NOAA Air Resources Laboratory

Quarterly Activity Report

FY2018 Quarter 4 (July-August-September 2018)

Contents:

DISPERSION AND BOUNDARY LAYER

1. Transfer Coefficient Matrix Application

Glenn Rolph was nominated to lead the effort to complete implementation efforts on the ARL-developed Transfer Coefficient Matrix (TCM) application for use within the World Meteorological Organization's (WMO) Emergency Response Activities (ERA) program. The TCM application will allow more flexibility by all WMO Regional Specialized Meteorological Centers (RSMCs) in the use and comparison of their dispersion model results (ARL and the National Centers for Environmental Prediction are members of RSMC Washington). Mr. Rolph will also attend the WMO Commission of Basic Systems' Expert Team on Emergency Response Activities meeting in Vienna, Austria, from October 1-5, 2018 to discuss progress on the work and how the other RSMCs can post their results to the developmental web server at ARL. RSMCs provide atmospheric dispersion model products to WMO member countries and the International Atomic Energy Agency during nuclear accident exercises and emergencies to model the transport of nuclear material from the source of the release. (glenn.rolph@noaa.gov)

2. 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 ARL's Field Research Division (FRD). The paper, which proposes a unifying model for turbulence in the stable boundary layer, was highly regarded by the journal's editorial staff. This led to it being featured by the American Geophysical Union as an *Eos* Research Spotlight and the cover of the journal's August issue. 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 and accepted for publication at the end of the quarter. Follow-up research is in progress, focused on the effects of low-level jets on turbulence and wind direction changes in the stable boundary layer.

The abstract for the oral presentation "Wind direction changes and plume behavior in very stable conditions" was submitted to the 99th American Meteorological Society annual meeting (scheduled for January 2019) 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)

Sudheer Bhimireddy has started his Ph.D. work at the University of Texas at 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, Mr. Bhimireddy gave an online presentation to FRD staff regarding his research plans and successfully conducted his dissertation proposal defense later in the month. Rick Eckman is a member of Sudheer’s thesis committee. (richard.eckman@noaa.gov)

3. 2017 Annual Site Environmental Report

The Meteorological Supplement to the 2017 Idaho National Laboratory (INL) Annual Site Environmental Report was completed during the fourth quarter and included in the report’s official publication. This supplement 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)

4. HYRad Dispersion System

The new JavaScript-based HYSPLIT Radiological (HYRad) version that utilizes the Leaflet mapping interface is now operational in the INL Emergency Operations Center (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 that the new version of HYRad is as stable and reliable as the Flash-based version. The 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 would sometimes 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)

5. 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)

6. Wind Forecast Improvement Project

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 NOAA's Earth System Research Laboratory 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 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)

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)

7. 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 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; so, 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 significantly reducing the quality control workload. (roger.carter@noaa.gov, Jason.rich@noaa.gov, devin.clinger@noaa.gov, adam.haggerty@noaa.gov)

In July, FRD staff discovered unknown meteorological equipment installed on the Advanced Test Reactor (ATR) Complex 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 didn't 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 was lost as a result of recent staff turnover within both groups. FRD's technicians worked with the new ATR staff to resolve the issue. (richard.eckman@noaa.gov, Devin Clinger, Adam Haggerty)

8. NOAA/ATDD sUAS Instrument Testing

The BlackSwift Technologies multi-hole probe was tested in the Atmospheric Turbulence and Diffusion Division's (ATDD's) wind tunnel. This probe was designed to mount on a small unmanned aircraft system (sUAS) and measure angles of attack and sideslip of airflow with respect to the sUAS. Data from this probe will be combined with data of the attitude and motion of the aircraft to calculate three-dimensional (3-D) turbulent winds with respect to Earth. The probe was cycled through a matrix of angles of attack and sideslip while the wind tunnel speed was maintained at 14.7 meters per second (m/s).

Initial analysis indicated a significant amount of white noise in the dynamic pressure signal that would swamp the probe's ability to resolve the vertical wind component to the desired 0.1 m/s tolerance. The probe was returned to the manufacturer for re-work.

