Total Deposition Science Committee Meeting

April 19, 2022 (Madison and online).

Agenda and participant list follow

Greg Beachley:

1. Recap of Fall 2021 meeting – approved minutes on website
   o TDep Leadership document approved and also on website
   o Workgroup updates
2. TDep Website status
   o Each working group (WG) now has its own section under the "Working Group" drop-down menu option. That section includes the name of the lead, a summary of the objectives or a mission statement. Group leads can request edits, post WG meeting minutes or other documents.
   o Greg would like to get a shared folder hosted on NADP site eventually
   o Total Deposition maps page updated with v2021.01 maps for 2000-2002 and 2010-2020, updated README and summary text. Older v2018.02 maps are available under "Archive Links." The fact sheet still needs updating as this was last done in 2015.
3. Annual report and project tracker
   o 2021 Report is finalized and is posted on website
   o All projects in tracker were updated in report
   o If you would like to add a project, please do
   o Some projects were linked to specific research needs identified in white paper as appropriate
4. Outlook for future meetings
   o Possibly in person for Fall 2022? Greg would like to preserve some virtual components as we've be able to attract more participants
   o Time constraints are growing, especially in the fall with the Science Symposium. We could potentially use workgroup calls to hash out details, using biannual meetings for more high-level summaries.
   o Start thinking about updates and projects. Expect the usual WG updates and a recap of the "TDep and Agricultural Stakeholder Forum" event. Reach out to Greg, Ryan or Amanda if you have other suggested topics.

John Walker – Tdep Stakeholder WG update

Two main activities this year:

1. Stakeholder Engagement Plan
   o Roadmap to engage more closely with agricultural community in response to research needs and links identified in white paper

- o Draft plan sent to TDep steering committee for feedback. Others can contact John if they would like to see/review.
- o Will post on NADP website and update annually following fall meetings
- o 2022 Communications activities:
    - TDep map fact sheet
    - Development of communication pieces on needs related to NH_x emissions, atmospheric composition, data/measurements of deposition in order to improve modelling
- o 2022 Engagement activities:
    - Inviting USDA representatives Dan Miller and Greg Zwicke to fall 2022 TDep meeting
    - Agricultural Stakeholder Science Forum

2. Agricultural Stakeholder Science Forum
- o Half-day virtual workshop proposed for August 2022
- o Coordinated with Peter Vadas, Greg Zwicke, Allison Costa of USDA
- o Explore agriculture/air linkages important to stakeholders
- o Invite groups working on best management practices for air emissions, farm-scale emission models
- o Discuss ways to enhance value of TDep/NADP data to agricultural stakeholders
- o Look for opportunities to link air monitoring with existing agricultural monitoring
- o Discuss ways to continue productive communication with this community

Kristi Morris/Chris Rogers – TDep EOS representatives' update

Month of May is Tdep's for posts to social media. Taking suggestions but would like at least 2 posts. One could be the stakeholder workshop planning. Other ideas?

Greg B. would like to make formal announcement of new set of maps
Greg B. also suggested having something more educational as another post (Kristi in favour)

Chris - fact sheet update would be a good post (doesn't have to be May). Is there a timeline for that?
    Greg B – Probably in the fall

Please participate in EOS meeting Thurs at 11:30 Eastern

Mike Bell – Deposition Uncertainty WG update

Not formally meeting over last couple of years, but projects are advancing. Contributions from Jesse Bash, John Walker, Leora Nanus, Meaghan Petix presented today.

WG purpose is to understand deposition uncertainty and its impact on critical loads and exceedances, as well as to strategically coordinate TDep and CLAD activities to inform each other's goals.

Studies:

1. Looking at how new TDep maps from EQUATES are impacting exceedances compared to old maps. Showed differences e.g. on N-sensitive lichen critical load exceedances in the west. Can be used to inform land managers of level of confidence in associated risk.
2. Examining the impact on critical load exceedances of disaggregating CMAQ dry deposition from 12 km to 500 m using land cover data. Reported on this at fall meeting and now preparing manuscript. Some differences are observed in exceedances.
3. Duke Forest Throughfall study (John W) will look at measurement differences for N, S, base cations, and PFAS in hardwood and pine stands. NADP/NTN sampling is underway and throughfall funnel sampling will start in May 2022.
4. Comparison of modelled deposition with ion exchange resin collectors along west coast (Leora). Presented at fall meeting. Will be looking at new EQUATES version of Tdep to assess whether comparison changes.
5. Using epiphytic lichen tissue N concentration to evaluation TDep N deposition in Pacific NW. Tdep values are higher than estimate from lichens in SW Oregon and in the west Cascades. This was correlated with higher precipitation regions.

