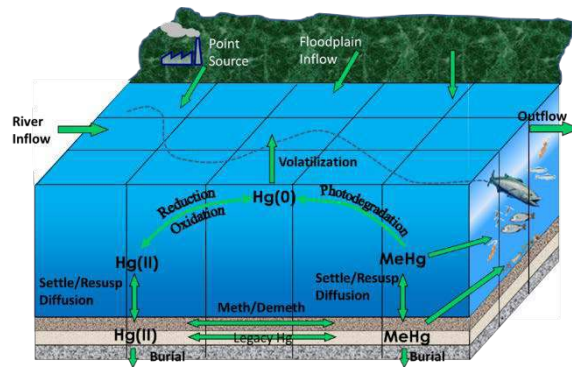
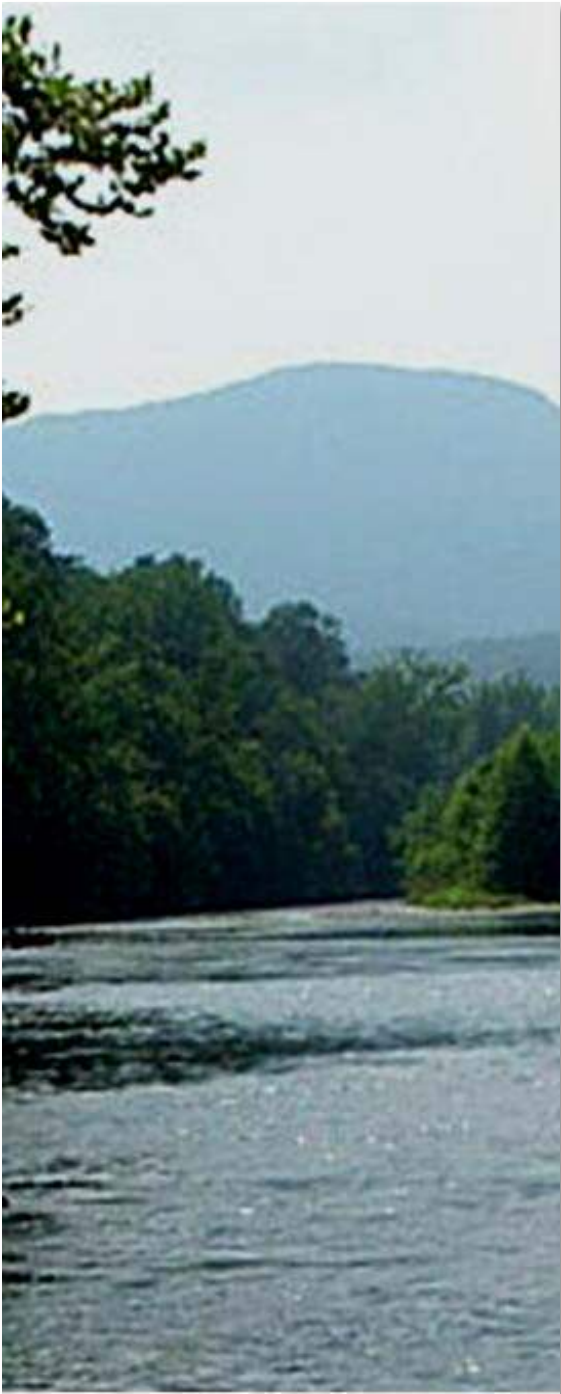


Mechanistic Mercury Modeling in the South River Project Update



Reed Harris, David Hutchinson and Don Beals
RHE Ltd.

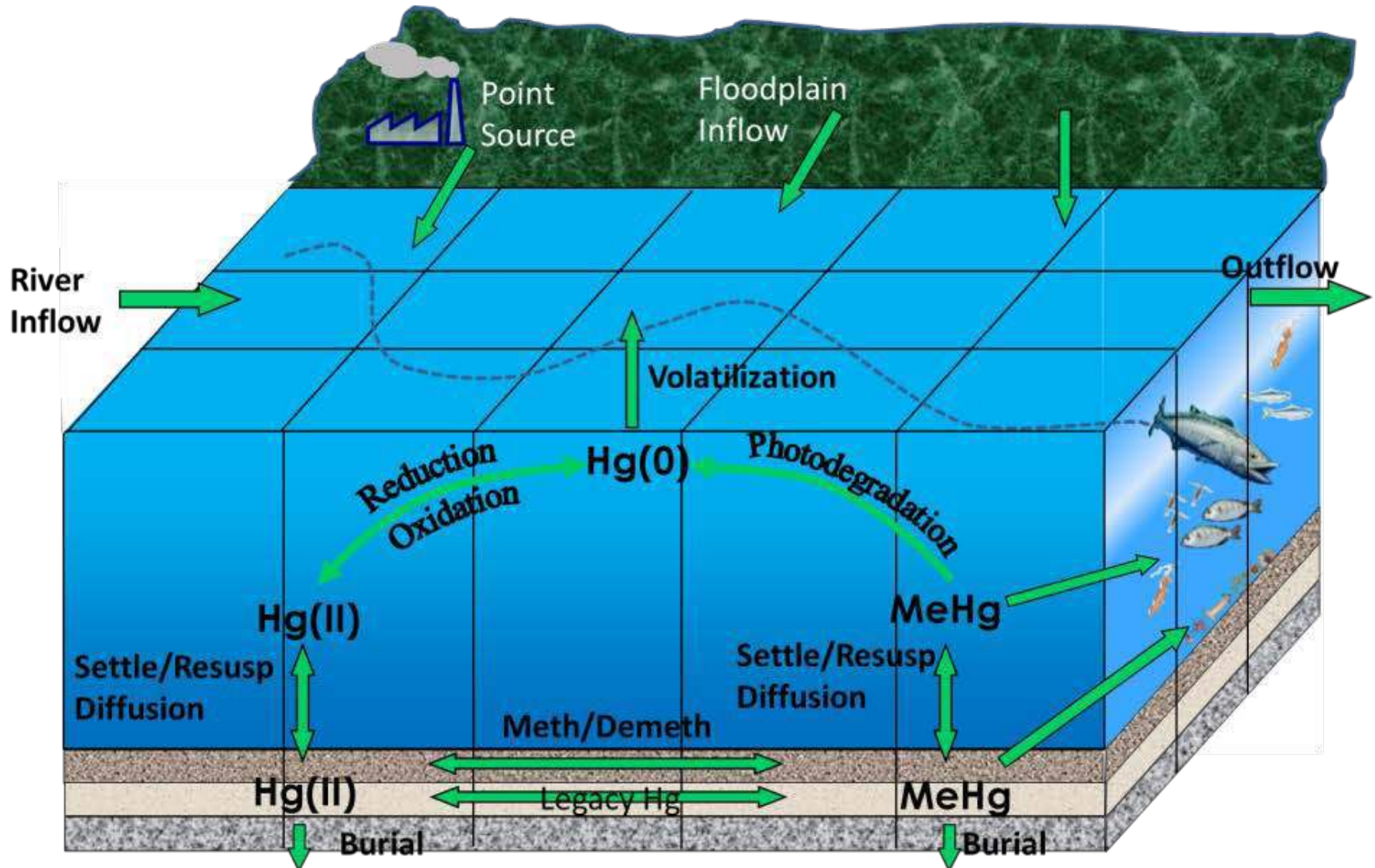
April 5, 2016



Presentation Overview

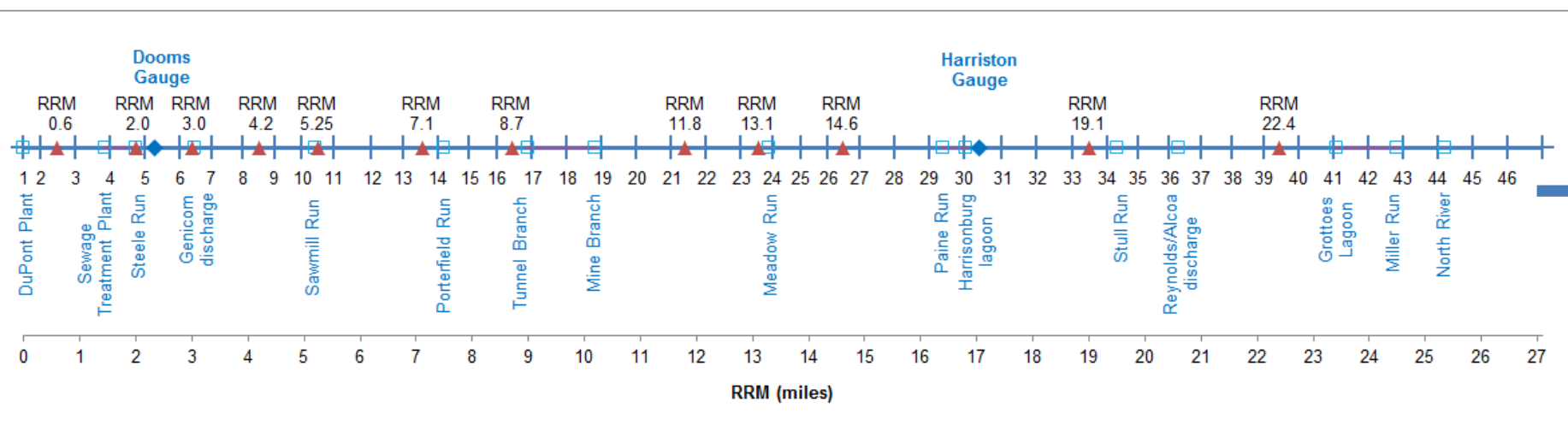
- Brief model description
- Results
- Puzzles
- Next steps

