RESEARCH PROGRAMS

Project Sagebrush

The manuscript “Distinct turbulence structures in stably stratified boundary layers with weak and strong surface shear” was published at the *Journal of Geophysical Research – Atmospheres*. This paper arose out of research conducted as part of Project Sagebrush with contributions from both Washington State University and FRD. The paper proposes a unifying model for turbulence in the stable boundary layer and was highly regarded by the journal’s editorial staff. This led to it being featured as an American Geophysical Union Eos Research Spotlight and on the cover of the August issue of the journal. Subsequently, it was featured in the OAR weekly report.

A revised draft of the manuscript “Mechanisms for wind direction changes in the very stable boundary layer” with responses to reviewer comments was submitted to the *Journal of Applied Meteorology and Climatology* in late July. The paper was accepted for publication at the end of the quarter. Follow up research focused on the effects of low-level jets on turbulence and wind direction changes in the stable boundary layer are in progress.

The abstract for the oral presentation “Wind direction changes and plume behavior in very stable conditions” was submitted to the 99th AMS annual meeting (January) and accepted at the end of the quarter. This presentation will synthesize some of the material included in the recently published “Plume dispersion in low-wind speed conditions during Project Sagebrush Phase 2, with emphasis on concentration variability” and the recently accepted “Mechanisms for wind direction changes in the very stable boundary layer”. [dennis.finn@noaa.gov](mailto:dennis.finn@noaa.gov)

Sudheer Bhimireddy has started his Ph.D. work at the University of Texas San Antonio using data from FRD’s Project Sagebrush. He intends to simulate some of the Sagebrush tracer releases using Large Eddy Simulations. In September, Sudheer gave an online presentation to FRD staff on his research plans and also successfully conducted his dissertation proposal defense later in the month. Rick Eckman is a member of Sudheer’s thesis committee. [Richard.Eckman@noaa.gov](mailto:Richard.Eckman@noaa.gov)

The Wind Forecast Improvement Projects (WFIP)

The manuscript "The Second Wind Forecast Improvement Project (WFIP2): Observational Field Campaign" was submitted to the *Bulletin of the American Meteorological Society*, with Jim Wilczak at ESRL as first author and Rick Eckman as one of the coauthors. This is an overview manuscript describing the observations collected during the 18-month field campaign in Washington and Oregon known as the second Wind Forecast Improvement Project (WFIP2). This is a major study with many participating organizations focused on improving the skill of weather forecast models in predicting boundary-layer winds for renewable energy applications. FRD deployed a 915 MHz radar profiler, sodars, and surface flux stations during the project. [Richard.Eckman@noaa.gov](mailto:Richard.Eckman@noaa.gov)
A revised version of the manuscript "Data Assimilation Impact of In Situ and Remote Sensing Meteorological Observations on Wind Power Forecasts during the First Wind Forecast Improvement Project (WFIP)" was submitted to *Wind Energy* after responding to reviewer comments. This manuscript is based on the first WFIP campaign (WFIP1) in Texas and the upper Midwest. Jim Wilczak is lead author, with Rick Eckman included as a coauthor. (Richard.Eckman@noaa.gov)

**FRD Tracer Program**

In order to maintain the tracer program and measurement capabilities at FRD after upcoming retirements, cross-training of FRD staff in procedures, troubleshooting, and equipment maintenance continued over the quarter. (roger.carter@noaa.gov, dennis.finn@noaa.gov)

**Boundary Layer Research**

FRD is collaborating with Washington State University and Boston University on a National Science Foundation (NSF) proposal to study coherent structures in the boundary layer using data collected at the Idaho National Laboratory. As described in last quarter’s report, the NSF program managers were supportive of the research based on favorable peer reviews but felt that additional equipment should be included to better observe the coherent structures. In consultation with FRD staff, the proposal has been revised and will be resubmitted to the NSF with a goal of conducting field measurements on the INL in 2019. (Dennis.Finn@noaa.gov, Richard.Eckman@noaa.gov)

**NOAA/IDAHO NATIONAL LABORATORY (INL) METEOROLOGICAL RESEARCH PARTNERSHIP**

**Renewal of Partnership**

A new five-year interagency agreement between FRD and the Department of Energy’s Idaho Operations Office was approved by both agencies during the fourth quarter, and the new agreement started on 1 October 2018. This ended an extended period of uncertainty that included a nine-month extension of the prior agreement. The latest agreement continues a nearly 70-year partnership in Southeast Idaho that started with the U.S. Weather Bureau and Atomic Energy Commission. (Richard.Eckman@noaa.gov)