Hoping to meet in coming months to discuss progress and identify any new projects. Please reach out to Mike if you have any projects to share or would like to participate in the WG.

Greg W – essentially, you are looking at uncertainty by looking at different model estimates and comparing models to measurements?
Mike – goal is to understand confidence in assessments of ecosystem risk for land management. From the modelling side, also looking at source of discrepancies for model improvement
Greg W – are you coming up with quantitative percent uncertainty of Tdep? Is that in the scope of the analysis?
Mike – A previous analysis was done looking at differences between CMAQ and TDep in the past for specific regions, to identify regions with higher discrepancies
Greg W – but it would be out of scope to estimate measurement uncertainty, e.g. of a wet deposition value?
Mike – I think this is more of a NOS question but it could be pulled in if someone wanted to look at it. John's study will help address some of the uncertainty around different types of measurements. Also these model comparisons are not accounting for uncertainty in ecosystem response.

Justin C – regarding the downscaling study, where will you go with this?
Mike – this initial study was a proof of concept; the next step would be to look at areas where there is dense enough data to repeat (lichens data, gradient measurements e.g. passives or snowpack sampling)
Donna – does the downscaling just use land-use specific deposition?
Mike – essentially, yes
Donna – this is important for dry deposition but wet dep (precip patterns) is also highly variable in complex terrain within the 12 km grid.
Mike - Yes, Meaghan's work with the lichens showed this as well

Greg B – to Greg W's question, measurement uncertainty could be within the scope of the proposed Measurements and Monitoring WG.

Greg Beachley – Measurement-Model Fusion WG update

Since Fall 2021 meeting, established 3 focus taskgroups (Outreach, Product Development, Improvements):

1. **Outreach** for website updates, social media updates, & stakeholders
   o Participation in WMO Measurement Model Fusion - Global Total Atmospheric Deposition (MMF-GTAD; Amanda Cole will update)
   o Updated Total Deposition Maps drop-down on website

2. **Product Development** for script modifications, QA routines, maps summaries
   o Revised script to properly handle missing Cl- data from 2000 - 2003
   o Implemented QA protocol for check on CMAQ input data
   o Corrections to input dataset: Substituted surrounding week-year input concentration data for missing Dec 2018 and Jan 2019 data from Shutdown and ran cross-validation to determine sensitivity

3. **Improvements** for planning and development of long-term improvements

Work in progress:

   o Finish remaining runs for 2003-2009
   o Create map summaries for version 2021.01
   o Obtain DOI
   o Complete manuscripts describing (1) script transcription and resulting method change impacts as compared to impacts from model updates (2) 2018.02 regional trends with comparison to 2021.01
   o Looking at intermediate products to understand bias correction process, improve model performance and identify outlier sites
   o Develop data completeness approach for TDep
   o Evaluate coverage of coastal sites
   o Investigate incorporating CMAQ wet deposition into TDep product

Assessment of measured data impact using MMF: Example of 2010 SO2 and SO4 annual deposition using EQUATES vs. TDep. Can determine where differences in TDep and CMAQ occur, what sites are different than model. Breaking down into bias correction step and fusion step can identify where most of the differences arise and evaluate most effective time scale for bias correction. Products are not necessarily going to be posted but Greg can provide.

Email Greg (Beachley.gregory@epa.gov) to be added to WG mailing list.

Greg W – on maps see differences of +/- 2 kg/ha some places. Can we use these differences, and those from Mike's group, to help set data quality objectives for network? In other words, network's objectives should be informed by TDep's needs and ability to estimate deposition.

Greg B - agreed, we need to make connections e.g. with Measurements and Monitoring WG, Deposition Uncertainty WG, NOS, QAAG.

