Modeling Quarterly Review Meeting
July 23rd and 24th, 2013
http://www.chesapeakebay.net/calendar/event/18875/

UPCOMING MEETINGS

- Conference Calls
  - Modeling Workgroup Conference Call, TBD in September (occurred 09/06/13)
    - Atmospheric deposition discussion – This analysis is needed prior to the May 2014 evaluation of the jurisdictions' milestones.
    - Review of Comprehensive Modeling Workplan.
    - Participants: Modeling Workgroup Members will be invited to attend.
  - Sea Level Rise Boundary Conditions Conference Call, TBD in mid-September
    - Participants: Lewis Linker, Ping Wang, Carl Cerco, Larry Sanford, Harry Wang, and Richard Winfield.
  - James River Chlorophyll *a* Study conference call, TBD in Fall 2013
    - To discuss boundary conditions.
    - Participants: Arthur Butt, Lewis Linker, Gary Shenk, and other s as needed.

- Modeling Quarterly Review October 2nd – 3rd, 2013 10:00AM – 3:30PM Joe Macknis Memorial Conference Room (Fish Shack) CBPO 410 Severn Avenue Annapolis, MD. http://www.chesapeakebay.net/calendar/event/18877/

MINUTES JULY 23rd, 2013 10AM – 2PM

Potential Impacts of Climate Change on Washington Metropolitan Area Water Supply – Ahmed-Schultz
Attachment A

Cherie Schultz and Sarah Ahmed of ICPRB described the use of the Phase 5 Watershed Model to examine estimated future Potomac flows and the report's findings on water supply for the Nation's capital.

Discussion and Questions

NEXT STEPS FOR ICPRB:

- To be evaluated in the 2015 reliability ICPRB study:
  - More operational efficiency.
  - Increased system flexibility.
  - Earlier and increased water use restrictions.
  - Additional water supply storage.

- It was suggested that ICPRB consider water supply generically. For example, include climate change and the impacts of groundwater withdrawal.
  Response:
  - Groundwater recharge is included in the basin-wide average water budget.

- ICPRB currently uses a single number to represent upstream consumptive use, which includes groundwater supply (needs to be refined, but trying to take it into account).

- It was suggested that ICPRB consider the effect of future metro DC climate change increases in water demand on wastewater. For example, wastewater flow is increasing, but the concentration is increasing, what are the implications?

- **FOLLOW UP:** ICPRB agreed to help the CBPO Modeling Team refine the Potomac reservoir operation rules for the Phase 6 Model.

Improving Estimates of Nutrient Loads to the Chesapeake Bay through Satellite Imagery-based Forest Disturbance Metrics – Deel
Attachment B

Lindsay Deel presented initial preliminary estimates of disturbed forest area due to silviculture, insect defoliation, drought, and other disturbances over time. Ultimately, an annual time series of the area of forest disturbance in each of the WSM land-river segments would provide the basis for improving Watershed Model performance.

Discussion and Questions

- Deel will present her findings to the workgroup at a future Modeling Quarterly Meeting. This could lead to Phase 6 Model refinement to include forest disturbance. Deel's work to be completed by May 2014 as part of her dissertation.

- **REQUEST**: Deel requested that any available on-the-ground information about harvest, storms, fire, and other forms of forest disturbance be provided to her. Amanda Pruzinsky will follow up with the Forestry Workgroup.

Phase 6 Sensitivities Analysis Overview – Shenk
Attachment C

Gary Shenk provided an overview of the work to document in detail the input-export response of all land uses in all model land-segments to provide necessary information for the development of an all-PQUAL based Phase 6 Watershed Model.

Discussion and Questions

NEXT STEPS FOR CBPO MODELING TEAM:
- Determine a generalized sensitivity from AGCHEM.
- Complete a literature/model search for sensitivities to input.
- A decision on the sensitivity approach from the Modeling Workgroup.
- Implementation of sensitivity in the Phase 6 Model.

