WQSTM Shallow-Water Simulation

• We received the shallow-water database from CBP circa autumn 2012.
• These are grab samples and measures collected when continuous stations are serviced and coincident with Dataflow cruises.
• More than 750,000 records.
• Roughly 84,000 useful observations.
• Observations are evenly distributed from April to October.
• We need a model from 2003 to 2011 to encompass these observations.
WQSTM Shallow-Water Simulation

• We are now running 2002 – 2011 as our calibration and development focus.
• Three graphical examinations of performance in shallow water:
  – Scatter plots of computed vs observed.
  – Cumulative distribution plots of computed and observed.
  – Comparisons to performance in deep water.
56920 Cell Grid (Run 9)

Dissolved Oxygen
mg/L

- Mean Diff: 0.6419
- Abs Mean Diff: 1.5356
- RMS: 2.0471
- Rel. Diff: 20.5485
- Number of Pairs: 21285

56920 Cell Grid (Run 9)
Salinity
PPT

- Mean Diff: 0.1238
- Abs Mean Diff: 1.3914
- RMS: 2.1226
- Rel. Diff: 17.8661
- Number of Pairs: 21486

56920 Cell Grid (Run 9)
Temperature
Degrees C

- Mean Diff: 0.1133
- Abs Mean Diff: 1.3629
- RMS: 1.8284
- Rel. Diff: 6.2824
- Number of Pairs: 21484
Mean Difference = model - observed

SW = shallow water
CB = Chesapeake Bay
Absolute Mean Difference characterizes the distance between computations and observed.

SW = shallow water
CB = Chesapeake Bay
Performance Summary

• In shallow water, the model provides representative computations of physical quantities: temperature, salinity, dissolved oxygen.

• Performance is comparable to model performance in the mainstem Bay.
Performance Summary

• In shallow water, there is little correspondence between individual observations and computations of “biogeochemical” substances.

• In shallow water, the model falls short in computation of all particulates, organic and inorganic.

• In this regard, model performance differs between shallow water and mainstem Bay.
What’s Going On and What to Do?

• Our wind-wave model is “fetch limited.” Where there’s no fetch there are no waves, limited bottom shear stress.

• This affects areas in constrained tributaries but not open shorelines.

• This influences inorganic particles but not organic particles which are not incorporated in the sediment transport model.
What’s Going On and What to Do?

• We don’t have any data on the particle distribution of eroding shorelines and marshes. We might have a significant fraction of small particles ("wash load").

• Increasing the fraction of fines in our bank erosion load will likely increase TSS in nearshore areas. We don’t know the impact on the mainstem Bay.
What’s Going On and What to Do?

• Organic particles still use our old concept of net settling so resuspension is not an issue.
• In shallow water, the net settling out of the water column is 1% of settling rate through the water so we’re not settling a lot of material in any event.
• It appears we need more primary production of organic particles in shallow water.
What’s Going On and What to Do?

- How do we increase phytoplankton abundance and production in shallow water without adversely affecting the computations in open water?
- Resuspension of benthic algae?