

Four Corners Air Quality Group

Four Corners Area Current Studies

October 2018

Ozone Studies

- The Intermountain West Data Warehouse – Western Air Quality Study (IWDW-WAQS) has produced an updated air quality model platform for year 2011 ([2011b](#)) for use by interested parties (see further description below under Multiple Pollutant Studies).
- The [Southern New Mexico Ozone Study \(SNMOS\)](#) was completed in early November 2016. The SNMOS assessed 2011 base year and future projection year ozone impacts and contributing source categories/regions in and around Doña Ana County, NM.
- 2014 Uinta Basin Winter Ozone Study final report is available here: <https://deq.utah.gov/legacy/destinations/u/uintah-basin/ozone/strategies/studies/2014.htm>.
- WESTAR/WRAP worked with Dr. Dan Jaffe and a team of federal and university scientists to publish a paper in the scientific journal *Elementa* on the state of the science of background ozone in the U.S.: http://www.wrapair2.org/pdf/BOSA_O3_Elementa2018_Jaffe_et_al.pdf.
- WESTAR/WRAP staff also had a paper published in AWMA *Environmental Manager* September 2018 issue on the topic of addressing background ozone and transport: <http://www.wrapair2.org/pdf/moore.pdf>.

Mercury Studies

- Two years of follow-up gaseous oxidized mercury (GOM) dry deposition measurements in the Four Corners Area 2017-2019; M.E. Sather et al.
- Mark E. Sather, Shaibal Mukerjee, Kara L. Allen, Luther Smith, Johnson Mathew, Clarence Jackson, Ryan Callison, Larry Scrapper, April Hathcoat, Jacque Adam, Danielle Keese, Philip Ketcher, Robert Brunette, Jason Karlstrom, and Gerard Van der Jagt, "Gaseous Oxidized Mercury Dry Deposition Measurements in the Southwestern USA: A Comparison between Texas, Eastern Oklahoma, and the Four Corners Area," *The Scientific World Journal*, vol. 2014, Article ID 580723, 14 pages, 2014. Doi:10.1155/2014/580723. The article can be accessed at the following link: <http://www.hindawi.com/journals/tswj/2014/580723/>.
- Sather, M.E., Mukerjee, S., Smith, L., Mathew, J., Jackson, C., Callison, R., Scrapper, L., Hathcoat, A., Adam, J., Keese, D., Ketcher, P., Brunette, R., Karlstrom, J., Van der Jagt, G., 2013. Gaseous oxidized mercury dry deposition measurements in the Four Corners Area and Eastern Oklahoma, U.S.A. *Atmospheric Pollution Research*, doi: 10.5094/APR.2013.017. <https://www.sciencedirect.com/science/article/pii/S130910421530386X>

- Mesa Verde NPS Mercury Deposition Network (MDN) monitor. NADP-MDN website <http://nadp.sws.uiuc.edu/mdn/> includes temporal trend graph for mercury. Total Hg in wet deposition has been monitored at Mesa Verde NP since 2002.
- Eagles-Smith, C.A., Nelson, S.J., Flanagan-Pritz, C.M., Willacker Jr., J.J., and Klemmer, A., 2018, Total Mercury Concentrations in Dragonfly Larvae from U.S. National Parks (2014-2017): U.S. Geological Survey data release, <https://doi.org/10.5066/P9TK6NPT>. See more here: <https://www.sciencebase.gov/catalog/item/5b92cffce4b0702d0e80a2d5>.

Methane Studies

- Smith, Mackenzie L., Alexander Gvakharia, Eric A. Kort, Colm Sweeney, Stephen A. Conley, Ian Faloon, Tim Newberger, Russell Schnell, Stefan Schwietzke, Sonja Wolter, 2017. Airborne Quantification of Methane Emissions over the Four Corners Region. Environmental Science & Technology. Abstract at: <http://pubs.acs.org/doi/abs/10.1021/acs.est.6b06107>.
- Frankenburg, Christian, Andrew K. Thorpe, David R. Thompson, Glynn Hulley, Eric Adam Kort, Nick Vance, Jakob Borchardt, Thomas Krings, Konstantin Gerilowski, Colm Sweeney, Stephen Conley, Brian D. Bue, Andrew D. Aubrey, Simon Hook, Robert O. Gree, 2016. Airborne methane remote measurements reveal heavy-tail flux distribution in Four Corners region. Proceedings of the National Academy of Sciences of the United States of America. <http://www.pnas.org/content/113/35/9734.full>
- Kort, Eric A., Christian Frankenburg, Keeley R. Costigan, Rodica Lindenmaier, Manvendra K. Dubey, Debra Wunch, 2014. Four Corners: The largest US methane anomaly viewed from space. Geophysical Research Letters, an AGU Journal. <http://onlinelibrary.wiley.com/doi/10.1002/2014GL061503/full>

Multiple Pollutant and Other Deposition Studies

- The Western Regional Air Partnership (WRAP) has a 2018-19 workplan led by the Technical Steering Committee in place and has continued operation of five technical work groups on key western issues: Regional Technical Operations; Oil and Gas; Fire and Smoke; Regional Haze Planning; and Tribal Data. Each work group is implementing tasks under the workplan and all work groups have contractor analysis support activities underway. The WRAP workplan can be found at: <https://www.wrapair2.org/TSC.aspx> along with related materials and progress reports.
- The Intermountain West Data Warehouse – Western Air Quality Study (IWDW-WAQS), sponsored by EPA Region 8, NPS, USFS, BLM, and the States of CO, NM, UT, and WY have completed approval of the Cooperator workplan in Sept. 2018 for the next 3 years of activities related to monitoring, emissions, and air quality modeling. The next regional modeling platform will be for the calendar year 2014 based on the NEIv2, with projections to 2023 and 2028 for use in regional air quality planning studies by the Cooperators while also supporting Regional Haze planning described in the WRAP 2018-19 Workplan. Work on the 2014 platform will include detailed model performance evaluation for year-round ozone, PM_{2.5}, nitrogen deposition, and visibility. The IWDW data are accessible at: <http://views.cira.colostate.edu/tsdw/>. The IWDW-WAQS

provides air quality data and analysis tools to support regulatory, research, and academic applications. Available datasets include emissions inventories, meteorological data, monitoring data, and air quality modeling platforms. Modeling platforms available through the IWDW support consistent AQ/AQRV photochemical grid modeling (PGM) for NEPA projects and other modeling studies.

