TDep Fall meeting notes 10-24-23

Introductions (see below for attendance list)

Introductory presentation led by Ryan Fulgham

Spring 2023 meeting summary

- Meeting minutes approved
- Presentation by Jeremy Schroeder (EPA) - Introduction to EnviroAtlas
- Discussion on monitoring network optimization
- Vote to incorporate WG's into other WG's
- Other WG updates

Website updates

- 2023 spring meeting minutes posted
- 2022 annual report posted
- TDep WG section updated
- TDep map fact sheet update nearly complete

Future TDep meeting outlook

- Potential to allocate spring meeting for measurement workshop; move TDep "Business" meeting to zoom preceding the workshop
- Spring and fall 2024 TDep meeting locations TBA

TDep Secretary nomination and vote

- Kristen Foley (EPA) nominated by Ryan Fulgham
    - Greg Beachley (EPA) seconds
- Are there other nominations? No
- 27 in person vote yes, 3 abstentions. Zero "no" votes
- 3 online in favor, remaining are abstentions. Zero "no" votes

WG updates

TDep MMF WG

- Outline
    - New version 2023.01
    - Go through the TDep MMF projects
    - Plan for future work including framework and tools for characterizing deposition uncertainty
    - WMO MMF-GTAD update
- Project tracker
- TDep v2023.01: Upgrades from v2022.02
    - Revisions
        - New bias adjustment method
        - Restored a maximum bias ratio (modeled/measured) adjustment factor of 10
            - Re-implemented due to inconsistences in PM size between the models and the CASTNET filter pack
        - Substituted in a weekly threshold maximum (1 kg N/ha/wk) for EQUATES NH3 dry deposition

        - Addresses error with CMAQ bidirectional NH3 using MODIS land use when the soil became very dry that caused very large annual values in TX (>500 kg N/ha-y)
    - CASTNET QA changes
- Revisions: TDep bias adjustment
    - W/ mothballing of CASTNET sites and ending of SO2 analysis for NPS sites in Aug 2023, current method of bias adjusting the input EQUATES data ('within year' seasonal) will be impacted.
    - Developed new method to consider multiple years to reduce the impact of the site closures
    - Tested six methods of bias adjustment
        - Methods used ALL modeled years (2002-2019) or a moving avg of recent 5 years (i.e. year +/- 2)
        - Methods were either:
            - Seasonal correction (current version)
            - Others
    - On an annual basis, week ratio has most variation
    - All year methods will not capture trends in the bias ratio, but are captured for the 5-year moving average
    - Seasonal methods much higher correction from 2000-2005 (likely due to choice of week at the end of season)
    - LWMA and lead/lag methods are consistent
    - On a weekly basis, week ratio has large variations.
    - Seasonal methods have 4 step changes, which are smoothed by the LWMA and lead/lag methods
    - LWMA reduced perturbation from outliers better than the lead/lag
    - Difference in deposition fluxes between +/-5 for IQR of all species in 2018, 2021
    - Differences of +/-10% for 2019, 2020
    - Minor variations to CONUS trends for 2018-2021 - will run for all years
    - Will summarize bias adjustment method changes in the TDep MMF README
        - Question: Any need for more information to support the version change of deposition fluxes?
        - (Mike Bell) Using TDep to evaluate CL's in legal spaces. This presentation would be helpful to have available for any questions that might arise, without asking for too much of a lift. – action item for Greg B.
    - Data question (Mike Bell) - about large values in TX related to dry soil. Sometimes looking at the distribution of TDep results in erroneous outliers ~90, 100 kg N/ha/y. Does this correction fix this? Greg: Yes, it will fix at least some of it. It's not the first time that CMAQ has produced wild results. I would recommend using a 1/99 or 10/90 percentile rather than min/max.
    - Thoughts on manuscript that compares old vs middle vs recent versions of TDep? Is that still in progress? It would still be useful. (Chris Rogers). Greg: It's frustrating that it's taken me so long because it's basically done, but now the "updated" version is no longer current. Will send email follow-up.
    - Revisions: Wet deposition from NTN
        - Wet deposition gap in North Central due to many NTN sites not meeting criteria (all analytes) - very slim margin in a few cases. Underscores need

to incorporate EQUATES modeled wet deposition in the measurement model fusion.