D-MCM Overview

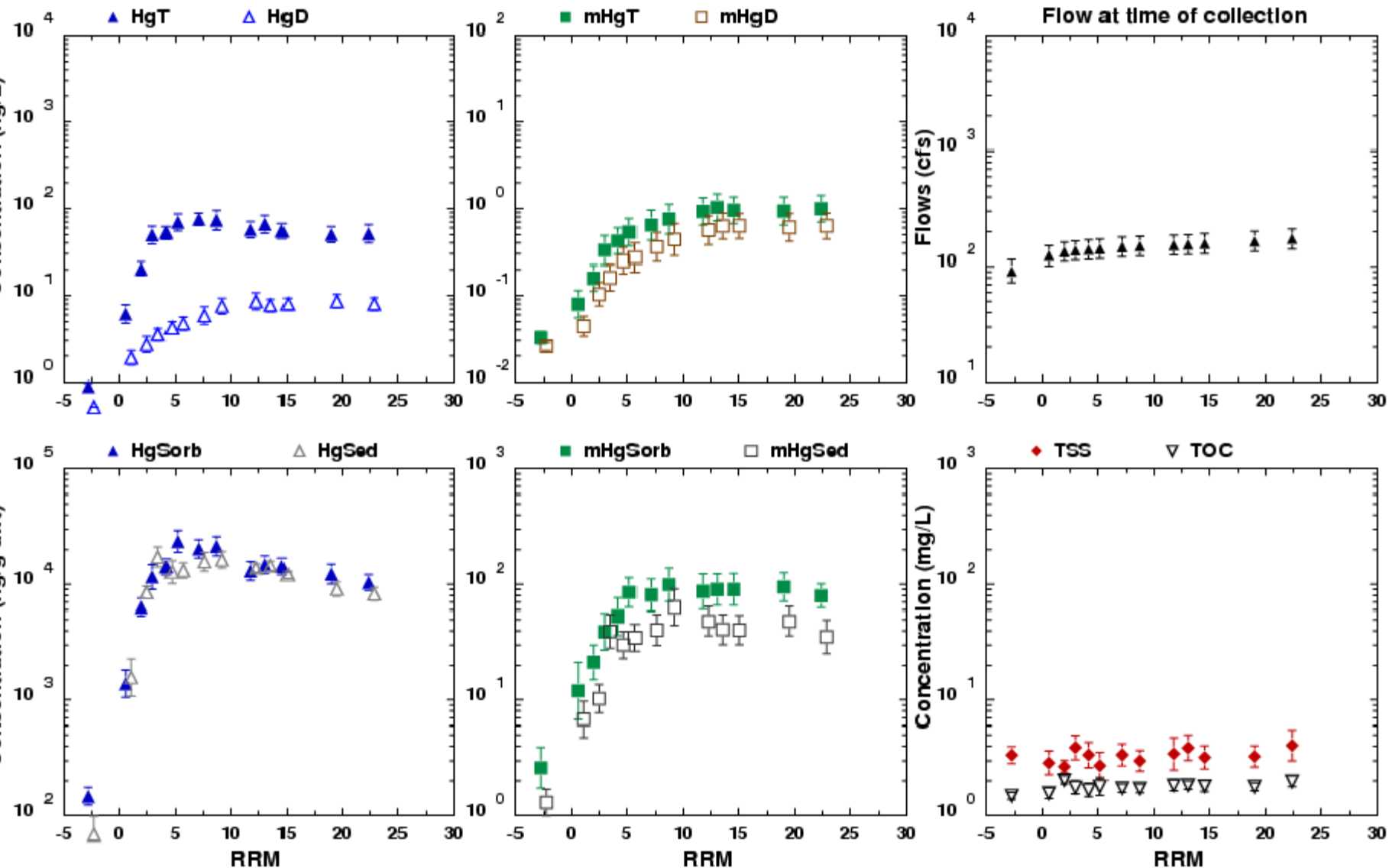


Model Grid

- 47 cells, each roughly 1 km long
- Simulation spans RRM 0 to ~RRM 27
- Water inputs increase flow along river



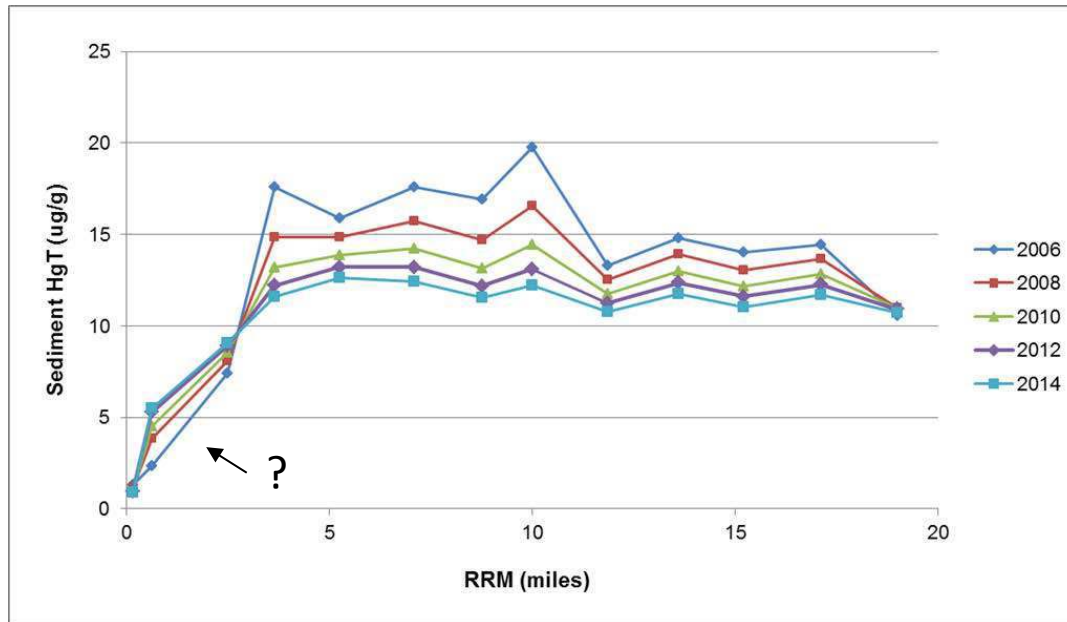
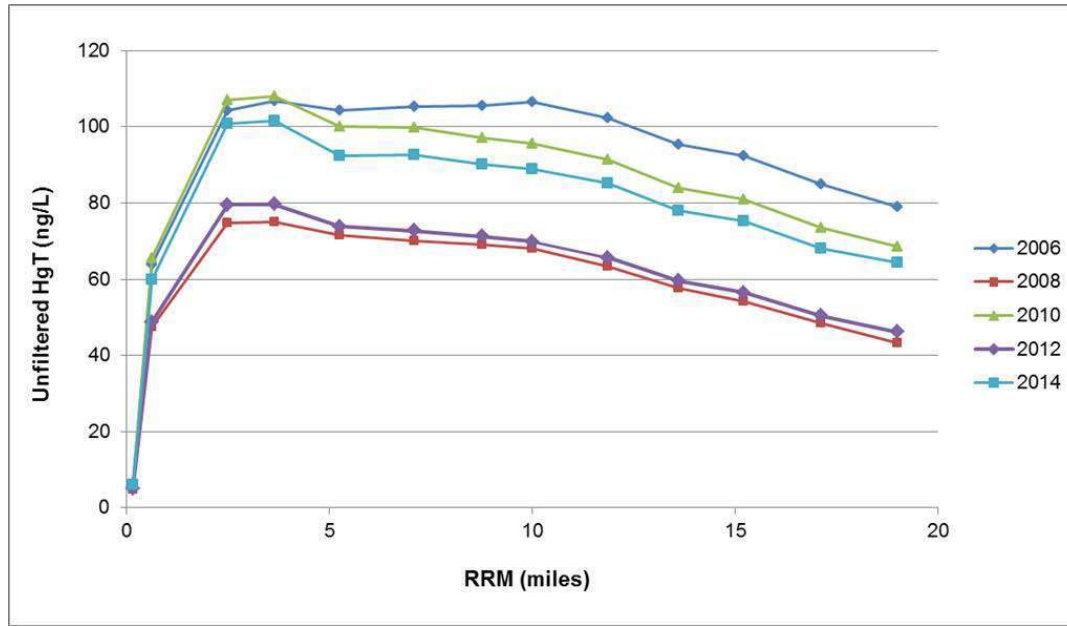
Monthly monitoring data: Summary of monthly monitoring data Mean and 2 standard errors.



