Approach to the Selection of Multiple Tributary Models for the Assessment of 2035 Climate Change Impacts in the Chesapeake Watershed and Bay

Quarterly CBPO Science Meeting

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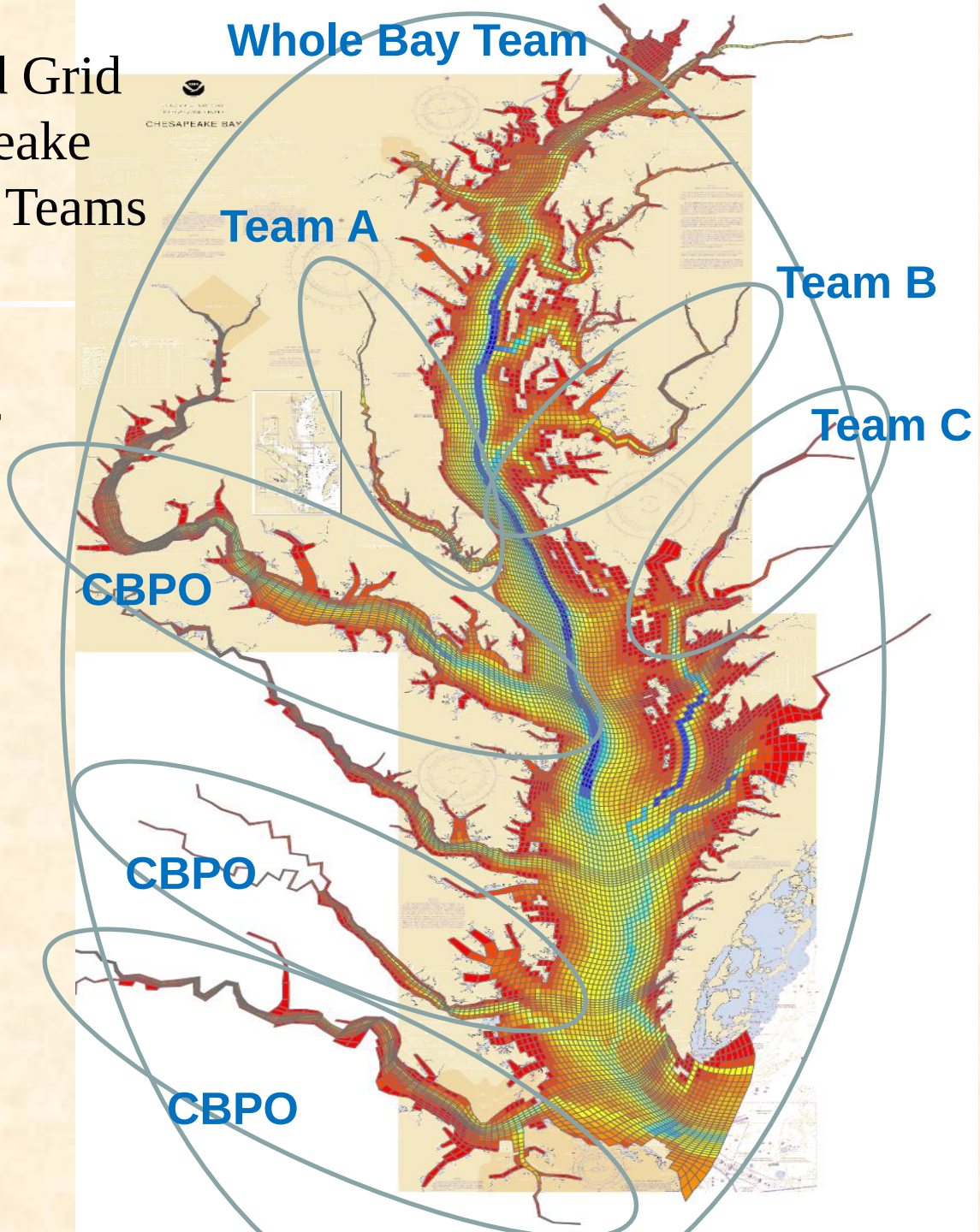
Chesapeake Bay Program
Science, Restoration, Partnership

2022 RFA for Development and Application of MTMs

- EPA is developing a 2022 RFA to support three MTM teams.
- CBPO can support two in-house MTM teams.
- CBPO can also complete the York MTM based on Nicole Cia's previous work in the York.
- Who decides which tributaries will have MTMs? WQGIT decides – Mod WG will proposes process.
- Assume MTM project begins ~ first Quarter of 2023.
- The MTMs will have the following timeline: 2025 Fully Operational, 2026 CBP Review, and 2027 CBP Application.
- The MTM teams will work in close collaboration with each other and with the MBM team.

How an Unstructured Grid Model in the Chesapeake with Multiple Model Teams Could Work

- Main Bay Model (MBM) of all tidal waters used for integration of tributary model findings and for management scenarios.
- Multiple Tributary Model (MTM) teams working in tributaries and sharing collaboratively information with all model teams on a quarterly basis.
- Similar to CMAQ multiple model approach.
- CBPO could do Potomac, James, and York.



