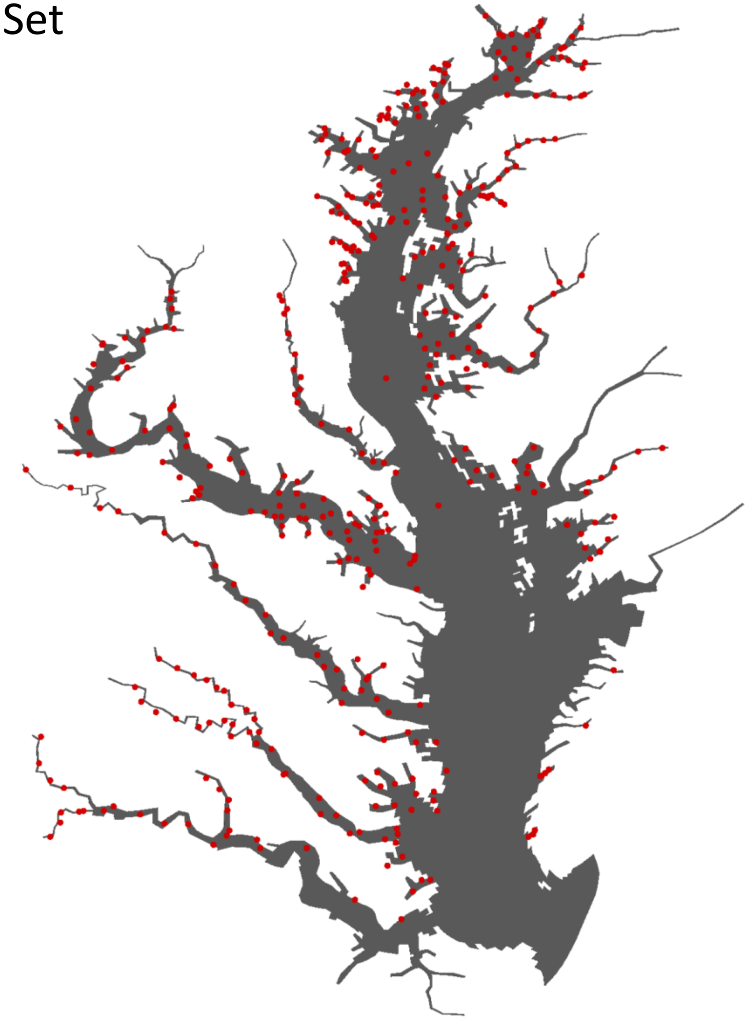
WQSTM Shallow-Water Simulation

- 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.

WQSTM Shallow-Water Simulation

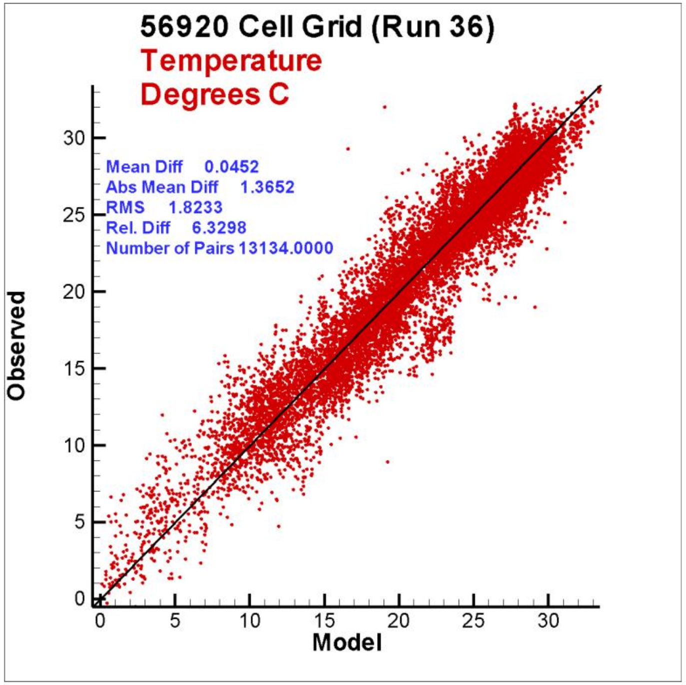
- We've reviewed the data and eliminated all stations more then two model layers deep.
- This eliminated roughly 20% of the data.
- We've repeated model-data comparisons with the latest model version and loads.

