NOAA Air Resources Laboratory

Quarterly Activity Report

FY2020 Quarter 2 (January - February - March 2020)

Contents:

BOUNDARY LAYER CHEMICAL TURBULENT MIXING CHARACTERIZATION & PREDICTION

1. Upgraded emission inventories for the National Air Quality Forecasting Capability (NAQFC)

ARL's NAQFC team recently delivered its annual emissions update package to NOAA's National Weather Service (NWS), our country's operational entity for air quality forecasting. Comprised of both upgraded emissions and code management, the package was uploaded to NWS' operational supercomputer at the National Centers for Environmental Prediction and will take effect on April 15, 2020. (pius.lee@noaa.gov)

2. Volcanic ash meetings

Karen Shelton-Mur, the new Federal Aviation Administration (FAA) international program lead for volcanic ash and aviation safety, other FAA staff, and Mark Zettlemoyer, NWS Aviation and Space Weather Services Branch, visited our building, the NOAA Center for Weather and Climate Prediction, to tour the Washington, D.C. Volcanic Ash Advisory Center (VAAC) and meet with ARL staff. Representatives of the NWS Anchorage VAAC and National Environmental Satellite, Data, and Information Service Center for Satellite Applications and Research participated remotely.

ARL fulfills an important role, working with HYSPLIT and developing products and services for the U.S. VAACs to assist in their predictive and advisory work related to volcanic ash plumes. The meeting provided an opportunity for the FAA representatives to hear Howard Diamond's overview of ARL, Barbara Stunder's description of our relationship with the VAACs and Alice Crawford's description of ongoing research and product development, particularly related to integrating observations and modeling. Allison Ring also participated in the discussion. (barbara.stunder@noaa.gov)

Meeting participants. *Credit: NOAA*

3. Locust forecasting web application

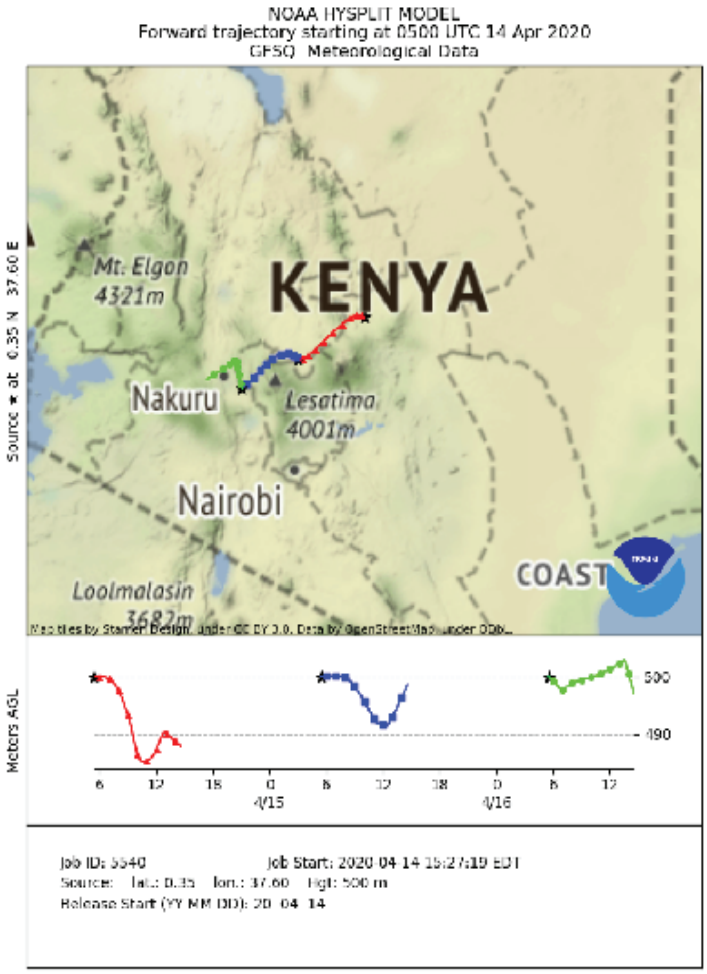
Countries in Eastern Africa and the Middle East are facing an unprecedented desert locust outbreak this year, creating significant threats to food security in the region. The Food and Agriculture Organization of the United Nations, known as FAO, is using HYSPLIT to determine where locust swarms originated and to predict where they are heading.

This information is critical to FAO's global coordination efforts, designed to help countries attempt to mitigate the serious impacts caused by these devastating pests.

Locusts are relatively passive fliers and their movements are primarily influenced by the wind. Further, they fly together in a swarm, making them ideal candidates for simulation using the air-trajectory modeling capabilities of HYSPLIT. Unlike smoke or chemicals though, locust swarms make an overnight stop. This makes it laborious to manually generate HYSPLIT input files from the previous day's outputs – for each swarm – and to repeat the process for a duration of three to seven days. FAO's senior locust forecasting officer, Keith Cressman, requested assistance from ARL to make the forecasting process more efficient and accurate.

Sonny Zinn and Mark Cohen, with assistance from ARL information technology experts Rick Jiang and Fred Shen, developed a user-friendly web application for locust forecasting that uses HYSPLIT, a set of custom-built data processing programs and NOAA NWS' global meteorological model outputs. The ARL team consulted with Cressman throughout the development process and, given the urgency of the problem, intensely focused on developing the tool in a short time.

