FRD ACTIVITIES REPORT
July - September 2009

RESEARCH PROGRAMS

ET Probe

Hardware and software upgrades for the Extreme Turbulence (ET) probes were completed in August. FRD also conducted a series of road tests in which the probes were mounted on a vehicle and driven at highway speeds. Some hardware issues were identified during these tests and corrected. Most of these issues were related to bad electrical connections or faulty sensors.

As the development phase was wrapping up, the focus shifted to deploying the ET probes at suitable marine locations and testing their ability to function over longer periods. One of the first locations to be investigated was the 560 m research pier at Duck, NC (Fig. 1) operated by the U.S. Army Corps of Engineers. After discussions with the Corps, a probe was deployed in late August on a tower at the end of the pier. Since the pier has both power and internet connectivity, the probe's data acquisition computer can be accessed remotely using standard internet protocols. The system has continued to function reliably except for some gaps mostly related to power losses. The longest data gap so far was caused by one of the data wires coming loose between the probe itself and the computer. This was easily fixed by a Corps employee.

Figure 1. ET probe on Duck pier.

Because NOAA funding did not materialize until June, a second

probe deployment was considered to be optional. However, by September FRD had secured permission to deploy a probe on the 15 m Tennessee Reef navigation light in the Florida Keys (Fig. 2). This site is only accessible by boat, but it has a wireless internet connection set up by the Great Lakes Environmental Research Laboratory. The greatest difficulty at this location was not installing the ET probe but in helping to erect a 6 m meteorological tower on the navigation light at the request of SEAKEYS. The SEAKEYS organization which services the structure and owns the tower underestimated the effort required to erect such a tower given the limited space available. After three days of effort and increasing concerns about safety, the attempt to erect the upper section of the tower was abandoned and the probe was installed at the top of the lower section. This is not ideal from a flow-distortion perspective but was the best that could be done under the circumstances. Since installation, the Tennessee Reef system has also had some power problems that are likely due to cables damaged or disconnected during the tower installation efforts. The SEAKEYS organization will revisit the site to investigate these issues. (richard.eckman@noaa.gov, Tom Strong, Roger Carter, Shane Beard, Randy Johnson)

Figure 2. ET probe on Tennessee Reef light.

WISDOM

The ARL Field Research Division WISDOM balloon launch team deployed to the Azores, Bermuda,

Figure 3. WISDOM tetroon launch from Bermuda.

and Dakar, Senegal for a four-week launch window of 13 September through 9 October, 2009. Unfortunately there was not much tropical cyclone development in the tropical Atlantic during deployment. Tropical Depression 8 (25-26 September), Tropical Storm Grace (4-6 October), and Tropical Storm Henri (6-8 October) were the only systems of note. However, the team successfully launched a total of 30 balloons: 7 from the Azores, 6 from Bermuda, and 17 from Dakar, Senegal. One of the balloons launched from the Azores on 05 October traveled over Paris, France, then Moscow, Russia, and was last observed near Tashkent, Kyrgyzstan. A balloon launched from Bermuda on 04 October traveled over Morocco, then Rome, Italy, and was last observed over Pakistan. Several balloons launched from Senegal traveled west across the Atlantic Ocean and were last observed over northern South America. (Kirk.Clawson@noaa.gov, Randy Johnson, and Shane Beard)

Figure 4. Inflating WISDOM tetroon in Dakar, Senegal.

LAMP Proposal

FRD has developed a proposal for a Low Altitude Measurement Platform (LAMP) that could provide critical meteorological data at the air-sea interface under hurricane conditions. LAMP is expected to be a low cost, long term, simple to use balloon system that could be used in large numbers to provide information from "data poor" regions in the North Atlantic Ocean. Data from LAMP could be used to help understand and characterize the low-level marine boundary layer, the evolution of the energy content of inflow to hurricanes and its relationship with hurricane intensity changes, Estimates of surface fluxes could also be obtained from a LAMP platform. Some of the measurements that LAMP could make just above the ocean surface include: 1) balloon position (latitude, longitude and altitude), 2) wind speed and direction, 3) barometric pressure, 4) air temperature profile, 5) relative humidity, 6) sea surface temperature, 7) solar radiation. (Randy.Johnson@noaa.gov)

U.S. Historical Climatological Network - Modernization

Jason Rich and Neil Hukari have begun working with ATDD personnel on data QA/QC for the U.S. Historical Climatological Network – Modernization (HCN-M) program. The HCN-M program is a subset of the current USHCN data that has been upgraded with new sensors and instruments. Currently the HCN-M program consists of 17 stations located in Alabama with additional stations expected to become operational across the southwest U.S. over the coming weeks.

As a part of the FRD effort, data from all Alabama HCN-M stations are being monitored every workday. Automatically generated hourly flag emails are checked for new flags and/or new problems. A program was written to sort the stations and flags found in the hourly emails to find possible reoccurring problems. Another set of programs were written to generate contour maps of the max/min air temperature and precipitation data. The contour plots show targeted areas or a bull's-eye where there could be possible instrumentation problems.