Tests were performed in ATDD's temperature/relative humidity chamber on the instrument package for the Meteomatics Severe Storm Edition (SSE) multi-rotor sUAS. The performance of these instruments was within manufacturer's specifications. As can be seen in Figure 1, the ratio and difference of the Meteomatics temperature from that of the platinum resistance thermometer (PRT) reference temperature can be seen as a function of the test temperature and relative humidity. Agreement within 0.3°C was seen throughout the range of test conditions. The performance of the Meteomatics relative humidity as a function of the test temperature and relative humidity is shown in Figure 2. Agreement within nine percent was seen throughout the range of test conditions.

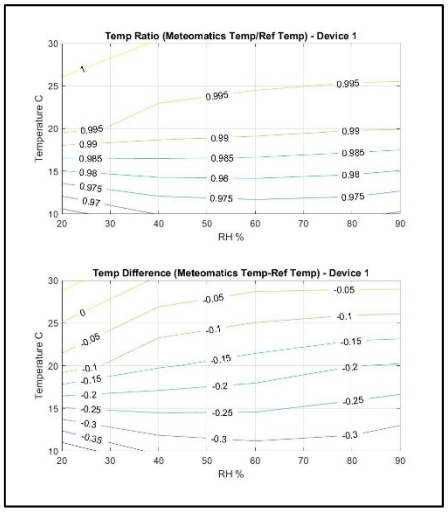

Figure 1: Ratio and Difference plot for Meteomatics temperature as a function of test temperature and relative humidity.

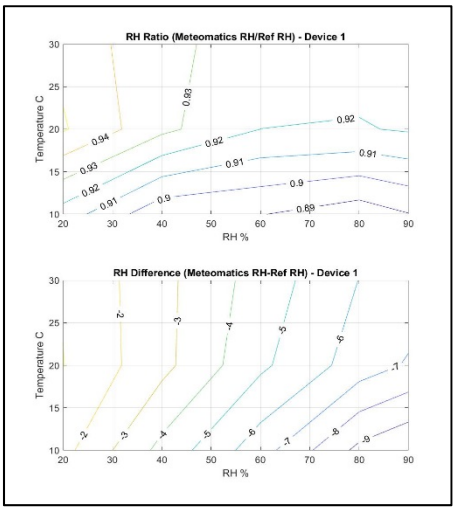

Figure 2: Ratio and Difference plot for Meteomatics relative humidity as a function of test temperature and relative humidity.

9. NOAA/ATDD sUAS Program Office Work

A field demonstration was conducted on September 24, 2018, at the House Mountain Radio Control (HMRC) model flying field in Corryton, Tennessee, to evaluate the ability of the Echodyne solid-state radar system to "see" objects in the sky that are non-participating with respect to air

traffic control (ATC), as well as to evaluate the performance of software developed by Kongsberg to provide information about participating aircraft that are tracked by ATC. A combination of these two systems will be used to assist ATDD in flying sUAS beyond visual line-of-sight.

For this demonstration, several small unmanned aircraft were flown within the field-of-view cone of the Echodyne radar system to test its ability to detect these types of aircraft. ATDD flew its DJI S-1000 sUAS with an Automatic Dependent Surveillance-Broadcast (ADS-B) transceiver affixed to the airframe in the cone of the radar system. Several radio-controlled (RC) sailplanes with wingspans of approximately 3.5-4 meters were also flown in the cone of the radar system. The University of Tennessee Space Institute was scheduled to fly a full-scale Cessna 172 aircraft over the HMRC field, but was unable to ferry the aircraft from Tullahoma, TN, due to bad weather. Therefore, the demonstration was limited to using only the small unmanned aircraft and RC sailplanes. The Echodyne radar system was able to detect the S-1000 and each of the RC sailplanes without any problems. The Kongsberg system was unable to detect the ADS-B transceiver affixed to the S-1000 due to technical difficulties, but was otherwise able to detect several full-scale aircraft, which were not part of this demonstration, flying within several miles of HMRC.