After specifying a few key inputs users can run a locust-swarm forecast and get highly useful forecast products, such as graphics. Simulations can be run backward in time to find where a swarm originated or forward in time to estimate where a swarm is likely to be heading. A powerful batch processing capability is also available, convenient for tracking multiple swarms at the same time. (sonny.zinn@noaa.gov, mark.cohen@noaa.gov)



Forecast simulation. *The map above depicts a three-day forecast simulation produced by ARL's HYSPLIT locust forecast model. A hypothetical swarm originates from a hypothetical location in Kenya, flying at a specified height of approximately 500 meters above the ground. Each day of the swarm's path is shown in a different color, along with its starting and stopping points. Credit: NOAA*

4. Development and evaluation of the NOAA-ARL Atmosphere-Chemistry Coupler (NACC)

Dr. Patrick Campbell (with collaboration from Dr. Youhua Tang) has led the inception, development and initial evaluation of the novel NACC, which is based on Meteorology-Chemistry Interface Processor version 5 and directly couples the latest Global Forecast System (GFS), version 16, to the latest Community Multiscale Air Quality (CMAQ) model, version 5.3.1. NACC-CMAQv5.3.1 is being developed for implementation to NOAA's NAQFC and is available to the greater scientific community via ARL's GitHub page.

Initial tests of the NACC-CMAQ system for a retrospective summer 2019 case (July 12 - 22, 2019) are very encouraging. The NACC-CMAQ shows much lower normalized mean bias (NMB) and normalized mean error (NME) for hourly ozone (O3) mixing ratios (NMB +18% → +10%; NME 32% → 30%) and increased Index of Agreement (IOA) (0.80 → 0.85) compared to the current operational NAQFC evaluated against the AirNow observation network (see next page, Figure 1). If implemented, the NACC-CMAQ system would represent a major upgrade to the current operational NAQFC. (patrick.c.campbell@noaa.gov)

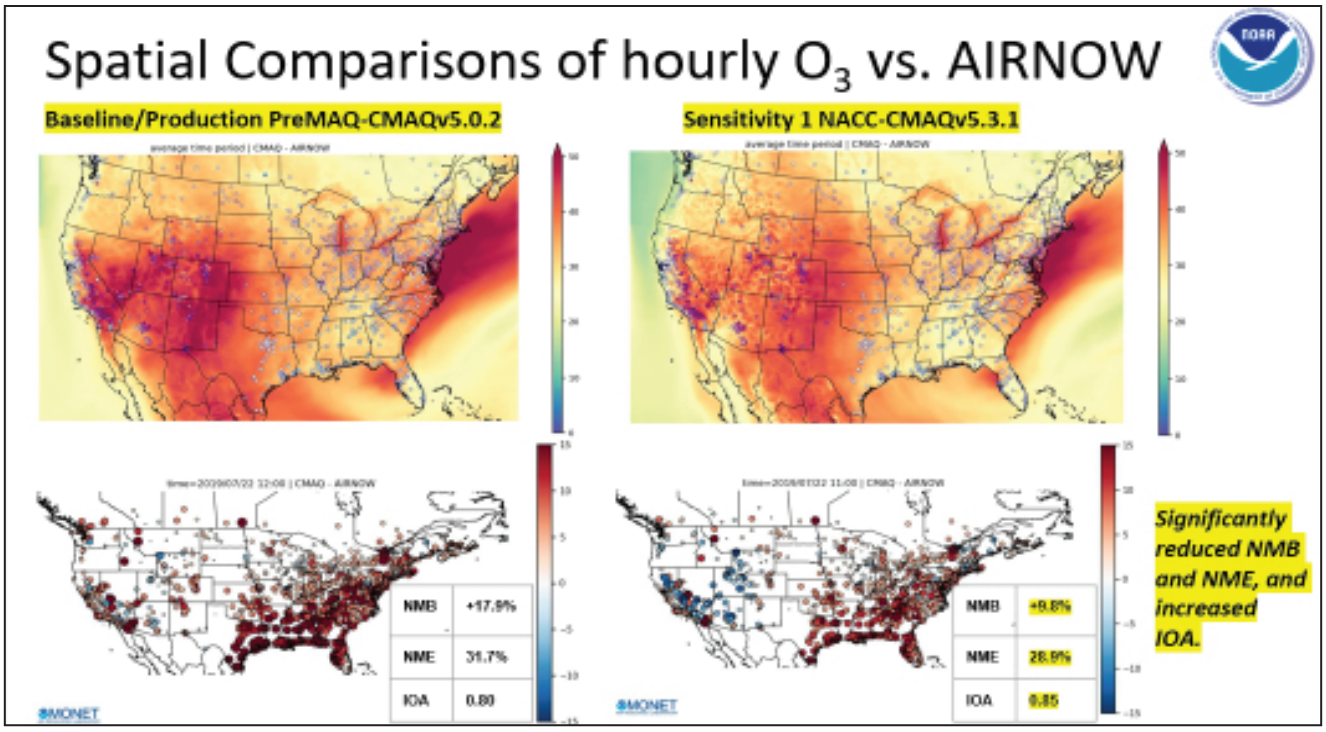


Figure 1. *For July 12-22, 2019: Average spatial overlay (top) and spatial bias plot (bottom) comparisons of the baseline production NAQFC (left) and novel NACC-CMAQ (right) simulations compared to AirNow observations of surface ozone for the continental U.S. Credit: NOAA*

5. Mauna Loa Observatory (MLO) site visit

From February 9-19, 2020, Paul Kelley and Winston Luke traveled to the Big Island of Hawaii to visit the MLO, where ARL's scientists measure trace gases (ozone, sulfur dioxide and carbon monoxide) and atmospheric mercury species under the auspices of the National Atmospheric Deposition Program's Atmospheric Mercury Network. While there, they performed semi-annual maintenance, repairs and calibrations of the trace gas and aerosol monitors; trained a new site operator (Ms. Michealene Iaukea-Lum) in the operation of the instrumentation; and collaborated with Dr. Akane Yamakawa from the National Institute for Environmental Studies in Tsukuba, Japan. Dr. Yamakawa spent five months at ARL (July-December 2019) and, with the assistance of Mr. Kelley, constructed a prototype sampler for the collection of gaseous oxidized mercury compounds for subsequent isotopic analysis. The two deployed and tested the sampler at MLO, where it will remain until the end of 2020. (winston.luke@noaa.gov)