- 2014 BLM Drill Rig NO₂ Impacts Study: Effort to better predict 1-hour NO₂ impacts from drill rigs through a field study. Monitoring NO₂ concentrations at multiple locations near operating drill rights combined with stack testing and modeling. Data analysis, model evaluation and reporting will occur in late 2016. Project website: <http://www.wrapair2.org/DrillRig.aspx>.
- BLM released a photochemical modeling analysis termed the Colorado Air Resource Management and Modeling Study (CARMMS) 1.5 in March 2016, with updated Mancos Shale modeling in northwestern New Mexico. The CARMMS predicts impacts from future federal and non-federal energy development in Colorado and parts of New Mexico.
- Western Regional Air Partnership (WRAP) Oil and Gas Phase III inventory for the San Juan Basin was completed in 2009. <http://www.wrapair2.org/PhaseIII.aspx>. An update to this inventory for the year 2014 was completed in September 2018. The new project also updates the Permian Basin emissions in west TX and southeast NM. The project website is at: <http://www.wrapair2.org/SanJuanPermian.aspx>.
- “Detecting the Impacts of Nitrogen Pollution on Vegetation and Soils in Grand Canyon National Park.” Funded by NPS, Researchers from Northern Arizona University. Completed in 2013.
 - Results from nitrogen isotope studies show that emissions from vehicles in the park add excess nitrogen to pine trees near roadsides, and emissions from the Navajo Generating Station add excess nitrogen to plants and soils on the Paria plateau. The study also found that it is feasible to continue work on remote sensing techniques that may be used in the future to assess nitrogen inputs to desert plants and soils.
- “Assessing the Risk of Nitrogen Deposition to Natural Resources in the Four Corners Region of Colorado and Utah.” Funded by NPS. Researchers from USGS and Prescott College. NPS funded portion was completed in 2013, USGS work is ongoing.
 - Results from the first phase of this study indicate that NO_x represents a significant source of nitrogen deposition in Mesa Verde NP. Researchers are continuing to look at how excess nitrogen may be impacting cheat grass invasions in the area, using fertilization studies. Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States: Report V June 2011. Hand et al.
- Epidemiology Report on PM_{2.5} Exposure from Wildfires during 2011 Wallow Fire by the NM Department of Health <http://www.arb.ca.gov/carpa/wallow-fire-smoke-exposures.pdf>.
- Beginning in 2010, the Southern Colorado Plateau Network (multi-park monitoring network) worked with Air Resources Division staff and EPA to sample waters for pesticides, pharmaceuticals and personal care products (PPCPs). Parks from the Four Corners area are included.

- Los Alamos National Laboratories deployed a solar-tracking Fourier Transform Spectrometer (FTS) at the NM Substation site in 2011. The sunlight is focused inside the observatory into the FTS which splits the light into the spectral regions between the near infrared and ultraviolet to measure absorption features from atmospheric gases. Analysis of the spectra provides column measurements of all greenhouse gases (CO₂, CH₄ and N₂O) and criteria pollutants (CO, NO₂, O₃, SO₂) every 3 minutes.
 - Please contact the Principal Investigator of the Remote Sensing Verification Project (RSVP), Manvendra Dubey (dubey@lanl.gov), for technical information and Amon Haruta (amon@lanl.gov) for logistics and operations support.
- Southern Ute Indian Tribe Air Quality Program
 - Operates three State and Local Air Monitoring Stations (SLAMS) within the exterior boundaries of the Reservation. SLAMS are configured and operated consistent with EPA requirements. Real time air quality data and meteorological data are available for SLAMS on the Tribe's Website at: <https://www.southernute-nsn.gov/justice-and-regulatory/epd/air-quality/ambient-monitoring/>
 - Operates two methane monitors to measure ambient concentrations of methane. Monitors are located at the Ute 3 and Lake Capote monitoring stations.
 - Conducting a study using vehicle-mounted mobile monitoring equipment. The study objectives include evaluating the accuracy, reliability, and practicality of the equipment, measuring average ambient methane concentrations on the Reservation, determining the effectiveness of the system for locating large methane leaks, and evaluating if methane concentrations measured at natural gas production and transmission infrastructure can be used to determine a correlation between methane concentrations and methane emissions identified with optical gas imaging cameras.
 - Completed comprehensive emissions inventory for the Southern Ute Indian Reservation for calendar year 2015. The final emission inventory report, titled "Final Report for 2015 Southern Ute Indian Tribe Comprehensive Emissions Inventory for Criteria Pollutants, Hazardous Air Pollutants, and Greenhouse Gases" is available on the Tribe's Air Quality website: <https://www.southernute-nsn.gov/justice-and-regulatory/epd/air-quality/>.
- VOCs were measured at five western National Parks for four months in 2017, including Grand Canyon and Carlsbad Caverns National Parks. VOCs serve as attribution tracers for sources that impact park air quality. Analysis of these measurements is in progress, and a report/publication is expected in 2019.