AGCHEM Sensitivities Analysis – Tian
Attachment D

Richard Tian described the overall findings and implications of the analysis of AGCHEM nutrient export sensitivities to input loads

Discussion and Questions

- Could CBP use kriging to evaluate the spatial autocorrelation? A variogram could be used to determine if there is a spatial pattern of the slopes. Lee Currey will follow up with Gary Shenk.

- This analysis was conducted using the landuses from Phase 5.32. If these landuses are changed in the Phase 6, how will this affect the sensitivities?
    - The Modeling Workgroup will have to make recommendations to the WQGIT on how to convert the current landuse data into the new landuse data. The Modeling Workgroup will have to make the recommendations about what the sensitivities should be, because judgment will be needed to discern between the difference findings of the Phase 5.3.2 sensitivities, literature sensitivities, and the sensitivities of other models.

- Were the outliers investigated in this study? No, the objective of this study is not to try to prefect AGCHEM. A major issue that the jurisdictions have with the current model is that there are outliers. We are trying to determine the generalized sensitivities in order to improve the model for decision making purposes and essentially eliminating the outliers

NEXT STEPS FOR CBPO MODELING TEAM/CLARIFICATION:

- These sensitivities are NOT the final Phase 6 Model sensitivities up for approval today.
    - The first step was to determine generalized sensitivity from AGCHEM.
    - Next these sensitivities will be used in a Phase 6 Model prototype, for investigation purposes, which will be presented to the Modeling WG.
        - Keeling would like more time to review this analysis for signing off on including this analysis in a Phase 6 Prototype.
        - The Modeling Team will follow up with Dr. Adil Godrej, whose student conducted an ACHEM and PQUAL comparison.
    - At the same time the Modeling Team will be investigating literature and other models for their sensitivity of nutrient export to nutrient inputs.
    - The final Phase 6 Prototype model will be informed by many mechanistic models, which will have to be reviewed, assessed, and given a particular weight or value with respect to their input/export sensitivity by the Modeling WG and ultimately approved by the WQGIT.

Extension of linked Watershed, CH3D, and ICM Models from 2002 to 2011 – Bhatt
Attachment E

Gopal Bhatt described the extension of the Watershed Model from 2002 to 2012 using a new NLDAS precipitation input. The calibration and application of the model will be described.

Discussion and Questions

- The Modeling Workgroup evaluated a comparison of the XYZ method or NLDAS method for the Phase 6 prototype and found that:
    - NLDAS can more easily extend the calibration to current conditions on an ongoing basis
    - Multiple Models – NLDAS is a national data product, which can facilitate the application of the same precipitation input in multiple models.
    - NDLAS provides in general a superior or equal calibration as the xyz and there is opportunity to improve the NLDAS calibration further.

- **DECISION:** Incorporate the NLDAS method into the Phase 6 prototype.

The Chesapeake Bay Watershed and Knowledge Systems for Sustainability (KSS) – Fowler
Attachment F
Attachment G

Lara Fowler (Penn State) described a specific Chesapeake Bay KSS project that's just getting underway. The mission of KSS is to leverage technical, financial, and other resources to better address critical issues facing land, water and energy decisions, and to help ensure that information is seamlessly transferable between institutions and to decision makers, both at a policy level and on the ground.

Discussion and Questions

- KSS would like to get input from all of CBP for prioritizing the topics that KSS is considering for research. The Modeling WG suggested face-to-face meetings with many members of the CBPO. Lara Fowler will follow up with Gary Shenk and Kevin Sellner.
    - The Mid Atlantic Water Program (funded through USDA) has also completed a stake-holder survey in the watershed and is developing a needs assessment report.
    - When reviewing topics that KSS is considering working on, the Modeling Workgroup suggested researching and providing recommendations for communication and management of the disconnect between when implementation happens and when results are seen.