MLO. *Left: ARL's instruments reside on the exterior platform of the historic Keeling Building. Right: A close-up of the atmospheric mercury measurement equipment shows the particulate-bound mercury and gaseous oxidized mercury monitors (top and bottom boxes, respectively). Credit: NOAA*

6. Fluxes of Greenhouse Gases in Maryland (FLAGG-MD)

In February 2020, Xinrong Ren and his colleagues at the University of Maryland, Purdue University and the National Institute of Standards and Technology conducted research flights for the FLAGG-MD project to characterize greenhouse gas (GHG) emissions from the Baltimore-Washington area. The University of Maryland's Cessna 402B research aircraft and Purdue University's Duchess flew over this area to measure GHGs (carbon dioxide and methane), meteorological variables, trace gas air pollutants and aerosol optical properties. Emissions were estimated based on the aircraft measurements, then compared to the emissions in state and national emission inventories. The aircraft data will also be used for inverse modeling. The FLAGG-MD project has produced policy-relevant science that aided in improved quantification of anthropogenic GHG emissions to the scientific community and regulatory agencies, such as the Maryland Department of the Environment, through direct analysis of ambient measurements and model simulations. (xinrong.ren@noaa.gov)

BOUNDARY LAYER METEOROLOGICAL CHARACTERIZATION & PREDICTION

7. Conducting profiles with unmanned aerial systems (UAS)

ARL began making daily profiles with the Meteomatics Meteodrone aircraft - a major goal for funding received from NOAA's UAS Program Office - in conjunction with the Morristown, Tennessee Weather Forecast Office (WFO). Ed Dumas and Randy White were pilot-in-command and visual observer, respectively, for a series of flights from January 22 - March 6, 2020. All flights were conducted at Oliver Springs Airport (OSI) in Oliver Springs, TN. Table 1 provides details for all flights completed this quarter. The frequency of these operational profile flights was adversely impacted by the abnormal amount of rain that East Tennessee received during the months of January and February. For example, February's total precipitation in Oak Ridge was 11.45 inches, with 15 days greater than 0.01 inches of rainfall.

Date	Number of Flights	Max Altitude (Above Ground Level)
01-22-2020	5	650 m
01-23-2020	7	700 m
01-30-2020	8	700 m
02-21-2020	10	700 m
03-06-2020	6	700 m

Table 1. *Details regarding flights completed in Q2 FY2020.*

The Meteodrone aircraft crashed during flight on March 6, 2020 and was returned to Meteomatics in Switzerland for evaluation, where it was determined that the accident was caused by an electronic speed control communication error with the Mikrocopter autopilot. Repairs were delayed due COVID-19-induced adverse effects to the component suppliers.

Beginning on March 16, all sUAS flights were suspended due to COVID-19 restrictions. (ed.dumas@noaa.gov, Temple Lee, Michael Buban, Bruce Baker)

8. UAS temperature acclimation testing

On January 22, 2020, the Severe Storms Edition performed a hover maneuver next to the OSI meteorological tower to compare air temperatures; shown in Figure 2 at right. Note the initial difference of 2.5 degrees that takes nearly one minute to equilibrate to the temperature measured by the tower. The aircraft's altitude is plotted as a function of time on the right Y-axis to show that altitude was maintained within a few meters of the height of the temperature sensor on the tower. In this case the aircraft was not allowed to equilibrate before sending it up.

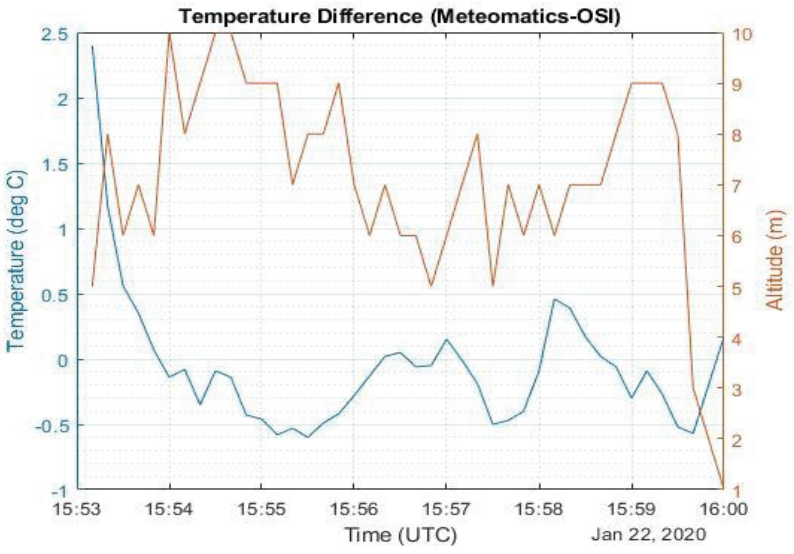


Figure 2. *Comparison of aircraft and tower air temperature while aircraft hovered adjacent to tower. Note the steep drop in air temperature (blue line) during the first minute from +2.4° C to 0° C.*

Figure 3 (right, top) illustrates the air temperature measured by the aircraft (continuous lines) and the tower (discrete points) for all flights on February 21, 2020. Note the little tails at the beginning of each flight. These show the temperature diving down at the beginning of each flight to match the tower at the beginning of each profile. In some cases, like the flight at 1:30 p.m. local time, the temperature difference is about six degrees Celsius. On this day the aircraft was allowed to acclimate for about five minutes before each flight.