Greg W – contamination can cause 0.5 kg/ha uncertainty at a certain site. If we can reduce that, does it really matter from the perspective of the maps.

Donna – note that the dry deposition is where the fusion happens (for now), and wet deposition is basically what is used for NADP, so comment re. DQOs can be applied to CASTNET data

John W – we don't know uncertainty of dry dep measurements, so DQOs for concentration measurements is important but we really need flux measurements to inform uncertainty in dry deposition estimates from CMAQ

Donna – we will see some of this modelling variability for O3 deposition in Olivia's talk; this is one we know relatively "well"

Amanda Cole – update on GAW's Measurement-Model Fusion for Global Total Atmospheric Deposition Initiative

Goal of initiative is to create TDep-like products of N, S and O3 deposition on a global scale. Updates for previous year:

1. Publication of the project's [Implementation Plan](#) in October 2021
2. Publication of [Perspective article](#) in ES&T in January 2022
3. Single year global maps – method development and proof of concept
    o Ozone deposition underway at Boston U (J. Geddes) with ECCC support
    o Global N and S based on 2010 HTAP multi-model mean, IDW approach (J. Fu)
4. Completion of the data gathering activity at NILU in December 2021
    o Harmonized 2010 data from NADP, CASTNET, CSN, IMPROVE, CAPMoN, EANET, INDAAF, EMEP so far
    o Publically available scripts
5. Organized/presented at UN Food Systems Summit Science Days side event "Risks to agriculture from air pollution" in July 2021
6. Presentation at COP26's "Atmospheric Deposition, the invisible threat – impacts on agriculture, ecosystem and oceans" side event in November 2021
7. Presentation by J. Geddes at NADP Fall Science Symposium 2021
8. Stakeholder engagement contract awarded to Swedish Environmental Research Institute (IVL)
    o Mapping of potential clients and sponsors
    o Outreach materials
9. Organizing MMF Techniques online symposium and workshop (Sept-Oct 2022)
    o Update state of the science since 2019 expert meeting
    o Discuss concrete steps for implementation of operational system

Greg Wetherbee – CityDep WG update

CityDep's goal is to enhance atmospheric deposition estimates in urban environments.

Research coordination grant proposal transferred from Leora Nanus to Alexandra? punette?, Janice Brady, Pam Templer

Pam Padgett sent out a new Forest Service report looking at ozone exposure of people in city parks, comparing underserved areas with more affluent neighborhoods.

Katie B sent out DOE funding opportunity (pre-proposals due today). Funding 5-year projects at $2-5 million each. Considered black carbon deposition in urban environments project but didn't have time to pursue. Katie and Alexandra putting together proposal that would incorporate NADP.

CityDep WG minutes are posted on the NADP website

Donna – environmental justice is an area where CityDep may be able to leverage some funding. Is this under discussion within the WG?
Greg W – Yes, DOE RFP has a broad scope and includes environmental justice. Trying to look at how AQ varies with land use as well as socioeconomic factors. CityDep is trying to expand NADP in urban environments so any funding would be helpful. Perhaps cities would be interested.
Justin C (in chat) – As you explore potential stakeholders, I would encourage you to reach out to NACAA and AAPCA: https://cleanairact.org/
        https://www.4cleanair.org/about-nacaa/aapca

        Many of the participating agencies have been directed to implement EJ metrics in their air monitoring networks and many recently tapped into the American Rescue Plan air monitoring funding for instrument turnover. There may be opportunities to collaborate there as well.

Greg Beachley/Ryan Fulgham/Amanda Cole – Measurements and Monitoring WG status

Not technically a WG, but leadership team feels this is a priority as it aligns with TDep's objectives. Intention to form was announced in 2021.

Potential topics:
- o   Development of dry deposition flux measurement methods
- o   Measurements/monitoring of occult deposition
- o   Measurements/monitoring of additional contaminants, e.g. organic N; P; microplastics…
- o   Complementary methods, e.g. throughfall, biomonitoring (overlap with Deposition Uncertainty WG)

Could be a joint WG with Network Operations Subcommittee

Still need a lead! Duties of workgroup lead:
- o   Announce intention to form WG and get approval from Steering Committee (completed)
- o   At subsequent biannual TDep meeting, provide (1) Statement of objectives and timeline for meeting, and (2) List of resources
- o   Hold at least one WG meeting between biannual TDep meetings.
- o   Give an update on WG activities at each biannual TDep meeting (in person if possible)

- o   Present the intent to continue or dissolve the WG every 2 years
- o   Provide update on WG activities in TDep Annual Report

Please consider volunteering to lead; leadership will reach out to prospective candidates if there are no volunteers. Reach out if you would like more information.

