



NOAA ARL Monthly Activity Report



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Highlights

1. *Climate Reference Network.* ATDD (Oak Ridge) is collaborating with the National Climatic Data Center in designing, assembling, and testing stations for the new national Climate Reference Network. The

first “pre-prototype” station was formally dedicated at the North Carolina Arboretum in Asheville on June 28. (hosker@atdd.noaa.gov, meyers, hall, auble@atdd.noaa.gov, Bruce Baker-NCDC)

2. Central California Ozone Study (CCOS). The ARL group in Idaho Falls is heavily involved in this study. Data from nine surface meteorological towers are now being downloaded on a regular basis. Quality control screening efforts have shown that these tower systems are working exceptionally well. However, radar and sodar systems continued to be plagued by a host of annoying problems, mainly a consequence of the high temperatures being encountered. Afternoon temperatures almost always exceed 30 EC and often approach 35 to 38 EC for the maximum. (jerry.crescenti@noaa.gov, Randy Johnson, Neil Hukari, Shane Beard, and Tom Strong)

3. WRF Development. Several ARL scientists are taking part in the development of the WRF model, from Research Triangle Park, Oak Ridge, and Silver Spring. The Science Board first met after the WRF users workshop on June 22 at NCAR, Boulder. Initial tasks will be to oversee the scientific development and make the various meteorological and air quality communities aware of the WRF. (jeff.mcqueen@noaa.gov)

4. Mercury in the Environment. ARL is involved in studies of airborne mercury in the Arctic and in Florida. Concentrations of reactive gaseous mercury (RGM) in the near-surface air at Barrow, Alaska, dropped from 400-500 pg m⁻³ on June 1 to 1-4 pg m⁻³ following snow melt on June 9. This dramatic change is believed to be due to the absorption of atmospheric bromine compounds into the surface melt waters. Production of RGM is believed to be catalyzed by bromine compounds, specifically bromic oxide, BrO. Thus removal of these compounds terminates local RGM production in the atmosphere. (brooks@atdd.noaa.gov, Meyers, Lindberg-ORNL)

Airborne mercury is a severe concern in southern Florida, where mercury levels in the environment are steadily increasing due to the accumulation of mercury deposited from the atmosphere. The Everglades are particularly vulnerable. Studies indicate that up to 60% of the mercury in Everglades’ waters comes from the air via rain. Mercury may arrive from distant sources, being transformed into water-soluble salts slowly along the way, or rapidly in thunderstorms. Alternatively it may be locally generated from incinerators and fossil fuel combustion. A NOAA team from Oak Ridge, Silver Spring, and Boulder employed the NOAA Twin Otter in the second phase of the Speciated Atmospheric Mercury Profile Experiment (SPAM-II) from May 30 through June 30, in collaboration with EPA’s National Exposure Research Laboratory (NERL). The NOAA Twin Otter was used to assess the relative importance of long- versus short-range transport of elemental mercury and RGM to the Florida peninsula. Flights were conducted over the Western Atlantic Ocean, the Eastern Gulf of Mexico, and the Florida Everglades. The experiments benefit from new instrumentation developed by the EPA and the State of Florida to identify atmospheric mercury compounds.

The Twin Otter carried real time (5 min response) analyzers for elemental mercury, denuder systems for the capture of RGM, and filter packs to collect particles. The aircraft also measured standard meteorological and aircraft parameters (position, velocity, altitude, WS, WD, dew point, pressures, etc.), and carried ARL trace gas and particle instrumentation (pptv level detection of NO, NO_x, and NO_y; SO₂, CO, O₃, and condensation nuclei) to provide ancillary measurements of primary and secondary pollutants and to aid in assessing the chemical history of the sampled air masses. A total of fifteen flights (approximately 62 flight hours) were conducted. (winston.luke@noaa.gov, gunter@atdd.noaa.gov, McMillen)