Figure 4 (right, bottom) shows the air temperature measured by the aircraft (continuous lines) and the tower (discrete points) for all flights on March 6, 2020. This day was perfect in terms of the agreement between the aircraft and the tower. In each case, the aircraft acclimated outside for about 10 minutes prior to each flight.

After analyzing data from both the aircraft and the OSI meteorological tower, we determined that the aircraft should start acclimating to the environmental temperature at least 10 minutes prior to flight. (ed.dumas@noaa.gov, Temple Lee, Michael Buban, Bruce Baker)

9. Instrumentation upgrade

Work continued this quarter on the installation of a Radiometrics MP-3000A microwave radiometer at the Oliver Springs Airport. It was determined that, due to the airport's remote location, installation of high-speed internet is cost-prohibitive. Thus, the first stage of this effort is to install high-speed internet at the airport owner's home. From there, a wireless network can be set up to transfer data from the microwave radiometer to ARL's Atmospheric Turbulence and Diffusion Division in Oak Ridge, TN. Our efforts were delayed due to new social distancing requirements resulting from the COVID-19 virus. (ed.dumas@noaa.gov, Temple Lee, Michael Buban, Bruce Baker)

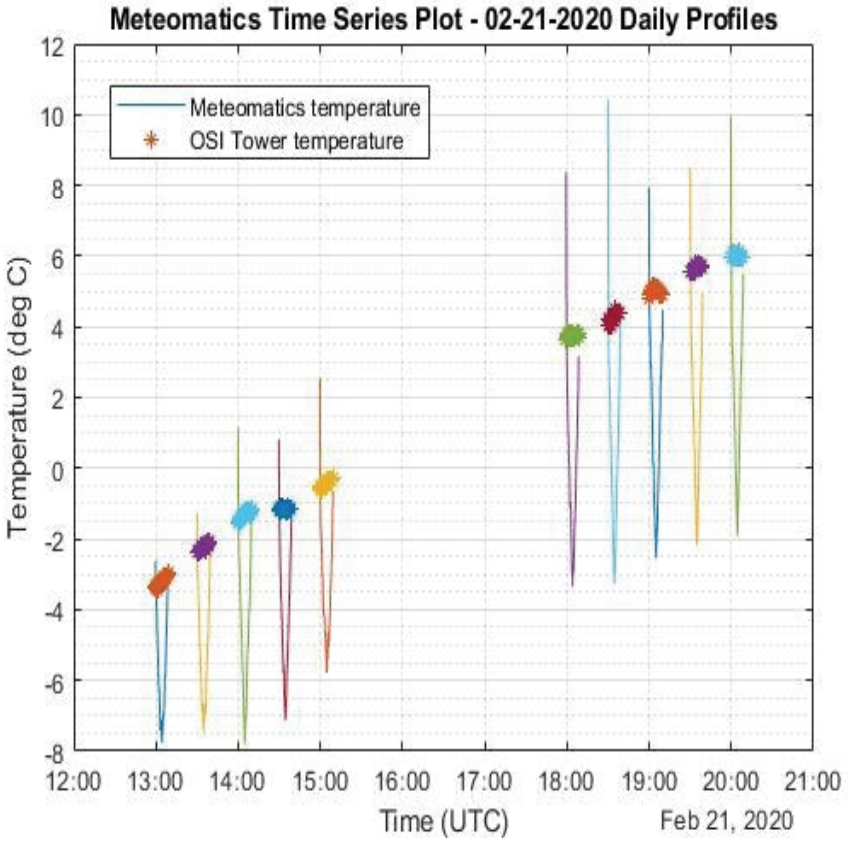


Figure 3. *Comparison of aircraft and tower air temperature during successive vertical profiles after five minutes acclimation.*

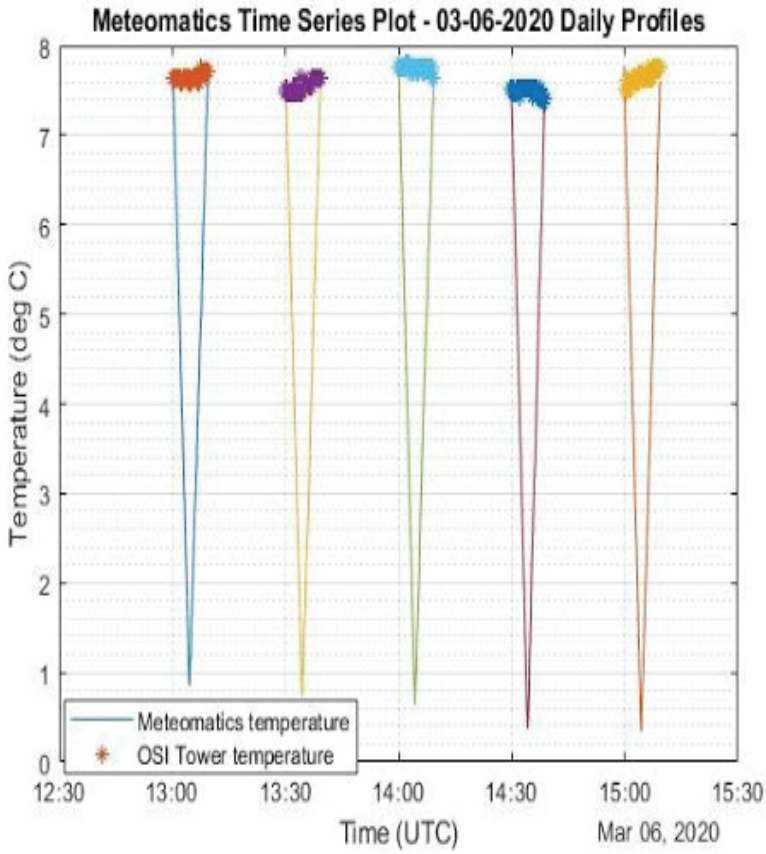


Figure 4. *Comparison of aircraft and tower air temperature during successive vertical profiles after 10 minutes*

