloud cover information that is important when the data are used to drive air dispersion models -- cloud ceilings and total cloud cover are typically available only up to 12,000 feet. Air dispersion models require cloud information for the entire vertical thickness. Cloud amounts and heights can be inferred from radiance information collected from the Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VAS) aboard the NOAA GOES satellite. Past testing shows satisfactory comparisons to traditional human cloud reports. Merging the satellite-derived cloud data with the ASOS data provides the information needed to perform the quality level of meteorological data needed for air dispersion modeling. This was shown by an example where the Ahoskie, NC, ASOS report indicated a present weather of rain and clear skies. Satellite data indicated 10/10 sky cover, along with a 14,000 foot ceiling. (Dennis Atkinson, 919 541 2803)

24. Hazardous Waste Identification Rule Workgroup. ASMD hosted a meeting of the Hazardous Waste Identification Rule (HWIR) workgroup. The team is developing a multimedia, multipathway risk assessment tool that will be used by the EPA's Office of Solid Waste to determine whether waste should be disposed of in Subtitle C or D facilities. The system is complete and is going through extensive testing and debugging at this time. In its current configuration, the software models land application units, surface impoundments, landfills, waste piles, and aerated tanks at selected locations throughout the United States. The system includes a chemical database consisting of organics, inorganics, and metals as well as extensive site-layout information. (Donna Schwede, 919 541 3255)

Idaho Falls

25. BRAVO Perfluorocarbon Tracer Release System Development. FRD is developing a new generation, fully automated perfluorocarbon (PFC) tracer release system. A PFC tracer experiment cannot be successful unless there is a carefully controlled and fully documented release of the tracer. This requires accurate regulation, measurement, recording of the tracer release rate, together with continuous monitoring of other system parameters. Spills or leaks of the tracer from the system must be prevented. In addition to

these basic requirements, it is desirable for the tracer release rate to be adjustable so that tracer can be released in proportion some other parameter such as stack effluent. In all previous PFC release experiments, these requirements were met by having a technician present to monitor and adjust the system. A person was on duty at all times which required technicians to work in shifts. This approach was labor intensive, inefficient, and expensive. The new PFC release system is designed to overcome the limitations of the previous systems. A computerized controller monitors a number of system parameters, and notifies operators when discrepancies are detected. The data is also accessible remotely via telephone or by a direct connection to the datalogger. The system is initially filled with the PFC of interest before the start of the release and then is fully sealed to minimize leaks and spills.

Assembly and testing of the prototype release system were begun in February. The original metering pump was found to be unreliable and has been replaced. The new system will be tested and four more units will be built for use in the Big Bend Regional Aerosol and Visibility Observational (BRAVO) study to be conducted in July through October 1999. (tom.watson@noaa.gov, and randy.johnson@noaa.gov)

26. Non-Proliferation and Anti-Terrorism. Field deployment for a tracer study at the INEEL test site has been moved up three weeks, to begin on 12 April. The tracers to be used in the project (SF_6 and di-iso methyl phosphonate) will arrive on April 1. The tracers will be released from the FRD Grid-III Tracer Stack and tracked by equipment from both FRD and the USAF. FRD's modeling capability will also be utilized and tested. The experiment will aid the USAF in their efforts to support non-proliferation of chemical agents and to reduce terrorism threats on U.S. soil. (kirk.clawson@noaa.gov)

27. Ongoing and Future Collaboration with Local Pocatello, ID NWS Forecast Office. Arrangements have been made to share our INEEL mesonet data through our home-grown INEELViz meteorological data visualization program with the forecasters in the NWS Pocatello; this has been found to be very useful. Mesoscale phenomenon such as convergence zones, cannot be observed in the very spatially-coarse NWS observation network, but are readily observed in the INEEL mesonet. We plan to maintain this level of cooperation indefinitely. Other areas of collaboration include: 1) a cooperative effort to implement and run the MM5 modeling system; 2) verification of KSFX WSR-88D precipitation estimates using the INEEL mesonet; and 3) FRD access to real-time KSFX WSR-88D data sets to support emergency operations at the INEEL. (kirk.clawson@noaa.gov)

28. Cluster Analysis of INEEL Wind Fields. As part of the ongoing study of the climate of eastern Idaho, a cluster analysis has been completed of eastern Idaho wind fields. Using over 7400 wind fields from 1997, seven natural clusters were identified using Adaptive Sample Set Construction followed by Iterative Adjustment of Clusters. The most interesting feature was that clusters accounting for 37% of the cases contained a definite terrain-driven gyre. The clusters will be reported in an updated climatology of the region and also used to tune automatic transport forecasting techniques under development. (roger.carter@noaa.gov)

29. INEEL Radar Wind Profiler and RASS Data. Data acquired by the 915-MHZ radar wind profiler and radio acoustic sounding system located at the Grid-III research facility have been screened using Weber-Wuertz pattern recognition routines, to identify and remove erroneous data caused by ground-clutter, radio frequency interference, and nearby moving objects such as automobiles, birds, and aircraft. The period of October 1995 through January 1999 was screened (40 months). A total of 56,561 profiles were acquired out of a possible 58,512 profiles over that time frame. The 3.3% loss of profiles was due to scheduled and unscheduled power outages, disruption in remote communications, and periodic maintenance. An additional

5 to 10% of wind values were discarded by the Weber-Wuertz algorithms. Less than 1% of the temperature data were discarded. (jerry.crescenti@noaa.gov)

Las Vegas

30. Hazardous Materials (HAZMAT) Spills Center (HSC) Mission. Project ORCA began the week of February 22 and continued through the week of March 1, 1999. This purpose of this project is to collect quantitative spectrographic and radiometric data of stack emissions. The data will be used to demonstrate remote collections and, evaluate how well a plume can be characterized remotely. Cloud height forecast and observations (especially clouds above 25,000 feet) were very important to the successful completion of this project. SORD provided daily weather support, including site specific wind, transport and dispersion, and hazardous weather forecasts to the project. The weather cooperated and the project was a success. (Jim Sanders, 702 295 2348)

31. DOE Meteorological Coordinating Council (DMCC). A report on the DMCC Meeting in Las Vegas, NV, in October 1998, has been completed, is being reviewed, and will be mailed to the membership by the Oak Ridge Institute for Science and Engineering in March. (Darryl Randerson, 702 295 1231)