Silver Spring

5. A Record Cold North Polar Stratosphere. During the past winter, the 100-50 mb temperature of the north polar zone was nearly 7K below the 1958-1999 average, exceeding by 1K the previous record cold in 1996. The record low temperature extended down into the 850-300 mb layer of the north polar zone (1.4K below the 1958-1999 average), but at the surface the temperature was only 0.2K below the long-term average. This accentuates the disconnect between surface and tropospheric temperature trend in the north polar zone, where the surface warmed by about 0.6K/decade during 1979-1998 but the tropospheric 850-300 mb layer did not warm at all. These cold stratospheric temperatures are associated with a considerable diminution of Arctic ozone, and again there is some concern that the Arctic Ozone Hole will develop comparably to that observed over Antarctica. (Jim Angell, 301 713 0295, x127)

6. Coastal Marine Demonstration Project (CMDP) Evaluations (June-July, 1999 and Feb 15 - April 15, 2000). For summer, 1999, evaluations of wind directions predicted for the Chesapeake Bay were especially good on days when the local forcing dominated. The afternoon up-Bay wind channeling is a dominating feature during the summertime, forced by the land-water gradients in friction and heat. CBRAMS frequently predicted this feature while the coarser resolution models run by NCEP could not. Several grid-points across the bay were required to resolve this flow.

Comparisons against observations obtained in the Bay in summer indicate that the average RAMS wind speed bias and error were close to zero during the period of the test, while Eta underpredicted by around 1.5 m/s. CBRAMS captured the up-bay channeling wind direction flow 83 % of the time.

During the winter test, the meteorology was dominated by synoptic weather disturbances (cold fronts, coastal lows, cold air damming). The larger area coarse grid (64 km grid spacings) better resolved these large scale features and reduced the impact of the lateral boundary on the 4 km grid predictions. For all forecast hours, wind speed error is reduced with the CBRAMS (bias -0.6) compared to ETA forecasts (bias -1.4 m/s). For wind direction, CBRAMS results were similar to Eta forecasts. In the northern Bay, CBRAMS errors were similar to Eta as the effect of large-scale flow dominated any local scale forcings that may have developed. (jeff.mcqueen@noaa.gov)

7. Nuclear Emergency Response Activities. A full-scale global Regional Specialized Meteorological Center (RSMC) exercise was initiated by the International Atomic Energy Agency (IAEA) and the World Meteorological Organization (WMO) on June 27 to test some modifications to the existing Environmental Emergency Response arrangements as given in the Manual on the Global Data Processing System of WMO. Before these modifications can be submitted to the appropriate bodies of WMO and IAEA for approval, a full scale global WMO exercise was needed to reactivate the existing procedures and test the new proposals. There was some confusion as to the start of the exercise because several faxes were received from RTH Offenbach that indicated the exercise had started, however the official method of notification is supposed to come as a request of support through the Global Telecommunications System (GTS) from IAEA through RTH Offenbach. Once the GTS message was received the exercise continued normally except that there were many more duplicated GTS messages that caused further confusion. RSMC Washington's initial and updated set of products were distributed to WMO regions III and IV by NCEP as well as IAEA member countries by IAEA. The Nuclear Regulatory Commission is the U.S. contact point for IAEA. (glenn.rolph@noaa.gov)

Boulder

8. SURFRAD. Annual instrument swaps and calibrations are underway in the SURFRAD network. Calibrations and maintenance have been performed at the Goodwin Creek, MS, Desert Rock, NV and Bondville, IL, stations. Upgrades are nearly complete for the entire network, including the addition of Total Sky Imagers at all sites, and the replacement of old solar trackers with new, more rugged units. Instrument swaps and calibrations will continue through the summer.