10. Weather balloon process overhaul

At the request of the Morristown WFO, two Graw rawinsonde balloons were launched on February 20, 2020 to provide supplemental data on upper level air temperature in advance of approaching storms in the East Tennessee region. Due to unforeseen technical difficulties, the data from these balloons was not collected as expected. To help remedy the problem, the balloon inventory and launch procedures are being reworked to keep better track of the expendables inventory and to streamline initialization and launch operations. (ed.dumas@noaa.gov, Michael Buban)

11. Field Research Division (FRD) Mesonet

Two new electronics technicians were hired and have been in extensive training with the current staff. They will be instrumental in completing the NOAA/INL Mesonet upgrade, keeping the network working properly and with general and semi-annual maintenance.

Progress continues on the planned mesonet upgrade. Remaining dataloggers, radios and other parts needed to complete the final phase were purchased, including now-assembled solar panels capable of powering the new radios and other additional equipment located at the off-road stations. One station was upgraded with the new datalogger/radio, bringing the total number of upgraded stations to 24. Other instrumentation is being replaced and/or changed during the upgrade process, including a newly purchased circuit built for calibrating the solar radiation sensor. The final phase of the upgrade is planned for completion during the spring and summer of 2020. (brad.reese@noaa.gov, jason.rich@noaa.gov, bai.yang@noaa.gov, jonathan.forman@noaa.gov, logan.honeycutt@noaa.gov, Shane Beard, Roger Carter).

12. Consequence assessment for the Idaho National Laboratory (INL)

Team D participated in a drill at the INL Emergency Operations Center on March 3, 2020. Nowcasts and short-term forecasts were provided during the drill, which centered on an accidental fire at the Specific Manufacturing Capability facility. (bai.yang@noaa.gov)

Routine training and practice were conducted to maintain qualifications and expertise. (jason.rich@noaa.gov)

13. INL support

The NOAA/INL Weather Center issued four weather alerts last quarter; two each for winds and snow. (jason.rich@noaa.gov, Bai Yang).

Datasets were developed to run the Clean Air Act Assessment Package – 1988 dispersion model as part of the National Emission Standards for Hazardous Air Pollutants compliance activities. This dataset included annual total precipitation, warmest and coldest monthly mean temperature and data in the STability ARray format from nine stations within the mesonet. (jason.rich@noaa.gov, Bai Yang)

Annual HYSPLIT runs (three stack releases and nine ground releases) were completed using 2019 mesonet observations to simulate annual radiological emissions from several facilities at the INL. These model outputs were provided to the INL Environmental Surveillance, Education, and Research program to compose the 2019 INL Annual Site Environmental Reports. These yearly reports estimate exposures to the public from INL activities. (bai.yang@noaa.gov, Roger Carter, Jason Rich).

14. HYSPLIT Radiological (HYRad)

HYRad was updated and configured to run on Windows Server 2016. (brad.reese@noaa.gov)

15. National Science Foundation (NSF) Project

FRD continued to coordinate with research groups from Washington State University and Boston University in support of their joint NSF project, "The Role of Coherent Structures in Scalar Transport over Heterogeneous Landscapes." We initiated the INL badging processing for the team that will come to Idaho Falls this summer with a goal to install the main components of their experimental setup on the 200-foot Grid 3 meteorological tower and surrounding area. (bai.yang@noaa.gov, karly.curtis@noaa.gov)

16. Consequence assessment for the Nevada National Security Site (NNSS)

Walt Schalk worked with the exercise/drill planning team to plan for the consequences of an accident for an upcoming exercise/drill to be conducted on the NNSS. Such exercises/drills simulate chemical, radiological and transportation accidents on NNSS and at its facilities. Routine training and practice are required to maintain consequence assessment qualifications and expertise. (rick.lantrip@noaa.gov, james.s.wood@noaa.gov, walter.w.schalk@noaa.gov)

17. Special Operations and Research Division (SORD) Mesonet

SORD/NNSS mesonet improvement efforts are ongoing and several areas of improvement continue to be researched. Topping the list of improvements are communications, three-dimensional sonic anemometer improvements/upgrades, weighing precipitation gauge replacements and radio communications. Radio issues have been complicated by the manufacturer going out of business - a new radio alternative has to be found quickly. We will be co-locating a laser snow depth sensor this spring/summer and have begun to reconstruct the wind profiler.

Wayne Bailey continues to perform routine monthly maintenance and verification checks on the NNSS mesonet. Some irregularities were found upon closer examination of communications issues, so Wayne is working to unify the radio and logger settings across the site.

Bailey, Rick Lantrip, and James Wood are waiting for the COVID-19 field activity restrictions to be lessened in order to begin the spring semi-annual mesonet verifications and calibrations with the appropriate health and safety protocols.

Walt Schalk and Lantrip provided NNSS Mesonet and lightning data to several groups on the site for use in the planning of experimental and construction activities. Wood provides precipitation data to the Environmental Monitoring Group on a monthly basis.

Lightning Detection System: We are continuing to work with our partners to install a new lightning sensor to the north. Connecting and getting information is challenging.

Schalk processed the 23-station NNSS Mesonet data for calendar year 2019, which included checking the data for missing and/or bad values. In addition, he used a subset of 12 stations to create a dataset comprised of information on atmospheric stability and wind speed and direction. This data will be used in annual environmental compliance report, National Emission Standards for Hazardous Air Pollutants calculations.