Work also continues with the team from NOAA's UAS Program Office and NOAA's Aircraft Operations Center (AOC) to create a Federal Aviation Administration (FAA) Certificate of Authorization (COA) application to perform extended visual line-of-sight operations with the BlackSwift S2. The purpose will be to measure vertical profiles of temperature and relative humidity for the National Weather Service (NWS) to an altitude of 1000 meters (3280 feet) above ground level on a regular basis. NOAA/AOC submitted the COA application to the FAA last quarter, and received feedback regarding an issue with regular air traffic over the test site. Refined procedures will be developed to eliminate the possibility of collision with manned aircraft. (ed.dumas@noaa.gov, T. Lee, M. Buban, B. Baker)

10. Experimental HYSPLIT Products

Current HYSPLIT operational products for the NWS are deterministic. Depending on the situation, the products may contain significant uncertainties that are not estimated or properly conveyed. Dispersion model ensemble members can be used to create a variety of dispersion model ensemble products that complement the current deterministic model output by providing additional information about the model variability and the probability of occurrence of hazardous levels of material in the atmosphere. Experimental dispersion ensemble products for fire smoke concentrations are now available at https://www.ready.noaa.gov/smoke-bin/ensmoke.py (alice.crawford@noaa.gov)

11. Consequence Assessment for the Nevada National Security Site

James Wood, Rick Lantrip, and Walt Schalk participated in two emergency response training exercises as the Consequence Assessment Team (CAT) for the National Nuclear Security Administration's (NNSA) Nevada Field Office (NFO). The training was conducted on the Nevada National Security Site (NNSS) with the DOE/NNSA/NFO Emergency Response Organization. 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. Dispersion and consequence assessment products were developed for use during exercise play as "ground truth." Routine training and practice is required to maintain consequence assessment qualifications and expertise. (rick.lantrip@noaa.gov, james.s.wood@noaa.gov, walter.w.schalk@noaa.gov)

12. SORD Mesonet

ARL's Special Operations and Research Division (SORD) continues to look to improve the SORD/NNSS mesonet. Several areas of improvement are being researched. 3D sonic anemometer improvements/upgrades, precipitation gauge replacement, gauges that can better record snow, snow depth sensors, and a LIDAR are at the top of the list of improvements.

Walt Schalk, Rick Lantrip, and Caleb Steele provided NNSS mesonet data to several groups on the site for use in planning experimental activities. James Wood provides monthly precipitation data to the Environmental Monitoring Group.

Lightning Detection System: A Vaisala lightning technician was at SORD for a week working with personnel to upgrade the hardware of our four lightning detection sensors, prepare for the addition of another sensor that will significantly enhance and improve our current system/network, and provide some initial training. Vaisala will return in the near future to upgrade the detection data processing software to improve location accuracy and better delineate between inter-cloud and cloud-to-ground strikes.

3D Sonic Anemometers: After a series of thunderstorms on the NNSS this quarter, six sensors stopped working. The sensors had to be swapped out and sent to the vendor for repair and recalibration. We are also going to review vendor documentation with regards to proper grounding and recheck sensor installation. (walter.w.schalk@noaa.gov, rick.lantrip@noaa.gov, james.s.wood@noaa.gov, caleb.steele@noaa.gov, wayne.bailey@noaa.gov)

13. Support to DOE/NNSA NNSS Projects and Experiments

Walt Schalk participated in several planning meetings in preparation for Phase II of non-proliferation experiments [Source Physics Experiments (SPE) – Phase I, Dry Alluvium Geology (DAG) – 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. One balloon was launched for the first experiment in the DAG series and practice runs were conducted with the new mobile upper air system. These activities will continue to evolve over the fiscal year. Planning is underway for the second experiment. Several radiosonde balloon launches are possible for this experiment.

James Wood, Rick Lantrip, and Caleb Steele provided specific point forecasts for the DAG experiment set-up. The experiment will be conducted on the NNSS in December. Caleb, James,

and Rick participated in the daily Plan of the Day meetings where the forecast was provided and any questions were answered. Particular items of interest were lightning and winds.

Walt Schalk continues to develop a portable micro-net of weather stations and a portable wind set package to support experiments on the NNSS such as the SPE/DAG. A micro-net station was set up to support the DAG experiments and has been collecting data for several months. These data were provided to the scientific team in the first experiment.