Spatial profiles for total mercury and methylmercury, TSS, and TOC in the South River. Each data point is the average of 12 values collected from March 2006 to February 2007.

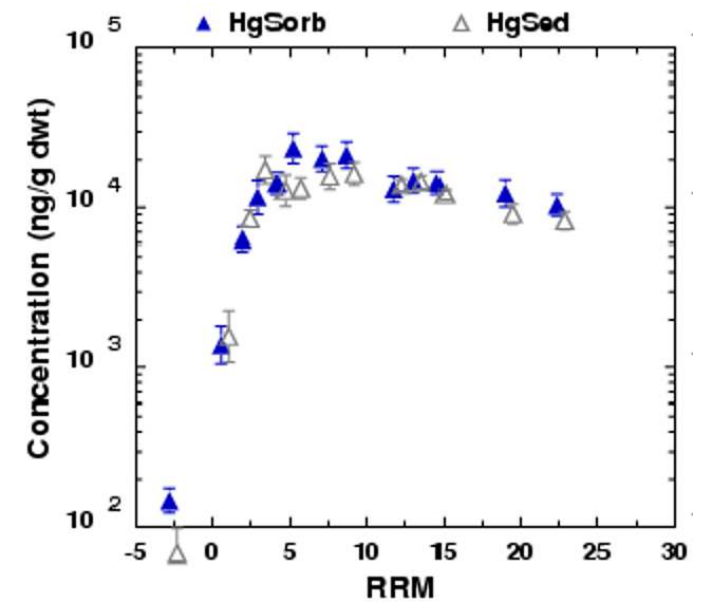
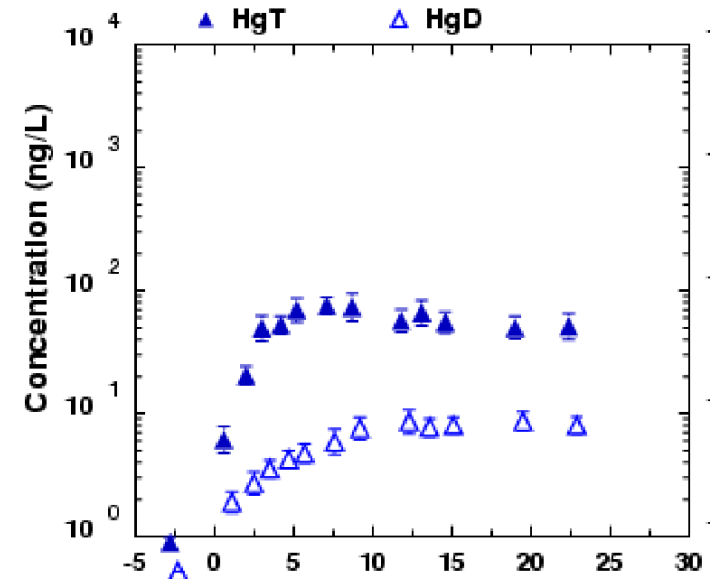
From Hydroqual (2008)

Model

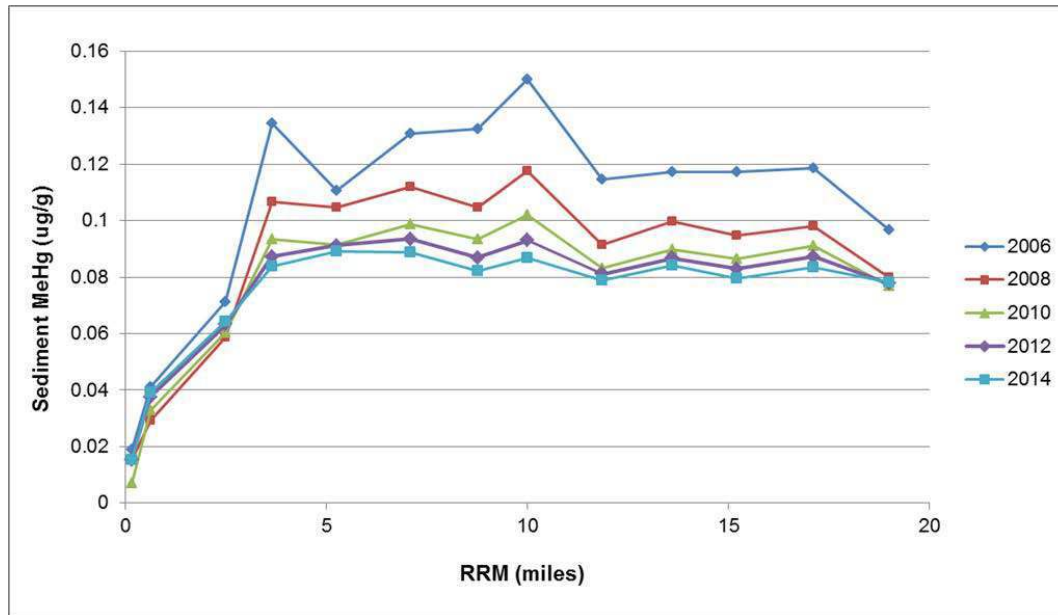
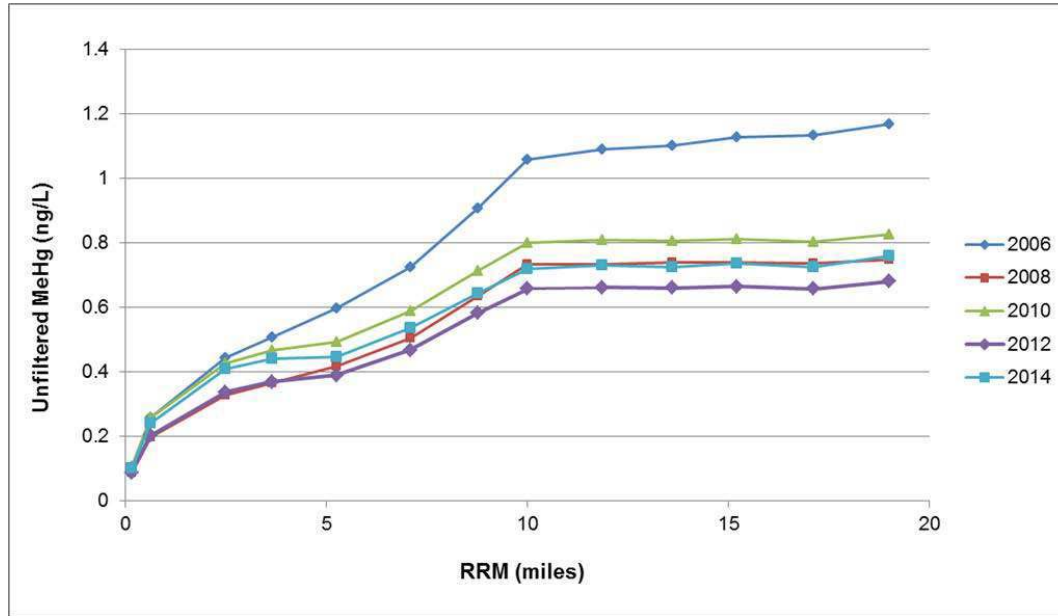