- Summary of site prioritization and white paper
  - Several CASTNET and NADP (AMoN and NTN) sites have been mothballed since May 2022
  - More sites and/or particular observations across sites may be lost without restored funding in FY24
  - EPA convened an SAB panel (May 2023) to inform future directions for network
  - Draft SAB report was made public in early October - contains a framework to evaluate sites that could potentially shut down
  - Considers many factors including model bias for different species (e.g. CASTNET FP, O3, W126)
    - SAB panel continuing to revise framework
    - EPA has been conducting internal evaluations - leave one out on concentration, deposition
  - Will summarize in white paper
  - Continue to solicit feedback
  - Model bias across CASTNET and local impact of monitoring data
    - Assess site representativity and relative importance of a specific location
      - Which sites will cause shifts in spatial gradients when considering loss of site density?
    - Assess the impact of a site to the whole modeling domain
      - What is a specific site's impact to overall model performance? Using leave-one-out analysis
  - Can extend these analyses for NADP/NTN sites: IDW substitution
  - Some thoughts on next steps
    - These analyses can be depressing, but are good practice for monitoring networks to conduct to improve management decisions moving forward
    - While conducting these analyses, we are making progress toward understanding deposition uncertainty
    - Should be something that we incorporate into NADP and other monitoring networks
    - EPA has framework scripts for leave-one-out for deposition that can be applied to TDep MMF
    - Building an MMF uncertainty model or protocol can be a tool that we can apply to concentrations, deposition and can be adapted for any monitoring network
    - Substantial interest from ecosystem and critical loads community, and monitoring network decision makers--will likely be more if we can extend to concentrations
    - Typical limitations of funding and FTE persist, how to push it forward?
  - Could you explain the leave-one-out for deposition? (Greg Weatherbee)
    - (Greg B) Calculates the full model, then removes one site and recalculates the deposition maps.

                - (Greg W) Could this be done with wet deposition? Thinking about it with respect to failure to meet monitoring criteria, in particular for MT00 which is very influential for IDW maps. Could this be used to evaluate data substitution based on both IDW and historic trends for that site? That kind of a study is something Wisc could do with "free fellows"
                - (Greg B) a great idea.
            - Ryan - Other groups have been independently working on these sorts of MMF uncertainty analyses too. There's a need for a centralized synthesis of this.
                - Greg B - I'll add this to the list. We will need funding and support at some point.
            - (Mike B) - Definitely bring this (short synthesis of site prioritization exercise) to Exec. As incoming chair something around this will be one of my priorities. It's really interesting and I want to dive into the ecosystem effects of this.
            - (John) - It's helpful for there to be a short synthesis for Exec to consider. What of this is within the scope that Exec can realize?
                - Greg B - A little more follow-up needed then.
            - Mike - It would be helpful for us to dissect this in exec to identify what are the resources we can allocate.
            - John - Maybe it would be helpful to have you present at an Exec meeting at some point.
            - Katie Blaydes – Greg W's idea for the APHL is great. A guaranteed year of pay with the possibility of two. Outline a project, assign a mentor, to be matched with a fellow. They're geared toward undergrads.
            - Colleen - Operationalizing this seems like an important general goal, from which a framework could be applied by an undergrad or a fellow.
    - Greg B (from here on) highlights upcoming projects
        - Deposition at Skaneateles Lake
        - Depositional lifetimes to inform interpolation radius for TDep
        - WMO-MMF's project to add global precipitation chemistry data to Barcelona Supercomputing Centre’s GHOST dataset
    - Join the TDep workgroup

Measurement WG

- Mission and objectives
    - Assess and advance AQ monitoring related to pollutant deposition in support of the NADP Total Deposition (TDep) Science Committee goals as well as scientific regulatory activities
    - Objectives
        - Support national networks relevant to atmospheric deposition by providing information on emerging measurement techniques and their uncertainties
        - (others)
    - Initial focus: reactive N and phosphorus
- Deposition Monitoring Workshop
    - Presentations and discussion by leading experts on routine and special monitoring programs to address reactive nitrogen or phosphorus deposition issues