Walt 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.
(walter.w.schalk@noaa.gov, james.s.wood@noaa.gov, rick.lantrip@noaa.gov)

14. Air Quality

Caleb Steele has been learning and working with the latest version of the AERMOD model in support of licensing activities for the NNSS. New model installation and verification has been conducted and a new meteorological database/files for the NNSS have been created/assembled. Initial model runs have begun using the previous source database and results are being reviewed. (caleb.steele@noaa.gov)

ATMOSPHERIC CHEMISTRY AND DEPOSITION

15. Long Island Sound Tropospheric Ozone Study

ARL supported the Long Island Sound Tropospheric Ozone Study (LISTOS) from July 1 - August 31, 2018. ARL contributed to research flights deploying two of its instruments to measure multiple pollutants with a goal to better understand the contributing chemicals, their emission sources, and the underlying weather patterns that influence their movement. This multi-agency collaborative study was focused on the Long Island Sound area, a region that perpetually suffers from high ozone concentrations and resulting poor air quality that negatively impacts the health and well-being of over 20 million people from the New York City metropolitan area to the Atlantic coast of Massachusetts. Other participants included the Northeast States for Coordinated Air Use Management (lead - http://www.nescaum.org/documents/listos), U.S. Environmental Protection Agency (EPA), National Aeronautics and Space Administration (NASA), state environmental agencies from New York, New Jersey, Connecticut, and Maine, and four universities including the University of Maryland, College Park. (xinrong.ren@noaa.gov)

16. National Air Quality Forecasting Capability

The NWS's National Air Quality Forecasting Capability (NAQFC) leadership held its 13th annual feedback meeting September 27-28, 2018. The meeting was held at the headquarters of NOAA's National Centers for Environmental Prediction (NCEP), in the NOAA Center for Weather and Climate Prediction, and was attended by representatives from 23 states and contributors from other governmental agencies and international operational institutes. The U.S. EPA and Environment and Climate Change Canada both presented significant progress in their respective

contributions. ARL's atmospheric scientists have led the research and implementation testing of NAQFC since the program's inception in 2003. NAQFC is an air quality forecasting service to the nation that is particularly vital to the daily living of sensitive groups who should minimize their exposure to unhealthy ambient air. ARL had a strong presence at the meeting, presenting 2018 progress and previews of potential advancements to be recommended for 2019. Drs. Pius Lee, Daniel Tong, Youhua Tang, Barry Baker, and Patrick Campbell contributed to the presentations and the open forum discussion on the strengths and potential deficiencies to be tackled in the near term. The ARL team works closely with NCEP Environmental Modeling Centers to upgrade and realize NAQFC as a NOAA operational service. (pius.lee@noaa.gov)

17. Atmospheric Chemistry

On August 23, Zachary Moon, a Ph.D. student at The Pennsylvania State University and NOAA Center for Atmospheric Science and Meteorology Graduate Fellow, presented a seminar entitled, "Modeling Radiative Transfer in a Forest Canopy and its Importance in a 1-D Air Chemistry Model." Mr. Moon's seminar described research he performed during his summer internship at ATDD, working with Rick Saylor and the Atmospheric Chemistry and Canopy Exchange Simulation System (ACCESS). In the research, Zach demonstrated that the methodology used to model radiative transfer and actinic fluxes through a vegetative canopy can have substantial impacts on the atmospheric chemistry occurring within and above the canopy. Zach's Ph.D. work will extend this analysis, evaluate the model results with field measurements of radiative fluxes through forest canopies, and incorporate his results into the ACCESS modeling system. (rick.saylor@noaa.gov)

18. U.S. Climate Reference Network

U.S. Climate Reference Network (USCRN) staff made 30 site visits; performing 28 annual maintenance visits, one site installation at Bethel, Alaska, and one unscheduled maintenance visit. (mark.e.hall@noaa.gov)

In July, August, and September, the National Centers for Environmental Information (NCEI) retrieved 47 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. This data is maintained in the ISIS (Integrated Station Information System) database on NCEI's server, along with a record of events that affect data quality. New ISIS events are identified from ATDD's field crews and archived data. (lynne.satterfield@noaa.gov)

19. Local Meteorological Support

Data reduction for July, August, and September was completed without problems. The monthly data was then entered into WxCoder and submitted. (lynne.satterfield@noaa.gov)

20. Asia-Pacific Mercury Monitoring Network

Dr. Winston Luke traveled to Manila, Philippines, to participate in the Asia-Pacific Mercury Monitoring Network (APMMN) Meeting and Workshop from September 3-7, 2018. The APMMN's purpose is to develop a harmonized network of ambient and rainwater mercury monitors in the

