

AQMEII4 Activity 2 Call February 6, 2024

Participants: Laurens Ganzeveld, Olivia Clifton, Annika Vogel, Colin Lee, Christian Hogrefe, Jesse Bash, Anam Khan, Kenjiro Toyota, Johannes Flemming

Olivia alerted the group that when Annika adapted some of Olivia's python analysis scripts, she found a minor issue that has the potential to cause errors for Ramat Hanadiv. The problem is that the timeseries for the DO3SE models is too long; an extra month of NaNs is added on to the end of the time series. The issue did not affect Olivia's analysis or Anam's ongoing work, but other people working off of these scripts (e.g. Colin and/or Kenjiro) should check with Olivia and Annika for further details to make sure their work isn't affected, either.

Olivia reported back on call with HTAP3 leadership. The call was held on January 12 to discuss how experiences from AQMEII4 (and TOAR) can inform the upcoming HTAP OPNS simulations. For its planned modeling and impacts (ozone damage to plants) work, HTAP3 may use a different approach to estimate stomatal ozone dose (top of canopy, sunlit only) from what is being calculated in typical CTM deposition schemes, likely because this approach is easier to link to chamber studies. Such calculations require multi-layer models and sunlit vs. shaded partitioning rather than information that most current deposition schemes can provide, though it might be possible to find relationships between that approach and the approach in most deposition schemes. HTAP3 leadership will likely initiate follow-up conversations in the future.

Anam presented two slides with updates of her ongoing work to calculate observation-based constraints for stomatal conductance and analyze model sensitivity simulations with perturbed input fields and parameter settings related to stomatal conductance. In her work presented at AGU, Anam showed that out of the input fields and parameters analyzed, soil moisture stress / wilting point had the largest impact on modeled stomatal conductance for all models. New analyses at Borden Forest focusing in on the month with the highest soil moisture stress confirmed the importance of this parameter in the model calculations. Expanding this analysis to all sites and years show that some parameters just change the magnitude of the error but not the seasonality, while others also affect the seasonality of the error (e.g. at Ramat). Laurens asked whether on a high level these analyses can provide evidence that some models are getting VPD and/or soil moisture impacts really wrong. Anam's initial response was that Jarvis-type models which have hard thresholds (e.g. for wilting point) might be susceptible to simulating exaggerated stresses, though maybe adjusting these thresholds could lessen this effect. Interpretation of the Borden Forest results is more complicated because the depth of the measured soil moisture may not represent tree-root level. Anam and Olivia will be working on creating an outline and collection of figures to distill the key points emerging from this analysis and then request feedback from modelers.

Annika presented a number of slides on her initial work relating to data preparation and the calculation of state statistics. The analysis is performed separately for each site. Annika's work requires complete data pairs across observations and all models, so one of the first steps was to prepare summaries of which datasets (observations, specific models) impose the greatest limit on the number of available datapoints at a given site. In many cases, observations impose the largest constraint, though the analysis also showed that CMAQ STAGE and MLC-Chem can also be limiting factors because they may require a greater number of input variables than other models. Annika is cross-checking with Laurens and Jesse

whether this is expected. The calculation of state variances showed that they can differ by orders of magnitude between models (e.g. the variance for DO3SE often is much smaller than that for GEM-MACH Wesely). The state variance is calculated by first subtracting the model-specific mean and then computing the variance, i.e. it reflects mostly diurnal and seasonal variability. These large differences between modeled variances may pose challenges for the statistical error estimation. Annika also analyzed cross-variances and state correlations, both between observations and models and between different models. As expected, the results showed that the correlations between observations and models was generally lower than the correlations between pairs of models, with some model pairs showing very high correlations. There was some discussion to possibly try to stratify the analysis to separate seasonal, diurnal, and possibly synoptic scale variability, though the latter would be expected to be very challenging. Possibly analysis approaches discussed by the group were data subsetting and/or working with daily mean or monthly mean data instead of hourly data.

Next call: Tuesday March 5, 10:00 EST / 15:00 GMT / 16:00 CET