NOAA Air Resources Laboratory

Quarterly Activity Report

FY2019 Quarter 2 (January-February-March 2019)

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DISPERSION AND BOUNDARY LAYER

1. Project Sagebrush

The manuscript “Effects of low-level jets on near-surface turbulence and wind direction changes in the stable boundary layer,” submitted to the *Quarterly Journal of the Royal Meteorological Society* late in 2018, was rejected for publication. We are now in the process of studying the relationships between wind direction changes and stability parameters under two contrasting turbulence regimes (presence of low-level jet versus no gradient of vertical wind). We will incorporate these new results into this manuscript before re-submitting it for publishing. (dennis.finn@noaa.gov, bai.yang@noaa.gov)

2. Field Research Division (FRD) Tracer Program

The division has continued testing a newer refrigerant called R-1234ze to determine whether it has any promise as an atmospheric tracer. R-1234ze and related chemicals have a low global warming potential but still contain electronegative elements (e.g. chlorine and fluorine) that tend to work best with the gas chromatography and electron capture detection methods used at FRD. Previous tests suggested that the refrigerant produces too small of a response to be a viable tracer, but there was some question whether the response was being masked by the large detector response to oxygen. Further tests confirmed that there was no interference by oxygen, so the refrigerant is not a good tracer candidate using the current FRD detection methods. (roger.carter@noaa.gov, bai.yang@noaa.gov)

3. Boundary Layer Research

We continued our Weather Research and Forecasting Model - Large Eddy Simulation modeling study. The model was largely validated by comparing its outputs with observations from the NOAA Idaho National Laboratory (INL) Mesonet for the periods when Sagebrush Projects (I and II) were conducted. We are improving the model by including a passive tracer so that tracer plumes can be simulated. Next, we will further validate the model capability of re-producing the tracer plumes under different stability conditions observed during the two projects. (bai.yang@noaa.gov)

4. Wind Forecast Improvement Program (WFIP)

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)" has been accepted for publication in *Wind Energy*, with Jim Wilczak at NOAA’s Earth System Research Laboratory as lead author and Rick Eckman as a coauthor. This manuscript looks at

the effects of increasing the density of observations used to initialize a regional forecast model on the resulting wind forecasts. The article has been assigned the DOI 10.1002/we.2332.

5. NOAA/INL Mesonet

FRD's meteorological network, the NOAA/INL Mesonet, has been experiencing communication issues related to problems with radio repeaters on separate mountain peaks. Thankfully, our foresight to set up multiple levels of backup has allowed us to continue operating through multiple failures. The primary radio repeater failed in February during a time when Southeast Idaho was affected by an atmospheric river event that dumped large amounts of snow. This repeater is on a mountain peak at around 9,000 feet (ft.) mean sea level (MSL), so the antenna may have been damaged by ice or winds. The backup repeater at the same site is not available because it was repurposed to support a network based on new radios planned for an upgrade to the system. The second backup repeater, located on an isolated butte at about 7,500 ft. MSL, has had issues of its own with ice likely covering the solar panels and not allowing the battery to charge. The ice has since melted but the battery is likely damaged. Due to lack of access to the repeaters at this time of year (the only options are via snowmobile or helicopter) and out of concern that the battery in the second backup may fail, we switched to our third backup option: utilizing a base station located near Grid 3 and the Grid 3 tower as a repeater. The computers in the office communicate with this base station via telephone lines. The Grid 3 tower can only communicate with the on-site stations and a few nearby stations, so the secondary repeater with the bad battery must still be utilized to reach some of the stations. However, a battery failure will not disable all the stations. This configuration is working, but does not always send the data on time. The situation will likely not change until the mountaintop repeaters are reachable in late May or June. (roger.carter@noaa.gov, devin.clinger@noaa.gov)

FRD has begun working on a new web-based version of Viz+ to replace the now defunct desktop version. This version will use the Leaflet API as the mapping interface, replacing Google Maps. Work has also started on an upgrade to the existing NOAA INL Weather Center interface and its underlying components. (Brad.Reese@noaa.gov)