Based on 5 day average flows

Observed 2006-2007

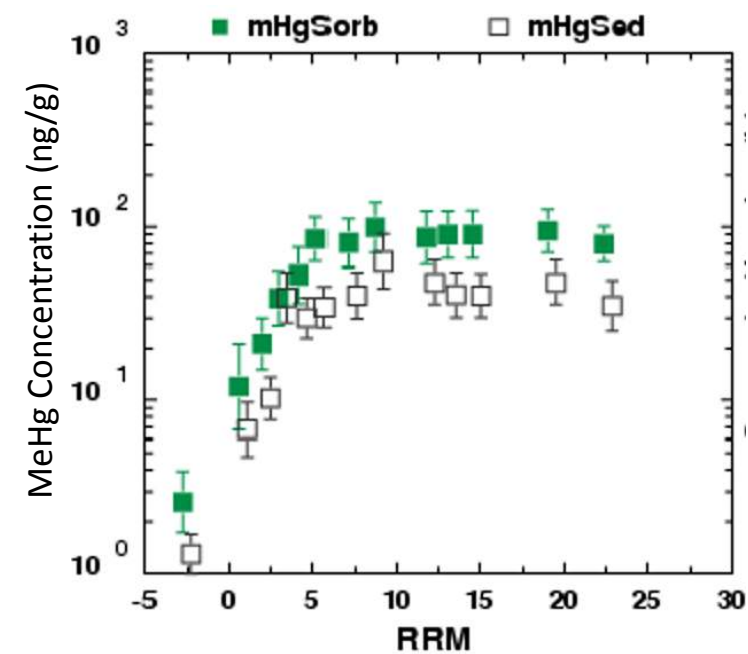
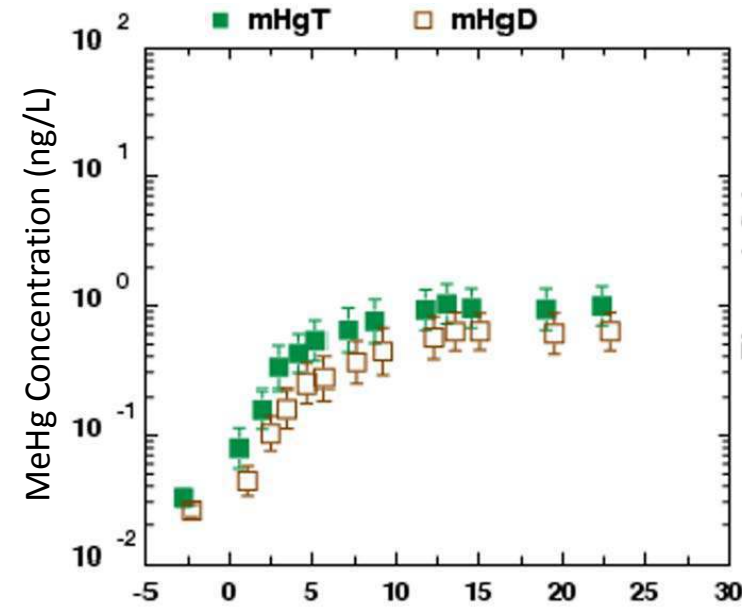


Model

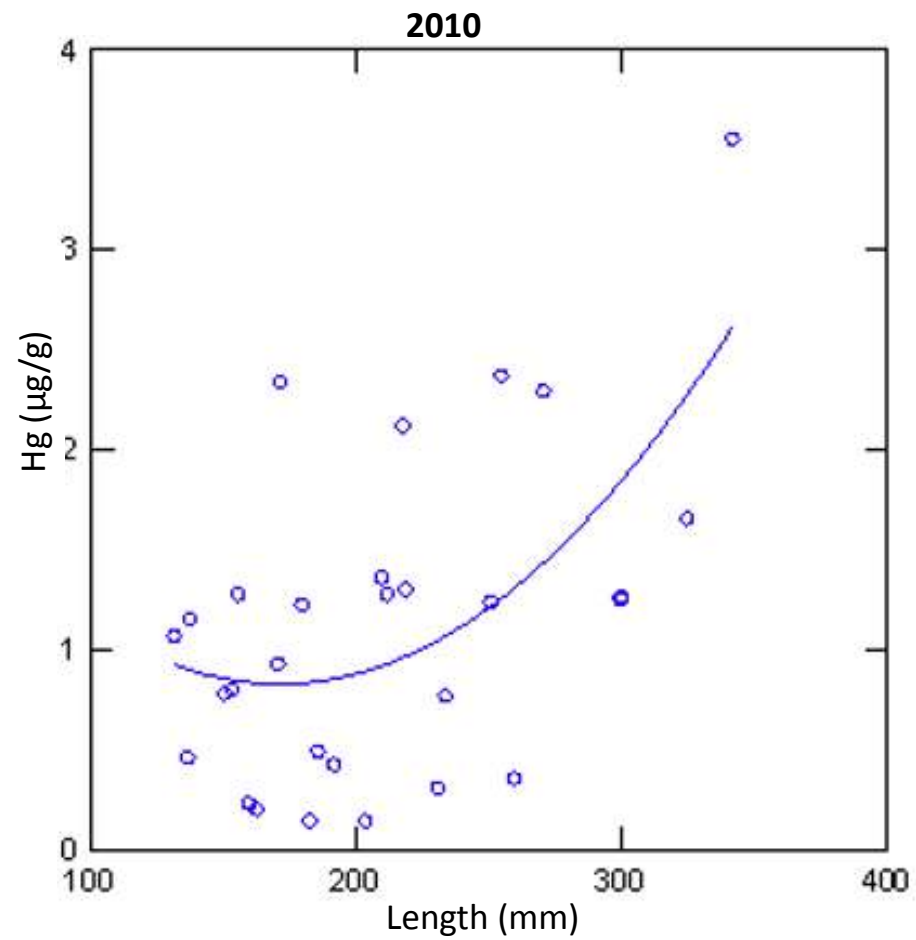
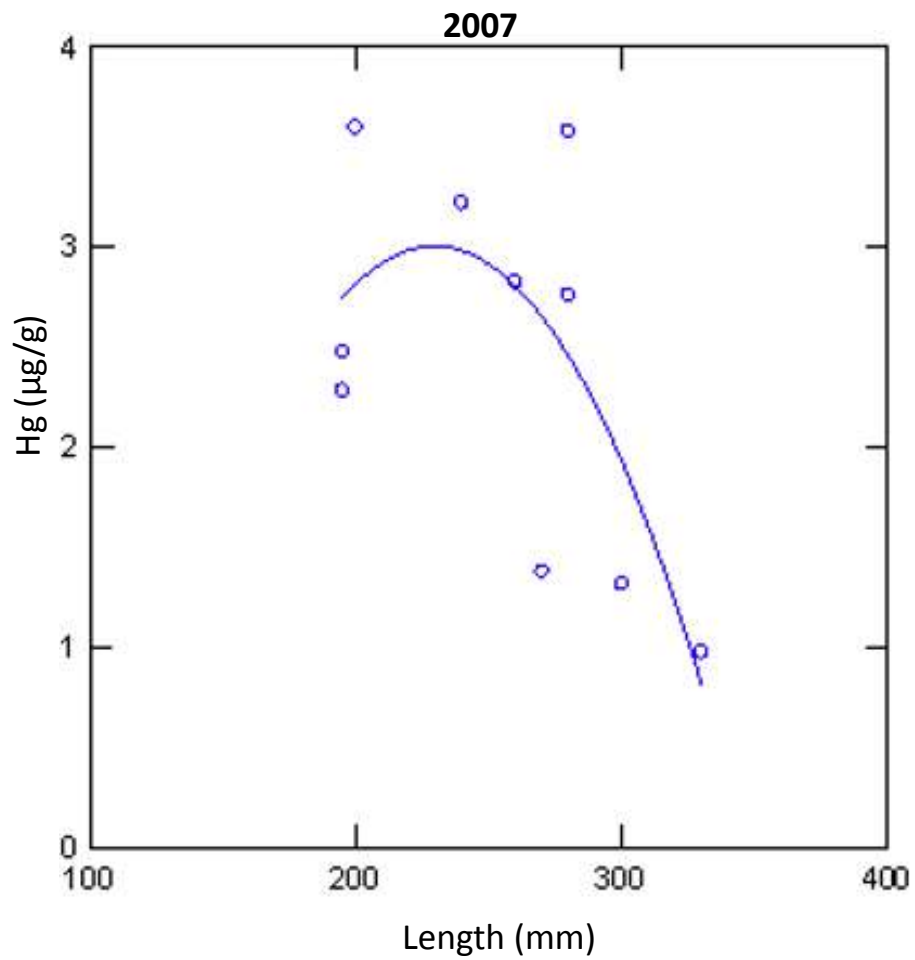