**NOAA/INL Mesonet**

The NOAA/INL Mesonet data collection computers were upgraded during this quarter. The upgrade solved several hardware and software issues with the old computers and allowed for tests of the new Campbell Scientific CR1000X data loggers. One of these data loggers is currently installed at a Mesonet station and is working well. FRD plans to eventually upgrade all the Mesonet data loggers, since the current CR23X models are no longer supported by Campbell Scientific. (roger.carter@noaa.gov, devin.clinger@noaa.gov, adam.haggerty@noaa.gov)

For many years, the failure of the aspirator fans at a Mesonet station has been the most difficult measurement problem to detect. These fans ventilate air past the temperature/humidity sensors to reduce errors related to the sun shining on the solar radiation shield covering the sensors. Considerable skill is required for a meteorologist to look at the temperature measurements and tell when the fans are not running. For several years, FRD has been working on a reliable way to detect when a fan is not running.
This quarter, staff finished installing circuitry at all the Mesonet stations that detects when the fans are not running. The circuit monitors the power draw on all the aspirator fans and returns a Running/Not Running flag with the data. This is detected by the automatic quality control system and flags are set on all temperature measurements. The system is running well and is reducing the quality control work load significantly. (roger.carter@noaa.gov, Jason.rich@noaa.gov, devin.clinger@noaa.gov, adam.haggerty@noaa.gov)

During the third quarter a vehicle crashed into the NOAA/INL Mesonet station in Idaho Falls. Most of the damage was to the public display kiosk and not to the tower and instruments. The station is still fully functional for reporting meteorological data back to FRD. The State of Idaho built the kiosk and has collected bids to repair the structure, including the costs to repair the chain-link fence surrounding the tower and meteorological equipment. The fence still prevents unauthorized access to the tower, but it is warped in a way that makes it difficult to open the entry gate. (Richard.Eckman@noaa.gov)

In July FRD staff discovered unknown meteorological equipment installed on the ATR tower. Someone had mounted a propeller vane just above FRD’s solar radiation sensor. An investigation revealed that the ATR Facility Support Manager requested the installation after the facility’s data link to the normal wind data on the tower failed. FRD sends output from its wind sensors to a separate data logger operated by the ATR Complex. This data logger transmits the wind data into the facility itself to support reactor operations. When this data logger failed, the ATR staff did not know who to contact, so they put up a new wind instrument. Part of the problem was that the previous coordination between ATR and NOAA were lost as a result of recent staff turnover within both groups. FRD’s technicians have worked with the new ATR staff to resolve the issue. (Richard.Eckman@noaa.gov, Devin Clinger, Adam Haggerty)

**HYRad Dispersion System**

The new Javascript-based HYRad version that utilizes the Leaflet mapping interface is now operational in the INL EOC. Testing and minor refinements continue, but the current version now provides essentially the same features and utilities as the older Flash-based version, plus some new capabilities through a new-look user interface. Testing indicates the new version of HYRad is as stable and reliable as the Flash-based version. This new version also corrects some browser-cache problems that affected the old version when the system was not run in the incognito modes available on modern browsers. Since the Site contractors have started to restrict the use of incognito modes on their computers, the old version sometimes would read data from a prior model run stored in the local browser cache rather than requesting current data from FRD’s web server. The old version based on the Flash plugin and the MapQuest mapping interface is still available for use in the EOC if necessary. An update to the User’s Guide to reflect these changes has been nearly completed at the end of the quarter. (brad.reese@noaa.gov, dennis.finn@noaa.gov)

**2017 Annual Site Environmental Report**

The Meteorological Supplement to the 2017 INL Annual Site Environmental Report was completed during the fourth quarter and included in the official publication of the report. It provides updates on the status of the NOAA/INL Mesonet, FRD’s work on dispersion modeling for the INL Site, and an overview of weather highlights during 2017. (Richard.Eckman@noaa.gov, Jason Rich)
**Emergency Operations Center (EOC)**

Team A participated in a drill held at the EOC on July 18th. The drill centered on a tornado that moved through the Specific Manufacturing Facility. Nowcasts and short-term forecasts were provided during the drill. ([Jason.Rich@noaa.gov](mailto:Jason.Rich@noaa.gov))

Team B participated in a drill held at the EOC on July 24th. That drill centered on a release of uranium at the Materials and Fuels Complex. Nowcasts and short-term forecasts along with HYRad plume models were provided during the drill. ([Richard.Eckman@noaa.gov](mailto:Richard.Eckman@noaa.gov)).