        - Existing network information content and gaps
        - Information sharing on new measurement techniques, data uses and how they can improve/be incorporated into the TDep maps
        - Monitoring data needs
    - April 29, 2024
    - Full/half day workshop
    - Organizing committee
        - Kristi Morris, Bret Schichtel
        - Volunteers?
    - Proposed workshop topics are as follows:
        - Ammonia measurements
            - AMoN passive network - David Gay
            - Satellite measurements of NH3 - Greg Beachley, Mark Zondlo, other
        - Dry deposition measurements
            - COTAG/Duke Forest studies? - John Walker
            - Ammonia dry deposition in Colorado Front range/RMNP, Collett or Da Pan
        - Total N and P measurements, deposition
        - Evolution of routine, e.g. CASTNet monitoring program
        - Urban deposition monitoring
        - Discussion on measurement needs and priorities
        - Flesh out by end of year
- (Elaboration of other Measurement WG activities continues here.) SNiPiT total nitrogen and phosphorus wet deposition monitoring evaluation
    - Objective
        - Assess measurement uncertainty and biases
        - Optimize sampling protocols for use in remote and high alpine environments
    - Locations and time
        - CSU Christman field and potentially Duke Forest
        - 5-6 month spanning spring and summer, e.g. March - August 2024
    - Sampling
        - 4 collocated NCON wet deposition monitors outfitted with SNiPiTs collecting weekly samples in bags and following the NADP protocols
        - 1 collocated NCON wet deposition monitor for event-based sampling
    - Analysis
    - Laboratories
        - CSU, Wisconsin
    - Data analyses
        - Event sampling results would serve as a check on the NCON+SNiPiT data
        - Duplicate analyzes in NCON and SNiPiT, eg total N and P, would serve as an additional check on SNiPiT data
            - In the case of total N and P, the NCON results should be equal or less than the SNiPiT
        - Replicate samples would be used to assess the data uncertainty
        - Cross-laboratory results would help to identify potential biases
    - Supplemental measurements with collaborators
- Shift in secondary inorganic aerosol formation in the rural CONUS from 2011-2020--is particulate nitrate formation NH3, NOx-limited or both?

    - Reductions in NOx have led to a shift in formation regime so that NOx is limiting more frequently
- Collaborative special study on sensitivity of PM to changes in NOx and NH3 emissions in SE Class I Areas
    - Interaction with states, support from Jim Boylan
    - Are there similar questions about ammonium sulfate as well?
    - Paul Makar - Are you measuring base cations? Nitrate will tend to go to coarse mode if there is dust available
        - Yes will be considered
    - Colleen - How are you accounting for the organic component?
        - Bret - there is a large focus on organics generally for NPS, but here we're focused on inorganic nitrate. The role of the sensitivity came into play for the regional haze rule where folks were looking at 10 year old data on sensitivity.

Ag stakeholder workgroup

- Main focus: Planning ag stakeholders forum
    - Considering a webinar-like approach of shorter virtual meetings over a series of weeks instead of one longer meeting
        - Help with participant engagement
        - Different topic for each virtual meeting
    - Mixture of presentations and moderated discussions
    - Planning for summer 2024
- Potential forum topics
    - Agricultural/air linkages of importance to stakeholders
        - Stakeholders that do not typically engage with TDep presentation-related research (e.g., USDA)
    - Enhancing the value of TDep and NADP data to agricultural stakeholders
        - Application of TDep/NADP data relevant to agriculture (e.g., modeling)
    - Linking air monitoring to other agricultural monitoring activities
        - Discuss opportunities for integrated/enhanced monitoring (e.g., integration of air/water)
    - Continuing productive engagement with ag. Stakeholders
        - Present examples of successful stakeholder partnerships
        - Next steps and future activities

EOS (C Rogers)

- EOS took place at 8am.
- Beck has been moved into leadership. Emmi is Secretary.
- Looking for new leadership in EOS.
- Looking for comment on TDep fact sheet. Should be finished soon.
- The manuscript on TDep revisions would be great.
- We'd love to announce the workshop. We can get that put out on social media.