Based on 5 day average flows

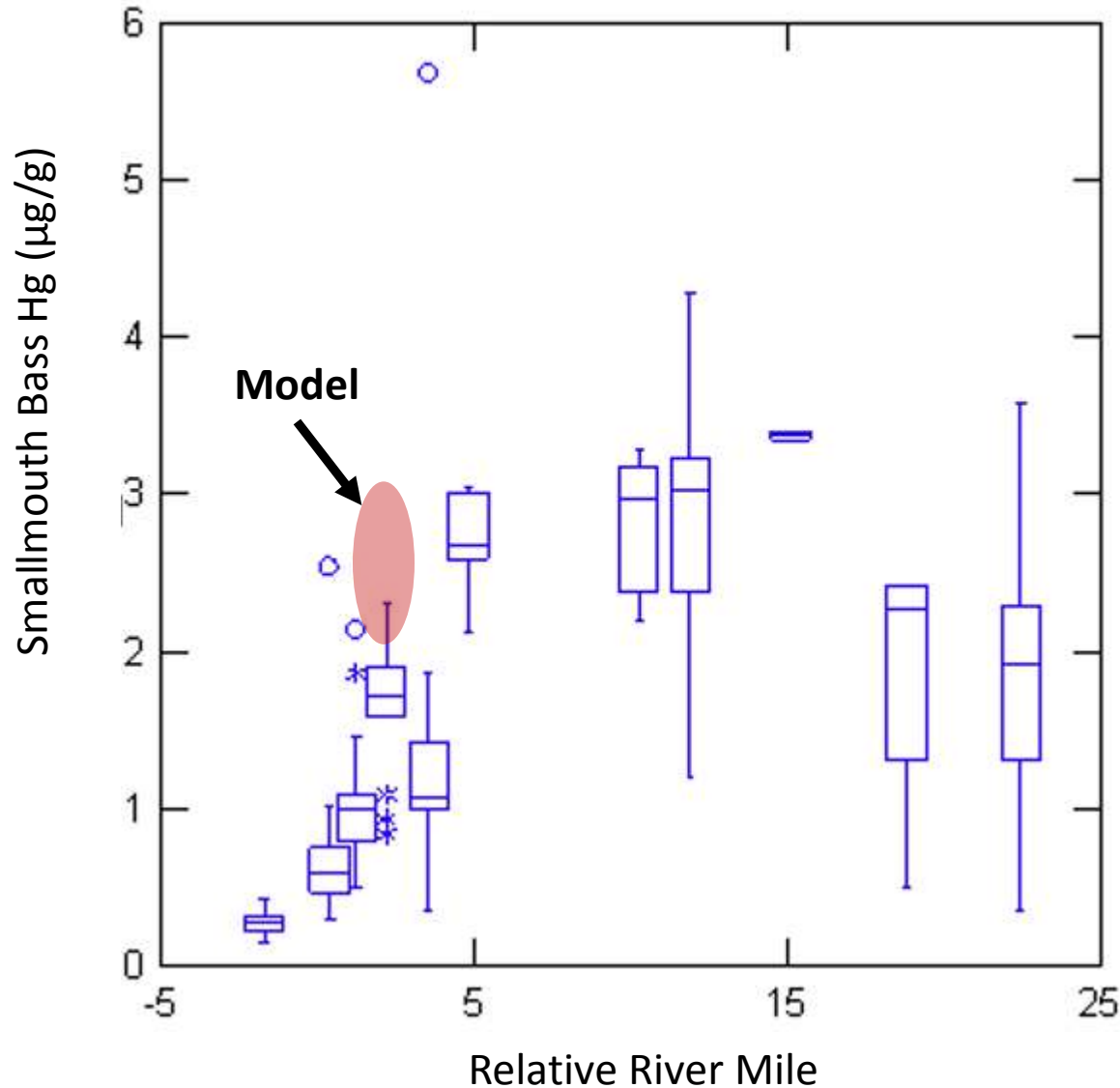
Observed 2006-2007



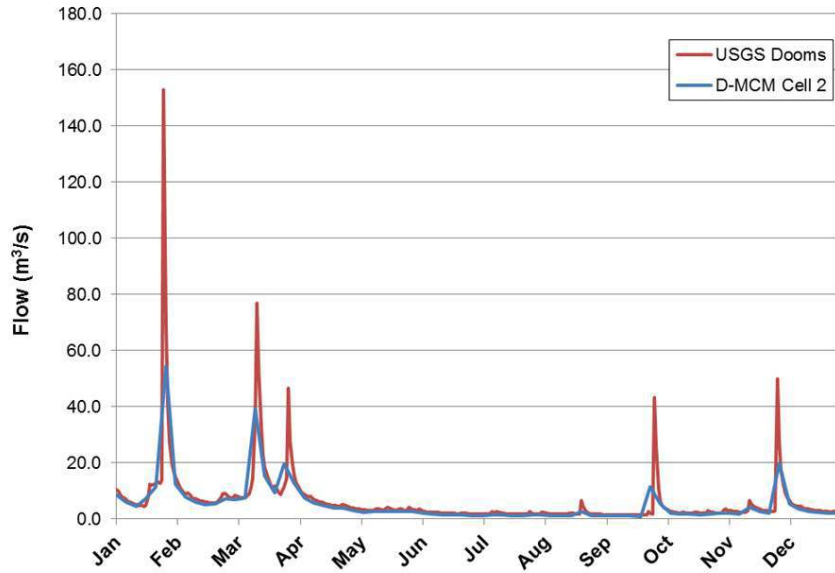
Mercury in Smallmouth Bass at RRM 22.45



Mercury Concentrations in 250-300 mm Smallmouth Bass in the South River (based on data from 2001-2012)

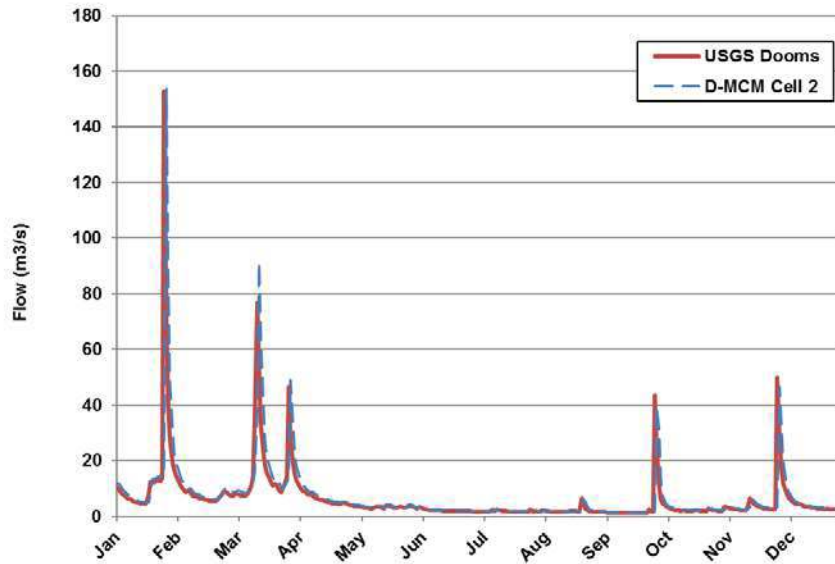


Simulated and observed flow for 2010



Started with 5 day average flows.....

Simulated and observed flow for 2010



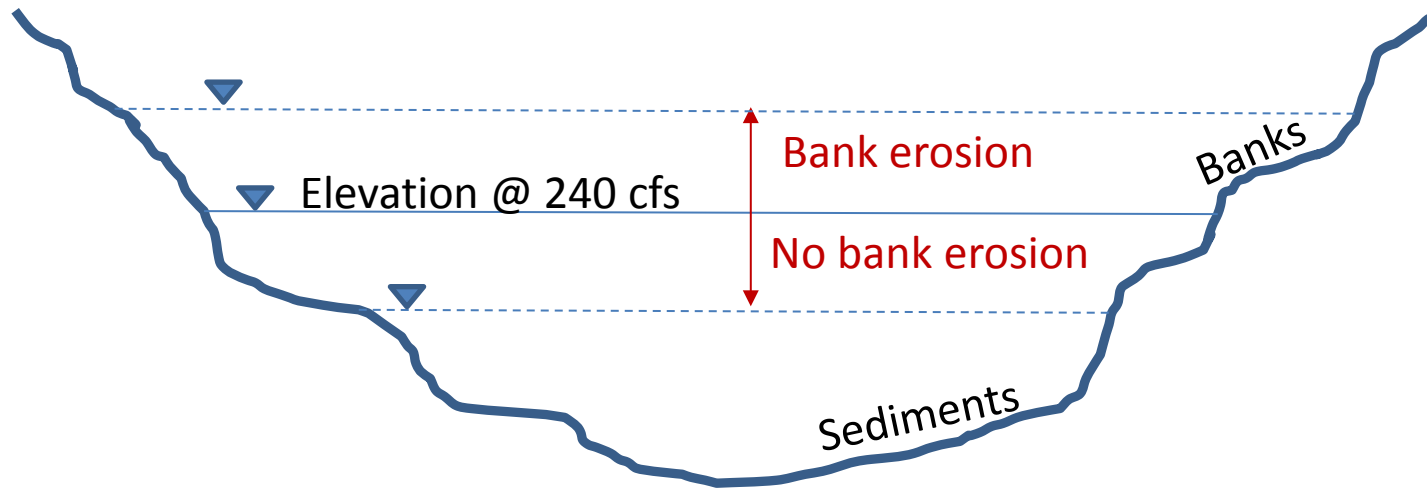
Switching to daily average flows..