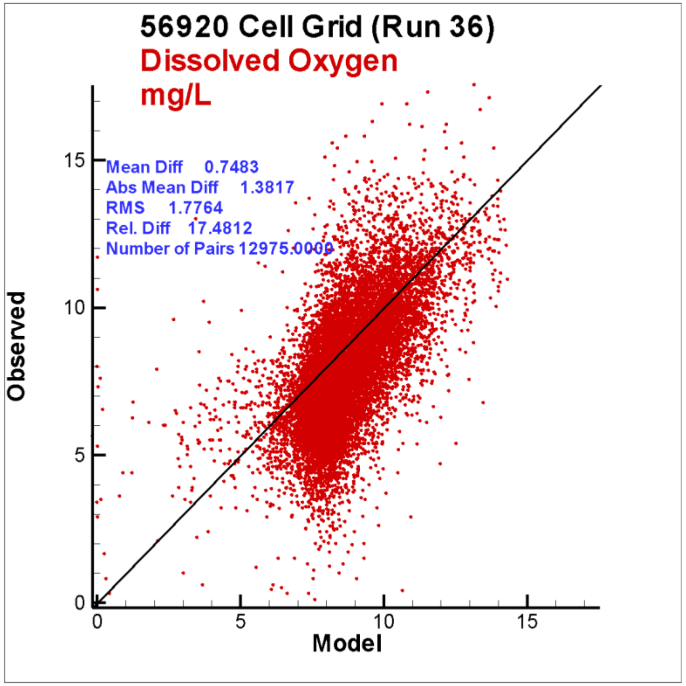
Complete
Data Set

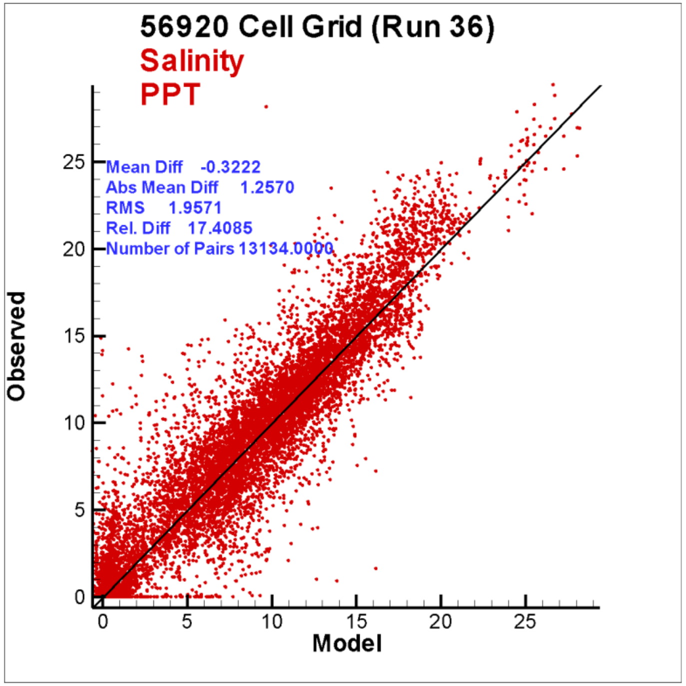


Revised,
< 4m deep

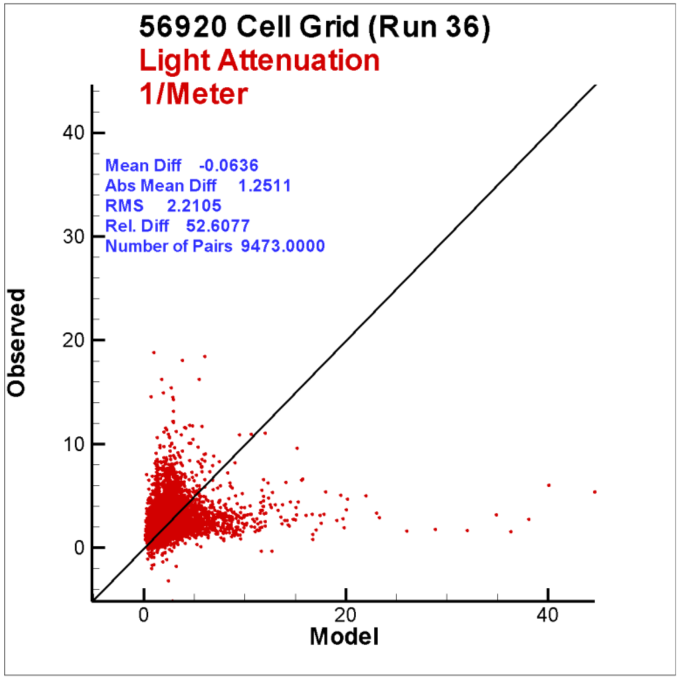
We're in reasonable agreement with physical quantities such as temperature, salinity, dissolved oxygen.