6. HYSPLIT Radiological (HYRad) Dispersion System

Contractor changes at the INL have led to changes in the scenarios provided for HYRad. Hazard assessment specialists are switching from the Radio Safety Analysis Computer to HotSpot for generating Emergency Action Level data and, as a result, scenario files for the Radioactive Waste Management Complex and Idaho Nuclear Technology and Engineering Center will now be defunct and any simulations run from these locations will require custom releases. To facilitate this change, modifications were made to the new HYRad interface providing up to 25 isotopes for a custom release scenario. The old interface provided five release locations with five custom isotopes. Now the first location can support 25 isotopes for a single release location. If the simulation requires multiple locations then the interface defaults back to five locations and five isotopes. (Brad.Reese@noaa.gov)

7. Emergency Operations Center (EOC)

Back in April 2018, FRD staff responded to an activation of the INL's EOC resulting from the breaching of drums containing radioactive waste. Several high-volume air samplers located at FRD's meteorological towers were activated for the event. Analysis of multiple observations, including the sampler filters at the FRD towers, indicated a spike above background radiation values around the time of the event. Although the spike was well below any safety thresholds, there has been an investigation since the drums were in a building with functioning containment systems to prevent outside releases. At a meeting in early February, it was revealed that the isotope mixtures on the analyzed filters do not match the contents of the drums; leading to speculation that the observed spike may have resulted from another INL site activity or perhaps natural variability that occurred around the same time as the event. For example, winds can sometimes raise dust containing fallout from long-ago atmospheric nuclear tests. (Jason.Rich@noaa.gov)

Bai Yang has completed the trainings required by the EOC, INL and is now part of the rotation of EOC shifts. (bai.yang@noaa.gov)

8. 2019 HYSPLIT Workshop

Plans are being made for the 2019 HYSPLIT Workshop to be held during the month of June. In the past, ARL hosted a four-day workshop in College Park, Maryland, that was designed to provide the user with hands-on instruction on how to install, run, and interpret the results of the PC/Mac-based version of the HYSPLIT model. Beginning in June 2019, the HYSPLIT workshop will no longer be held in person or "live" via video conferencing. Instead, an agenda will be created that will guide the user through each section of the online training materials, with each of the four weeks focusing on several sections of the training materials (such as installation, meteorology, trajectories, dispersion, etc.). This will allow the user to learn the materials at their own pace and time. During the week, users will be able to submit questions to the HYSPLIT Forum that will be answered by HYSPLIT experts during the week. ARL will then hold live one-hour sessions on the following Monday at 4 p.m. EDT and on Tuesday at 9 a.m. EDT. During these sessions, the instructor will review the questions that were received during the week and, if time permits, allow users to ask new questions on the material covered in that week's session. Additional information and registration can be found at https://www.ready.noaa.gov/register/HYSPLIT_hyagenda.php. (glenn.rolph@noaa.gov)

9. Atmospheric Turbulence & Diffusion Division (ATDD) – Unmanned Aircraft System (UAS) Program Office Work

On March 4-6, 2019, Temple Lee, Michael Buban, Ed Dumas, and Bruce Baker traveled to Avon Park, Florida, a U.S. Air Force test range north of Sebring, FL, to conduct first-of-a-kind tests with two of ATDD's sUAS: a Meteomatics Meteodrone Severe Storms Edition (SSE) and a BlackSwift Technologies S2 fixed-wing aircraft. During testing, the team also deployed an Echodyne ground-based radar system integrated with Kongsberg geospatial software to determine its ability to mitigate potential threats to the sUAS by targets within the airspace.