Work has begun on adding a seventh SURFRAD station to the network. The new station will be located in the Canaan Valley in West Virginia. (Chris Cornwall, 303 497 7316)

9. Central UV Calibration Facility (CUCF). June was a very busy month for the CUCF. Preparations were made to present the last UV Spectroradiometer Intercomparison results at the Quadrennial Ozone Symposium held in Japan at the end of June. The CUCF also hosted a visiting researcher from the Meteorological Service of Canada, who spent 5 days at CUCF. Several objectives were met during his visit including intercomparison of irradiance standards, instructions on Brewer operations and repairs, and intercomparison of portable field calibration systems. One result of the visit was the finding that the EPA Brewer 101 operating at the Table Mountain Test Facility was measuring ozone low by at least 10%.

The CUCF has been working to implement a new system for measuring the angular response of multi-filter instruments. This has been a very difficult measurement to make due to skew in scanning the seven channels. This skew introduces a relatively large amount of noise. A new system now in initial stages of testing should greatly reduce the noise problem and thereby, produce extremely accurate results. (Patrick Disterhoft, 303 497 6355 and Kathy Lantz, 303 497 7280)

Oak Ridge

10. Arctic – Barrow Hyperspectral Tram. In collaboration with California State University, Los Angeles, a tram system provided by NOAA/ATDD was placed in operation within NOAA/CMDL's clean-air sector for tundra in Barrow, Alaska. The tram car carries a prototype PP Systems Unispec II hyperspectral radiometer that records incident and reflected radiation in 200 frequency bands. The 105 m long tramway, placed within the footprint of the eddy-correlation flux tower, spans tundra communities of pond, grass, sphagnum moss, lichen, and dwarf willow. This tram system is expected to provide detailed frequency-dependent albedo measurements and phenology information to supplement data sets from flux towers and aircraft. (brooks@atdd.noaa.gov)

11. Canaan Valley. Upgrades are in progress at the Canaan Valley Air Quality Research and Monitoring station to fit SURFRAD standards and to observe the total energy balance. The additions will include a suite of radiation sensors measuring both incoming and outgoing shortwave and longwave radiation. Direct flux measurements for heat, moisture, CO₂, and momentum will be added, and soil behavior will be monitored. The Canaan Valley site is expected to be integrated into the SURFRAD network within the next few months. The extensive radiation monitoring will provide ground truth to test remote sensing of the area. All of the additions are vital to improving numerical models of atmospheric pollutant deposition in this region. (vogel@atdd.noaa.gov)

12. East Tennessee Ozone Study. Repair of numerous ETOS sites continued. By the end of June, all sites of the previously existing ETOS network had been repaired. The network currently includes 20

meteorological sites (temperature, relative humidity, wind direction and speed, rainfall) and 12 ozone monitoring sites for a total of 21 sites. The Oak Ridge Scarborough site was relocated to Seymour, TN to allow better spatial coverage in the Central East Tennessee Valley. Data were archived (CD-ROM) and preliminary quality assurance was performed on the data set. This included supplementary ASOS/AWOS data obtained from the National Weather Service and the State of Tennessee. (birdwell@atdd.noaa.gov, White, Bellis)

13. NSF Multi-User Environmental Research Aircraft. The spatial variation of air-surface exchange of CO₂ in early June was sampled over chaparral shrub land, using the Sky Arrow flux aircraft operated by San Diego State University (SDSU). The chaparral on the Sky Oaks Biological Field station in California is distributed in stands of various ages created by a decades-long practice of controlled burns. Great variability in the strength of the midday carbon dioxide sinks was found in these data. The flights also successfully tested the recent design modifications by NOAA/ATDD to the airborne Mobile Flux Platform (MFP) system.

