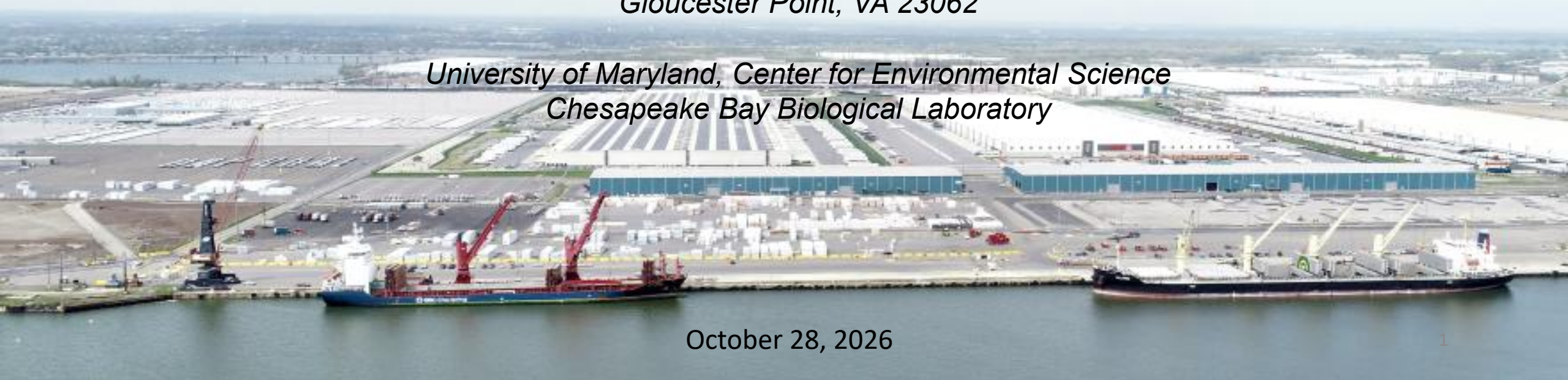


Progress on the Patapsco/Back MTM

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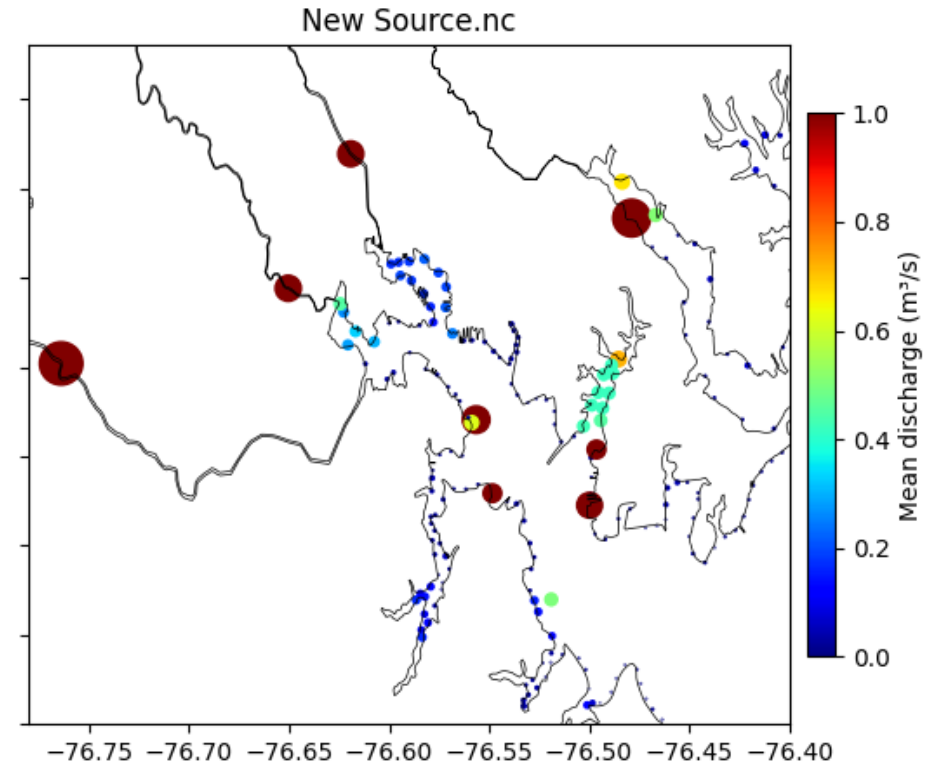
October 28, 2026