The tests were very successful. Over the three-day period, the team performed over a dozen flights with the Meteodrone and six flights with the S2. The Meteodrone was flown up to a maximum altitude of 950 meters (m) above ground level (AGL), whereas the S2 was flown to 1200 m AGL. During all tests, the Echodyne ground-based radar system was able to detect the Meteodrone and S2, as well as other full-scale air traffic in the area. The S2 was found to be visible with the naked eye at 1200 m AGL altitude and the Meteomatics was found to be visible at about 600 m AGL; however, once it reached 700 m AGL, it was completely invisible.

To further evaluate the ground-based radar system, on March 5, 2019, a NOAA Twin Otter aircraft from the agency's Aircraft Operations Center in Lakeland, FL, performed multiple flyovers of the site, and the ground-based radar system was able to detect this aircraft as well. Additionally, Meteodrone data were used to generate analyses of temperature, moisture, and wind fields in near real-time using the Meteomatics software package. Overall, this work is a step toward flying sUAS to higher altitudes. Once Federal Aviation Administration Certificates of Authorization are obtained, both of ATDD's sUAS will be used for vertical profiles of the lowest one kilometer (km) of the atmosphere. These data will be shared in real-time with local National Weather Service (NWS) forecast offices to assist with weather forecasting decisions.

ATDD conducted first-of-a-kind small unmanned aircraft systems tests using the BlackSwift Technologies S2 fixed-wing aircraft and Meteomatics Meteodrone Severe Storms Edition. Credit: NOAA

Progress was made to further test the MD4-1000 lidar system. An "on-the-go" adapter was purchased to couple the Samsung Galaxy tablet to the ground station telemetry receiver and, following reconfiguration of a jumper in the aircraft, the system operated properly. Following a test flight on March 27, 2019, data from the system are being processed to evaluate its performance.

Contact was made with the manager of the Oliver Springs Airport in March 2019, and permission to fly NOAA/ATDD's sUAS at the airport was obtained on March 21, 2019. Oliver Springs is a privately-owned airport that is relatively quiet during the week with very little air traffic. The first flight of a NOAA/ATDD-owned sUAS at Oliver Springs was the MD4-1000 with its lidar system on March 27, 2019.

Contact was made with Kevin Hoyt of the University of Tennessee (UT) Arboretum regarding securing permission to operate the Meteomatics Meteodrone SSE and the BlackSwift S2 sUAS aircraft from UT Arboretum property. An initial meeting was held at the site between Kevin and Ed Dumas on February 15, 2019, to discuss the basics of operating each sUAS and see first-hand the sites that are available. The visit was promising and identified several sites from which the Meteomatics could be operated, and possibly one site where the S2 could be operated. A

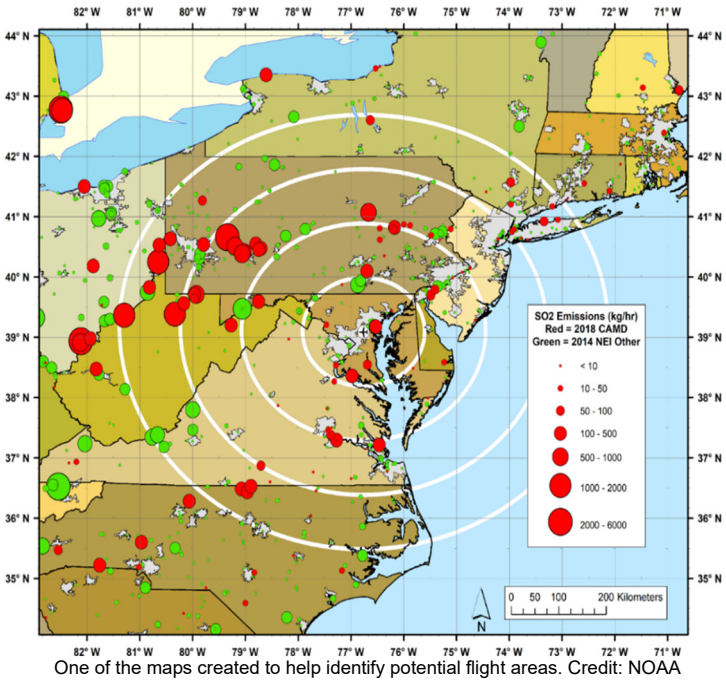
follow-up meeting is scheduled for next quarter. (Ed.Dumas@noaa.gov, T. Lee, M. Buban, S. Klemenz, B. Baker)