A new web page has also been created that will help with the quality control of the HCN-M data. The web page can be found at www.noaa.inel.gov/crn/crn.htm. This new web page displays the contour plots and summary flag values from the previous day. Data are available on the web page back through early July.

Weekly time-history plots of the data are also reviewed to find bad instrumentation. Any problems discovered in the QC process are reported to ATDD so the problems can be fixed by their technicians. (Jason.Rich@noaa.gov and Neil Hukari)

EPA Roadside Sound Barrier Tracer Study

The manuscript "Tracer studies to characterize the effects of roadside noise barriers on near-road pollutant dispersion under varying atmospheric stability conditions" was revised in response to reviewer comments and re-submitted to the journal Atmospheric Environment. The revised draft is presently under review. (Dennis.Finn@noaa.gov)

JU2003 Urban Plume Dispersion

The draft manuscript "Analysis of urban atmosphere plume concentration fluctuations" was submitted for ARL review. This represents a significantly revised draft that had previously passed ARL review but was subsequently rejected by a journal. The reason for going through ARL review again is that, substantively, it is a new paper. (Dennis.Finn@noaa.gov)

Miscellaneous

FRD submitted several proposals and PPBES alternatives for funding consideration during the reporting quarter. These include: 1) a joint proposal with NSSL to improve urban dispersion estimates through the use of WSR-88D and TDWR output to derive a gridded boundary layer wind field as the input to HySPLIT, 2) a PPBES alternative to develop new atmospheric tracers and real-time analyzers, 3) a joint PPBES alternative with ARL HQ to use atmospheric tracers to improve gridded wind fields in wildfires, and 4) a joint PPBES alternative with ESRL and several ARL divisions for renewable energy research. (Kirk.Clawson@noaa.gov and staff)

NOAA/IDAHO NATIONAL LABORATORY (INL) METEOROLOGICAL RESEARCH PARTNERSHIP

Emergency Operations Center (EOC)

FRD EOC Team D participated in a drill at the EOC on 14 July. It involved a radiological spill at an INL facility in the City of Idaho Falls. The scenario was coordinated with local law enforcement and fire departments. The MDIFF model was used to create a plume plot for the potential release. (Richard.Eckman@noaa.gov)

The annual EOC drill for Idaho Cleanup Program, managed by CH2M-Hill Washington-Group Idaho (CWI) was held on 22 July. The scenario was a spilled liquid from a drum of unknown contents at Idaho Nuclear Engineering and Technology Center (INTEC). The spilled quantity was approximately 1 gallon. A FRD meteorologist provide dispersion forecast expertise and advice, operated the MDIFF dispersion model, and provided short-term weather forecasts. (Kirk.Clawson@noaa.gov)

The annual INL EOC exercise was conducted at the EOC on 12 August. The drill simulated a vehicular accident involving the release of acetylene and other gases with multiple people injured at CFA. A wild fire was also ignited by the accident. FRD, as a member of the EOC team, produced nowcasts and short-term forecasts and ran the Aloha dispersion model to produce plots of the acetylene and smoke plumes for the Assessment Specialist and Emergency Director throughout the drill. (Dennis.Finn@noaa.gov and Kirk Clawson)

FRD assisted in the partial EOC activation for an actual site emergency on 25 August. The activation was caused by a leaking container at the Materials and Fuels Complex (MFC). FRD assisted during the activation by operating the MDIFF dispersion code and providing nowcasts and short-term forecasts. (Jason.Rich@noaa.gov).

The annual EOC assessment specialist drill with all INL Assessment Specialists and EOC personnel from the State of Idaho INL Oversight Program was held on 27 August. This was an opportunity to work in a relaxed and undocumented environment to refresh ongoing working relationships. As a part of the drill, comparisons of various release scenarios using FRD's MDIFF and the State's APGEMS dispersion models were compared. Qualitative comparison of the plume isopleths indicated good agreement. (Kirk.Clawson@noaa.gov)

INL Hazardous Weather Alert System

Ten weather alerts/statements were issued during the last quarter. Four of the statements were issued for high winds while the other six statements were issued for lightning. Average lead time for wind statements was about 2 hours. All four of the wind statements verified with winds reaching at least 25 mph. Two of the six lightning statements were issued well ahead of the first strike. The other 4 statements were issued as the lightning strikes were either approaching or already on the INL. (Neil.Hukari@noaa.gov and Jason Rich)

Transport and Dispersion Modeling

FRD has continued its efforts to develop a HYSPLIT-based dispersion model system for use in INL activities. The main goal has been to develop a prototype HYSPLIT system by the end of this fiscal year, and this goal has been reached. There were three main lines of progress during the quarter: 1) improvements to the user interface, 2) automation of WRF mesoscale forecast model output and conversion to packed ARL format, and 3) work on utilizing mesonet observations within HYSPLIT.

The Flash-based user interface now includes the basic information required to run HYSPLIT, including release parameters, desired run duration, choice of meteorological model (WRF, NAM) or Mesonet observations, selection of contouring option, and percent of maximum release. The release location can be selected from a drop-down menu of INL sites or by clicking directly on the location on the map interface. Currently, the scheme is focused on radiological releases but will be expanded later to include chemical releases. Preconfigured release scenarios for INL will also be added, but these will require more input from our INL partners.