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

18. Project and experiment support to the U.S Department of Energy (DOE) / Nevada National Security Site (NNSA) / NNSS

Walt Schalk participated in several planning discussions in preparation for the next set of non-proliferation experiments, including discussions regarding the number and location of additional surface stations to be fielded. Plans include conducting radiosonde releases and forecasting to support the experiments, as well as participating in an on-site meteorological measurement experiment. Acquisition of several mobile towers (e.g. on trailers) is in work.

Schalk continues to hold monthly meetings with Nevada Field Office (NFO) contractor personnel 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)

ARL Second Quarter Publications

Bae, M., Kim, B-U, Kim, H. C., and Kim, S. (2020). A Multiscale Tiered Approach to Quantify Contributions: A Case Study of PM2.5 in South Korea During 2010–2017, *Atmosphere*, 11, 141; https://doi.org/10.3390/atmos11020141

Bae, C., Kim, H. C., Kim, B-U., Kim, Y., Woo, J-H., and Kim, S. (2020). Updating Chinese SO2 emissions with surface observations for regional air-quality modeling over East Asia. *Atmospheric Environment* 228, 117416. https://doi.org/10.1016/j.atmosenv.2020.117416

Cahuich-López, M. A., Mariño-Tapia, I., Souza, A. J., Gold-Bouchot, G., **Cohen, M.**, and Lozano, D. V. (2020). Spatial and temporal variability of sea breezes and synoptic influences over the surface wind field of the Yucatán Peninsula. *Atmósfera*, [S.l.], v. 33, n. 2, p. 123-142. https://doi.org/10.20937/ATM.52713

He, H., Liang, X.-Z., Sun, C., Tao, Z., and Tong, D. Q. (2020). The long-term trend and production sensitivity change in the US ozone pollution from observations and model simulations, *Atmos. Chem. Phys.*, 20, 3191–3208. https://doi.org/10.5194/acp-20-3191-2020

Kim, H. C., Kim, S., Lee, S-H, Kim, B-U, **Lee, P.** (2020). Fine-scale columnar and surface NOx concentrations over South Korea: Comparison of surface monitors, TROPOMI, CMAQ and CAPSS inventory. *Atmosphere*, 11(1), 101; https://doi.org/10.3390/atmos11010101

Kramer, S. J., Kirtman, B. P., Zuidema, P., Ngan, F. (2020). Subseasonal Variability of Elevated Dust Concentrations Over South Florida. *JGR Atmospheres*, 125(6). https://doi.org/10.1029/2019JD031874

Lee, K.-K., Park, Y., Han, S.-P., Kim, H. C. (2020). The Alerting Effect from Rising Public Awareness of Air Quality on the Outdoor Activities of Megacity Residents. *Sustainability*, 12(3), 820; https://doi.org/10.3390/su12030820

Lopez-Coto, I., Ren, X., Salmon, O. E., Karion, A., Shepson, P. B., Dickerson, R. R., **Stein, A.**, Prasad, K., Whetstone, J. R. (2020). Wintertime CO2, CH4 and CO emissions estimation for the Washington DC / Baltimore metropolitan area using an inverse modeling technique. *Environ. Sci. Technol.*, 54(5), 2606-2614; https://doi.org/10.1021/acs.est.9b06619

Loughner, C. P., Follette-Cook, M. B., Duncan, B. N., Hains, J., Pickering, K. E., Moy, J., and Tzortziou, M. (2020). The benefits of lower ozone due to air pollution emission reductions (2002–2011) in the Eastern United States during extreme heat. *Journal of the Air & Waste Management Association*, 70:2, 19305; https://doi.org/10.1080/10962247.2019.1694089

Pal, S., Lee, T. R., Clark, N.E. (2020). The 2019 Mississippi and Missouri River Flooding and Its Impact on Atmospheric Boundary Layer Dynamics. *Geophysical Research Letters*, 47(6). https://doi.org/10.1029/2019GL086933

Ren, X., **Luke, W. T.**, Kelley, P., **Cohen, M. D.**, Olson, M. L., Walker, J., Cole, R., Archer, M., Artz, R. and **Stein, A. A.** (2020). Long-term observations of atmospheric speciated mercury at a coastal site in the northern Gulf of Mexico during 2007–2018, *Atmosphere*, 11, 268; https://doi.org/10.3390/atmos11030268

Scanlon, T. M., Riscassi, A. L., Demers, J. D., Camper, T. D., Lee, T. R., and Druckenbrod, D. L. (2020). Mercury accumulation in tree rings: Observed trends in quantity and isotopic composition in Shenandoah National Park, Virginia. *Journal of Geophysical Research: Biogeosciences*, 125. https://doi.org/10.1029/2019JG005445

Tang, W., Worden, H. M., Deeter, M. N., Edwards, D. P., Emmons, L. K., Martínez-Alonso, S., Gaubert, B., Buchholz, R. R., Diskin, G. S., Dickerson, R. R., Ren, X., He, H., and Kondo, Y. (2020). Assessing MOPITT carbon monoxide retrievals over urban versus non-urban regions, *Atmos. Meas. Tech.*, 13, 1337–1356. https://doi.org/10.5194/amt-13-1337-2020

Wang, J., Liu, Y., Ding, Y., Wu, P., Zhu, Z., Xu, Y., Li, Q., Zhang, Y., He, J., **Wang, J. X. L.**, and Qi, L. (2020). Impacts of climate anomalies on the interannual and interdecadal variability of autumn and winter haze in North China: A review. *International Journal of Climatology*. https://doi.org/10.1002/joc.6471

Wilson, T. B., **Diamond, H. J.**, **Kochendorfer, J.**, **Meyers, T. P.**, Hall, M., Casey, N. W., **Baker, C. B.**, Leeper, R., Palecki, M. A. (2020). Evaluating time domain reflectometry and coaxial impedance sensors for soil observations by the U.S. Climate Reference Network, *Vadose Zone Journal*, 19 (1). https://doi.org/10.1002/vzj2.20013

Wulfmeyer, V., Späth, F., Behrendt, A., Jach, L., Warrach-Sagi, K., Ek, M., Turner, D. D., Senff, C., Ferguson, C. R., Santanello, J., Lee, T. R., Buban, M., and Verhoef, A. (2020). The GEWEX Land-Atmosphere Feedback Observatory (GLAFO). *GEWEX Quarterly* 30(1), 6-11.