10. Boundary-Layer Meteorology

The paper "Permafrost nitrous oxide emissions observed on a landscape scale using the airborne eddy-covariance method," by J. Wilkerson, R. Dobosy, D. S. Sayres, C. Healy, E. Dumas, **B. Baker**, and J. G. Anderson has appeared in *Atmospheric Chemistry and Physics* (ACP), published by the European Geophysical Union. The ACP co-editor selected it as a highlight article. It describes the first spatially extensive high-latitude measurement of nitrous oxide (N_2O) flux. The campaign, Flux Observations of Carbon from an Airborne Laboratory (FOCAL), took place in August 2013 and ranged over a region of about 100 km by 250 km on the North Slope of Alaska. The arctic was generally assumed to be a negligible source of N_2O because of nitrogen limitation. Several chamber studies identified "hot spots" of N_2O emission, but also found the emissions to be spotty over the landscape. The FOCAL expedition provided the first spatial survey to assess the overall importance of N_2O emission. FOCAL confirmed the spottiness of the emissions, and found the overall North Slope N_2O source to be considerably stronger than had been assumed. The result calls for further confirmation and monitoring. Improved trace-gas sensors like that on the FOCAL are now more widely available to do this. (Ron.Dobosy@noaa.gov, E. Dumas, B. Baker)

11. Decision Support for Flight Planning

Mark Cohen carried out a number of activities to aid in aircraft flight planning in support of the Tracers of Opportunity project, including: (1) Updated and re-started the Baltimore region forecast system that had been developed for last summer's Ozone Water-Land Environmental Transition Study field campaign. This forecast system is based on NOAA's North American Mesoscale forecast model, with three km spatial resolution, and is automatically produced four times per day, providing a 48-hour forecast of conditions relevant to flight decisions. (2) Created and implemented a new forecast system for flight planning in the Virginia/North Carolina region. This was similar to the Baltimore region forecast, but included several new features including plume rise estimates for emissions sources and the locations of ground-based monitoring sites (so that they could be overflown if desired). (3) Created a series of maps



One of the maps created to help identify potential flight areas. Credit: NOAA

centered on the Tipton, Virginia airport - the home base of the aircraft being used for the ARL flights - so that possible flight areas could be identified. Recent emissions and monitoring information was included on the maps to aid in decisions. Ready-to-use data sets for import into Google Earth were also created so that team members could examine regions as needed. (mark.cohen@noaa.gov)

12. Interagency Meeting

A high-level meeting between ARL and the U.S. Environmental Protection Agency's (EPA) Clean Air Markets Division (CAMD) was held March 6, 2019 at CAMD headquarters in Washington, D.C., to advance opportunities for collaboration, particularly in regard to the Tracers of Opportunity project. EPA's CAMD is the group that assembles continuous emissions monitoring system (CEMS) data from power plants. They carry out quality control and quality assurance procedures and make the data available to interested parties. These high-quality, temporally resolved (e.g. hourly) data are critical to the Tracers of Opportunity project, and the meeting allowed ARL to establish new connections with the CAMD Emissions Monitoring Branch that have already resulted in new and improved data access to data for the project. The CAMD Assessment and Communication Branch was also included in the meeting, which was very constructive since the branch is involved with a range of ambient monitoring programs whose data are also critical to the Tracers of Opportunity project. ARL representatives at the meeting included Ariel Stein, Mark Cohen, Alice Crawford, Chris Loughner, Winston Luke, Xinrong Ren, and Barbara Stunder. (mark.cohen@noaa.gov)