<u>Invited Presentations</u>

Paul Makar - Air Quality Model Evaluation International Initiative 4 (AQMEII4) update

- Regional model intercomparison
    - Two full years of simulations, 2010 and 2016 for NA
    - Common set of input emission fields and lateral chemical boundary conditions

    - Meteorological fields have been simulated by each group
    - Additional 'non-standard' diagnostics also required
- Variety of models used, simulations contributed from US, European and Canadian groups.
    - UCAR WRF-Chem, EPA CMAQ-M3Dry, EPA CMAQ-STAGE, GEM-MACH, etc.
- What is the range of predicted potential ecosystem damage associated with S and N deposition, using an ensemble of models in Europe and NA?
- What are the underlying causes of that range in predicted ecosystem damage?
- Metrics of S, N ecosystem damage: Exceedances of critical loads
    - Regional model annual deposition estimates are usually used for this purpose--usually a single regional model.
- North American CL data
    - New combined USA/Canada datasets
        - Forest ecosystems
        - Aquatic ecosystems
    - US
        - Sensitive epiphytic
        - Herbaceous species community richness
- CL exceedances
    - Model 1 and Model 2 show more severe exceedances than the other models
    - Spatial distribution and extent of exceedance varies between models.
- Models simulate a reduction in exceedances between 2010 and 2016
- CLE's for aquatic ecosystems--also have spatial variability and variability in extent of exceedance, reduction between 2010 and 2016
- For lichen CLE's, where N deposition dominates, there's a larger variation between the model's location and extent of CLE.
    - Most models show an improvement between 2010 and 2016, except for Models 1 and 2.
- Herbaceous species community richness
    - Very large differences between the models
    - N deposition dominates
    - Model 1 and Model 2 predict large areas of severe exceedance
- Why are there differences between the models?
    - "non-standard" diagnostic outputs from each model
        - Detailed profiling of gas-phase deposition pathways
        - The diagnostics allow a better understanding of causes of model differences to make model-specific recommendations for follow-up
- Contributions to S deposition
    - Model 1+2: wet deposition
    - Models 4-6: sulfate dry deposition
- For CAPMoN and generally NADP, the models are low relative to the obs for wet SO4. Models 1, 4 and 6 have better agreement and highest SO4 wet dep.
- Daily PM2.5 SO4 - generally models biased high. Models 1 and 2 closest. Model 3 is low.
- Seems to be related to Emerson et al., 2020 updates to size-relationship of PM dry deposition. Requires updates to scavenging as well. Ryu and Min 2022, Ghahreman et al., 2023. multiphase hydrometeor scavenging
- Contributions to N deposition - Models 1 and 2 have 10x the dry Dnh3 DEPOSITION.
- Also some differences in wet NH4, dry NO3--high for models 4-6.
- Given the dry NH3 differences, evaluating the models against NH3 concentration observations.

    - For 2016, using CRiS and AMoN.
- Models 1 and 2 have low biases in [NH3] relative to other models (likely due to excessively high NH3 dry deposition).
- Models 1, 2, 4 and 5 use bidi NH3 flux algorithms.
- Looking in greater detail at the diagnostics, some terms are in common.
- Ra the same.
- "Rsum" is different for Model 1 and 2.
- Net compensation point - Model 2 has much lower compensation point over forested areas.
    - Are compensation points held constant?
- Ground and stomatal
    - Lower in model 2, Model 1 & 2.
- Model 1 and 2 have high NH3 deposition fluxes over forests. Suggests that too much NH3 is being deposited; the downward flux is too high.
- Land use type investigation
    - High deposition fluxes in Model 1, Model 2 seem to be associated with forests downwind of grassland and agricultural areas
        - Off-gassing of NH3 from agriculture, deposition downwind from forests
- Diurnal variation of NH3 in bidi flux models
- Next biggest source of N variability: p-NH4 dry deposition
    - Models 4-5 total Pnh4 dry deposition is higher than the others.
    - Used an inorganic heterogeneous chemistry solver that only includes SO4, NH4, NO3 chemistry (no base cations).
    - Including size-differentiated base cation deposition would reduce the bias.
    - Suggests including updates to hydrometeor scavenging.
- Spatial distribution of PM2.5 NH4 normalized mean biases.
    - Individual stations suggest common model problem: Specific observation locations where all models are biased high.
    - Good performance of some models is due to a lot of moderate negative biases being offset by high positive biases locally.
- Worth examining the sources of particle ammonium, sulfate and nitrate and their precursors.
- Next biggest source of N variability: Wet NH4 deposition
    - Seasonality is off. Models are showing that the peak is in summer, obs show in spring.
    - Scavenging is more efficient in snow, and most of these models don't include snow scavenging.
- Wet NO3 deposition
    - Model 1 and 2 generally had the best performance.
- Dry HNO3 deposition: 3rd largest contributor to N dep, 5th largest contributor to N dep variability.
    - Mass flux is a combination of dep velocity and atmospheric concentration.
    - Concentrations are affected by other processes aside from deposition (eg chemistry)
    - For HNO3, the cuticle and soil pathways dominate the dry deposition mass flux; stomatal and lower canopy pathways are many orders of magnitude smaller in importance.
    - A large amount of the HNO3 deposition flux is occurring at night, via these pathways.
- Summary
    - Forest ecosystems - Area in exceedance and magnitude dropped between 2010 and 2016