The SDSU Sky Arrow arrived in Barrow, Alaska on June 25 for the Arctic Transitions in the Land Atmosphere System (ATLAS) Study. After a brief weather delay, the first measurement flight of the season was conducted on June 29. This year's effort will be the first time that airborne flux measurements will cover an entire tundra growing season, June-September. (brooks@atdd.noaa.gov, Dumas)

Research Triangle Park

14. Evaluation of Compartmental Model Dry Deposition Velocity Estimates. ASMD has been working on the development of state-of-the-science dry deposition research models for some time. A parallel effort is underway to evaluate the performance of an advanced compartmental screening level model, designed for use by a wider, less sophisticated audience. The goal of the evaluation is to ensure that such models remain compatible with current high performance computing modeling frameworks, reflect current modeling advances reported by the research community, and produce the most scientifically sound estimates possible. An evaluation of the dry deposition module of the Multimedia Distribution of Toxics (MEND-TOX) screening level compartmental model was performed and results reported at the Sixth International Conference on Air-Surface Exchange of Gases and Particles in Edinburgh, UK. The implementation of a chemical kinetic model for the dry deposition of gas-phase chemical to foliar surfaces was evaluated using field observations of nitric acid deposition velocity over a soybean field near Nashville, TN, during summer 1995. MEND-TOX deposition velocity estimates were compared to field measurements and to estimates made using the NOAA Multilayer Dry Deposition Model (MLM). The present MEND-TOX evaluation indicates that the model performs quite well ($r^2 = 0.74$). Similar results were obtained for nitric acid deposition velocity over corn at Bondville, IL, during late summer 1994, and over a fescue pasture at Sand Mountain, GA, during spring 1995. At present, the most serious limitation to the application of the MEND-TOX dry deposition velocity algorithm is that it responds only to variability in atmospheric resistance. Organic resistance is treated as constant. It is concluded that, within the constraints of the model assumptions, the existing screening level model for the dry deposition of non-hydrophilic chemicals to foliar surfaces is adequate and equal to currently published research models. It is recommended, however, that algorithms reflecting the effects of stomatal resistance be added and further tests performed against available field data. A model to predict time-varying cuticular resistance, recently developed by ASMD post-doctoral scientist Dr. Yihua Wu, should also be considered for future inclusion in MEND-TOX. An extended abstract of the soybean analysis is available in electronic format. (Ellen Cooter, 919-541-1334)

15. Using MM5 Version 3 for Air Quality Modeling. Version 3 of the Fifth-Generation Penn State/NCAR Mesoscale Model (MM5v3) has been set up for air-quality modeling simulations in ASMD. Initially released

in July 1999, MM5v3 has been intermittently updated by NCAR with bug fixes and various improvements. MM5v3 was configured for a retrospective simulation of 14-29 July 1998. This case study uses Eta data assimilation system (EDAS) analyses for background fields and it exercises some of the new physics options in MM5v3. Experiences with trouble-shooting the Eta analyses as input to MM5v3 were presented by Tanya Otte at the Tenth MM5 User's Workshop in Boulder, CO, in June. This case study was also used for an application of the NOAA Multi-Layer Dry Deposition Model and for evaluation of the Pleim-Xiu land-surface model in MM5v3. The MM5v3 fields will be ultimately used for input to the Community Multi-Scale Air Quality Model (CMAQ) to compare with field experiment data from an isoprene study during that time. (Tanya Otte, 919 541 7533)

16. Release of Version 4.0 of the Models-3/Community Multiscale Air Quality (CMAQ) Model. The Windows-NT version of Models-3/CMAQ was released in June and the Sun UNIX version is expected in the next few weeks. A version adapted for Silicon Graphics platforms, currently in beta-testing, is expected to be released by the fall of 2000. The PC/NT Version 4.0 of Models-3/CMAQ is being made available to the public through the National Technical Information Service (NTIS) (www.ntis.gov/fcpc/cpn8867.htm). The NTIS order number is PB2000-500065 and the cost is \$750. The Sun UNIX and SGI versions will be available directly from ASMD (web page: www.epa.gov/asmdnerl/models3). Models-3/CMAQ Version 4.0 represents significant advances in both the availability of a stand-alone version for a PC/NT with good performance at significantly less hardware and software cost to users, and in improvements to the science and framework code of the system. In addition, the Sun UNIX version has been updated to run under a Solaris 2.7 operating system and maintenance has further stabilized the system through software bug fixes. Users now have the option of using Mesoscale Model (MM5) Version 3 high-resolution land use data in preparing meteorological data. In addition, the Models-3/CMAQ model's modal aerosol algorithms now include variable standard deviations, and plume-in-grid simulations may be continued across sequential temporal simulations. The CMAQ is now compatible with Fortran 90 code. A fall 2000 interim release of Models-3/CMAQ will include the fast and efficient Sparse Matrix Operator Kernel Emission (SMOKE) processing system in place of the current emission data processor. (Bill Benjey, 919-541-0821)

