Modeling Workgroup Quarterly Review

July 16, 2019

CBPO Conference Room - The Fish Shack

Event webpage:

https://www.chesapeakebay.net/what/event/july_modeling_wg_inperson_meeting

Phase 6 Climate Change Model Development – Gary Shenk, USGS-CBPO

Gary presented an overall plan and schedule for the 2019 model development of the Phase 6 simulation of future climate risk in the Chesapeake watershed and tidal Bay. The presentations today asked for approval by the Modeling Workgroup. The material planned for review in the October Quarterly was outlined.

Gary went over the CBP climate work plan from 2018 to 2021 and the plan for 2019 specifically. Gary highlighted the decisions needed to be made by the Modeling WG during July Quarterly Meeting and October Quarterly Meeting. Documentation for July topics was sent out to MWG, CRWG, and interested parties on June 28th. Next three presentations followed this one will talk more in depth on the July decisions.

Discussion:

- Dave asked if diversion was ignored in this review process.
    - Gary responded that diversions data is available up to 2014 and it is marked as completed.
- Gary provided the list of sections for approval below.
    - Land use
    - Agricultural data
    - Carbon Dioxide Effect
    - Combined Sewer Overflows
    - WWTP and other sources
    - Diversions
    - Groundwater travel time
    - Growth and respiration curve modifications
    - Ignore Wind effects
    - Sea level rise
    - Ocean boundary temperature and salinity

Simulation of Precipitation and Other Watershed Processes – Gary Shenk, USGS-CBPO

The approach taken for meteorology and precipitation (Section 2) land use (Section 3.2) agricultural inputs (Section 3.3) non-CSO direct loads (Section 3.4.2) CO_2 stomatal resistance (Section 4.1) deterministic simulation of hydrology and sediment (Section 4.2.3) and groundwater lag (Section 4.7.3) was reviewed.

For additional information, please review the documentations (pdf version and word version) posted on the webpage.

Topics being reviewed in July Meetings

Section 2: Climate Inputs

• Precipitation • Temperature • Potential Evapotranspiration • Carbon dioxide

Section 3: Land use and Management

• Land use • Agriculture • WWTP and other direct sources • Diversions
Section 4: Simulation
• Carbon Effect • Use of HSPF for hydrology • Use of HSPF for sediment
Discussion:

- Dave asked for clarification that 2.67% increase in annual rainfall for 2025 projection is for every month and Gary confirmed.
- Karl commented that using Groisman et al. published in 2004 for intensity reference maybe outdated. Lew responded that Groisman referenced used 100-year record.
    - Gary added that this information will be reviewed again in 2025.
    - Kyle echoed Karl's point and recommended Gary to go over the deciles again in slide 5. Kyle expressed concern with the methodology of precipitation distribution on slide 6.
    - Mark responded that to do that we need to abandon 1990 to 2000 hydrology but at the moment we can't do that.
- Bill pointed out that precipitation and pet are not directly coupled, and it is wrong to not coupled precipitation and PET during 2035 to 2055. Bill added that it may be worthwhile to try to couple these two in one of the years and see what correlation between the two.
- Carlington pointed out the precipitation for 2035, 2045 and 2055 are very different.
- Scott asked why the precipitation applied evenly to each month even though most of the rainfall is in the highest decile. Mark responded that it is because of statistical validity. He added that when breaking the GCM result into months, we lose the statistical validity.
- Bill recommended to address uncertainty in future modeling workgroup work.
- James raised the concern that the impact of climate change on agriculture was not thoroughly investigated: the effect of climate change on agriculture would be tremendously important in terms of growing season, the length of growing season, and cover crop.
    - Gary recommended that we accept the methodology on agriculture and make a note and plan for better estimate of climate effect on future years.
- Bill raised the uncertainty associated with the sediment simulation with the HSPD.

DECISION: Modeling Workgroup accepted all the sections of the Climate Change assessment documentation with Virginia abstaining.

Simulation of CSO loads Under Future Climate Hydrology – Isabella Bertani, UMCES

The simulation of combined sewer overflow (CSO) loads under future climate hydrology (Section 3.4.1) was discussed and reviewed.