    - Aquatic ecosystems - Area in exceedance and magnitude dropped between 2010 and 2016
    - Sensitive epiphytic lichen species - large variation between models
    - Herbaceous - large variation
- Particle SO4 deposition causes most variability for S. Dry NH3 causes most variability for N.
- Questions
- (Bret Schichtel) First, really nice work. More of a comment specific to NH3. We're trying to constrain our understanding based on concentrations--both emissions and deposition are uncertain and competing factors. I'm struggling with trying to ascribe problems to high/low deposition or emissions--what is driving these issues. It's not clear to me that we have the information to definitively say that it's one or the other.
    - (Paul) We have a case where the models are tracking off from one another with transport in between. Not to say that it's definitely emissions (?)
    - It would be useful to get some fluxes using chemical ionization mass spectrometry. Mostly we have fluxes based on ozone and SO2. What's been needed is to get observations of the other gases.
    - Collaboration on this issue?
- John: Great presentation. I have a lot of questions. Did I see correctly that the models that were biased high for NH3 dry deposition were biased low for NH3 concentration? (Paul) They think that the magnitude of fluxes might be right but the compensation points are low.
    - John: Having flux measurements to constrain net flux measurements is good. We also need long-term measurements, especially of cuticular fluxes at night.
    - Paul: Every oxygenated gas other than SO2 we don't have that much information. Need to start doing that as a community.

Ozone Critical Load group (Jeff Herrick)

- 2020 ozone NAAQS review
    - Final Integrated Science Assessment (ISA): April 2020
    - Final Decision: December 2020 (retained without revision)
    - Announcement of reconsideration: October 2021
- New review
    - Announcement of new review: August 2023
    - Science and Policy Kickoff Workshop: Publicly announced for spring 2024
        - Publish workshop proceedings: Publicly announced for summer 2024
        - Interested in feedback and engagement around this
- Projects
    - Tree seedling exposure-response functions
    - Ozone critical levels using FIA tree growth and survival
    - Effects of ozone on herbaceous plants in CA
    - Work on foliar injury
    - Exploring wildfire and ozone exposures
    - Open-top chambers and FACE comparison
        - Poster on Wed by Jeff Herrick on the relationship between ozone exposure in larger vs smaller trees based on obs in Wisconsin
    - STOTEN paper - synthesizing European studies of AOT40 (similar to W126)
    - Kriging applied for exposure contours in SW USA
    - Including O3 in FIA analysis - using Horn et al. 2018 framework to expand ML method from Pavlovic et al. to ozone