13. Ashfall Project

Alice Crawford attended a teleconference to close out the U.S. Department of Energy's (DOE) ashfall project on February 20. This project was a collaboration between the DOE Office of River Protection (ORP), NOAA's Air Resources Laboratory, the U.S. Geological Survey (USGS), and the Desert Research Institute (DRI) to estimate concentrations of airborne ash that might be expected at the DOE Hanford site if an eruption of Mount St. Helens were to occur. DRI, USGS, and NOAA ARL each submitted a final report in the spring of 2018. In the fall, report authors responded in writing to questions from a peer review and from the Defense Nuclear Facilities Safety Board, or DNFSB. The teleconference allowed a detailed oral discussion of DNFSB's questions with DNFSB, DOE ORP, and the report authors. (alice.crawford@noaa.gov)

14. Consequence Assessment for the Nevada National Security Site (NNSS)

James Wood, Rick Lantrip, and Walt Schalk participated in four emergency response training exercises/drills as the Consequence Assessment Team (CAT) for the National Nuclear Security Administration (NNSA) Nevada Field Office (NFO). In these events, conducted on the NNSS, the activities to be conducted were discussed, local weather data and weather forecasts were provided, and dispersion products were generated based on the worst case event information provided for the scenario. In addition, the CAT worked with field measurement teams to help identify/locate the plume. These events were conducted with the DOE/NNSA/NFO Emergency Response Organization. Dispersion and consequence assessment products were developed for use during exercise play as "ground truth". These exercises/drills simulated chemical,

radiological, and transportation accidents on NNSS and at NNSS facilities. One exercise was evaluated by the Evaluation and Assessment Office of DOE (EA-33). The SORD CAT received very high marks and very positive comments and was considered to be one of the best in the DOE complex.

Routine training and practice are required to maintain Consequence Assessment qualifications and expertise. Several other emergency response exercises are in the planning stage and dispersion calculations have been generated for these future events. (rick.lantrip@noaa.gov, james.s.wood@noaa.gov, walter.w.schalk@noaa.gov)

15. SORD Mesonet

SORD continued researching several areas in an attempt to improve the SORD/NNSS mesonet. Three-dimensional (3-D) sonic anemometer improvements/upgrades, precipitation gauge replacement, gauges that can better record snow, snow depth sensors, and radio communications top the list of improvements. Sonic anemometers have to be reset on occasion.

Wayne Bailey continues to perform routine monthly maintenance and verification checks on the NNSS mesonet. Walt Schalk and Rick Lantrip have provided NNSS Mesonet data to several groups on the site for use in the planning of experimental activities. James Wood provides precipitation data monthly to the Environmental Monitoring Group.

Lightning Detection System: SORD continued working with its partners to install a new lightning sensor to the north, but getting information is challenging. We continued working to solidify our information technology support and, when this occurs, Vaisala will return to upgrade the detection data processing software that will improve location accuracy and better delineate between inter-cloud and cloud-to-ground strikes. (walter.w.schalk@noaa.gov, james.s.wood@noaa.gov, rick.lantrip@noaa.gov, wayne.bailey@noaa.gov)

16. Support to DOE/NNSA NNSS Projects and Experiments

Walt Schalk participated in several planning meetings in preparation for the third experiment in Phase II of non-proliferation experiments (Source Physics Experiments – Phase I, Dry Alluvium Geology – Phase II). Discussions continue with Los Alamos scientists to determine collaborative and support areas, especially in the area of using balloons to elevate instrument platforms. Radiosonde releases are conducted to remain qualified.

Schalk continues to meet with NFO contractor personnel monthly to discuss NNSS efforts to complete the vulnerability screening activity for the mandated Site Sustainability Project – Climate Resiliency.

Air Quality: Atmospheric dispersion modeling system (AERMOD) modelling was completed and the results were reviewed and documented. The final results were provided to the NFO contractor for submission to the State. (walter.w.schalk@noaa.gov, james.s.wood@noaa.gov, rick.lantrip@noaa.gov)

ATMOSPHERIC CHEMISTRY AND DEPOSITION

17. **National Air Quality Forecasting Capability (NAQFC) Upgrade**

In February 2019, ARL delivered an upgraded emission and code management package to the NWS, the organization responsible for operating our country's National Air Quality Forecasting Capability (NAQFC). The significance of this particular upgrade is that it enabled the operational NAQFC to capture and project changes into real-time emission rates distributed across the country at hourly intervals, thereby ensuring more accurate air quality forecasts.

