

NW-AIRQUEST meeting notes: 4 February 2021 meeting

Participants:

- WA ECY: Anna Tai, Beth Friedman, Farren Herron-Thorpe, Graeme Carvlin, Jill Schulte, Matt Kadlec, Paul Rossow, Ranil Dhammapala, Tes Ghidey
- PSCAA: Clem Mieke, Erik Saganic, Matt Harper, Phil Swartzendruber
- SRCAA: Mark Rowe
- ORCAA: Odelle Hadley
- WA DNR: Carolyn Kelly
- IDEQ: Brian Himes, Jacob Wolf, Kimi Smith, Melissa Rhein, Rong Li, Sally Hunter, Sara Strachan, Steve Miller, Tami Aslett, Wei Zhang
- Nez Perce: Julie Simpson, Mary Fauci
- ODEQ: Anthony Barnack, Daniel Johnson, Phil Allen, Svetlana Lazarev
- LRAPA: Lance Giles
- EPA R10: Jay McAlpine, Nicole Briggs, Robert Kotchenruther, Sarah Waldo
- Ministry of Environment & Climate Change Strategy: Li Huang, Lin Li Guo
- WSU: Ana Carla Fernandez Valdes, Joe Vaughan, Mahshid Etesamifard, Von Walden
- UW: Cliff Mass, Dan Jaffe, Honglian Gao, Matthew Ninneman, Nate May, Noah Bernays
- WRAP: Tom Moore
- ENV: Jerome Robles

Workgroup updates:

- Emissions Inventory (Farren Herron-Thorpe, WA ECY)
 - Updated to 2017 NEI in Dec (point and nonpoint).
 - Monthly emissions summary script needs to be updated; Farren is working on this.
- Wildfire modeling (Farren Herron-Thorpe, WA ECY)
 - Now using the FIS feed, which doesn't give us FIPS codes. We either need to get the FIPS codes from the FS or WSU needs to install new python packages so we can run new scripts. Farren is working on this.
- Model evaluation (Joe Vaughan, WSU)
 - Joe is tracking the progress of Jordan's masters paper on decadal impacts. This will eventually be posted on the WSU website.
- Small sensors (Von Walden, WSU)
 - Calibration of sensors: Von is seeing a different calibration at high (over 80-100 $\mu\text{g}/\text{m}^3$) and low concentrations. Von and his student may be able to present on this at the June meeting. He sees sensors overpredicting at low concentrations and underpredicting at high concentrations.
 - Dan Johnson: we've seen the same for years with nephelometers.
- Training and education (Nicole Briggs, EPA R10)
 - Plan is for a series of videos on common topics of interest, developed by NW-AIRQUEST and the Northwest Regional Modeling Consortium (NRMC).
 - Looking into collecting relevant resources in a repository.
 - It will take 6 months, but likely the FS can share the annual Air Resource Advisor trainings for those involved in wildfire air quality forecasting.

Notes in the following sections reflect Q&A/ discussion. See slides for more details on these topics.

Creating air quality forecast polygons using background concentrations and spatially constrained multivariate clustering (Sara Strachan, IDEQ)

- How do you account for the x, y, and z of air flow?
 - The input data are ground level and with the 24-hour integration, we think that the polygons are representative, at least for 24-hour AQI values.
- Is it possible to use monitors across the state borders rather than limiting the geography to Idaho (e.g., Yellowstone, OR monitor in Ontario, Jarbidge in northern NV)?
 - Yes, it's possible to extend the analysis across state boundaries. It would be very interesting to use the entire extent of the background concentrations (entire NW). I can imagine how it would change polygons in the Coeur d'Alene/Spokane area or the Cache Valley ID/UT area.
- Is there an option to force each polygon to contain a monitor, or to limit each polygon to only one monitor? Or does the tool ignore the point locations?
 - Since the point locations are included in the background concentrations, the clustering is only considering the PM_{2.5} concentrations and you cannot force it to contain a monitor. What's interesting is that it shows you areas that may be overmonitored (if that's possible!) because the concentrations are so similar across the region. One way you could possibly force it would be to add in a population grid as input.
- It looks like your polygon boundaries are smoothed from the 4km grid - did you have to do the smoothing manually or does that happen automatically?
 - The clustering was done on point centroids for the 4 km grids and then I buffered the cluster by 4 km and it created weird scalloped edges. Some were smoothed manually.