NEXT STEPS FOR KSS:

- Briefings/discussions with work groups/committees to inform them of KSS and prioritize KSS's mission in the Chesapeake.
    - KSS will be meeting with the WQGIT and other CBP groups. Gary Shenk is setting up these presentations.
        - There has already been a meeting between members of CBP and KSS. Gary Shenk and Kevin Sellner are the main contacts, but other federal, jurisdictional, and CBP group representatives were invited and attended.
- Further outreach to producers.
- Seek funding/resources/partners outside of CBP.

- Further follow up with Ann Mills.
- Create partnerships/leverage opportunities that don't already exist.
  - i.e., integration of social sciences.

CBP Agriculture Workgroup and Agricultural Modeling Subcommittee Update – Dubin-Dell
Attachment H

Mark Dubin on behalf of Curtis Dell, AMS Chair, described the work of the nascent Agricultural Modeling Subcommittee that will advise the Agricultural Workgroup, but will also cover topics that overlap with the WQGIT and Modeling Workgroup.

Discussion and Questions

- AMS requests continued and regular communications between the Agricultural Modeling Subcommittee and the Modeling Workgroup.

Evaluation of RDM for Chesapeake Bay Water Quality Decision-Making Under Uncertainty – Julius-Johnson
Attachment I

Susan Julius and Tom Johnson described the progress in a prototype application of RDM (Robust Decision Making) in the Chesapeake. RDM is a decision framework which provides quantitative estimates of uncertainty related to management decisions and climate change. The proposed STAC Workshop on Climate Change was also discussed.

Discussion and Questions

TIMELINE AND PRODUCTS:

- The RDM analysis will be complete in August 2013
- Disseminate RDM results:
  - Give presentations to CBP, EPA OW and R3, Maryland (MDE, MDNR), and others – Beginning in October
    - Invited to present at the October Modeling Quarterly Review.
- Prepare journal articles – September 2013
  - Prepare RAND report to EPA – September 2013
  - CBP/EPA report focused on policy implications? – Beyond September 2013

Climate Change Forcing Functions – Najjar-Herrmann
Attachment J

Ray Najjar and Maria Herrmann presented a Phase 5 model sensitivity analysis of the separate climate change forcing functions of hydrology including temperature, precipitation change, and potential evapotranspiration. The work is aimed at providing a deeper understanding of estimated hydrologic differences under climate change conditions.

Discussion and Questions

- Consider conducting a storm event study instead of spreading out the precipitation evenly (has been suggested by Bob Hirsch outside of this meeting and was asked to be considered by the Modeling Team).
    - Tom Johnson has conducted this type of analysis and should be contacted for his results.
    - USGS is currently analyzing storm data from 1970 to present.

- When conducting this research consider investigating the implications for water quality.

Modeling the Terrestrial Effects of Climate Change on Nutrient Loading to the Chesapeake Bay – Wilusz
Attachment K

Dano Wilusz (JHU) described his work examining the influence of climate change on trends in nutrients, sediment, and flow in the Chesapeake watershed.

Discussion and Questions

NEXT STEPS FOR DANO WILUSZ:

- Literature Review
    - Document key parameters for testing in the WSM 5.3.2 Runs.
- WSM 5.3.2 Runs
    - Continue developing expertise with model by running changes in temp and precipitation.
    - Adjust for other terrestrial effects and identify the most significant (e.g., ground temp, growing season, and crop mix)
    - Revisit literature review to develop and beta test model enhancements.
- Long term
    - Feed results into Phase 6 development plan and Factors Affecting Trends Work Group.
    - Develop PhD dissertation proposal.

Chesapeake Modeling Lab Action Team Status - Bennett

The status of the response to the NAS recommendation for a Chesapeake Modeling Laboratory was reviewed.

Discussion and Questions

- Modeling Laboratory Action Team is finishing up the recommendation report and having their last face-to-face meeting Monday July 29th, 2013.
    - MLAT will present to the Management Board at their September Meeting.

MINUTES APRIL 24th, 2013 10AM – 2PM

Watershed Modeling for Nanosilver Risk Assessment – Dale
Attachment L

Amy Dale described the development of a nanosilver watershed transport and transformation simulation for nanoparticle risk assessment. Nanosilver is a widely used bioavailable broad-spectrum biocide.