Discussion:

- The motivation for CSO projections under climate change is due to workshop recommendation by STAC climate change workshop that overflows could be assessed through the existing
- combined sewer overflow model at the CBP. Isabella went over how historical CSO are obtained and the methodology used to project future CSO volumes under climate change effect. It is estimated that by 2025 there is a 2.1% increase in CSO.
- Gary pointed out the estimated changes in CSO volumes under future climate change scenarios are based on no action loads.

Simulation of Sea Level Rise, Ocean Boundary, and Other Estuarine Processes – Richard Tian, UMCES

The simulation of sea level rise (Section 5.1.3) ocean boundary, (Section 5.1.4) wind (Section 5.1.2) and expansion of algal growth and respiration curves (Section 5.2) was reviewed.

Discussion:

- Carl raised concern with both the temperature control and respiration being changed in the model.
    - Richard responded that the change was recommended during both quarterly review and modeling quarterly review because they are strongly related to climate change.
    - Carl added that this decision is a judgment call but he recommended against it.
    - Richard added that Raleigh and others recommended temperature control on phytoplankton respiration Q10 should be changed in the model.
    - Carl recommended Richard to make additional run with temperature adjustment to the growth but not to the respiration and see if there is tremendous difference.
    - Richard recommended to loop Raleigh in this process.

DECISION: Growth curve adjustment is accepted but more analysis needed with respiration adjustment.

- Richard recommended wind speed change is a minor change in climate change assessment.
- Larry commented that a published paper indicated that wind direction would have major influence on hypoxia.
- Lew added that GCM models show no trend in wind direction.
- James recommended adding wind direction analysis in GCM into the documentation.
- Lew will email Ray Najar to get related information.
- Richard asks for group's decision on if the salinity change at the entrance of the bay or just non adjustment or non-adjustment for SLR but adjustment for climate change. And the graphs show no change at the deep layer. Saba et al. suggests that the salinity change could due to reasons other than sea level rise.
    - Richard added that Pierre's presentation tomorrow will provide what other models suggested.
    - Carl commented that these three predictive models are different and the modeled result could be different.
    - Pierre recommended increasing salinity at the open boundary.
    - Mark added that Marjy's previous comment that salinity should be changing at all water columns, and there is no significant difference between top and bottom column.
    - Pierre added that other models suggest changing salinity at the open boundary.

DECISION: The workgroup approved to adjust salinity at the open boundary as currently represented in the documentation rather than the method proposed in the presentation.

- VADEQ is interested in water supply under climate change using phase 6 and they have been using the phase 5 models and they will need to take up Gopal's time to do that. In exchange, DEQ will fund rogram that will benefit the bay program through USGS. The

raised proposal is to have a better understanding on water supply and diversion on a finer scale at the Chesapeake Bay watershed and how that will change under climate change.

- James raised the question regarding the Rap loads in Figure 4-11 in the documentation and is curious to understand why Rap is higher than what he would expect.
    - Gary will add documentation regarding James's question.

Meeting Participants:
Mark Bennet
Gary Shenk
Lew Linker
Cuiyin Wu
Richard Tian
Danny Kaufman
Isabella Bertani
Dave Montali
Carlington Wallace
Bill Keeling
Bill Ball
Guido Yactayo
Cassandra Davis
Ted Tesler
Karl Berger
Scott McLaughlin
Glint Gill
Rebecca Murphy
George Onyullo
Kyle Kurtis
Bill Ball
Clifton Bell
Jenifer Sincock
Emily Trentacoste
Larry Sanford
Robert Burgholzer
Pierre St Laurent
Hassan Mirsajadi
Mukhtar Ibrahim
Bruce Michael
Pierre St-Laurent

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Impacts of Sea Level Rise on Chesapeake Hypoxia: A Multiple Model Intercomparison Project – Pierre St-Laurent, VIMS

Progress made in assessing the influence of sea level rise on Chesapeake hypoxia through a multiple model intercomparison project was presented by Pierre.