NAQFC model upgrades are performed each year and are centered on the U.S. EPA National Emission Inventory (NEI) data for a static base year. The last several annual upgrades utilized 2011 data, but scientists can now use 2014-based data thanks to ARL's aggressive overhaul of the base year inventory. A comparative analysis of 2011 to 2014 data identified the oil and gas industry, energy generation plants, and mobile sources due to vehicular transportation as experiencing the largest changes in terms of ozone and particulate matter precursor species.

ARL also streamlined the NAQFC multiple domain forecast into a single, unified modeling system by synchronizing all software components and versions of the modeling system. The Continental U.S., Alaska and Hawaii no longer have separate software systems; rather – and for the first time – all three domains utilize a single, unified software package called Air Quality Monitoring Version 5.1 (AQM V5.1). ARL collaborated with the Environmental Modeling Center at NOAA's National Centers for Environmental Prediction to accomplish this upgrade, which is publicly available at https://airquality.weather.gov/. (pius.lee@noaa.gov)

18. **Major Upgrade on Point Sources and Characterization**

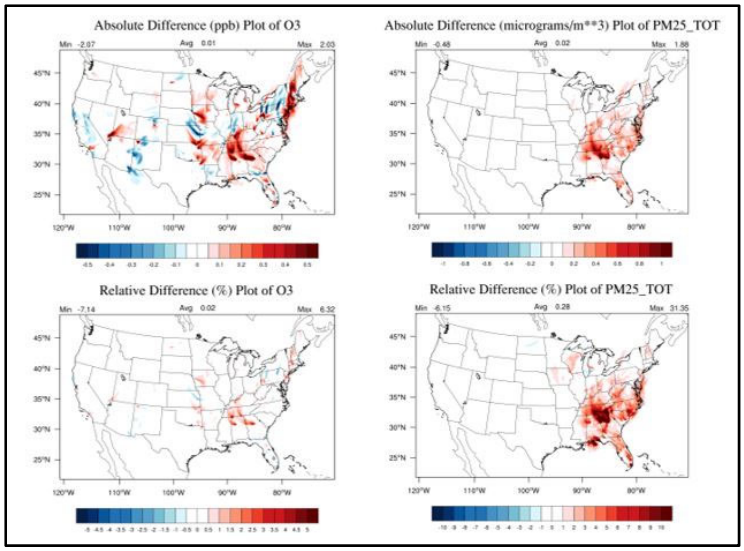
Accurate pollutant emission is critically important for the NAQFC, and Nitrogen oxides (NO_x) and Sulfur dioxide (SO_2) emissions are of particular interest. Point source (i.e. single, identifiable source) emissions mainly represent tall and large stacks from energy generation units (EGU) at power plants, many of which use coal and/or gas. The activity of these EGUs are monitored and reported to the U.S. EPA. ARL's Patrick Campbell developed an emissions update based on both continued energy monitoring, in-situ (at the stack) discharges in 2017 and the U.S. DOE's energy outlook forecast for 2019. This update was adopted by NWS and will take effect from NAQFC's 12Z cycle forecast on April 16 2019 over the continental United States.

Point sources represent a significant percentage of the total emission makeup. In summer, energy demand by air conditioning units results in the largest percentage point source component among the seasons; however, point source in all seasons are around 10 percent of the total emitted pollution, where area and mobile sources are considerably bigger sources.

A July 01, 2018 test forecast (image below) suggests the following implications for the upcoming summer ozone (O_3) and fine particle pollution ($PM_{2.5}$) concentrations:

- O_3 stays largely flat except a ~ 6 % increase in southeast (SE)
- $PM_{2.5}$ is projected to increase up to 30 % in SE due to SO_2 increases.