    - Estimating ozone exposure using Voronoi approximation (VNA) - generally use W126.
    - Ozone deposition progress limited
        - On Monday discussed possibility of evaluating ozone stomatal flux in the US and what potential datasets may be out there for this type of analysis
            - Limited places where there is enough data to calculate flux/deposition to specific species
            - Need to relate flux/deposition to an ecological effect
            - NAAQS generally are ambient air concentrations
        - People working on ozone deposition flux
            - Huiting Mao (SUNY-ESF) - Modeling ozone metrics at Yellowstone and Grand Teton National Parks
            - Anam Khan (U Wisconsin) - Monitoring the stomatal component of tropospheric ozone dry deposition over an agricultural field in central Illinois
    - Ozone surfaces
        - How to get at gaps for interpolation surfaces?
        - Clarified that plot shown is max 3-month average
        - Where are we at with TDep ozone surfaces?
            - Project was out of Boston U, led by Bo Wang. Ran out of funding, not sure where that stands. She presented at Knoxville NADP meeting and also AGU. She made progress on adapting the TDep scripts
        - Have tried other approaches to interpolation but don't feel confident in evaluation of results, open to collaborating

Sally Ng - ASCENT - Atmospheric Science and Chemistry mEasurement NeTwork

- New long-term, ground-based, high time-resolution aerosol measurement network
- 12 sites
- 3-year grant ($12M) before transfer to another organization, possibly NCAR
- Objectives
    - Establish new long-term ground-based aerosol measurement network
    - Develop advanced protocols, create a database
    - Enhance training
    - Strengthen collaborations with international atmospheric observation network
- Site map
    - Combination of urban and rural sites, collocated with other networks
    - Some offset in terms of the collocation of NADP and NTN sites
- Site selection
    - 3 sites in CA take advantage of transport across the basin to understand aerosol aging between LA and Joshua Tree (collocated with CASTNET, Joshua Tree)
    - Great Smoky Mountains have a lot of biogenic aerosol, also in Atlanta along with urban pollution. Sites in these locations facilitate urban-rural processing
- High time-resolution aerosol instrumentation
    - ACSM - organics
    - Xact - trace metals
    - Aethalometer - black and brown carbon
    - SMPS - particle number size distribution
- All instruments are compact, easily deployable
- Instrument delivery, training, instrumentation

    - Instrument delivery finished by Jan. 2023
    - In-person training for ACSM; remote training for others; evaluated instrument performance
    - Instrument installation: First site up and running (Queens College, Dec. 2022); all instruments installed at the sites and running since spring/summer 2023, except Joshua Tree and Houston
- Standard Operation Procedures
    - Some tasks completed, currently developing SOP for data analysis
    - Will release all SOP freely and openly on ASCENT website in the future
- SOP - Intercomparison Plots
    - e.g., ACSM S vs. Xat S.
- Example at Pico Rivera and Rubidoux, CA: Aerosol composition
    - Fireworks event - ASCENT data used to assess what are the components of firework PM
    - Timeseries shows evolution between Pico Rivera to Rubidoux to Joshua Tree
- Cheeka Peak - relatively clean compared to sites in LA.
    - Occasional high PM loading from slash and burn events.
    - Witness new particle formation events
- Queens College in NYC.
    - PM2.5 in NYC is dominated by organics.
    - Organics at GA Tech have increased from 60 to 80% in recent years.
    - Organic measurements at ASCENT will improve understanding of PM processing.
- Wildfire events
- Value-added products
    - FTIR
    - Real-time source apportionment
        - Uses gas-phase data available at all sites
        - Offline positive matrix factorization (PMF) analysis
        - SoFi-RT (Source Finder software, Datalystica), real time source apportionment
- Data Infrastructure
    - Collaboration with UC Davis Air Quality Research Center software engineering time
- Example of data visualization and analysis based on data infrastructure
- Collaborations
    - Upcoming meeting at GA Tech and workshop
    - >100 people in attendance and joining virtually
    - Some organizations have reached out
        - CARB, TARTA metals (low cost)
        - Vocus Elf - VOCs
        - Low-cost sensors (PurpleAir, QuantAQ)
        - "friends" of ASCENT (same measurements in new locations)
            - SCAQMD
            - NSF MRI at U of M, App State
            - Ongoing discussions with ACTRIS, MAIA, DOE AMF3 and SPARTAN
- Questions
    - Amanda: For data visualization tools, do you expect to make them available?
        - Sally: We are testing them internally, and we hope to incorporate these associated with the database in the future.
    - Ryan: Is meteorology measured?
        - Sally: Each of the sites have meteorology measured.