WA wildfire season AQI forecasting performance evaluation (Ranil Dhammapala, WA ECY)

- Can this be extended to ID?
 - Sara/ Steve (IDEQ): we're going to start using the ML forecasts internally, and are not making them public at this time.
 - Ranil: the point forecasts are developed for all three states, so the option is there for any of our three states.
 - Steve: Wei may do a cross-analysis of the point forecasts with his analysis.
- It would be helpful for context to see how your forecasts compare to something like a persistence forecast. Is that possible, or maybe you've already done that?
 - I noticed the ML forecast often behaved as a persistence forecast (because it doesn't know about emissions, only meteorology. Often missed the start and end of an episode). Yesterday's measured value weights the Random Forest prediction most heavily. I didn't specifically look at how it compared with a persistence forecast per-se but this is probably pretty close to that.

Using 0-D photochemical modeling to understand smoke impacts on O₃ (Matt Ninneman, UW)

- Does the model you're using incorporate heterogeneous chemistry, e.g., with semi-volatiles?
 - FOAM doesn't account for heterogeneous chemistry at this point in time.
 - Dan: Why do we not see O₃ production when PM_{2.5} is high? This might be due to loss of semi-volatiles on aerosols.
- Do you take into consideration the loss of actinic flux due to smoke?

- Not at this time, but could be something we think about. We currently include a solar zenith angle factor.
- Is this a NOAA sponsored project?
 - Yes.
- Where do you get your VOC data?
 - EPA AQS.
 - Odelle: when we did our toxics study on wildfires, we found that some SVOCs were missing from the EPA dataset. We think they were actually present but weren't in the EPA data because they were transformed in a way that the measurements didn't pick them up.

Non-purple sensors: successes, surprises, and challenges with other brands (Jill Schulte, WA ECY and Odelle Hadley, ORCAA)

- Von: comment on Jill's slides-- We're seeing very similar results from our 10 Clarity Node-S units in Spokane. Will send an e-mail on what we've found.
 - Dan Johnson: can you send this to us as well? We've also been looking at other options.
 - Von: we'll send you both a summary of what we've found so far while we work on our paper.
- Just wanted to ask about the calculation for the slopes for the comparisons, is it ordinary least-squares? Not sure if you are familiar with this already...the reason being that as the correlation gets worse, the slope from an OLS regression develops a significant low bias. Just something to keep in mind.
 - Jill: Yes, just OLS for now, though we may develop more sophisticated methods in the future if necessary. For now, we're seeing such strong correlations and good linearity during smoke events that it seems to be adequate for what we're trying to do, which is to estimate concentrations at least within the correct AQI category. Our main concerns with data quality are drift over time, interferences like spiders/water, whether individual sensor units are interchangeable, and how necessary site-specific vs regional correlations are.
 - Odelle: yes, we're sticking with OLS for now because of its simplicity.
- I don't find it unexpected or unreasonable that raw uncalibrated \$30 sensors vary by +/- 25%. As long as precision is good, they can be scaled if we have enough data to guide us. As with much more expensive instruments, the calibration ranges are important, and for light scattering methods, there are more variables to consider. The questions... what data quality do you need and what can you support/verify? Depending on your data quality objectives, those corrections may or may not be necessary. To advise public health, we think +/- 20% is a good target -- similar to nephelometer.
 - Odelle: agreed. The goal is to be able to use the data to provide advice to the public when they install sensors.
- Ranil: should we be looking into seasonal, piece-wise, or sensor-specific correction factor for the region, rather than the national one-size-fits-all correction?
 - Von: I think we should; we'll discuss in the sensor working group.
 - Ranil: preferable if the correction for the region can be done on the fly rather than requiring human intervention.

Air quality urban simulations using WRF-Chem model: analysis of the grid resolution, urban land use classification and urban parametrization effects (Ana Carla Fernandez Valdes, WSU)

- In your forcing data, did you introduce the smoke from the wildfire event?
 - Yes, it was in the emissions data.
- Are you sure it was a wildfire event?
 - Yes, that's why we chose those dates. There was a lot of wildfire activity in that area at that time. The whole area was covered by smoke from many fires.
- 12 km did better than higher resolutions, so meteorological parameters may have played a big role. WRF has had this kind of issue in picking up similar events, i.e., it might be a microphysics problem.
 - Yes, agreed. But, I'm not sure if this is the entire problem, because the emissions were likely also a problem.

Progress on SFY21 NW-AIRQUEST contract and upcoming staffing changes at WSU (Von Walden, WSU)

- No questions