2022 RFA for Development and Application of MTMs

- Suggest CBP partners reserve the Potomac, James, and York for CBPO in-house MTM work because of possible assessments that could be done by VA, MD, and/or DC in 2027 or beyond.
- CBP partners will choose the five tributaries for MTM development and application. The Potomac & James should be included in the MTMs chosen (3+2+York) even if CBPO does the MTM work.
- CBP partners can choose among the Patuxent, Choptank, Rappahannock, Chester, Nanticoke/Wicomico, the Upper Bay, and other tributaries for the three RFA MTMs.
- The July Quarterly initiates the descussion of the process for the selection of the three tributaries to be assessed by MTMs.

Criteria CBP Partners could use for MTM selection:

- Prioritize tributaries with management challenges.
- Prioritize well-studied tributaries with multiple monitoring and shallow water monitoring sites and with a sizeable body of research.
- Prioritize tributaries with oyster sanctuaries and/or a high concentration of filter feeder aquaculture.
- Prioritize tributaries that have, or are adjacent to, the new high frequency tidal monitoring sensors being deployed in 2022-2023. (Also, a coordination opportunity with CBP monitoring.)

Criteria CBP Partners could use for MTM selection:

- Large tributaries should be prioritized.
- Prioritize tributaries that can best support and inform water quality processes in the Chesapeake Bay Main Bay Model (MBM).
- Prioritize tributaries where current model performance with the CBP 2017 Bay Model is particularly deficient.
- Assuming that the Potomac, James, and York are a given for MTM work, the Eastern Shore tributaries are underrepresented.

Motivation for Development and Application of MTMs

Assisting and Improving All Tidal Chesapeake TMDLs. The MTMs will be able to bring all the TMDLs in Chesapeake tidal waters up to date and link with the latest 2025 watershed, airshed, and estuary models. This will allow an updating and integration of local tidal Bay TMDLs completely into CBP's 2025 Chesapeake TMDL. A major advantage of the MTMs would be the ability for updating of all Chesapeake tidal water TMDLs to future climate change conditions and to have them be entirely consistent among themselves and to the overall Chesapeake TMDL.

Motivation for Development and Application of MTMs

Resolving Special Issues - James River Chlorophyll TMDL. The MTMs will be able to resolve special issues like the James Chlorophyll TMDL. The James River chlorophyll TMDL is currently oriented to 2025 climate change conditions but there is an interest in updating the TMDL for climate change conditions anticipated beyond 2025. With the MTMs this can be done by taking advantage of the CBP work in the assessment of 2035 conditions with updated watershed, airshed, and estuary models and in leveraging the combined analysis to provide the most complete assessment available for the James Chlorophyll TMDL at least cost.

Motivation for Development and Application of MTMs

Improved Assessment of Shallow Water Processes. The MTMs will be able to better assess shallow water processes in the shallow Open-Water regions of the Bay. It is notable that the majority of the 93 Chesapeake TMDL segments, also called designated uses, have only an Open-Water DO water quality standard and entirely lack Deep-Water DO and Deep Channel DO standards. The current 2017 CBP Bay Model is unable to effectively simulate shallow water Open-Water DO standards under climate change conditions. Generally, the simulation of shallow water processes are poorly understood and documented. The MTM models will provide the CBP partners with enhanced decision support tools for determining how to best restore and protect the Bay's extensive shallow water habitats. Also, the ability to better simulate the fate of key living resources under climate change such as SAV, tidal wetlands would be improved with MTMs.

Motivation for Development and Application of MTMs

Increasing CBP Science and Analysis in Chesapeake Climate Change Impacts. The MTMs will fully integrate and dovetail into the MBM by increasing the CBP science teams looking into Chesapeake water quality in shallow tidal waters. Over the course of the project, multiple modeling teams will apply at a fine scale grid the same unstructed model codes, water quality state variables, and watershed and airshed loading as the MBM in different Bay tributaries. The MTM teams will improve Chesapeake Bay shallow water simulations of dissolved oxygen, chlorophyll a, suspended solids, and water clarity in order to better understand the impacts of alternative management strategies on water quality and living resources in the tidal Chesapeake Bay. In addition, the MTMs will be able to utilize the CBP investment in shallow water continuous monitoring for the first time in the Chesapeake TMDL. The MTMs would augment the MBM in collaborative investigation approach with the MBM team collaborating and coordinating with all of the MTM teams on a quarterly basis over the entire project period. Under this structure all would learn from the others in understanding and simulating the new shallow water nutrient dynamics and processes, improving both the MBM and the MTMs.

Adherence to STAC Guidance on Bay Modeling.
The MTMs support the recommendations by STAC in the 2019 report *Chesapeake Bay Program Modeling in 2025 and Beyond: A Proactive Visioning**

* Hood, R.R., G. Shenk, R. Dixon, W. Ball, J. Bash, C. Cerco, P. Claggett, L. Harris, T.F. Ihde, L. Linker, C. Sherwood, and L. Wainger. 2019. Chesapeake Bay Program Modeling in 2025 and Beyond: A Proactive Visioning Workshop. STAC Publication Number 19-002, Edgewater, MD. 62 pages.