Team B participated in a drill held at the EOC on August 21st. This drill involved a control rod that got stuck at the TREAT near the Materials and Fuels Complex. Nowcasts and short-term forecasts along with HYRad plume models were provided during the drill. ([Richard.Eckman@noaa.gov](mailto:Richard.Eckman@noaa.gov)).

Team C participated in a drill held at the EOC on September 19th. This drill was centered on a box of radiological material being spilled at the Radioactive Waste Management Complex. Nowcasts and short-term forecasts along with HYRad plume models were provided during the drill. ([Jason.Rich@noaa.gov](mailto:Jason.Rich@noaa.gov)).

**INL Hazardous Weather Alert System**

Fifteen hazardous weather alerts were issued by the NOAA INL Weather Center. Eight of the alerts were issued for high winds and the other seven alerts were issued due to lightning. ([Jason.Rich@noaa.gov](mailto:Jason.Rich@noaa.gov), [Dennis.Finn@noaa.gov](mailto:Dennis.Finn@noaa.gov), and Richard [Eckman@noaa.gov](mailto:Richard.Eckman@noaa.gov)).

**Climatography of the Idaho National Laboratory 4th Edition**

The Climatography of the Idaho National Laboratory 4th Edition has been published. The third edition contained NOAA/INL Mesonet observations through 2006, whereas this new edition extends the record through 2015. It is anticipated that FRD’s latest climatography will continue to be useful to planners and staff supporting activities at the INL Site. Hard copies are available at FRD, or a PDF version is available at [http://niwc.noaa.inel.gov/climate/INL_Climate4th_Final2.pdf](http://niwc.noaa.inel.gov/climate/INL_Climate4th_Final2.pdf). ([Jason.Rich@noaa.gov](mailto:Jason.Rich@noaa.gov))


**INL Tornado Study**

In early August, Rick Eckman gave a presentation to DOE and contractor staff regarding the risks to the Site associated with tornadoes and other high-wind events. The presentation was requested as a result of the severe weather that occurred in the region earlier in the year, including an EF1 tornado that touched down at the INL Site on 31 May. Staff supporting the INL Site have made assumptions about design-basis winds for the facilities and were concerned that those assumptions may need to be reevaluated. Although this has been an active year for strong thunderstorms in Idaho, it has not been so active to be far outside the range of variability experienced in past years. The presentation also mentioned that that a better estimate of straight-line wind risk could be obtained by using extreme-value statistics on data from the NOAA/INL Mesonet. ([Richard.Eckman@noaa.gov](mailto:Richard.Eckman@noaa.gov))
**White-nose Syndrome Bat Study**

FRD staff are collaborating with biologists affiliated with the INL and Brigham Young University Idaho to investigate meteorological factors affecting the spread of white-nose syndrome in bats. The INL Site and surrounding areas contain a number of caves where bats hibernate in the winter. Recent research indicates that bats intermittently become active during their hibernation period and fly outside the caves, and these active periods are correlated with weather changes. This cold-season activity appears to be linked to the spread of white-nose syndrome. FRD operates meteorological towers near the caves in Southeast Idaho, so the meteorological observations can be combined with acoustic observations of bat activity to better understand the effects of weather on bat hibernation behavior. ([Richard.Eckman@noaa.gov](mailto:Richard.Eckman@noaa.gov) and [Jason.Rich@noaa.gov](mailto:Jason.Rich@noaa.gov))

**OTHER ACTIVITIES**

**Safety**

Several FRD employees attended the INL Health Fair in July.

Donna Davis participated in the OAR Safety Council meeting on July 19.

Video on Hearing Loss, Myths & Facts was viewed during July staff meeting.

All federal employees and contractors attended the Shooter Simulator Training with BEA Physical Security on August 14.

Shawn Williams at CFA inspected all climbing harness/equipment on August 21. It is required to have all climbing harness/equipment inspected twice a year.

EPA provided a video on Indoor Air Quality Pollution that was viewed during September staff meeting.

**Training**

FRD federal employees completed required Ethics Training on August 16.

All federal employees and contractors completed the required FY2018 NOAA Information Technology Security Awareness course by August 31.

**Travel:**

Bai Yang traveled to Boulder, CO July 23 - 27 to attend Weather Research and Forecasting Model workshop at the National Center for Atmospheric Research.