Outline:

- I. Summary of changes in last quarter
- II. Back River scenarios to understand under-prediction of Chl-a, TN, TP
- III. Summary and Next Steps

I. Summary of changes in last quarter

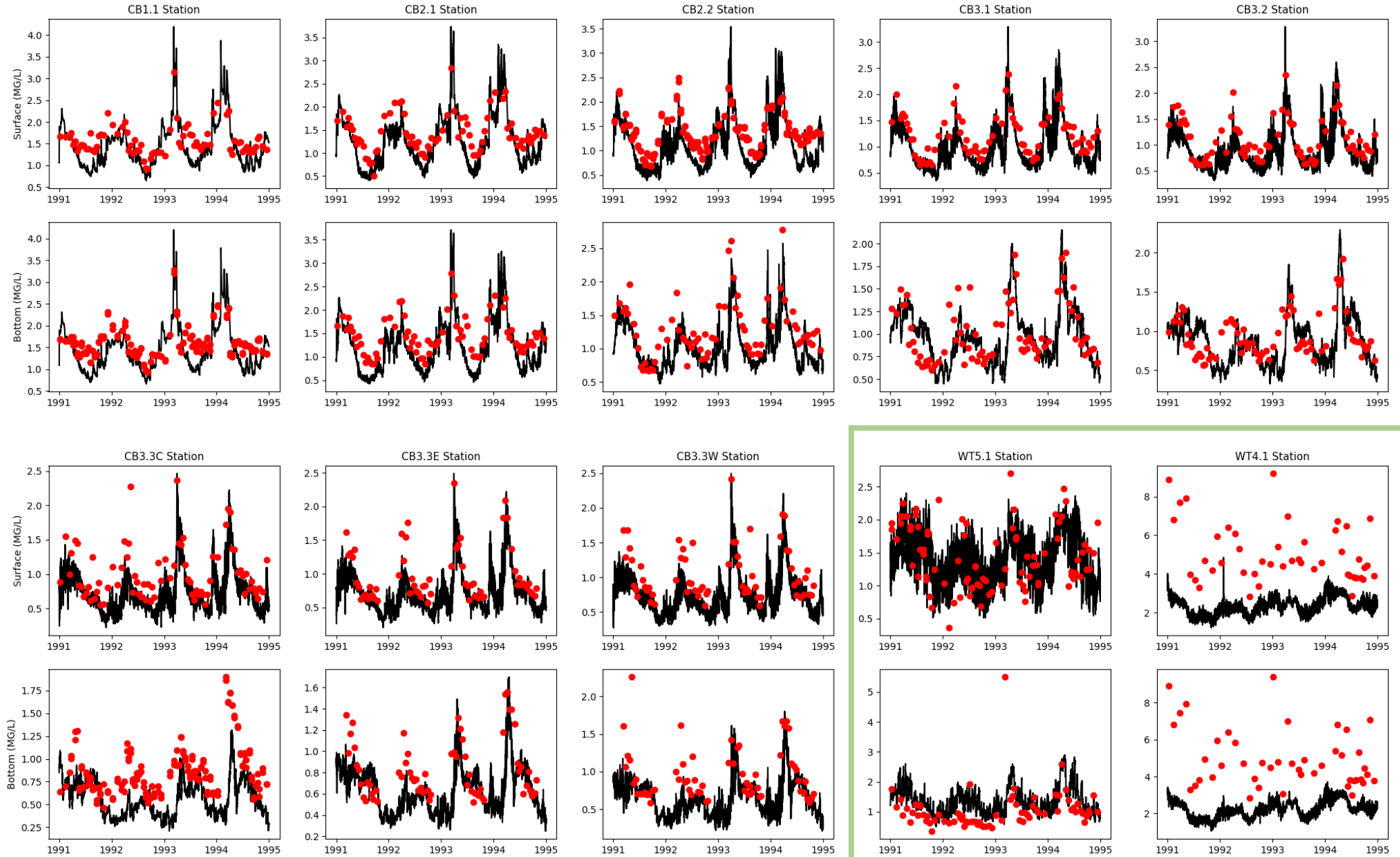
- a. Fixed locations of watershed inputs to Back River
 - a. Patapsco streams
 - b. WWTP outfalls
- b. Model runs from 2015-2020
 - a. Capturing periods of Patapsco and Back WWTP load reductions
- c. Changes to sediment initial conditions and parameters
 - a. Adjusting initial sediment CNP particulate material
 - b. Testing P-sorption parameters