(pius.lee@noaa.gov, patrick.campbell@noaa.gov)



1 July 2018 test forecast image

19. **Research Sampling Flights**

Allison Ring, Xinrong Ren, Mark Cohen, Winston Luke, and Paul Kelley, as well as a few HYSPLIT team members including Ariel Stein, Alice Crawford, and Christopher Loughner, participated in an aircraft project to sample plumes from coal-fired power plants to evaluate the HYSPLIT model that has been developed and improved by NOAA/ARL. Two research flights were conducted on March 26 to sample coal-fired power plants in Roxboro and Belews Creek, North Carolina. A number of chemical and meteorological parameters were measured and recorded from the aircraft, including sulfur dioxide (SO_2, a tracer for coal-fired power plant emissions), carbon dioxide (CO_2), nitrogen oxides (NOx), temperature, pressure, relative humidity, horizontal wind speed and wind direction.

The HYSPLIT model is a complete system for computing simple air parcel trajectories, as well as complex transport, dispersion, chemical transformation, and deposition simulations. HYSPLIT is one of the most extensively used atmospheric transport and dispersion models in the atmospheric sciences community. Aircraft data are used to evaluate the transport and dispersion in the HYSPLIT model to improve the accuracy of model results. The emission rates of SO_2, CO_2, and NOx can be estimated using the aircraft observations based on the mass balance approach. These aircraft-based emission rates are compared to the emission rates in the CEMS. (xinrong.ren@noaa.gov)

CLIMATE OBSERVATIONS AND ANALYSES

20. **U.S. Climate Reference Network (USCRN)**

CRN staff made 25 annual maintenance visits this quarter.

In January, February, and March, the National Centers for Environmental Information (NCEI) retrieved 20 data files from USCRN sites through the server ftp.atdd.noaa.gov. Data are passed to NCEI by this path when retrieved episodically by ATDD from individual site visits to fill data gaps. Data for each site are maintained in the Integrated Station Information System (ISIS) database on NCEI's server, along with a record of events which affect data quality. New ISIS events are identified from ATDD's field crews and archived data.

Data reduction for January, February, and March was completed without problems. The monthly data for this period was entered into WxCoder and submitted. (lynne.satterfield@noaa.gov)

ARL 2nd Quarter Publications

Buban, M. S.; Lee, T. R.; Dumas, E. J.; **Baker, C. B.**; Heuer, M. (2019). Observations and Numerical Simulation of the Effects of the 21 August 2017 North American Total Solar Eclipse on Surface Conditions and Atmospheric Boundary-Layer Evolution. *Boundary-Layer Meteorol* 1–14, https://doi.org/10.1007/s10546-018-00421-4

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Kumar, R., Monache, L.D., Bresch, J., Saide, P.E., Tang, Youhua, Liu, Z., da Silva, A.M., Alessandrini, S., Pfister, G., Edwards, D. and **Lee, Pius**, 2019. Towards improving short-term predictions of fine particulate matter over the United States via assimilation of satellite aerosol optical depth retrievals. *Journal of Geophysical Research: Atmospheres*. 124, 2753–2773. https://doi.org/10.1029/2018JD029009

Salinger, James; Renwick, James; Behrens, Erik; Mullan, Brett; **Diamond, Howard J.**; Sirguey, Pascal; Smith, Robert; Trought, Mike C.T.; Alexander, Lisa V.; Cullen, Nicolas; Fitzharris, B. Blair; Hepburn, Chris; Parker, Amber; and Sutton, Phil J. (2019). The unprecedented coupled ocean-atmosphere summer heatwave in the New Zealand region 2017/18: drivers, mechanisms and impacts. *Environmental Research Letters* https://doi.org/10.1088/1748-9326/ab012a