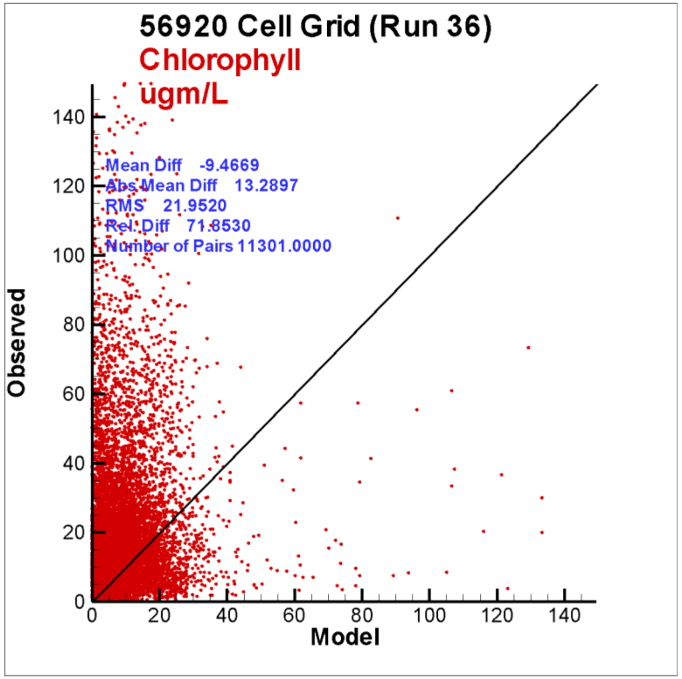


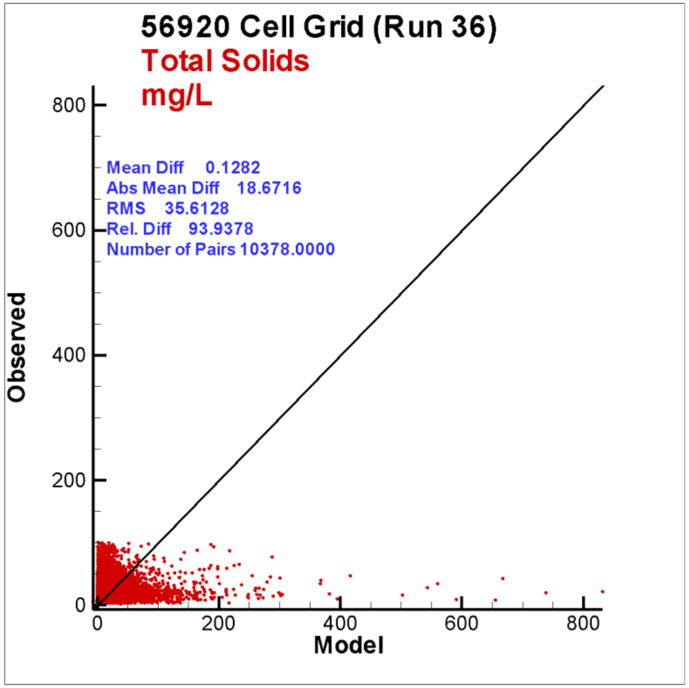




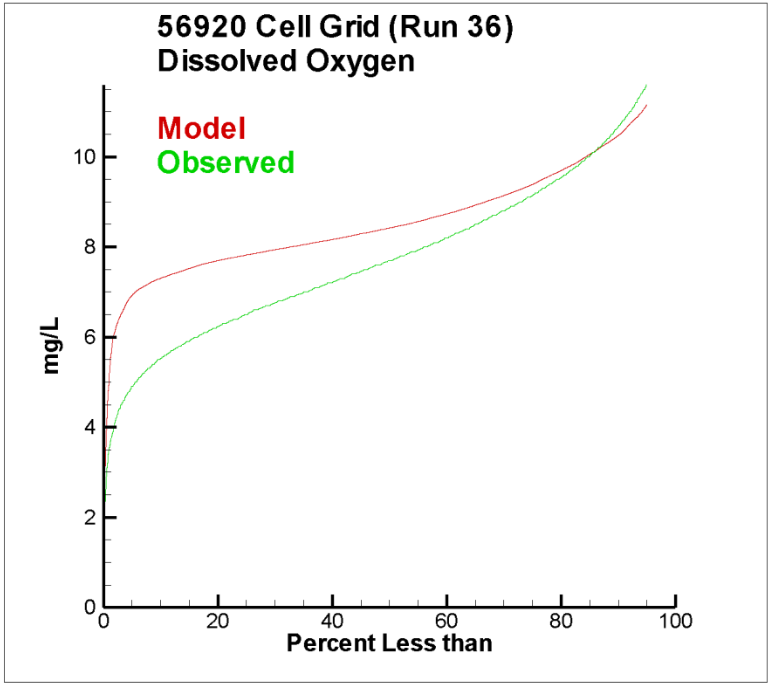
There's little correspondence between individual observations and computations of "biogeochemical" substances.