Note that many of the projects we explore in TDep meetings could fall under this WG, and we may not have as much time to explore the details in future meetings.

Luke Valin – Opportunities for NO2 remote sensing to inform total oxidized nitrogen deposition estimates

Focus is on trace gases rather than fluxes, but interested in opportunities to overlap interests.

Pandora network's primary focus is satellite validation. Began with DISCOVER-AQ campaign in 2011 and since used in multiple other campaigns.

Instrument is particularly useful in shoreline environments with shallow layers of air movement to get a "3D" view of air pollution.

To use NO2 satellite data to get at deposition, need to recognize that column is not always related to surface concentrations. Pandora ground-based spectrometers fill the gap between satellite column and surface. Pandora running in MAX-DOAS mode are more sensitive to the surface, opposite to satellite instruments.

Data are available at data.pandonia-global-network.org. Data processing can take a great deal of time and effort. Products include total column NO2, O3, SO2, HCHO and profile NO2 and HCHO.

The intent of the Pandonia Global Network is to run full-time fixed sites and would like to get most use possible out of them. How could the information be best suited to enhancing deposition estimates? Model evaluation? Site-specific case studies? Additional data formats that lend themselves to incorporation in MMF? Perhaps a TDep-PGN working group?

Case studies:

- o   Presented some preliminary results from a study at Duke Forest including LiDARs, ceilometers, Pandora and in situ NO2 samplers.
- o   Vertical column information over urban site (Philadelphia) showing much larger concentration gradients in the morning vs. afternoon.
- o   Madison, CT, shoreline site with 27 elevation angles showing strong gradients near Long Island Sound

Greg B – are these shoreline data being used to improve models like CMAQ?

Luke – 12 km model doesn't typically perform very well in these shoreline regions but comparison with routine operational model results would be the first step. There is a planned NASA site in Maryland that would be a nice counterpoint to this Long Island site.

Greg B – it would be great to look at NO2 compared with CMAQ

Luke – I could help with processing the data to make it easier to use

Amanda – when did measurements start?

Luke – 2019 is when the network became operational and it's still growing, though data from field studies before that could be available for specific sites

Nate Topie – Efforts to Quantify Water-Soluble Organic N on CASTNET Teflon Filters

Project with John Walker, Ryan Fulgham

Goal is to develop robust methods to quantify bulk WSON on routine CASTNET filters, with long-term goal to incorporate routine measurements of bulk organic nitrogen into CASTNET sampling and analytical protocols.

Method is to analyze Teflon filter for NO_3^-, NH_4^+ and total nitrogen (TN) and calculate WSON = TN – (NO_3^- + NH_4^+). Using Shimadzu TOC-V$_{CSH}$ with TN module.

Storage tests:

- Initially tested TN using different storage times at different temperatures. Refrigerated samples were more stable than room temperature, but no relationship with storage time. Additional tests to look at NO3 and NH4 as well as TN and include frozen vs. refrigerated samples. Used 11 typical transit and storage times based on network statistics (longest delay).
- Duplicate packs in Gainesville, FL, to test extraction after 14 days at room temperature vs. immediately. Slight increases in total and inorganic N (median 2-3%) after delay, ON differences variable due to lower concentrations.
- Duplicate packs in Mackville, KY, split to compare immediate vs. post-refrigeration, immediate vs. post-frozen. Refrigerated samples showed small loss of NH4 (median 1.4%) and small increase in NO3 (median 0.8%), large variability in ON as well as TN. Similar results for frozen samples.
- Standard storage methods didn't appear to significantly impact median WSON concentrations.

Looked at fraction of water-soluble TN as ON:

- Average 11%
- Higher fraction at Gainesville and Mackville samples March-June compared to 5 other sites sampled January-March, possibly due to seasonal variation.