Asia-Pacific region. The workshop brought together government officials and experts from over 10 countries to share strategies, experiences, and challenges in conducting and optimizing mercury monitoring in environments ranging from rural to urban. Dr. Luke presented the results of NOAA's latest research (NOAA is recognized as an international leader in mercury measurements and modeling), and participated in workshop technical training sessions to demonstrate best practices for mercury monitoring. Dr. Luke's participation, like that of other international mercury experts, was sponsored by the U.S. EPA through the International Environmental Partnership (IEP); a program established with EPA Taiwan (EPAT) to build a network of worldwide experts working together to strengthen capacity for addressing environmental challenges. Through IEP, EPA and EPAT address common priorities such as climate change, environmental education, electronic waste management, air pollution, mercury monitoring, and contaminated soil and groundwater. This close partnership has evolved into a robust platform for sharing experience and expertise, as well as assisting environmental agencies and partners in the Asia-Pacific region, Latin America, and Africa. Other workshop hosts included the Japanese Ministry of the Environment, Philippines Department of Environment and Natural Resources, and the U.S. Embassy in Manila. Scientists and officials from a number of Asian nations participated in the meeting/workshop. (winston.luke@noaa.gov)

21. Ozone Water-Land Environmental Transition Study 2

In July 2018, Paul Kelley, Xinrong Ren, Winston Luke, and Mark Cohen were involved in the Ozone Water-Land Environmental Transition Study 2 (OWLETS-2), a NASA-led study examining the roles played by chemistry and meteorology in controlling levels of photochemical ozone and fine particulate pollution across the water land transition zone around the Northern Chesapeake Bay. Xinrong Ren was involved in research flights over Baltimore, the upper portion of the Chesapeake Bay, and Eastern Shore to capture horizontal and vertical gradients ozone and its precursors. Kelley, Ren, and Luke deployed in situ trace gas instrumentation (O_3, CO, SO_2, NO, NO_2, NO_Y, CO_2, CH_4 and Hg^0) at a monitoring site on the Hart-Miller Island, approximately 10 miles east of Baltimore's Inner Harbor. Weekly maintenance was performed to ensure the quality of the data collected. The project officially ran for a month from June 6 to July 7, but the measurements at the Hart-Miller Island were extended to the end of July to sample additional pollution events.

During OWLETS-2, Mark Cohen developed forecast products for the Baltimore-Washington region to inform flight planning of research aircraft, deployment of mobile sampling platforms (boats, automobiles), and preparation of special sampling programs at ground sites (e.g., ozonesonde launches, etc.). The product was nominally produced four times per day, and was based on the NOAA North American Mesoscale Forecast System 4 km 48 hour forecast. Each PDF file contained an explanatory cover page and 47 hourly forecast pages. The graphics and other post-processing were accomplished using ARL's HYSPLIT model and made available to study participants through a Google Group. (winston.luke@noaa.gov)

22. National Atmospheric Deposition Program

Winston Luke traveled to the Grand Bay National Estuarine Research Reserve (NERR) in Moss Point, Mississippi from July 23-27. The NERR is home to one of ARL's three sites in the National Atmospheric Deposition Program's Atmospheric Monitoring Network. This maintenance trip focused on the inspection, calibration, and as-needed repair of the trace gas and aerosol monitors (CO, O3, SO2, Black Carbon, Speciated Mercury), meteorological sensors (wind speed and direction, temperature, pressure, relative humidity, rainfall, and incoming solar radiation), and precipitation collectors. (winston.luke@noaa.gov)

CLIMATE OBSERVATIONS AND ANALYSES

23. U.S. Climate Reference Network

U.S. Climate Reference Network (USCRN) staff made 30 site visits; performing 28 annual maintenance visits, one site installation at Bethel, Alaska, and one unscheduled maintenance visit. (mark.e.hall@noaa.gov)

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ARL 4th Quarter Publications

Amos, H.M., Miniat, C., Lynch, J., Compton, J., Templer, P.H., Sprague, L.A., Shaw, D., Burns, D., Rea, A., Whitall, D., Myles, L., Rose, A.K., Walker, J., Gay, D., Bales, J., Nilles, M., Deacon, J., and Pouyat, R. (2018). What Goes Up Must Come Down: Integrating Air and Water Quality Monitoring. Environmental Science and Technology, 52 (20), 11441-11448. https://pubs.acs.org/doi/10.1021/acs.est.8b03504

Clawson, K.L., J.D. Rich, R.M. Eckman, N.F. Hukari, D. Finn, B. Reese (2018). Climatography of the Idaho National Laboratory 4th Edition, NOAA Technical Memorandum OAR ARL-278, Air Resources Laboratory, Idaho Falls, Idaho. 214 pp. doi.org/10.25923/ze6p-4e52

Diamond, H. J., and C. Schreck, Eds. (2018). The Tropics [in "State of the Climate in 2017"]. Bull. Amer. Meteor. Soc., 99 (8), S101–141, doi:10.1175/2018BAMSStateoftheClimate.1.