The user interface features three main windows, all of which can be easily resized/rescaled. One window contains the map for plume output. The background is a Google Maps shaded relief topographic map with INL site boundaries and other cultural features. Another window is a run status window that keeps the user informed of progress of the model run. The third window is for user input. Multiple input parameter pages are built into this window and all are easily accessed, in any order desired, with a simple mouse click. New features that have been added to the interface in this quarter include:

1) a distance calculation utility.
2) a run status summary window (progress update for model run).
3) a display annotation option.
4) the ability to share model runs with other users by posting to a public directory.
5) ability to display previous model runs (available through the run status window).
6) plume transparency adjustment.

FRD has been running the WRF forecast model for several years on 4 and 20 km horizontal grids. WRF output is now being exported to the computer running HYSPLIT for direct HYSPLIT ingest. Scripts have been written to automate this export and subsequent conversion into the required packed ARL format. The packing is done using the program ARW2ARL developed at ARL Headquarters. The packed files representing the latest WRF model run will always be ready for use, cutting several minutes off the HYSPLIT model run times. Rapid response times are a very important consideration for the EOC requirements. A similar scheme will eventually be developed for the NAM and other NOAA forecast models.

A rudimentary scheme for creating HYSPLIT input files from INL Mesonet observations has been developed. It uses existing software components in HYSPLIT to populate the model grid using a weighted $1/r^2$ interpolation of the observations. We have been able to achieve plume model results that appear to be consistent with observed winds and with the output of the fully validated MDIFF model. Recent efforts have focused on devising a way to minimize model run

times during emergency operations by continually packing the latest observations and appending them to a packed file rather than having to generate and pack a completely new file when each new set of observations is added every 5 minutes. A more sophisticated version of the interpolation scheme will be completed in fiscal year 2010. (Dennis.Finn@noaa.gov, Rick Eckman, Roger Carter, Brad Reese, Jason Rich)

FRD completed an effort to analyze five years of Mesonet data and provide the results in two formats used by Nuclear Regulatory Commission dispersion models. This was needed as part of a relicensing effort for the Advanced Test Reactor at INL. On a related topic, FRD is also restarting its efforts to convert INL Mesonet data into a format usable by the EPA AERMOD dispersion model. This model is now being used for certain applications at INL, and FRD can expect to be getting requests for AERMOD-compatible observations. (richard.eckman@noaa.gov, Neil Hukari)

NOAA INL Mesoscale Meteorological Network (Mesonet)

A number of changes to the single frequency radio network used to retrieve the data from the INL Mesonet have been implemented this quarter. These were discussed during a training session provided by Campbell Scientific last June. So far we have upgraded the firmware in the radio modems at the stations, reorganized the network topology to make it more efficient, and changed the stations to return minimum battery voltage instead of average battery voltage. One station has been converted to use the newer 'one way data protocol' as a test. This protocol requires less overhead. If it works well on this station, others may be converted during fall semi-annual maintenance. Our plan also calls for installing experimental heaters in some stations this fall and changing how the radio is connected to the battery. (Roger Carter, Shane Beard, Tom Strong, Brad Reese, Randy Johnson)

Miscellaneous

Brad Reese received a 20 year service award in August.

OTHER ACTIVITIES

Outreach

A number of posters and pamphlets on weather were provided to the INL Technical Library for use on their monthly bulletin board. (Roger Carter)

Papers

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, R.M. Eckman, S.G. Perry, V. Isakov$_2$, and D.K. Heist, 2009: Tracer studies to characterize the effects of roadside noise barriers on near-road pollutant dispersion under varying atmospheric stability conditions. (In review at Atmospheric Environment)

Finn, D., K.L. Clawson, R.G. Carter, J.D. Rich, and C. Biltoft, 2009: Analysis of urban atmosphere plume concentration fluctuations. (Submitted for ARL review)

Safety

"Fire Hazards" by Safety Watch Productions was viewed by all employees at our August staff meeting.

Training

Kirk Clawson completed 508HHS Drug Regulations for Employees training in August.

Shane Beard provided hands on fire extinguisher training to the staff at our September staff meeting.

Travel

Jason Rich and Neil Hukari to Oak Ridge, TN, July 6-9, to train on the Historical Climatological Network - Modernization program.

Randy Johnson to Bermuda, the Azores, and Dakar, Senegal, July 20-30, to coordinate the WISDOM balloon launches scheduled in September.

Rick Eckman and Tom Strong, to Duck, NC, August 25-28, to deploy ET Probe.

Randy Johnson, to the Azores, September 12-October 10, to launch WISDOM balloons.

Shane Beard, to Dakar, Senegal, September 12-October 10, to launch WISDOM balloons.

Kirk Clawson, to Bermuda, September 13-October 10, to launch WISDOM balloons.

Rick Eckman and Tom Strong, to Key West, FL, September 14-18, to deploy ET Probe on the Tennessee Reef.