Additional tests showed decreased variability in TN (and ON) with averaging of multiple injections on Shimadzu. Increasing replicates could potentially improve precision. This could be done through

reducing number of instruments. New instrument SEAL AutoAnalyzer can run both NH4 and TN and will be assessed.

12-month study planned for 27 CASTNET sites. Would like to combine with NADP SNiPiT precipitation sampler study.

Greg B – what is the percent uncertainty on the ON and how does it compare to the differences seen in the tests?
John W – precision for ON duplicates was 25% and came down to 16%; hoping this will improve further. This is just the instrument but there are multiple samplers at the study sites so can get inter-sampler values as well.

Doug – would there be any wildfire contribution to WSON?
Nate – we weren't aware of active fires around these sites during this time of year but could be part of wider study
Chris R – Tim Sharac is collaborating on a related study that could be combined with these data (glucosan levels)
Melissa/Tim – Amy Sullivan is the person leading this pilot study, looking around Rocky Mountain NP

Jeff Herrick – CLAD Ozone working group

Working group formed Fall of 2021, hoping for in-person kickoff Fall 2022 to expand beyond small group.
Goal is to coordinate research on ozone effects on ecosystems in North America.
Covering two projects today: (1) tree seedling exposure-response functions, and (2) Ozone critical levels using FIA tree growth and survival. Other projects include effects of ozone on herbaceous plants in CA, and foliar injury study (Kris Novak).

1. Resurrection of seedling data
   o Open-top chamber studies attempted to correlate exposure with biomass, foliar injury, etc.
   o Data from 37 studies was on an old UNIX machine in Corvallis.
   o Classified sensitivity of species based on exposure resulting in 5% biomass loss, in order to identify most sensitive
   o Manuscript in review (Lee et al.)

2. Including O3 in Forest Inventory Analysis
   o Based on Horn et al. (2018) paper framework, and database, expanded to O_3 exposure
   o Analyzed 141 species, found 55 species where a O_3 critical level for growth could be identified, and 18 species that may have survivorship critical levels
   o Interpolate O_3 W126 metric values from AQS monitors (including CASTNET), sometimes using CMAQ to nudge the interpolation

- o Note that W126 calculated from earlier version of CMAQ didn't agree particularly well with observations
- o Nearly all U.S. exposure-response data are based on concentration metrics rather than flux

Next steps for WG:

- o Establish monthly meetings – contact Jeff, Kris Novak, or Emmi Felker-Quinn to be added
- o Continue work on O3 critical levels from FIA project
- o Future projects: California herbaceous plant project, link up with O3 garden network, link up with project on O3 flux and W126 in Yellowstone (Huiting Mao, Barkley Sive), wildfire effects on O3 exposure
- o Work with TDep on O3 exposure estimates

Leiming – will produce ozone stomatal flux product for 2016-17 across North America

Olivia Clifton – Dry deposition of ozone from AQMEII4

- o AQMEII evaluating regional CTMs, phase 4 focusing on dry and wet deposition.
- o Looking at both deposition velocity and fluxes
- o Common resistance approach for dry deposition velocity is flexible and useful, but values used for those resistances are highly variable between models, resulting in high variability in deposition velocity (also due to some differences in schemes, land use/cover inputs), up to factor of 2-3.
- o Can start to identify sources of variability by breaking down contributions of individual pathways (stomatal, soils, etc.) to total deposition using "effective conductances", and of land-cover-specific deposition.
- o Activity 1: Grid model intercomparison of annual simulations for 2 years over North America and Europe with common emissions, boundary conditions, process and LULC categories (see Galmarini et al, ACP 2021).
  - o For a given LULC category, model variability is still very high. Also the case within individual stomata, cuticle, and soil/lower canopy effective conductances.
  - o Evaluation of dry deposition schemes typically by comparing deposition velocity cycles at a few sites, with limited understanding of the processes leading to differences/similarities. Observations showing strong interannual variability of deposition velocity suggest that short-term measurements are not sufficient for model evaluation.
  - o Available measurements are predominantly short-term; only 11 sites with >5 years. For AQMEII years, one data set in NA for 2010 and none for 2016, and 5 in Europe 2009 and 6 in 2010.
  - o Gridded meteorology can be significantly different from site conditions, leading to deposition velocity differences

