Simulating Impacts of Climate Change on the Estuary

1. **Comparison of existing climate change simulation results**
   - What are the largest discrepancies and how can they be remedied before 2019?

2. **Next generation estuarine model**
   - What is needed to extend climate change simulations 2050?
   - What needs to be done before 2025? After 2025?

3. **Uncertainty**
   - How can model uncertainty be quantified?
   - How can confidence/uncertainty be communicated to stakeholders?

4. **STAC Synthesis**
   - What are the most critical needs for synthesis and research?

Recommendations for short-term WQSTM analyses

1. Examine model parameterizations – temperature-dependence:

- Revise WQSTM temperature parameterizations
  - → Modify growth curve for phytoplankton (exponential rather than flattening; should not change calibration too much, because only changing impact of very higher temperatures)
  - → Also examine T-dependent mortality/grazing/remineralization terms

2. Examine forcing – wind:

- M. Herrmann has provided the CBP with future winds; how do these (minor) changes in winds impact hypoxia in WQSTM?
  - → weaker winds? Small change in direction?
  - → run scenario with delta change in winds

3. Examine conflicting results – SLR:

- Why are we getting opposite SLR results?
  - → Same result with and without reduced nutrients
  - → Is this a water quality discrepancy or a hydrodynamic discrepancy?

Recommendations for medium-term analyses

Medium term

- Conduct rigorous multiple model comparison and skill assessment (fit-to-purpose) over historical time period over which we have data (1985-2018)

  → Will likely provide additional confidence in modeling system

Recommendations for long-term analyses
(Important modeling issues that need to be examined for next generation model)

Physical model structure:

- Carefully add high resolution where we need it (not where we don't)
  → unstructured grid is required
- Wetting/drying (expanding coastline)
- Include spectral wave model (to get shoreline erosion and sediment transport)
- Moving boundary condition offshore
  → Relax to observations where we have them at Bay mouth
  → Re-examine outer boundary conditions – obtain from MAB modeling efforts (Note not clear yet if MAB is increasing or decreasing salinity (right at latitude between reducing and increasing S)

Recommendations for long-term analyses
(Important modeling issues that need to be examined for next generation model)

Model WQ parameterizations:

- Improve temperature-dependent and salinity-dependent parameterizations
- Investigate invasive species (with scenario runs)
- Consider potential for new HAB species
- Examine changing stoichiometric relationships (e.g. N:P ratios)
- Improved marsh/wetland models (account for changes in Zostera)
- Consider adding zooplankton back into WQ model (perhaps single group)
- Acidification (critical for oysters)

Recommendations for long-term analyses
(Important modeling issues that need to be examined for next generation model)

Model forcing:

- Look at future atmospheric forcing; more low pressure systems?
- Examine impact of change in tide range (15% change?)

Model impacts:

- Look at things other than hypoxia – examine impact on water clarity, chlorophyll, productivity….
- Look at impacts on higher trophic levels

Q3: Uncertainty

How can model uncertainty be quantified?

- Ensemble of different estuarine models
- Examining different parameters and formulations
- Examining different GCMs and downscaling methods
- Emission scenario less important by 2025 and 2050

How can uncertainty be communicated to stakeholders? (Requirement of providing one number to managers…)

How much risk are stakeholders willing to take?

- If OK with 10% risk that this will happen, then….. x
- If OK with 30% risk that this will happen, then….. y
- If OK with 50% risk that this will happen, then….. z

We can really provide "one number" only if managers tell us what amount of risk they want

Q4: STAC Synthesis

Resolution of SLR discrepancy!

- Why are we getting opposite SLR results?
  - → Same result with and without reduced nutrients
  - → Is this a water quality discrepancy or a hydrodynamic discrepancy?

→ Absolutely critical

→ Something we can do within 3-8 months