Model (black lines) versus observations (circles) across domain: TN

TN

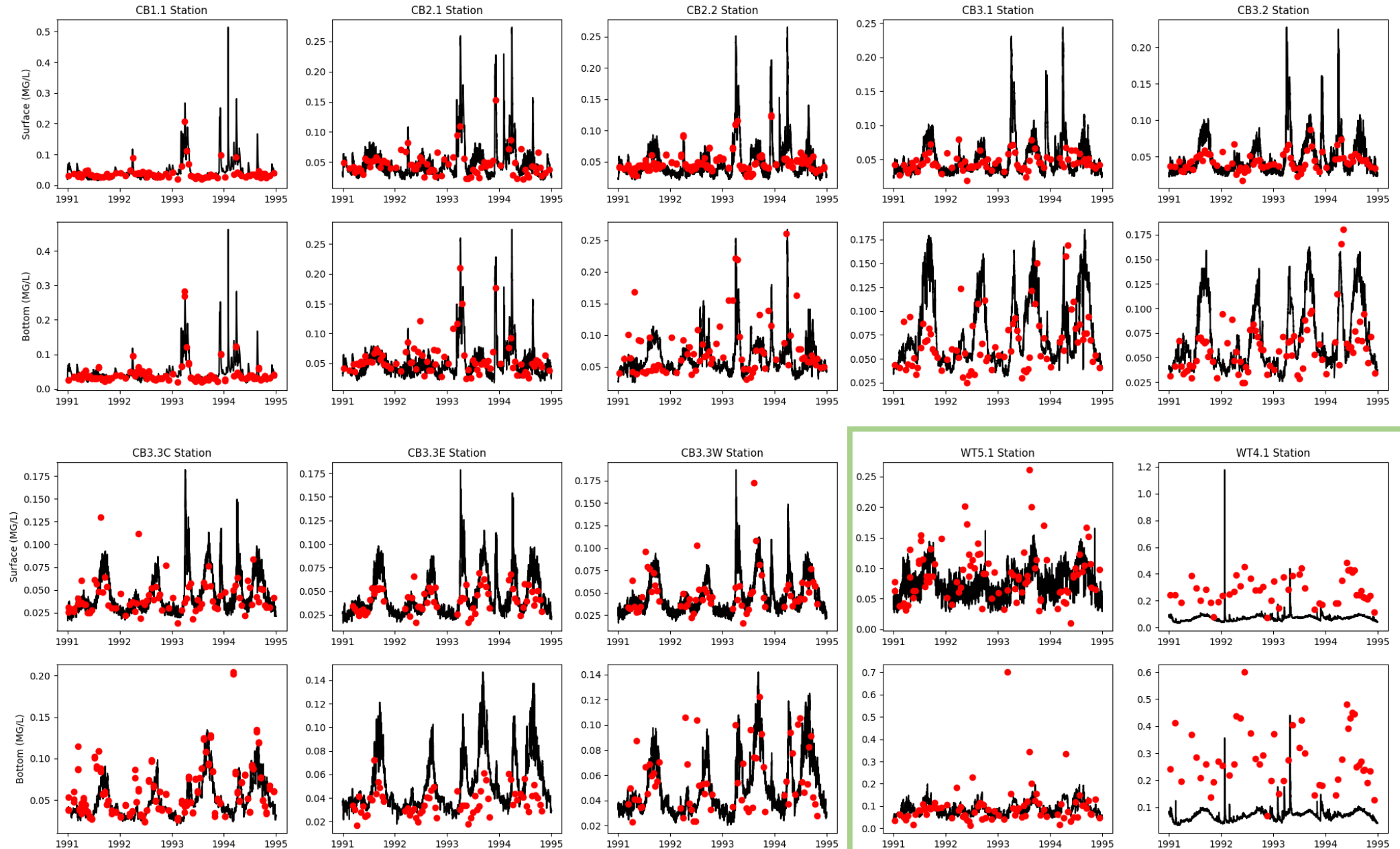
— modeled ● observed



Model (black lines) versus observations (circles) across domain: TP

TP

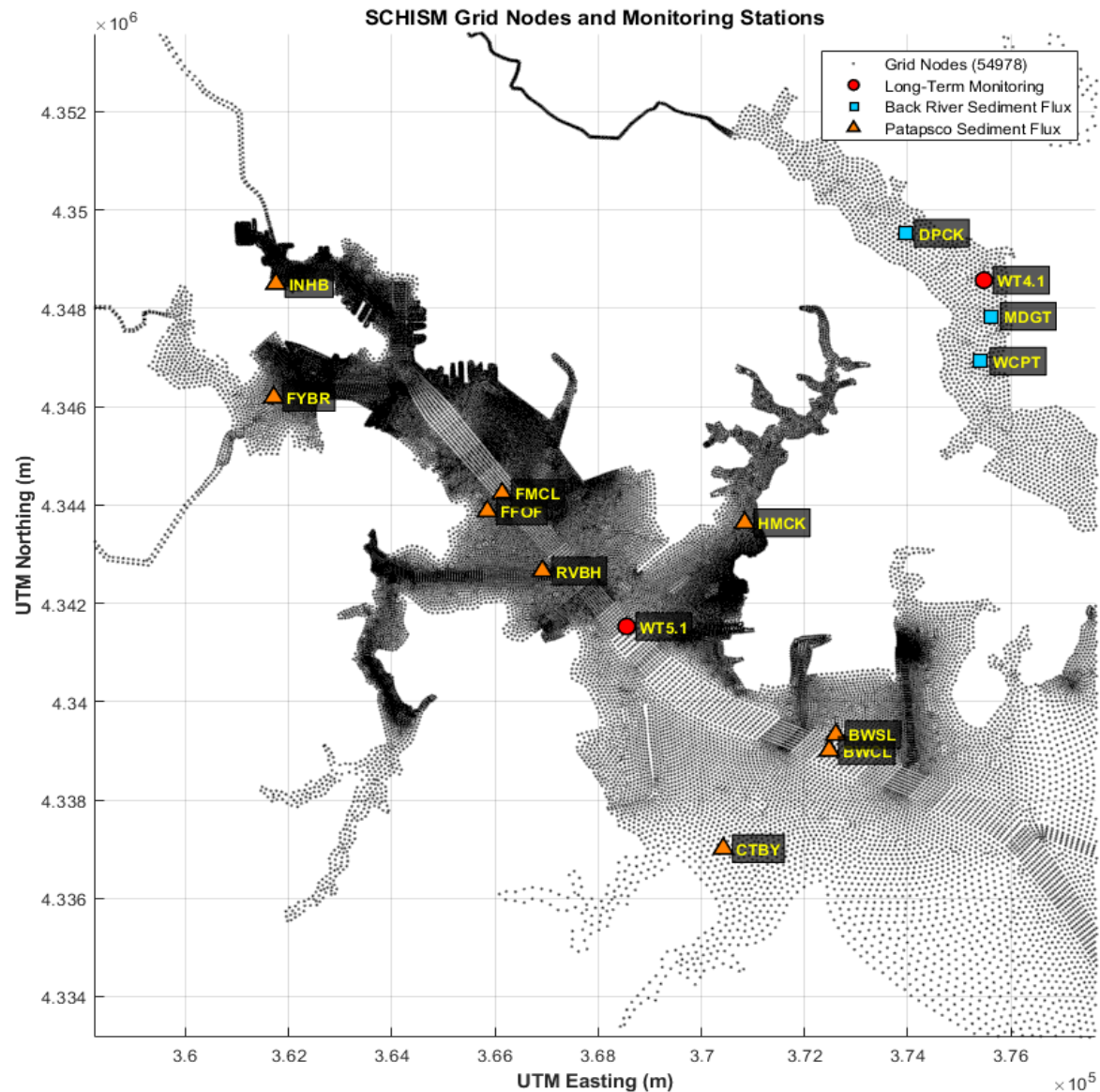
— modeled ● observed