    - Bret: This is an exciting network. AMoN is colocated at Look Rock in Great Smokey Mountains NP. Will you be able to get at organic nitrates? ACSM measures total organics and can segregate the inorganic and organic portion. One limitation is the time resolution. I'm interested to see if we can do total apportionment with ACSM.
    - Justin: I'm not too familiar with SoFi-RT. (Sally) It allows us to import mass specs from different sites, with rolling PMF which allows us to evaluate the source profiles.
    - Justin: How are you reconciling the different time resolution? Sally: We are going to average the time resolution to the shortest averaging period that we have while maintaining the raw data at higher resolution.

Chris Florian - NEON

- An update on atmospheric deposition data products at NEON
- NEON - a continental-scale, long-term (30 year) observatory, funded by NSF and operated by Battelle
    - Enables: Analysis, comparison, interoperability (integration with other networks).
    - Flux towers, insects, airborne platform, remote sensing, range of in situ products
- NEON is a distributed observatory across the US
    - 81 field sites
    - >180 data products
    - Intent is to have this running for 30 years
- Atmospheric deposition data products
    - Wet deposition chemical analysis
    - Stable isotopes in precipitation
    - Particulate size
    - Particulate mass
- Wet deposition chemical analysis
    - Collected at 44 sites, 37 terrestrial and 7 aquatic
    - Major ion concentrations
    - pH and conductivity
- Stable isotopes in precipitation
- NEON wet deposition locations (at most but not all sites)
- NEON is collocated with NTN in some places, expands coverage out west and in AK
- Difference in methods between NTN and NEON
    - NTN collection occurs at ground level
    - Most NEON collection takes place at the top of instrumented towers
    - NEON uses N-CON 00-127 collector because it also collects isotopes
    - Half of NEON sites have a weighing rain gauge, remainder have tipping buckets
    - Sensor too far from weighing rain gauge at some sites
    - Sampling window 14 days/biweekly
        - Nitrogen transformation, pH, isotope sample evaporation and incomplete annual measurements are biggest concerns
- Data quality challenges
    - 20-25% of all samples are over the 14-day sampling window
    - 10-20% of samples are discarded (>21 days requires discard)
    - Climate control issues (both heating and cooling)
    - Mechanical issues with collector
    - Precipitation data issues - spurious trace amounts from weighing gauge
- Gaps in sampling

    - Some sites have more sampling issues than others, improving over the last year
    - 14-day sampling intervals, each gap is a significant amount of time
- Future plans - wet deposition
    - 13 co-located NEON-NTN sites (though some are up to 10 km apart)
    - Intercomparison study could investigate impacts of 14-day sampling
    - Analysis will need to ensure sampling of the same precipitation events
    - Move the collectors off the tower top to the ground, closer to primary precipitation and easier for sample collection
    - Experiment with prototyping bag collection method with NADP
    - Increase sampling frequency (hopefully weekly), but we would need to reduce sites to accommodate
        - Interested in feedback on this tradeoff
    - Comparison analysis of co-located NADP and NEON sites
- Dust and particulate sampling (more on the dry deposition side)
    - Currently measured at six NEON sites in the RMNP region (CPER, NIWO, RMNP, ONAQ, MOAB, STER)
    - Focus on transportation of PM from Great Basin to the Great Plains
    - This is the only NEON product that has unique instruments
- Particulate sampling (at tower top): two instruments and data products
    - Hi-Vol - PM mass - High-volume sampler, PM10 collected on quartz filters. Samples available from the NEON biorepository. Do not do any chemical analysis of these filters.
    - DustTrak - PM size - near real-time using an optical sensor
- Data quality challenges
    - Particulate size
        - Average data validity of ~15% across the six sites
        - Maintaining required flow rate is the biggest issue. Also gaps in size ranges, plausibility tests for range and spikes failed in similar size ranges
    - Particulate mass
        - HiVol 3000 sampler specifications do not align with conditions at our sites
            - Operating range of 0-45C and below wind speeds of 36 km/h not met 30% of the time
        - >30 incidents of HiVol problems since late 2018
        - Large particles regularly on filters, lids blow off in strong winds
- Science community input - Particulate mass
    - Sampling design does not align with science community needs
        - Single quartz filter, not suitable for total nutrient inputs
        - Collects PM10, not entire size range of particulates
    - Only two groups have requested samples
    - Proposed discontinuing sampling to the NSF, currently no final decision
- Future plans - Particulate size
    - Review field procedures, ensure that flow rate calibration is being performed.
    - Move to a more reliable external pump.
    - Data comparisons with external sources
        - Check if QC algorithms are overly strict, look for bugs in QC algorithms
    - Encourage external projects to sample dry deposition at NEON sites
- NEON research support and assignable assets
    - Can propose to deploy other instruments on NEON towers but need to provide external funding