Guannan Geng, Nancy L. Murray, Daniel Tong, Joshua S. Fu, Xuefei Hu, Pius Lee, Xia Meng, Howard H. Chang, Yang Liu (2018). Satellite-Based Daily PM2.5 Estimates During Fire Seasons in Colorado. JGR: Atmospheres, 123: 8159-8171.

https://doi.org/10.1029/2018JD028573

Lan, C., Liu, H., Li, D., Katul, G. G., & Finn, D. (2018). Distinct turbulence structures in stably stratified boundary layers with weak and strong surface shear. Journal of Geophysical Research: Atmospheres, 123: 7839–7854. https://doi.org/10.1029/2018JD028628

Lee, T. R., M. Buban, M. A. Palecki, R. D. Leeper, H. J. Diamond, E. Dumas, T. P. Meyers, and C. B. Baker (2018), Great American Eclipse data may fine-tune weather forecasts. Eos, 99. https://doi.org/10.1029/2018EO103931

Richard T. McNider, Arastoo Pour-Biazar, Kevin Doty, Andrew White, Yuling Wu, Momei Qin, Yongtao Hu, Talat Odman, Patricia Cleary, Eladio Knipping, Bright Dornblaser, Pius Lee, Christopher Hain, and Stuart McKeen (2018). Examination of the Physical Atmosphere in the Great Lakes Region and its Potential Impact on Air Quality - Over-Water Stability and Satellite Assimilation. Journal of Applied Meteorology and Climatology. https://doi.org/10.1175/JAMC-D-17-0355.1

Ren, X., Salmon, O. E., Hansford, J. R., Ahn, D., Hall, D., Benish, S. E., Stratton, P. R., He, H., Sahu, S., Grimes, C., Heimburger, A. M. F., Martin, C. R., Cohen, M. D., Stunder, B., et al. (2018). Methane emissions from the Baltimore-Washington area based on airborne observations: Comparison to emissions inventories. Journal of Geophysical Research: Atmospheres, 123: 8869-8882. https://doi.org/10.1029/2018JD028851

Sullivan, J.T., T. Berkoff, G. Gronoff, T. Knepp, M. Pippin, D. Allen, L. Twigg, R. Swap, M. Tzortziou, A.M. Thompson, R.M. Stauffer, G.M. Wolfe, J. Flynn, S.E. Pusede, L. Judd, W. Moore, B.D. Baker, J. Al-Saadi, and T.J. McGee (2018). The Ozone Water-Land Environmental Transition Study (OWLETS): An Innovative Strategy for Understanding Chesapeake Bay Pollution Events. Bull. Amer. Meteor. Soc., 0, https://doi.org/10.1175/BAMS-D-18-0025.1

Jing Wang, Qiaohua Zhao, Zhiwei Zhu, Li Qi, Julian X.L. Wang, Jinhai He (2018). Interannual variation in the number and severity of autumnal haze days in the Beijing–Tianjin–Hebei region and associated atmospheric circulation anomalies. Dynamics of Atmospheres and Oceans, 84: 1-9. https://doi.org/10.1016/j.dynatmoce.2018.08.001

Wulfmeyer, V., D.D. Turner, B. Baker, R. Banta, A. Behrendt, T. Bonin, W. Brewer, M. Buban, A. Choukulkar, E. Dumas, R. Hardesty, T. Heus, J. Ingwersen, D. Lange, T. Lee, S. Metzendorf, S. Muppa, T. Meyers, R. Newsom, M. Osman, S. Raasch, J. Santanello, C. Senff, F. Späth, T. Wagner, and T. Weckwerth (2018). A New Research Approach for Observing and Characterizing Land-Atmosphere Feedback. Bull. Amer. Meteor. Soc. https://doi.org/10.1175/BAMS-D-17-0009.1