Discussion:

- Lew pointed out the ICM model underestimate the hypoxia level at the Rapp river.
- Lew recommended Pierre to extend the physical changes caused by SLR experiments up to the Oligohaline area. He added if possible tributary result will be also valuable.
- Carl pointed out the top panel of CH3D covers area from Conowingo to the bay mouth on slide 12.
- Lew pointed out to STAC recommendation is to move the boundary off the shore
- Gary asked the why salt mass increase in the bay but the flow out increase under climate change and concentration has no change at the boundary (slide 13).
    - Richard commented that relative increase of outflow of salinity in the surface is higher than the bottom

Change in Temperature discussion:

- Carl disagreed the reason of the change in delta T but rather because of importing more heat from shelf water in the winter.
    - Larry agreed it is the effect from the shelf.
    - Lew recommended additional runs to reconcile the disagreement.
    - Larry added that increased tidal mixing is another explanation.
    - Dave asked if the change in boundary condition is consistent across the runs.
- Gary pointed out the we haven't investigate the SLR effect on the size of change in DO concentration at the surface mix layer and concentration at lower mix layer. This is related to how the attainment is measured at the Bay Program.
- Lew added that half meter SLR of CH3D model should be sent to Pierre by beginning September.
- Carl recommended looking into the vertical transport and horizon transport.
- Larry echoed with Carl and added that for estuarine circulation it is important to have uniform upward direction, which will explain the salt and temperature change.

Analysis of Nutrient Limitation Changes in the Bay – Qian Zhang, UMCES

Qian described an analysis of observed nutrient concentrations in the Chesapeake that estimates changing nutrient limitation patterns in the Bay with the ongoing nutrient reductions of the Watershed Implementation Plans.

Discussion:

- Lew asked about the classification of Spring.
    - Qian responded that it is from March to May.
- Lew asked the definition of light limitation.

    - Qian responded that Tom defined it as lack of response to Nitrogen and Phosphorous.
- Lew added that policy implication for this analysis should be considered by the team.
    - Gary added that this analysis is important in terms of validating next phase model.
- Clifton B had a concern with including seasonality pattern since the seasonality is changing under climate change. Clifton asked if validating the model through this work is in the schedule.
    - Gary responded that it is not included in the schedule.
    - Dave added that this will be in the 2023-2025 timeframe.
- Lew discussed with group on the condition to launch the new bioassay monitoring.

Scenario Optimization Tool for CAST – Daniel Kaufman, CRC

Danny will provide an overview of the ongoing development and improvement of a CAST BMP optimization tool. Strategies for expanding the set of BMPs included in the current Beta-1 optimization system will be described, along with online tool updates to a second Beta version planned for October.

Discussion:

- Dave recommended coming back with update in October and asked about the end of current funding cycle.
- James asked about the next beta release and how broad we would like to cover. He added that with Beta 2 release, in order to receive constructive feedback. We need to follow up the presentation with an email including a link, additional information, and detailed timeline.

Preliminary Analyses on Spatial and Climatic Factors Influencing Nitrogen Speciation Across the Chesapeake Bay Watershed – Isabella Bertani, UMCES

Overview of preliminary results on the analysis of WRTDS data to understand Nitrogen speciation patterns across the watershed as a function of climatic, geomorphological and land use factors.

Discussion:

- Qian recommend for slide “candidate predictors of N specification” to compile a dataset of baseflow.

Conowingo Pilot Project – Scott McLaughlin and Deni Chambers, Northgate Environmental Management, Inc.

Scott and Deni will provide an update of progress on the Conowingo Pilot Project including development of a sediment sampling and analysis plan in the Conowingo Reservoir.

Discussion:

- Scott provided an update on the pilot program for beneficial reuse of dredged sediment and assessment of sustainable long-term solutions. They have been performing data gap analysis. The dataset is limited in terms of the depth of the sampling. The next step is to perform the modeling analysis. He reviewed the potential beneficial use.
- Dave commented that not all the dredge materials are the same and if they have plan to work on the fine grain materials.

- Scott mentioned that this program will potentially evolve into an annual dredging program.
- Deni mentioned that they are investigating a creative way to use the fine grain dredging materials. They will be dredging 365 days of the year and the group will investigate on interpolating the transact.
- Larry commented that it would be great if Exelon will be willing to share the model with the public.
- Carl added the corps of engineer researched years ago they found that it is economically unfeasible to dredge the materials.

Meeting Participants:
Marjorie Zeff
Hassan Mirsajadi
Larry Sanford
Carl Cerco
Cassandra Davis
George Onyullo
Mukhtar Ibrahim
Qian Zhang
Clifton Bell
Guido Yactayo
Gary Shenk
Lew Linker
Cuiyin Wu
Richard Tian
Danny Kaufman
Isabella Bertani
Dave Montali
Rebecca Murphy
Scott McLaughlin
Deni Chambers
Mark Bennet
Ted Tesler
Clint Gill
Pierre St-Laurent