17. Multi-phase Air Quality Modeling Study. The first phase of an assessment of the relative effectiveness of alternative control strategies for reducing concentrations of fine particles (PM_{2.5}) has been completed. The Regulatory Modeling System for Aerosols and Deposition (REMSAD) was used to simulate fine particle formation and transport within a domain covering the continental United States and adjacent portions of Canada and Mexico. As part of this phase, REMSAD simulations were conducted for six emissions scenarios using 1990 meteorological data from MM4. These scenarios included a projection of emissions from 1996 to 2010 with various future-year, sulphur dioxide emissions reduction scenarios. The results indicate lower sulfate concentrations primarily across the eastern United States, higher nitrate concentrations in areas where sulfate levels are reduced the most, and a net reduction in fine particle concentrations. The second phase will include MM5 simulations of meteorological data for 1996 and the translation of MM5 outputs into inputs for annual REMSAD runs. An updated 1996 base year emissions inventory is also being developed along with projections to 2020. (Norm Possiel, 919 541 5692)

18. First Annual Models-3/CMAQ Workshop. This workshop marked the first gathering of developers and users specifically to discuss the future application of Models-3/CMAQ in air quality modeling, and attracted nearly 200 participants from the various segments of the air quality regulatory community. Model applications and evaluations were presented by ASMD, state and local regulatory agencies, academic institutions, and professional firms. This diverse group discussed the environment for supporting and maintaining Models-3/CMAQ, and began consideration of a framework to bring improvements and new modules into the modeling system. A consensus of the attendees was that Models-3/CMAQ is a sound

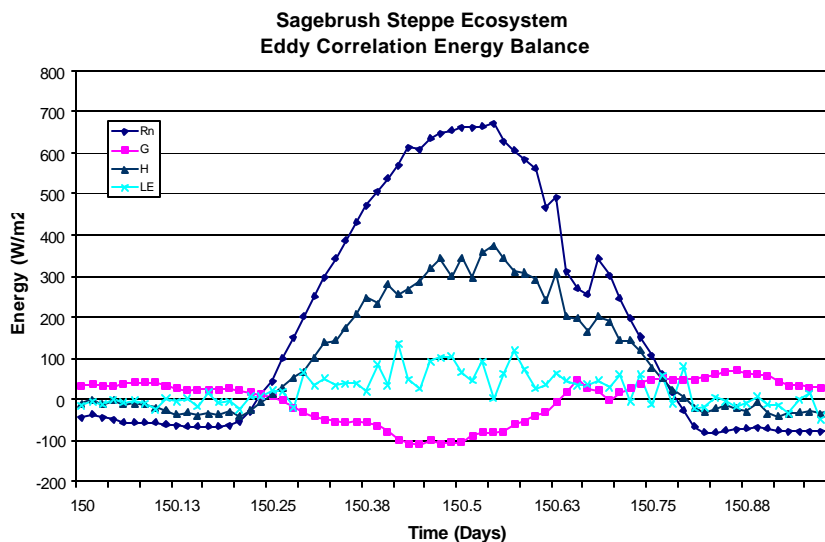
modeling system, and many attendees expressed a strong desire to use it in their next operational simulations. (Mark Evangelista, 919-541-2803)