II. Back River scenarios to understand under-prediction of Chl-a, TN, TP

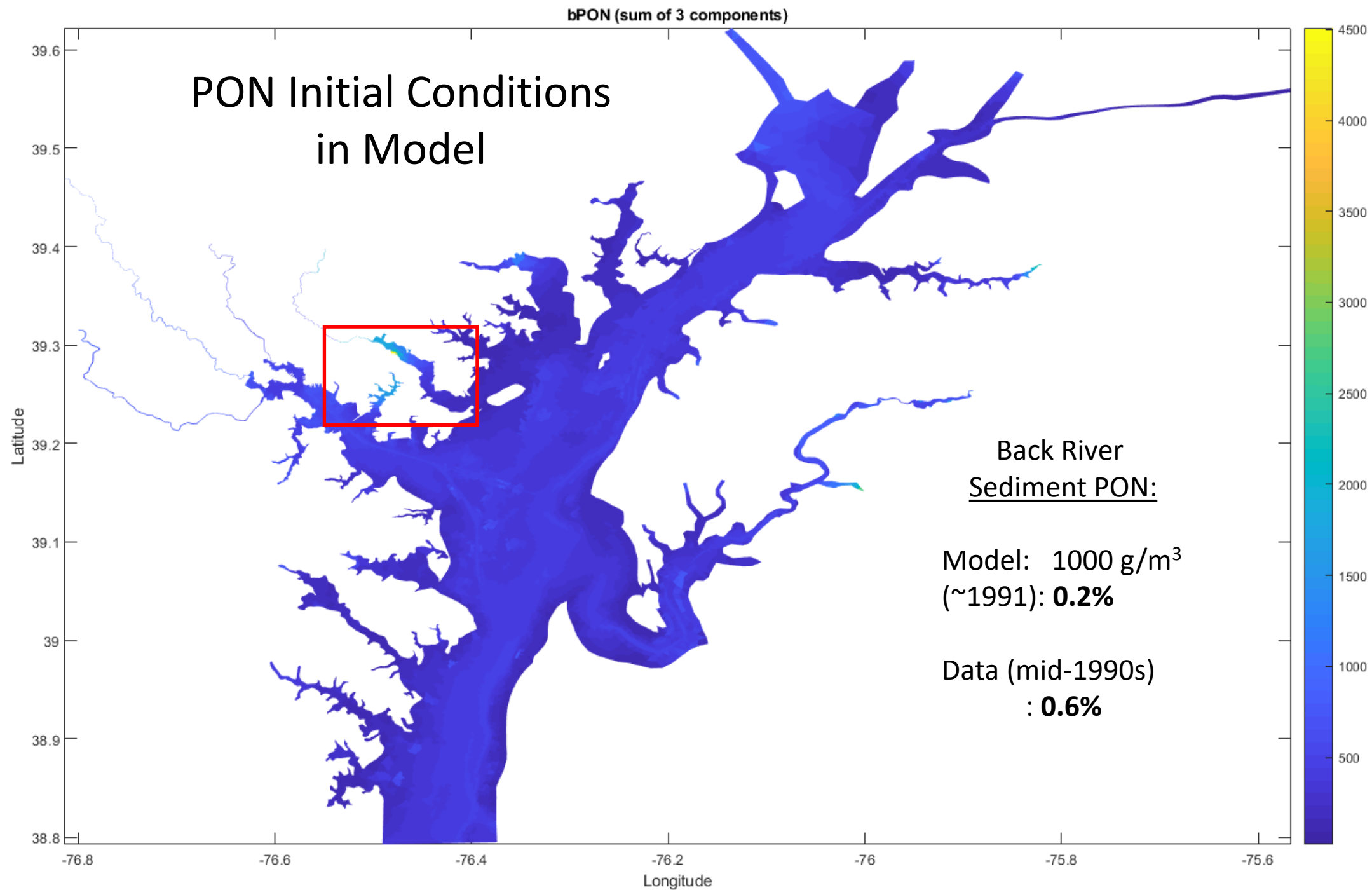
Hypotheses

- a. Legacy nutrients in sediments not accounted for
 - a. Low C, N, and P in initial conditions
 - b. Reduced sediment-water fluxes, not enough P-B coupling
- b. Missing load of N and P
 - a. Water-column PO₄ and DIN are lower in model than observations
 - b. Is Back River WWTP represented well?
- c. Other hypotheses
 - a. Flushing too high in model (seems unlikely)
 - b. Light limitation (seems unlikely: ISS and TSS match data reasonably)