Improved ability to capture peak flows.



Where do we draw the line between river banks and sediments....?

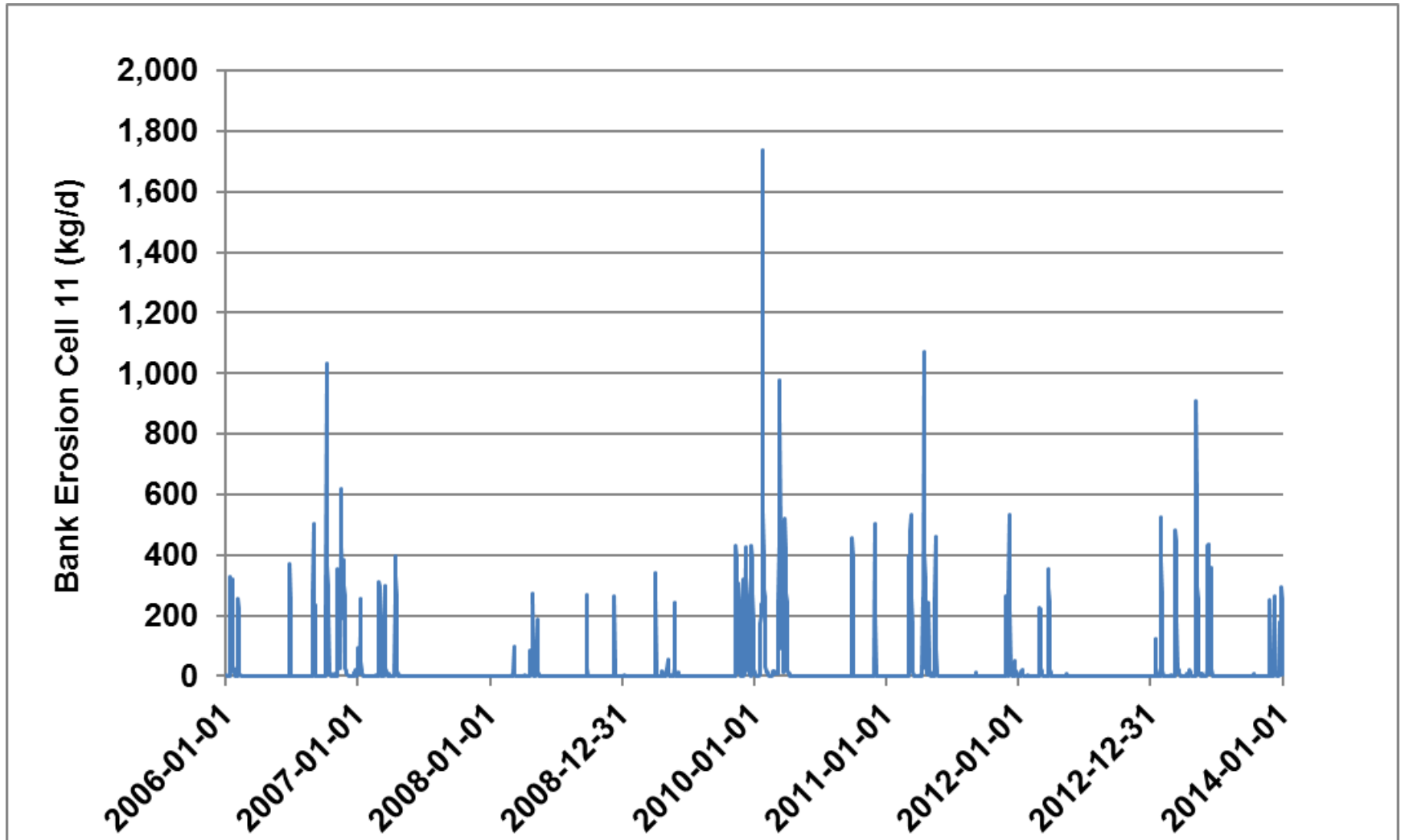
- Water surface @ flow = 240 cfs defines banks vs sediments
- No bank erosion if flows < 240 cfs



Bank Erosion of Solids

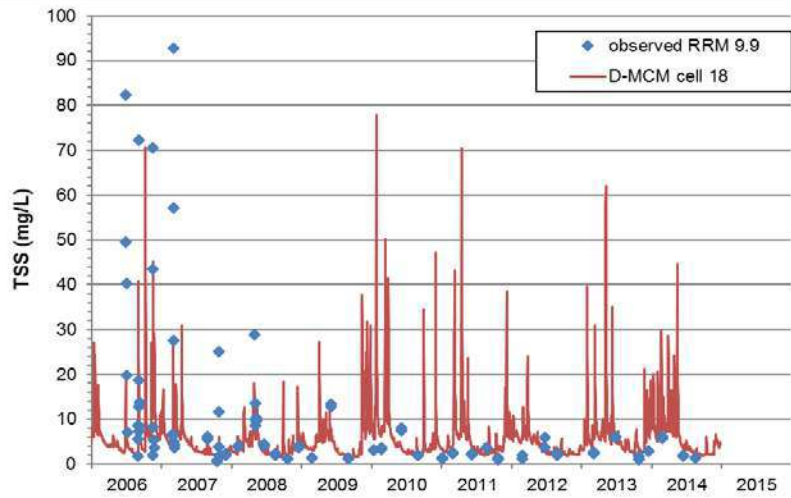
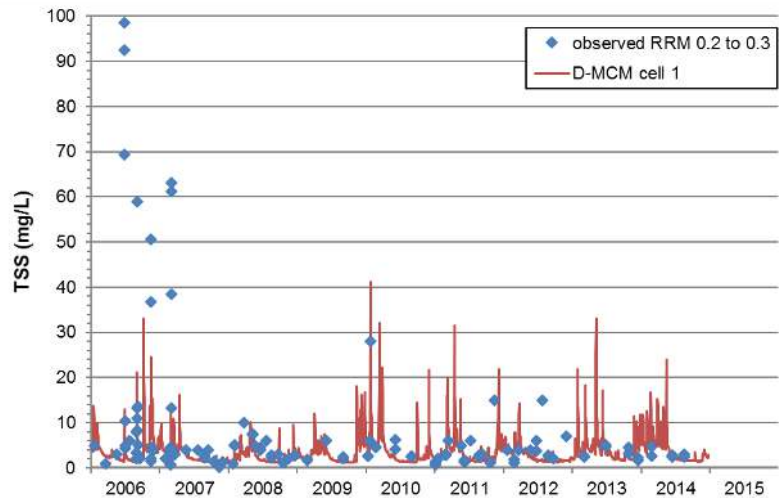
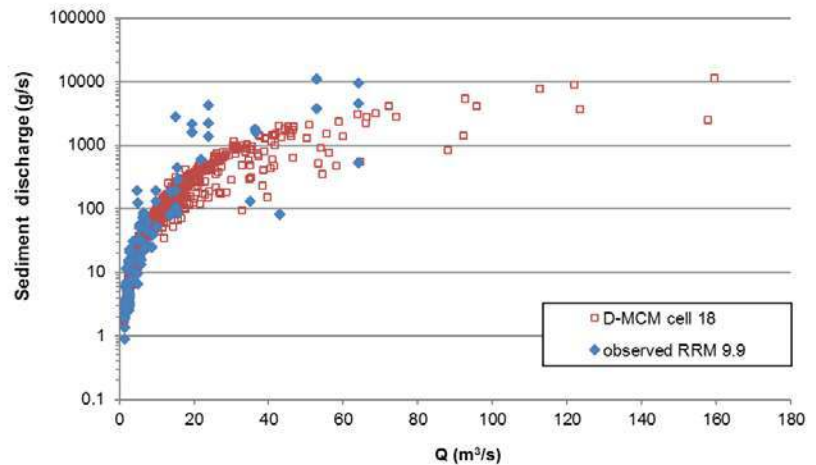
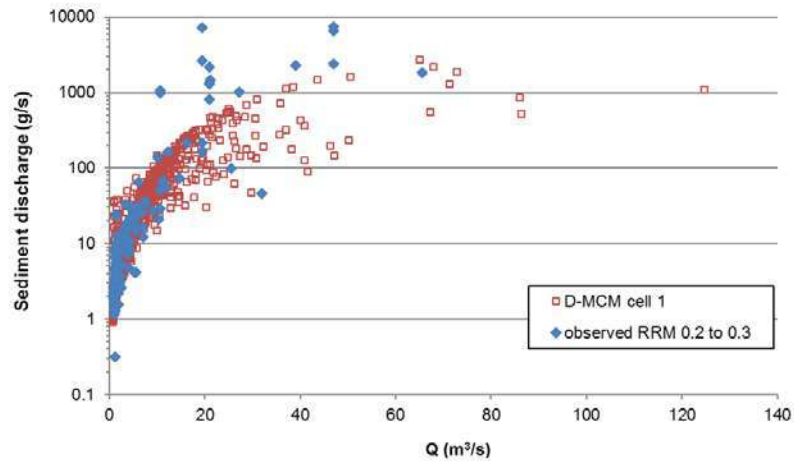
Data from URS South River Statistical Model Data.xlsx.