Idaho Falls

19. Atmospheric Tracers – Vertical Transport and Mixing Experiment-Chemical and Biological Non-proliferation Program 2000 (VTMX-CBNP 2000). FRD's role in the VTMX-CBNP project continues to expand. Plans now call for using all 121 of FRD's whole air samplers, 6 of FRD's 8 mobile SF₆ analyzers, all of FRD's available sonic anemometers (2), and FRD's mobile radar profiler and RASS system. The whole air analysis system has been brought out of standby mode and is nearly fully operational. The mobile analyzers are now fully operational, but are undergoing modification to make them safer and more transportable (see next paragraph). Examination of the whole air sampler containers resulted in the discovery that the containers are beyond their useful life. New containers are being fabricated and the sampling mechanisms will be transferred from the old containers to the new containers. A few new samplers will also be built for replacements should any existing sampler fail during the upcoming tests. Bag cleaning and whole air sampler checkout will occur next month. (kirk.clawson@noaa.gov and staff)

As part of the preparations for the VTMX study, the SF₆ continuous analyzer system has been redesigned to make it smaller and easier to operate. A mock up of the new system was installed in a vehicle for two days this month for review by the FRD staff. A number of good comments and suggestions were generated and a decision made to go ahead with the conversion. A data acquisition card has been purchased and is being tested. The software to use the new data card and the increased capabilities of the system is in the testing stage. The electronic interface between the TGA-4000 and the computer system is prototyped and being tested. Modifications to the gas flow system on all analyzers are in progress. (roger.carter@noaa.gov), James Angell)

20. Sagebrush Steppe Ecosystem Flux Site. The data have been pouring in from the eddy correlation system installed in FRD's permanent flux site in local sagebrush steppe ecosystem. This month, significant progress was made in analyzing the data. Figure 1 shows the energy balance for the 29th of May. The traces of soil, sensible, and latent heat are indicative of the limited water available in the root zone for evapotranspiration. Total precipitation for all of the month of May was only 23 mm, most of which fell on May 5 and 6. There is active interest in the data being obtained, from USDA, and the Universities of Idaho and Utah. (kirk.clawson@noaa.gov)



21. SHOWEX. In an effort to understand air-sea energy exchange under light wind conditions, aircraft data acquired by LongEZ N3R during the Shoaling Waves Experiment (SHOWEX) are analyzed. N3R conducted numerous low-level (~ 10 m) east-west transits from the Outer Banks of North Carolina to the edge of the Gulf Stream on 20 November 1999 (Table 1). Six legs were flown over the same track over the course of the flight. Each leg was approximately 100 km in length and took about 30 to 35 minutes to fly.

The region was dominated by a high pressure system located off the Nova Scotia coastline. Horizontal surface pressure gradients were generally weak and skies were clear. In general, the aircraft observed winds were from the south to southwest with speeds ranging from near calm to about 4 m s⁻¹. Near the edge of the Gulf Stream, wind speeds generally increased and were in the range of 5 to 8 m s⁻¹.

The data reveal the conventional increase of Cd with wind speed, but also an inverse dependence at very light winds. (jerry.crescenti@noaa.gov, Jeff French, Tim Crawford)

22. Hurricane Balloons. Globalstar satellite telephones have been selected for data communications in place of the failed Iridium satellite phone system. The phones have been tested for signal strength inside the PVC enclosure and have a good clear voice signal. Since the signal is digital, Code Division Multiple Access (CDMA), it therefore provides a very quiet voice signal and allows much greater data throughput rate. Data transmission will be at 9600 bits per second rather than the 2400 bits per second that was planned for the Iridium phone system. Testing of actual data transmission will not take place until some time in the 4th quarter of 2000 when point-to-point asynchronous data capability is introduced for Globalstar.