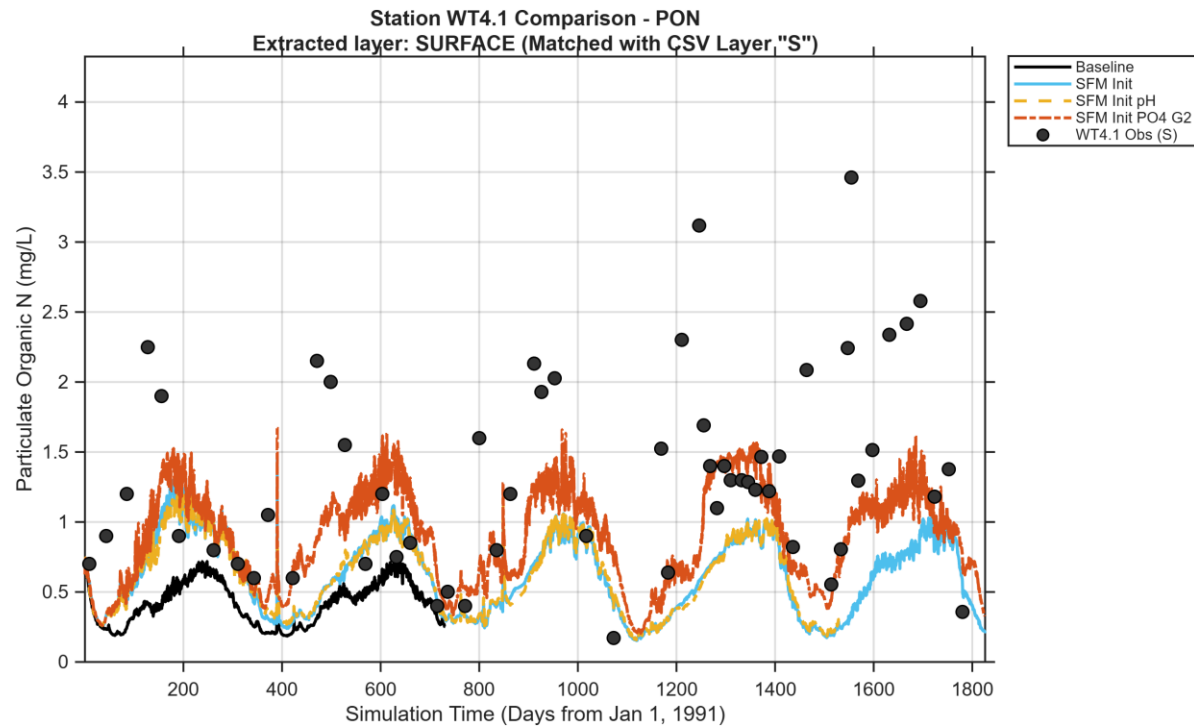