- o Activity 2: Single point model intercomparison of stand-alone dry deposition schemes from multiple CTMs using common, observed site conditions, at 8 flux sites.
  - o Examines performance of models as well as sensitivity to environmental conditions
  - o Initial results show large model variability, not always bracketing observations. Relative contribution of different deposition pathways also differs between models
  - o First paper in preparation, additional ones planned
- o Hosted ozone dry dep workshop in March 2022 with Louisa Emmons and Arlene Fiore, to identify recent advances and establish future priorities in ozone dep modelling. Draft report is underway.

Greg W - what's needed to coordinate a network from the existing flux sites?
Olivia – most are individual PIs. There are efforts to coordinate in Europe, but needs $ in U.S. for infrastructure, e.g. from NSF or NEON.
Donna – Note that the 103 sites includes many short term campaigns that don't overlap.
Olivia – also, for some of the older sites the data are not available any more

Greg B – given the high variability between models, is the major need measurement data?
Olivia – Well, we definitely need to improve the models. One outcome of these studies could be identification of the type of measurements we need more of (e.g. over forest, crops…). Also need to understand limitations and uncertainties of measurements.
Donna – Modelers need fundamental measurements like leaf wetness, soil moisture and temperature, which are often not taken or not reported.
John – the idea of setting minimum measurement requirements for flux calculations is a community need, and sounds like it could come out of AQMEII work
Olivia – Yes, some of these recommendations are in the 2020 review paper but could expand with AQMEII.

Jeff – We don't have a lot of data linking biological effects to fluxes, just to concentration. For CLAD work, we would be interested first in enhancing our interpolation of the concentrations.
Donna – In Europe, they do have more of these data so they are using stomatal conductance more
Olivia – In an earlier modelling study, we found that daily fluctuations in concentration didn't have as big an impact as stomatal conductance on cumulative stomatal flux.
Jeff – Thinking from a policy perspective, will it be used as a policy tool if it's too complex? For individual species, or canopies, it's a big challenge to model stomatal conductance.
Greg B – There is certainly a spectrum between the research angle that Olivia is talking about to the policy application angle from Jeff
Olivia – Ronan et al (from Chris Holmes' group) used gridded O3 observational product using ambient ozone and flux tower observations and showed that trends in concentration metrics suggest that NOx reductions are protecting plants, while stomatal metrics are suggesting they are not.
Jeff – This is really interesting, we just need the biological data to better make the link

Greg B – any thoughts on what TDep can do on ozone dep?
Donna – what is CLAD looking for? Any interest in deposition anticipated?
Jeff – initially we are looking at W126 because that's what we have, but are interested in understanding how well the model is doing for stomatal flux. Is there capability to look at individual sensitive species?

Olivia – perhaps if there's a forest that is dominated by sensitive species could be a site for flux measurements, and use single point models from AQMEII to evaluate performance.

Jeff – The working group should discuss internally what are the next priorities but this conversation is a great starting point.

Kris Novak – Perhaps the WG should explore what species or cover types we have enough information about. Europe had concentration data and physiological data that they started with, then moved over to flux. We need to assess where we are at in that transition.

Emmi – would love to have W126 annual surfaces. We are already using these metrics based on monitors in park management (for risk assessment).

Donna - time series from EQUATES has 15 years of CMAQ data. [Kristen F - don't routinely extract W126 but could do that in processing]. We could also extract land type specific fluxes (not at species level).

Olivia – could also compare W126 metric from AQMEII with stomatal fluxes.

Mike B – from Parks perspective, use general W126 thresholds nationally. Concerned about use in arid areas where stomatal flux would be significantly different. Perhaps area-specific concentration metrics would be needed for management decisions.

Greg B – Thanks for all the presentations, and we will continue discussions in the future.