The purchase of a Globalstar telephone completes the selection of components to be used inside the transponder. These components are attached to the transponder mounting plate and enclosed in the balloon transponder housing. The complete enclosure is fabricated from PVC pipe and PVC plates and is fitted inside the high strength Spectra balloon shell. This enclosure will provide not only gathering and communications of balloon data, it will also provide the necessary mechanical interface between the internal bladders, the balloon shell and the atmosphere. (randy.johnson@noaa.gov)

23. Refractive Turbulence Project. Plans have been finalized for a short field experiment during the first three weeks of August. Krzysztof Haman (Warsaw University) and Owen Cote (USAF Research Laboratory) will participate in this experiment. Dr. Haman will provide two versions of his Ultra-Fast Temperature (UFT) sensor. This probe responds to temperature fluctuations at 10⁻⁴ s, with a resolution of 0.1 C. Data from this will be compared with the ARL/FRD designed and built high-resolution temperature sensor. This probe is designed to respond to fluctuations of 0.005 C at 0.04 s. Both instruments will prove useful for measuring small temperature perturbations on small spatial scales. (jeff.french@noaa.gov, Tim Crawford, and Randy Johnson)

24. Wildfires in the West. Over the past few years, it has become apparent that a significant portion of FRD's support to the INEEL Emergency Operations Center is associated with wildfires at the site. An effort is now under way to develop a wildfire modeling capability at FRD. Several different wildfire models of varying complexity have been developed by groups around the world. The simplest treat the spreading fire as an ellipse, whereas the more complex models are often integrated with a Geographic Information System (GIS). Any model used at FRD should be able to take advantage of the wind data available from the INEEL tower network. (richard.eckman@noaa.gov)

25. INEEL Mesoscale Modeling. As reported last month, large differences were observed in the near-surface soil moisture reported by the Eta and RUC (Rapid Update Cycle) models. The MM5 mesoscale

forecasts for Southeast Idaho being run at FRD often show quite different behavior depending on whether the soil moisture is initialized from the Eta or RUC models. Several emails were sent out in an attempt to determine why the models display such large differences in soil moisture, but the model developers did not seem to be particularly interested. Some of the faculty in the Biology Department at Idaho State University (ISU) have been collecting soil moisture measurements at INEEL and have provided a sample data set for one of their sites. They do not collect the soil-moisture data frequently enough to allow it to be directly used in the MM5 initialization, but the data are useful for determining whether the Eta or RUC soil moisture is more realistic. ISU also has some soil-moisture data for irrigated plots, which will be helpful for the eastern side of the Snake River Plain where irrigated farmland is prevalent. (richard.eckman@noaa.gov)

Las Vegas

26. *Upper Air Data at Desert Rock.* To help maintain high quality upper-air observations at our Desert Rock Meteorological Observatory (DRA), SORD invites the National Weather Service to provide an independent inspection and evaluation of our DRA operations. This year's inspection was conducted on June 16. DRA was rated as "excellent" and was reported to be "one of the elite Upper Air sites in the country". The inspector also noted that DRA is "always rated in the top five (stations) and most of the time vying for the top spot". (Darryl Randerson, 702 295 1231)

27. *Las Vegas Temperature Trends Study.* A final review was completed on the report for temperature trends in Las Vegas. The study shows upward trends for the minimum temperatures in Las Vegas and Southern Nevada. The urbanization of the Las Vegas Valley has produced the larger upward trend in the minimum temperatures, but the nearby more rural locations also show upward trends in their minimum temperatures for the 50- year period (1949 to 1998). These findings are consistent with other investigations concerning temperature trends. (Doug Soule', 702 295 1266)

28. *Interagency Monitoring of PROtected Visual Environment (IMPROVE) Network.* On June 21st, Dr. M. Pitchford presented a paper at the Air and Waste Management Association (AWMA) Annual Conference in Salt Lake City, UT, titled "Expanded IMPROVE Network for Regional Haze Monitoring." The paper described the approach used to select monitoring locations representative of regional haze conditions at 155 visibility-protected national parks and wilderness areas. The 110-site network collects fine particle samples by filtration for subsequent gravimetric and chemical speciation analysis. IMPROVE particle composition data will be used to calculate visibility levels as mandated by the Regional Haze Regulation to track progress towards the national goal of reducing visibility impairment to natural levels for all protected areas. (Marc Pitchford, 702 895 0432)