Dean Carpenter - Albemarle-Pamlico National Estuary Partnership

- APNEP mission - To identify, restore and protect the significant resources of the Albemarle-Pamlico estuarine system
- Implemented through the conservation management plan
- Despite recent downsizing, APNEP has largest area of any national estuarine program.
- APNEP's adaptive management cycle
    - Plan, manage, assess, monitor
- DPSER model - adapted from EPA's ecosystem model c. 2010 to address biggest policy problems
    - Land use change, nutrient inputs, climate change
    - APNEP has one of the most complex land use patterns in USA
    - Atmospheric emissions is a discharge pressure; climate change exogeneous
- Florida water column sub-model - indicating atmospheric pressures.
- APNEP monitoring and assessment teams activity: 2017-2018.
    - Air resources and monitoring team has made progress
    - Comprises state agencies, federal agencies and universities
- AR indicators and metrics (2018)
    - Concentrations, deposition
    - Assessment questions
        - How is atmospheric nutrient deposition on the watershed changing? (among other questions)
    - Focal metric reports
        - Nutrients (among other metrics)
- N deposition metric report
    - Formatted based on a previous round of this report--intended to give policymakers support in making decisions
- (John Walker) First phase is to develop reports for different metrics
    - Demonstrating how this organization uses NADP products
    - Metrics
        - Annual inorganic wet N dep
        - Annual concentrations of inorganic N in precip
        - Modeled total N deposition
        - Annual air concentration of NH3
    - N deposition metric report
        - In 2020, high percent N dry deposition due to NH3
        - Recommended increasing NH3 measurements in area with high ag activity
    - Indicator target levels are related to critical loads
    - Air monitoring strategy
        - Integrates indicators/metrics (nitrogen, ozone, climate)
        - Monitoring goal is to reduce uncertainty in indicator
            - Increase spatial coverage (NH3)
            - Expand monitoring to include missing metrics/indicators (dry deposition, organic N, phosphorus)
        - Illustrate importance of continuity of current networks
            - Quantitative impacts of site closure
        - Identify emerging issues
            - PFAS
- Follow up with Dean if you have questions.

(Ryan) Motion to adjourn
(Selma) Second.
~ 25 in favor in person.

Attendees
In-person
Ryan Fulgham - US EPA
Amanda Cole - ECCC
Justin Coughlin - Sonoma Tech
Jason Worden - NADP
Jeremy Ash - USFS
Jason Lynch - US EPA
Greg Beachley - US EPA
Ian Rumsey - US EPA
Kevin Mishoe - WSP
Melissa Puchalski - US EPA
Brett Schichtel - NPS
Lourdes Pineda - UNAM MEX
Richard Tanabe - NADP
Todd McDonnell - E+S
Mark Kuether - NADP
Michael Butler - EEMS
Tim Mendenhall - EEMS
Eric Hebert - EEMS
Anne Marie Macdonald - ECCC
John Walker - US EPA
Chris Rogers - WSP
Tracy Dombek - RTI
Katie Benedict - LANL
Lillian Naimie - CSU
Jian Feng - ECCC
Mike Bell - NPS
Jeff Herrick - US EPA
Selma Isil - WSP
Greg Wetherbee - USGS
Catherine Collins - USFWS
Katie Blaydes - NADP

Online
Marcus Stewart - WSP
Jayde Alderman - WSP
Kristen Foley - US EPA
Nate Topie - WSP
April Leytem - USDA
Vincent Vetro - ECCC
Hazel Cathcart - ECCC