Conference Presentations & Invited Talks

Scientists from ATDD attended a workshop at Cherokee Farms Innovation Campus and Research Park on September 20, 2018. Hosted by the University of Tennessee, Knoxville (UTK) Office of Research and Engagement, the workshop's purpose was to foster interdisciplinary research

collaborations between ATDD and faculty from UTK, the UT Space Institute, and the UT Institute of Agriculture. Four research topics – Global Weather and Climate Modeling; Reactive Nitrogen Measurements and Modeling; Boundary Layer Observations and Simulation; and Forest Ecosystem Interactions with Weather and Climate – were discussed during brainstorming sessions with each group. Research ideas were identified and refined for future projects and proposals. The following ATDD scientists participated in the workshop: Howard Diamond, John Kochendorfer, Tilden Meyers, Michael Buban, Nebila Lichiheb, Rick Saylor, Temple Lee, Praveena Krishnan, and LaToya Myles. ATDD Director Bruce Baker provided opening remarks, along with Stacy Patterson, Vice President for Research, Outreach and Economic Development in the UT System. Bruce LaMattina, Associate Vice Chancellor for Research Development at UTK, provided the workshop charge and participated in brainstorming sessions. (latoya.myles@noaa.gov, rick.saylor@noaa.gov)

ARL's HYSPLIT group presented "Then and Now: How HYSPLIT Changed the Course of Transport and Dispersion Modeling and Fundamentally Embedded Itself into both Research and Operational Decision-Making" at NOAA's first General Modeling Meeting and Fair in College Park, Maryland. Coordinated by Dr. Alice Crawford, this exhibit on September 11, 2018 featured work by the entire HYSPLIT team; summarily guiding participants through the 30+ years of development highlights that propelled HYSPLIT into its current position as one of the most extensively used transport and dispersion models in the atmospheric sciences community. (alice.crawford@noaa.gov)

On August 30, 2018, Alice Crawford presented a HYSPLIT overview during a departmental seminar organized by the University of Maryland's Department of Atmospheric and Oceanic Science. (alice.crawford@noaa.gov)

Outreach & Engagement

Alice Crawford and Glenn Rolph served as poster evaluators for the 2018 Student Science and Education Symposium held August 2 at NOAA Headquarters in Silver Spring, Maryland. (alice.crawford@noaa.gov)

Training

SORD Training

NOAA computer-based safety training was completed in preparation for the mandatory in-person session, which Karen Balecha and Walt Schalk are scheduled to attend in October in Seattle. (walter.w.schalk@noaa.gov)

Other

DOE Meteorological Coordinating Council Activities

Walt Schalk prepared/finalized the agenda for and ran the bi-monthly (every other month) conference call. The call consisted of a round robin update of program status of those present, a discussion on the path forward with the new U.S. Department of Energy (DOE) Order and the development of the new Criteria Review and Approach Documents, recent DOE Meteorological Coordinating Council (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." Finally, the council's name was changed from DMCC to DOE Meteorological Sub-Committee (DMSC) to reflect the naming convention of the parent organization, Emergency Management Issues Special Interest Group, or EMI-SIG. (walter.w.schalk@noaa.gov)

ARL/SORD Site Tour

Walt Schalk and James Wood gave a tour to about 15-20 people in September, with attendees consisting of DOE National Laboratory scientists and Department of Defense representatives. The tour, part of the Federal Expertise Training program hosted by NNSA, took place at the NNSS's Desert Rock Weather Observatory. Schalk and Wood presented a verbal history of the SORD program, support of the testing program, and an overview of current activities. The numerous instrumented sites that SORD maintains for NNSS Programs (SOnic Detection And Ranging, mesonet and lightning detection network) and hosts for a variety of NOAA Programs (CRN, Surface Radiation Budget Network) located in the immediate Desert Rock area were also discussed. As a finale, a pilot balloon release was demonstrated. (walter.w.schalk@noaa.gov, James Wood)

SORD Website

Work continues to add improvements, updates, and new capabilities to the website. Caleb Steele improved the mesonet data table display for internal use. The web address is www.sord.nv.doe.gov. (walter.w.schalk@noaa.gov, caleb.steele@noaa.gov)