Discussion and Questions

- Silver is a recommendation criteria under the Clean Water Act.
    - There are currently no regulations for nanosilver specifically; it is under the total silver regulations.
    - Total silver is currently regulated as a pesticide on a product by product basis.
    - Silver is toxic to marine species, but not humans.

- Consider policy implications of this work and the implications of different toxicity levels of different forms of silver.

Progress on Lower Susquehanna Dams – Cerco
Attachment M

Carl Cerco described the progress being made on the simulation of the Lower Susquehanna Reservoirs including movement of Jan. 1996 Big Melt storm to June, October, and the simulation of "No Storm" conditions to examine large flow events simulated under Conowingo infill conditions on Chesapeake DO and SAV-clarity.

Discussion and Questions

- Consider conducting a separate analysis of river scour compared to watershed loading of nutrients and sediment during a storm event. This type of analysis was inherent in the January 1996 Big Melt, but could be interesting to investigate other months.

Stoplight Plots of DO and Clarity – Linker-Tian
Attachment N

Updated Conowingo infill scenario stoplight plots of DO and water clarity attainment were presented.

Discussion and Questions

- **ACTION:** The CBPO Modeling Team will transpose the 1996 storm data to 1993 – 1995 to assess the impact on the TMDL.

Tributary Hypoxia: Is it Locally Initiated or Primarily under Bay's Influence? – Wang-Irby
Attachment O

Harry Wang, Marjy Friedrichs, and Isaac Irby of VIMS conducted a data analysis comparing hypoxia onset timing and duration characteristics in the Maryland tributaries. It was found that the hypoxic events in the tributaries distinctly differentiate themselves from the associated events in the main stem of the Bay,

suggesting that the initiation of hypoxia in the tributaries is triggered by local conditions.

Discussion and Questions

- Consider conducting an analysis of the Eastern Shore tributaries since they will be greatly influenced by the bay.

- Feedback from the group towards part 1 of the presentation: The Potomac River has a sill at its mouth and a large load from its watershed, so it is not surprising that the formation of hypoxia in the Potomac is largely independent of the Bay hypoxia. The Patapsco River has a relatively small drainage area and a large mouth, so it is not surprising that it is closely linked with the Bay. There is a paper on the Patuxent River by Bill Boicourt.

Extension of the WQSTM to 2011 and Shallow Water Assessment Plans – Cerco
Attachment P

Extending the WQSTM to 2012 in order to incorporate, for the first time, the shallow water monitoring observations into CBP model calibration was discussed.

Discussion and Questions

NEXT STEPS FOR CARL CERCO:

- Improving Understanding and Simulation of Shallow Water Processes in the Chesapeake Bay (working with Larry Sanford, UMCES).
    - Improve estimates of shoreline erosion loads.
    - Investigate physical processes in Susquehanna Flats.
    - Development of a shallow-water ribbon model.
        - There is the possibility for one or two workshops on modeling shallow-water processes.

Developing Oxidized Nitrogen Atmospheric Deposition Source Attribution from CMAQ for Air-Water Trading for Chesapeake Bay – Dennis-Linker
Attachment Q

A demonstration prototype approach to applying aggregate emission reductions beyond the 2020 Air Allocation Scenario will be reviewed. The prototype demonstration is an approach for establishing CBP airshed/watershed nitrogen exchanges on an aggregate basis for all CBP states using delta emissions from proposed updated state emissions and allocation air scenario in order to account for air nitrogen emission load reductions made beyond the 2020 Allocation Air scenario.

Discussion and Questions

- This topic will be discussed in a conference call to prepare for WQGIT. This analysis is needed prior to the May 2014 evaluation of the jurisdictions' milestones.