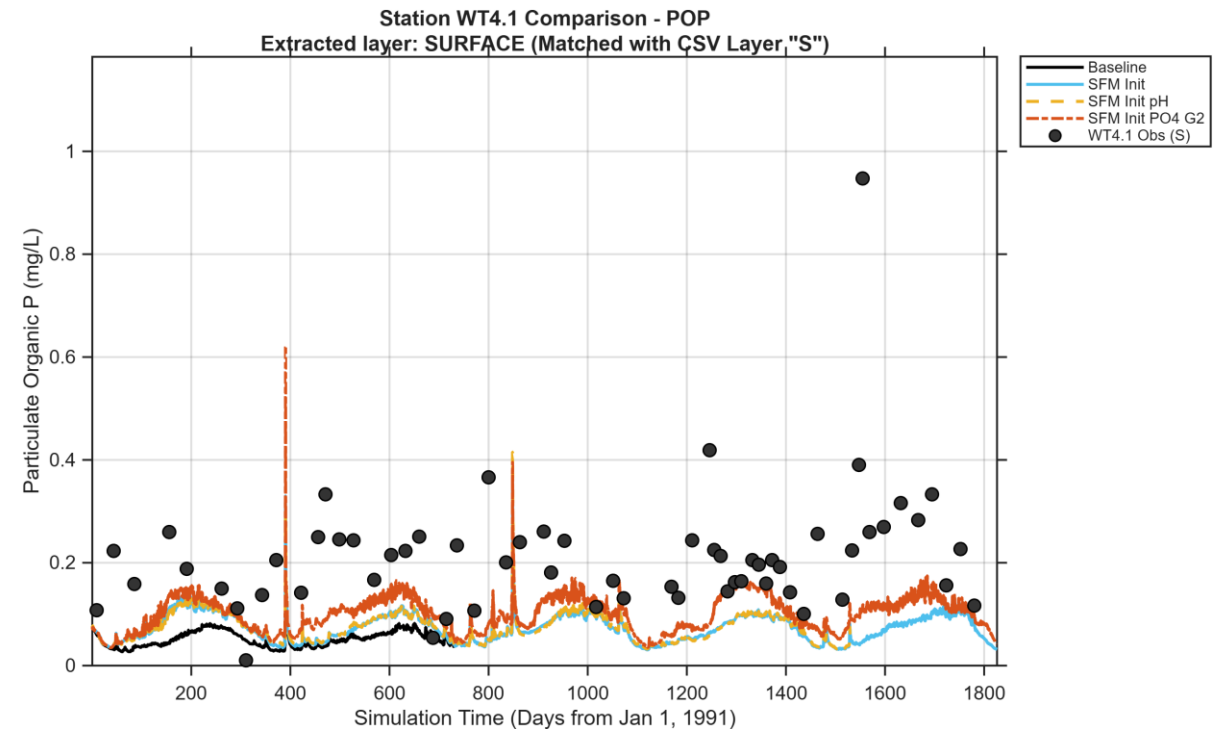