Saylor, Rick D.; Baker, Barry D.; **Lee, Pius**; Tong, Daniel; Pan, Li; and Hicks, Bruce B. (2019). The particle dry deposition component of total deposition from air quality models: right, wrong or uncertain? *Tellus B: Chemical and Physical Meteorology*, 71:1, 1-22. https://doi.org/10.1080/16000889.2018.1550324

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Lee, T. R., M. Buban, D. D. Turner, **T. P. Meyers**, and **C. B. Baker**, 2019: Evaluation of the High-Resolution Rapid Refresh (HRRR) model using near-surface meteorological and flux observations from Northern Alabama. *Weather and Forecasting*, https://doi.org/10.1175/WAF-D-18-0184.1

Pal, S., and T. R. Lee, 2019: Contrasting air mass advection explains significant differences in boundary layer depth seasonal cycles under onshore versus offshore flows. *Geophysical Research Letters*, 46, https://doi:10.1029/2018GL081699

Buban, M. S., T. R. Lee, E. J. Dumas, **C. B. Baker**, and M. Heuer, 2019: Observations of the effects of a total solar eclipse on surface and atmospheric boundary layer evolution. *Boundary-Layer Meteorology*, 2019, 1-14, https://doi:10.1007/s10546-018-00421-4

Lee, T. R., M. Buban, E. Dumas, and **C. B. Baker**, 2019: On the use of rotary-wing aircraft to sample near-surface thermodynamic fields: results from recent field campaigns. *Sensors*, 19 (1), 10, https://doi:10.3390/s19010010

Conference Presentations & Invited Talks

99th American Meteorological Society (AMS) Annual Meeting: Dennis Finn and Jason Rich planned to attend this meeting, which took place January 6-10, 2019 in Phoenix, Arizona. Dennis was scheduled to give an oral presentation related to the Project Sagebrush studies at the INL. Unfortunately, the partial shutdown of the federal government forced the cancellation of this travel.

ATDD staff members Temple Lee and Michael Buban, employees of the Cooperative Institute for Mesoscale Meteorological Studies (CIMMS), attended the AMS meeting and presented papers. Dr. Lee was the lead author and presenter of "Toward obtaining daily vertical profiles of in-situ meteorological measurements from small unmanned aircraft systems," co-authored by Michael Buban, Edward J. Dumas, Jr., Tilden P. Meyers, and C. Bruce Baker. Dr. Buban was the lead author and presenter of "Using the US Climate Reference Network to improve gridded soil moisture products over the conterminous U.S.," co-authored by Drs. Lee, Baker, and Meyers, and C.R. Hain.

Other

FRD Staff Changes:

- Dennis Finn retired at the end of January. Since 2013, Dennis had focused on research related to FRD's Project Sagebrush field studies. This work resulted in a number of highly-regarded publications on dispersion and boundary-layer structure, particularly new insights into dispersion in the stable boundary layer. Dennis's knowledge and contributions will be sorely missed and we wish him all the best in retirement.
- Adam Haggerty left FRD. Adam worked as an Electronics Technician servicing and maintaining the meteorological towers associated with the NOAA/INL Mesonet. We wish him the best in his new job.
- At the end of March, the division's Acting Director, Richard Eckman, retired after 32 years of service. FRD wishes Rick the best in his retirement adventures. Walt Schalk is the Acting Director until a permanent director is chosen.

DOE Meteorological Coordinating Council (DMCC) Activities: Walt Schalk prepared / finalized the agenda and ran two bi-monthly (every other month) conference calls that consisted of a round robin update of program status of those present, a discussion on the path forward with the new DOE Order and the development of the new Criteria Review and Approach Documents, recent DMCC activities and projects, and site met program discussions. Another topic of interest was an introductory discussion regarding DOE's definition of a "qualified meteorologist". Planning is underway for the annual meeting to be held in September 2019 in Knoxville, Tennessee. (walter.w.schalk@noaa.gov)

SORD Website: Work continues to add improvements, updates, and new capabilities to the website, www.sord.nv.doe.gov. (walter.w.schalk@noaa.gov)