SUMMARY:

- Now seeing a potential for significant load reductions using the aggregate approach in the air-water nitrogen exchanges:
    - Makes sense to work at the watershed level.
    - Makes sense to use total state-level NO_X emission reductions.
    - Makes sense to combine NO_X emission reductions across states.
        - Need to determine if states can combine or share efforts on this.
- Working at the state level may be a viable approach when combined with state watershed area attenuation factors.
- Including the reduction in direct load to the Bay is beneficial.
- Presented this to Air Directors Meeting in March 2013 and got concurrence on using the aggregate approach to account for all states and all sectors.
- Through the Air Director's, the Modeling Workgroup, and the Water Quality Goal Implementation Team will develop an air-water exchange procedure to account for nitrogen emission reductions above and beyond what's already accounted for.
- Only implemented emission reduction programs will be counted in the air-water exchanges; double-counting avoided.
- Increases in air emission as well as decreases will be taken into account.
- At the 2017 Midpoint Assessment, the new bi-directional CMAQ and updated scenarios that include the latest State SIPS and national program changes would replace previous air-water exchanges.

Considering Climate Change in the CMAQ Simulation System – Dennis
Attachment R

To prepare for climate change simulations with CMAQ, the VIC (Variable Infiltration Capacity) hydrologic model is being coupled with the WRF meteorological model. VIC is a macro-scale model and techniques to dynamically downscale global climate to regional climate using our WRF meteorological model are being developed at a 12km Chesapeake grid resolution. The coupled WRF-VIC system will work with climate change projections from global models to estimate changes in temperature, surface runoff, ET, and other variables of interest. CMAQ will be driven with these runs to develop changes in nitrogen deposition using mid-century simulations.

Discussion and Questions

- There needs to be a follow up discussion between the CBP Modeling Team and Robin Dennis (and team) about setting up this type of climate change work for the Chesapeake Bay.

- Need to articulate the scenarios used in analyses when presenting on climate change in particular. These meetings may be a great place to determine a set of similar scenarios for climate change for comparison reasons.

Assessment of the Influence of Sea Level Rise in the Chesapeake Bay – Wang
Attachment S

Progress in simulating sea level rise in the mid-century with the CH3D Hydrodynamic Model was presented.

Discussion and Questions

- Two issues: geometry and boundary.
    - The CBPO Modeling Team should consider running the model with changed boundary conditions and no salinity changes.
    - There are 19 layers in CH3D currently. To simulate an increase one can:
        - Increase each layer the same amount – Members of the Modeling Workgroup advocate for this rather than adding a layer or increasing the surface layer.
        - Add a layer.
            - Must consider that biologically the top layer is extremely important, so only increasing the top layer could result in an incorrect simulation from a biological standpoint.

- The CBPO Modeling Team should not necessary match up exactly with the study that Hong and Shen completed. There are many major changes to consider at the open boundary, so the CBP Modeling Team shouldn't restrict the study to exactly match the salinity in Hong and Shen's study.

- The fact that the simulation is showing one affect when salinity is not changed at the boundary and a completely different affect when salinity is changed should be investigated.

- The implications of these types of studies are of public health and water quality concerns.

- **FOLLOW UP:** Conference Call to further discuss the boundary condition with Carl Cerco, Larry Sanford, Harry Wang, Ping Wang, Richard Winfield, and Lewis Linker will be set up in August.

James River CHLa Study: 2012 Summary and 2013 Research – Butt
Attachment T
Attachment U

The status of the James River chlorophyll analysis was reviewed.

Discussion and Questions

- There needs to be a discussion on the level of effort of and whether or not to approve the incorporation of the James River study model into the Bay Model.
    - **FOLLOW UP:** There will be a conference call between members of the CBPO Modeling Team and the James River Chlorophyll a Study Team in fall 2013 to discuss boundary conditions.

Other Discussion Topics – All

- The Modeling WG and partners must work together to create a Climate Change set of scenarios for comparative purposes.
- The Modeling WG should work to develop global climate change modeler contacts.
- The Modeling WG will work with the Modeling Team to devise a comprehensive modeling workplan, Review the workplan in September and provide it to other CBP Workgroups and partners for coordination.

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