Conference Presentations and Invited Talks

100th American Meteorological Society (AMS) Annual Meeting, January 12-16 in Boston, Massachusetts. ARL staff gave a total of 14 presentations spanning seven of the nearly 50 conferences and symposia comprising the event, with topics ranging from modeling, forecasting, prediction, analysis and validation, to meteorological observation and instrumentation, to model interoperability, hazard detection and prediction, to hydrological and climatic interactions.

Commemorative selfie. Credit: ARL Deputy Director Dr. Ariel Stein.

- **Dr. Rick Saylor** gave a presentation entitled "Initial Development of a NOAA Emissions and eXchange Unified System (NEXUS)" with co-authors Patrick Campbell (the originally scheduled presenter), Barry Baker, Daniel Tong, Youhua Tang, Pius Lee, Stu McKeen, Greg Frost and Christoph Keller. The talk outlined the development of a new emissions processing capability that is being developed by ARL to provide trace gas and aerosol emissions for atmospheric chemistry and composition models in NOAA's new Unified Forecast System (UFS).

- **Rick Saylor** gave a second presentation entitled, "Description and evaluation of the FENGSHA dust emission model in FV3GFS-Chem". This work, with co-authors Barry Baker, Daniel Tong, Kerstin Schepanski and Partha Bhattacharjee, described the implementation of a new dust emission algorithm in NOAA's new UFS-based global aerosol model. Dust accounts for the largest total fraction of aerosols in the global atmosphere

and can act to alter net radiation reaching the Earth's surface as well as precipitation patterns.

- **Rick Saylor** also provided a general audience overview of the importance of dust emissions for weather and climate predictions. This talk was given in NOAA's exhibit.

- Temple R. Lee, "Evaluation of the High-Resolution Rapid Refresh (HRRR) Model Using Near-Surface Meteorological and Flux Observations" and "Development and Evaluation of New Monin-Obukhov and Bulk Richardson Parameterizations to Improve the Representation of Surface-Atmosphere Exchange in Weather Forecasting Models"

- Michael Buban, "Using the U.S. Climate Reference Network to develop gridded soil moisture products over the conterminous U.S." and "Evaluation of New Monin-Obukhov and Bulk Richardson Parameterization of the Surface Layer in Large Eddy Simulations"

- Allison Ring, "Volcanic Ash Forecast Verification Using HYSPLIT and Satellite Ash Observations Identified by VOLCAT" and "Anthropogenic VOCs in the Long Island Sound, New York, Airshed and Their Role in Ozone Production"

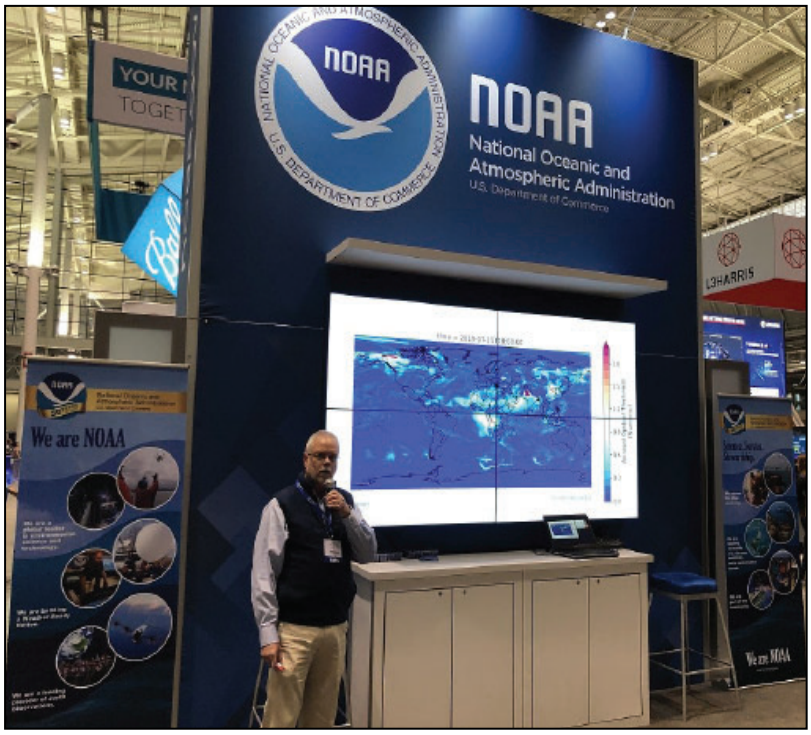
- **Alice Crawford**, "A Tracer of Opportunity Dataset for Atmospheric Transport and Dispersion Model Evaluation"