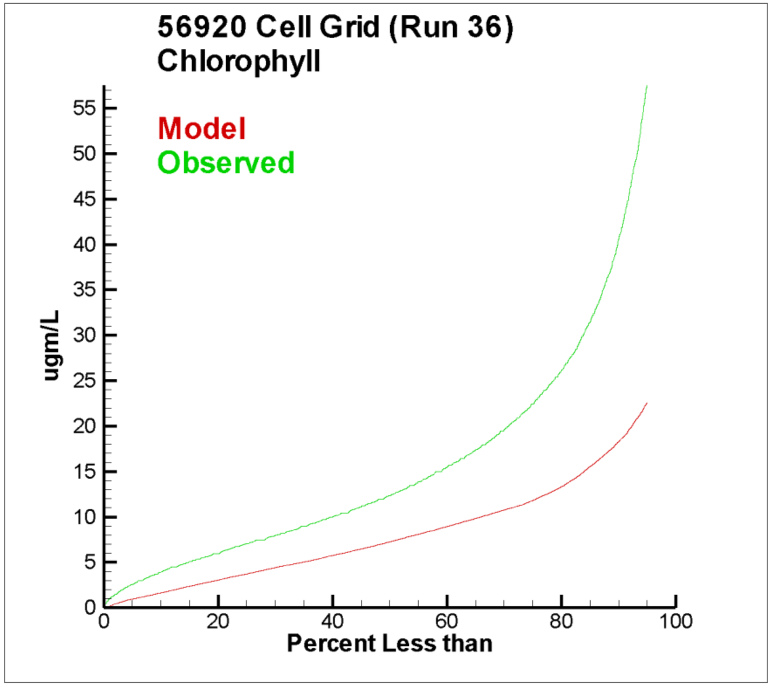


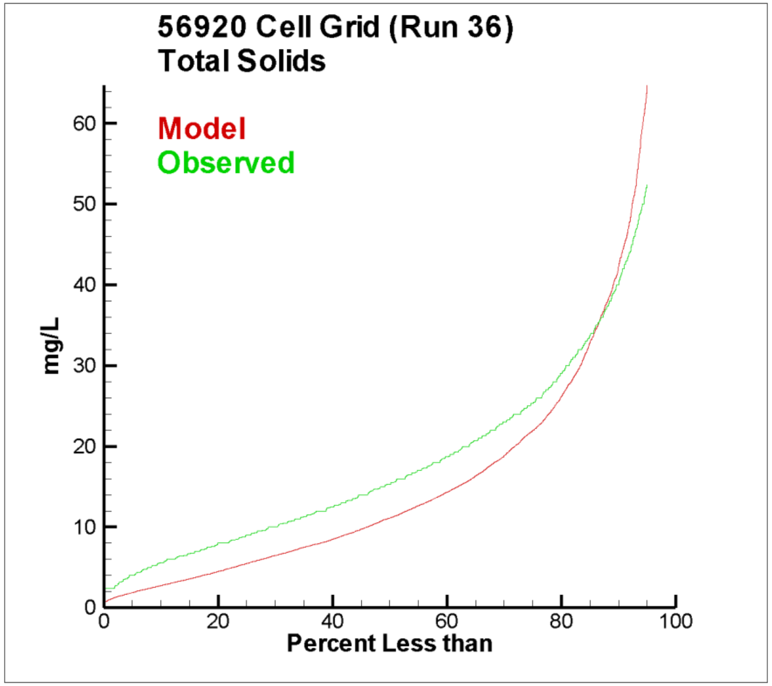


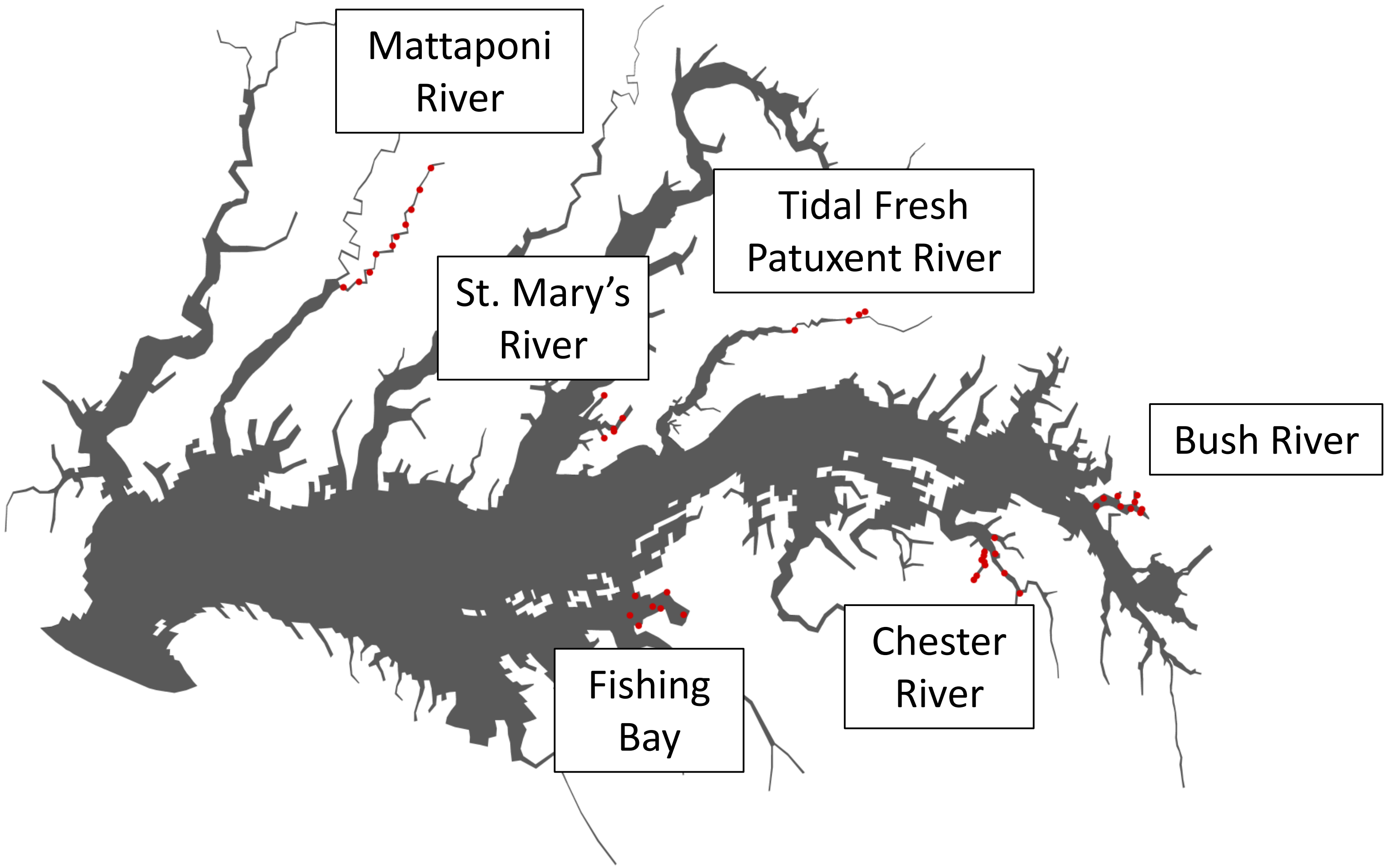


Overall, we tend to be low on chlorophyll, TSS, high on dissolved oxygen.








Mattaponi River
Tidal Fresh Patuxent River
St. Mary's River
Bush River
Chester River
Fishing Bay

Mattaponi River – Tidal fresh environment, abundant wetlands. Continuous monitor at Muddy point, Walkerton.

St. Mary's River – One of many Potomac embayments, well-monitored, some management interest.

Tidal Fresh Patuxent – Abundant wetlands, usually a problem area for the model. Continuous monitor at Jug Bay, Iron Pot Landing.

Bush River – Typical upper Bay embayment. Continuous monitor at Lauderick Creek.

Chester River – Site of shallow-water multi-modeling effort. Will allow for inter-model comparisons between system-wide and individual models. Continuous monitoring at Ralph's Wharf and Deep Landing.