- *Some days with no erosion...*

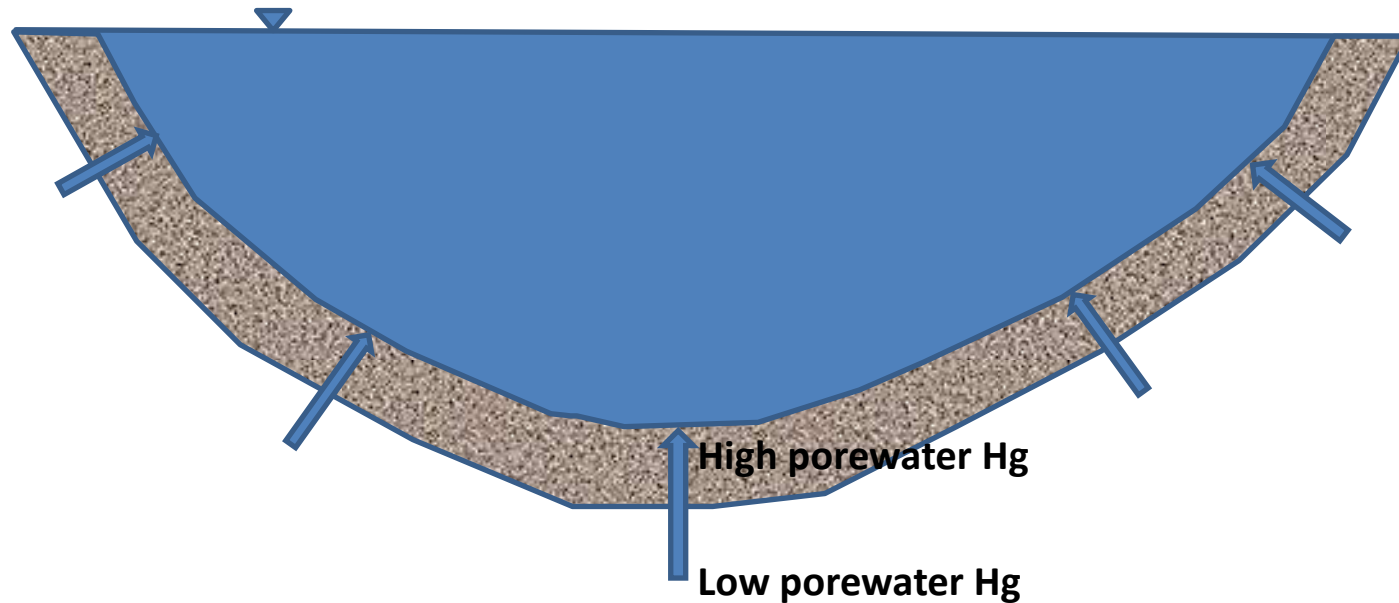


TSS predictions

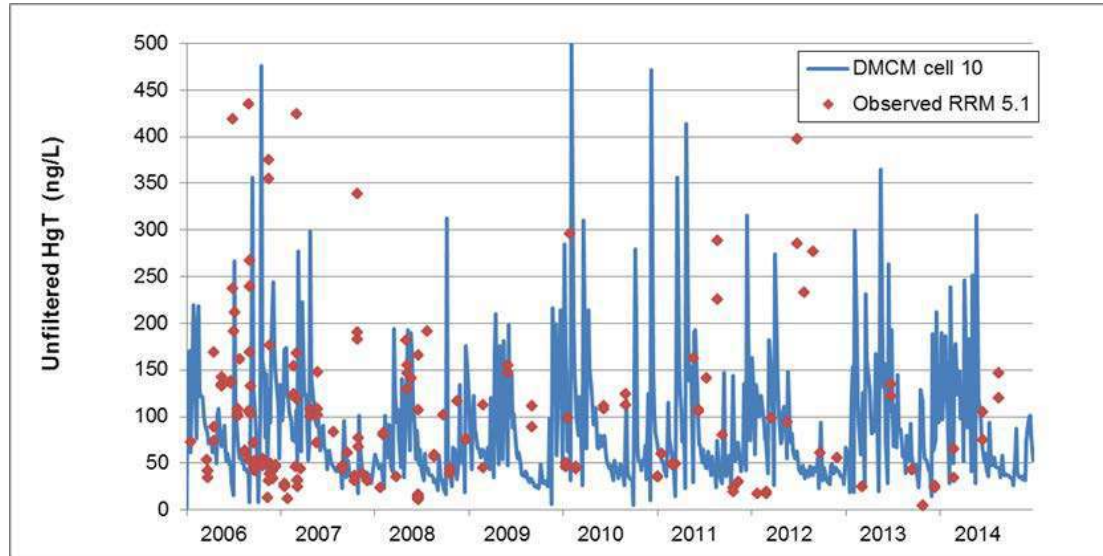
D-MCM performs a mass balance for solids which includes advection, settling and resuspension.



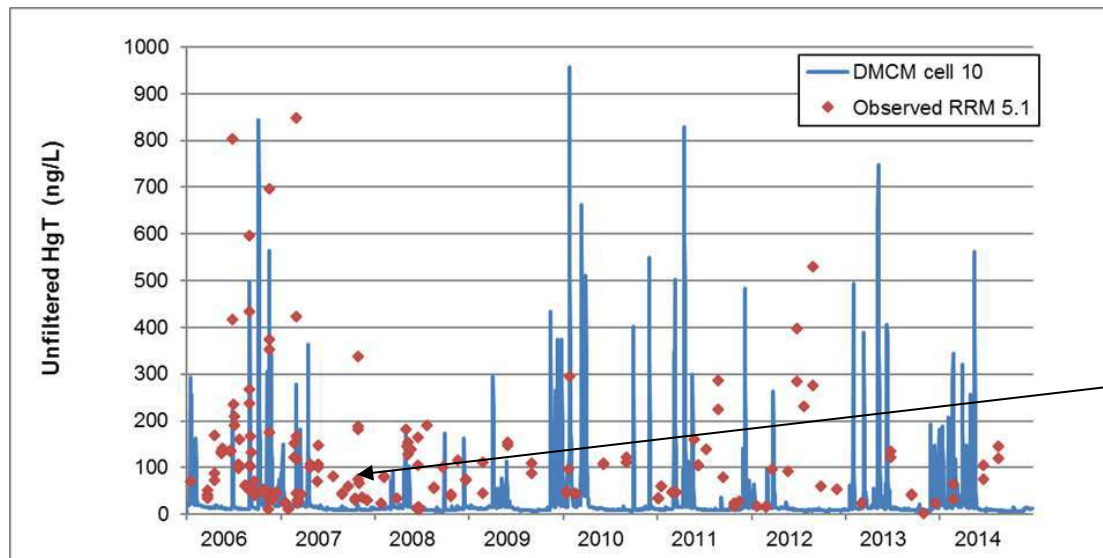
- Need to add advective groundwater flux.....
- Important Hg/MeHg load under low to moderate flow conditions?