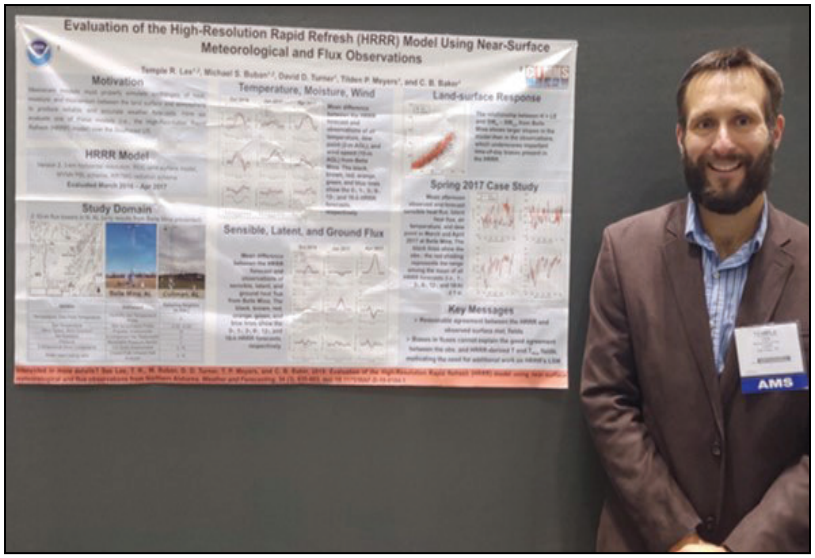
- Fong Ngan, "Evaluation of Turbulent Mixing in HYSPLIT Using a Tracer of Opportunity Dataset"

- **Christopher Loughner**, "Evaluation of STILT Features Incorporated into HYSPLIT"

- **John Kochendorfer**, "A New and Improved Wind Shield for the Measurement of Solid Precipitation"

- Tianfeng Chai, "HYSPLIT Inverse Modeling Using Flight Observations to Estimate SO2, CO2, and NOx Point Source Emissions"





Dr. Lee with his paper. Credit: NOAA

Xinrong Ren gave a remote presentation to the Northeast States for Coordinated Air Use Management Monitoring and Assessment Committee Meeting on March 4. Titled "Aircraft Observations in summer 2019 during LISTOS2019," the talk focused on spatial distribution of ozone and its precursors over the New York City and Long Island Sound area during two ozone events in summer 2019. Dr. Ren also attend-

ed the University of Maryland – Maryland Department of Environment Quarterly meeting in Baltimore, MD on March 5. At the meeting, scientists shared recent results on air quality observations and modeling. Ren gave a presentation titled "Emission Evaluation Using Observations from winter 2020 Flights" to summarize the results from research flights conducted in February 2020. (xinrong.ren@noaa.gov)

Dr. Patrick Campbell and Dr. Barry Baker were invited to attend a two-day collaborative meeting with Professor Daniel Jacob's Atmospheric Chemistry and Environmental Engineering research group at Harvard University. Held March 4-5, 2020 in Cambridge, Massachusetts, the collaborative NOAA-Harvard meeting was focused on the use of HEMCO – the Harvard-NASA Emissions Component – in NOAA's Unified Forecast System (UFS), as well as progress, needs and future. Attendees laid out an explicit, collaborative plan on the development of HEMCO at Harvard and NOAA's needs to adapt HEMCO for the UFS. We also presented our plans to adapt and further develop HEMCO into NEXUS, which would facilitate a productive collaboration between NOAA and Harvard going forward. (patrick.c.campbell@noaa.gov)

Outreach and Engagement

Ed Dumas participated as a judge in the 60th Southern Appalachian Science and Engineering Fair in March 2020. Due to COVID-19 restrictions, the fair was held virtually and was quite a success. Two projects were given cash awards from the American Meteorological Society's Smoky Mountain Chapter for their outstanding achievement for creative scientific endeavors in atmospheric and related oceanic and hydrologic sciences. (ed.dumas@noaa.gov)

Training

Logan Honeycutt completed Tower and Fall Rescue Training in Las Vegas, Nevada, March 16-17, 2020.

Other

Many of the computers on the FRD network were upgraded from Windows 7 to Windows 10 and all of the servers were upgraded to Windows Server 2016. (brad.reese@noaa.gov)

DOE Meteorological Subcommittee (DMSC) activities: Walt Schalk plans and conducts monthly teleconferences with DOE and DOE/NNSA site meteorology representatives. These calls provide a forum for an exchange of information ranging from interesting weather events to instrumentation issues and successes. A main focus for the near term will be the DOE/NNSA headquarters request for the DMSC to develop a DOE/NNSA meteorological program guide. The recently-discussed topic of what a "Qualified Meteorologist" is for DOE will be part of this guide and there will be a section that addresses remote access working (e.g. telework), which will address situations like those dealt with during the COVID-19 pandemic. (walter.w.schalk@noaa.gov)

SORD Website: Work is ongoing to replace the web server in the new IT construct. With this, work will continue to add improvements, updates and new capabilities to the website. The web address is www.sord.nv.doe.gov. (walter.w.schalk@noaa.gov)

SORD IT: Efforts to move the SORD servers to the DOE/NNSA/NFO Management and Operating Contractor, MSTS, are ongoing. Servers responsible for data collection, database, data processing and data distribution are currently in the process of being stood up in the MSTS IT structure. SORD staff computers have been moved to the MSTS IT infrastructure. (walter.w.schalk@noaa.gov)

FRD Personnel Changes:

- Roger Carter retired on February 28, 2020 with over 26 years of government service. Roger did many things around the office but, most notably, kept the NOAA/INL Mesonet network and instrumentation operational. He will be greatly missed and we wish him the best in retirement.
- Karly Curtis, the new Administrative Officer, joined on January 21. Karly brings management and administrative strengths derived from 25+ years' experience supporting and leading IT projects in the fields of retail, insurance, pharmaceutical, banking, and state and local government offices.
- Jonathan Forman, a new Electronics Technician, joined on January 21. Jonathan came from California, where he worked as an electronics technician for the casino industry. He also served seven years in the U.S. Navy servicing and performing maintenance on the P3 Orion turboprop submarine hunter.
- Logan Honeycutt, also an Electronics Technician, joined on February 18. Logan served three years in the U.S. Army then worked as a technician servicing roadside meteorological stations for the Idaho Transportation Department.