Adjourn

TDep 2022 Spring Meeting Agenda

9:00 EDT on April 19th, 2022

Registration and Zoom link: https://us06web.zoom.us/meeting/register/tZAkf-ygqTkoHNOtzY4vzj4ls9z3A55RCu_i

9:00 Introduction/Overview (*Greg Beachley, EPA; Ryan Fulgham, EPA*)
- Recap of Fall 2021
- 2021 TDep Annual Report/TDep Project Tracker

9:10   Workgroup Updates

Stakeholder Workgroup (*John Walker, EPA*)
- Update of Stakeholder Engagement Plan
- Update on NCDC233 Sources and Fate of NH_3 Across the Region
- Plan for 'Strengthening connection between TDep and Agricultural Stakeholders Forum'
  - Identifying potential connections and stakeholders

EOS (*Chris Rogers, Wood; Kristi Morris, NPS*)
- TDep Twitter material for EOS (products, Educational awareness, other ideas?)
- May Tweet

Deposition Uncertainty Workgroup (*Mike Bell, NPS*)

Measurement Model Fusion (MMF) Workgroup (*Greg Beachley, EPA*)
- Update on results from MMF Script Transcription, status of 2020 TDep runs with EQUATES
- Update on work in WMO Measurement-Model Fusion for Global Total Atmospheric Deposition (MMF-GTAD; *Amanda Cole, ECCC*)

CityDep Workgroup Update (*Greg Wetherbee, USGS*)

Measurement & Monitoring Workgroup (*TDep Leadership*)
- Prospective Mission Statement and focus

10:25   --- BREAK ---

10:40   Presentations and Discussions

Presentation: *Pandonia Global Network NO_2 total column and profile measurements across the N. America (Luke Valin, EPA)*

Presentation: *Efforts to quantify Water-soluble Organic Nitrogen (Nate Topie, Wood)*

11: 30   Ozone Deposition Session:
- Walkthrough of CLAD's efforts on Ozone Deposition and formation of new Working Group 6: Ozone Critical Levels (*Jeff Herrick, EPA; Emmi Felker-Quinn, NPS*)
- **Presentation:** *Summary of AQMEII Ozone Deposition Modeling (Olivia Clifton, NASA)*
- **Discussion:** *Strategies for TDep to get involved in Ozone Deposition*

12:15   Additional Business; Wrap up, and Adjourn

Attendees

<u>Online</u>

Alexia Prosperi	Greg Beachley	Lukas Valin
Allison Steiner	Gregory Wetherbee	Marcus Stewart
Amanda Cole	Hayley Curilla	Mauro Cortez Huerta
Amy Mager	Hayley Olds	Melissa Puchalski
Ana Alarcon	Henry Anderson	Michael Harwood
Andrew Vickery	Ian Rumsey	Mike Bell
Anne Glubis	Irene Cheng	Naomi Tam
Anne Marie Macdonald	Jason Lynch	Nate Topie
Arsineh Hecobian	Jason O'Brien	Olivia Clifton
Cari Furiness	Jeffrey Herrick	Pablo Sanchez Alvarez
Catherine Collins	Jim Szykman	Pleasant McNeel
Christopher Rogers	John Jansen	Ralph Perron
Cody Clemens	John Walker	Rick Haeuber
Colin Kelly	Justin Coughlin	Rodolfo Sosa Echeverría
Colleen Baublitz	Katie Blaydes	Russ Bullock
Daimy Avila	Kemp Howell	Ryan Fulgham
Dana Grabowski	Kevin Mishoe	Ryan McCammon
Da-Wei Lin	Kris Novak	Sarah Nelson
Emmi Felker-Quinn	Kris Novak	Selma Isil
Eric Baumann	Kristen Foley	Timothy Sharac
Eric Uram (Eric Uram)	Kristi Morris	Todd McDonnell
Forrest Cook	LaToya Myles	Tom Butler
Gary Yip	Leiming Zhang	Winston Luke
Gilberto Fuentes	Loren Trick	Yijia Dietrich
Ginger Tennant	Lorenzo Labrador	Yuan You
Graciela Velasco	LOURDES PINEDA	Zac Najacht

<u>In person</u>

Linda Geiser	David Gay	John Walker
Mike Bell	Richard Tanabe	Mike McHale
Donna Schwede	Colleen Flanagan-Pritz	Eric Uram
John Offenberg	Emmi Felker-Quinn	
Doug Burns	Jim Hermanson	