Predicted and observed total mercury in surface waters at RRM 5.1



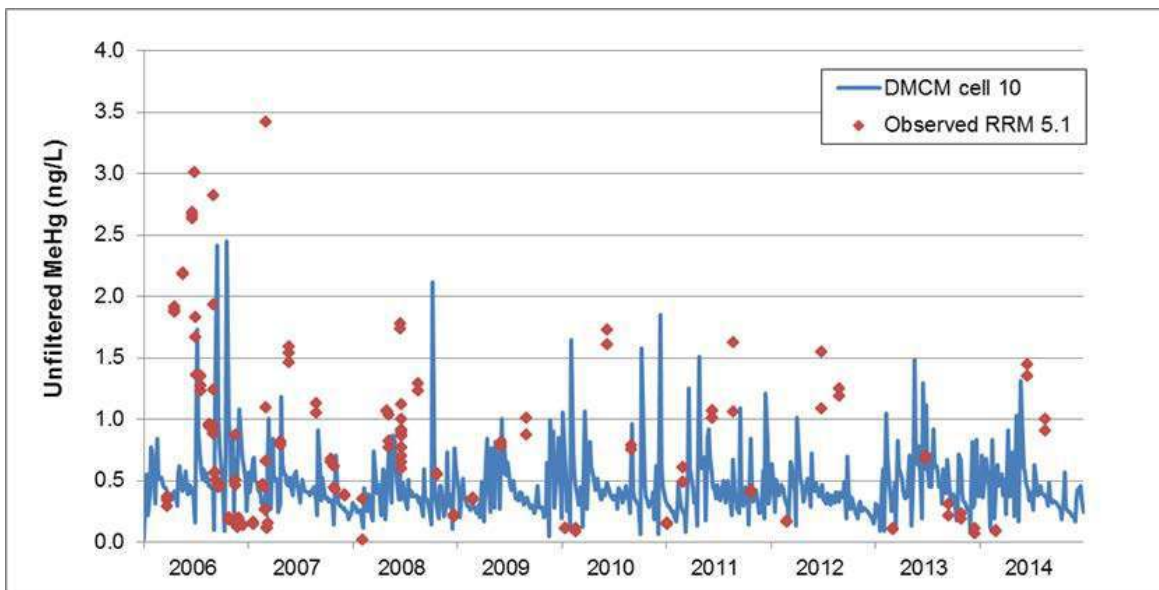
Using 5 day average flows



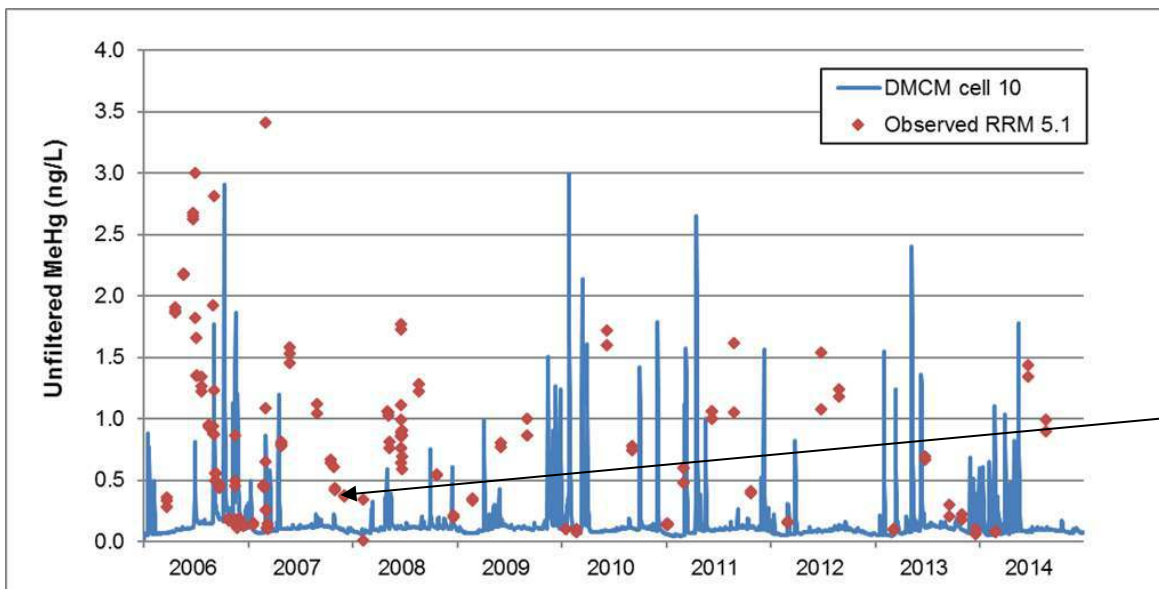
Using daily average flows

Model underpredicts observations during low flow conditions..

Predicted and observed methylmercury in surface waters at RRM 5.1



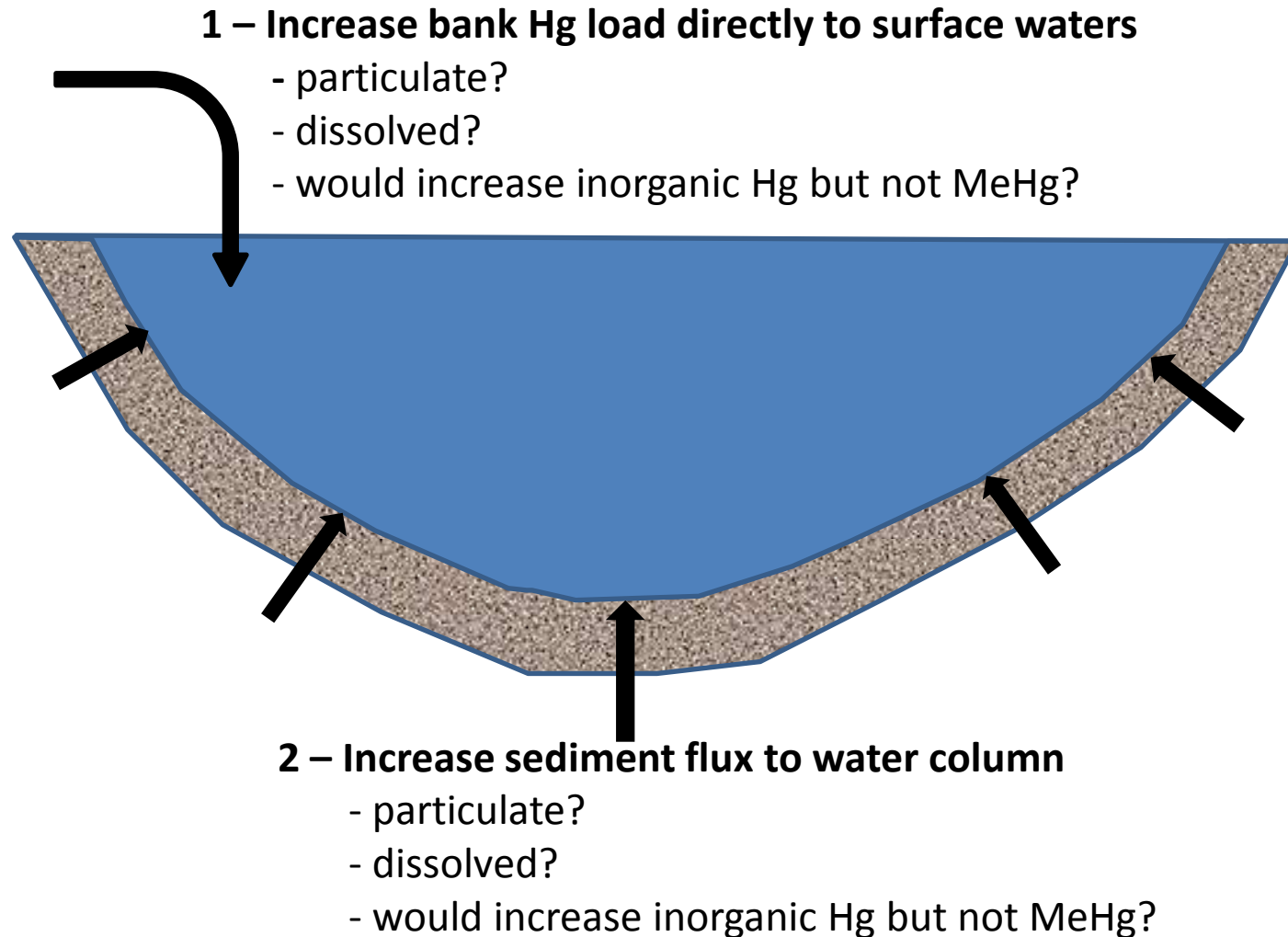
Using 5 day average flows



Using daily average flows

*Model underpredicts
observations during low flow
conditions..*

Options to increase water column Hg concentrations in model during low-moderate flow periods...



Next steps

- **Extend model into South Fork Shenandoah River**
- **Resolve issues with low predicted THg and MeHg in water column under baseflow conditions.**
- **Refine boundary between banks and sediments.**
- **Finish calibration to existing conditions (April)**
- **Scenario testing**