Fishing Bay – Lower eastern shore embayment. Under influence of wetland erosion. Several continuous monitoring stations.

First Indications

- The selected systems are characterized by high chlorophyll (> 20 µg/L) and low DO (≈4 mg/L during daylight hours).
- The St. Mary's River is a standout. Repeated complete anoxia.
- The Bush and Chester are standouts. Chlorophyll repeatedly attains 100 µg/L or more.

First Indications

- Problem: How can we raise chlorophyll concentration while simultaneously lowering DO concentration?
- Nutrients aren’t always so abundant as to readily support additional phytoplankton.
- Are there pH effects with bottom sediments? Anoxia effects? What happens at night?

First Indications

- Can we generalize model parameters across systems? What parameters/processes from the Bush River can be applied to Fishing Bay?
- It appears our erosion rates etc. for Blackwater aren't helping the model results in Fishing Bay.

Where Are We Going?

- Improve model performance in selected shallow-water regions.
- Potential interaction with multiple investigations:
  - Climate change and sea-level rise,
  - Wetlands module,
  - Shoreline nutrients,
  - Reactivity of eroded materials.

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.
- A model with more resolution and/or improved wave dynamics might provide a better representation of bottom shear stress.

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.
- The shallow-water teams might investigate effects of varying particle size in eroded material.

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?.
- A new shallow-water algal group?