Model Scenarios

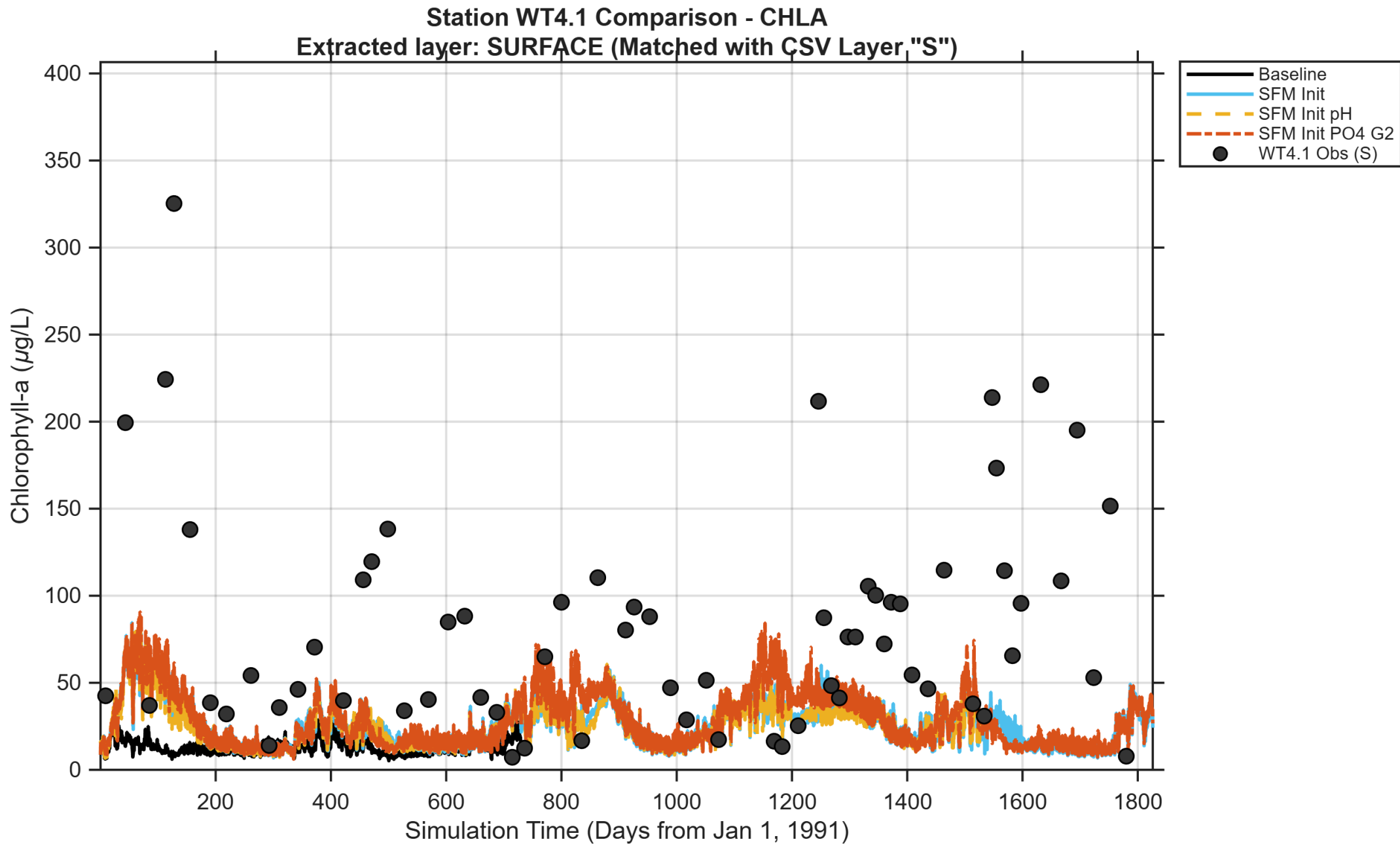
#	Scenario	pH Model	Sediment IC Update
1	Baseline	No	None — default initial conditions
2	SFM Init	No	bPOP0, bPON0, bPOC0 updated to [0.1, 0.07, 2.86], [0.36, 0.49, 4.22], [2.02, 2.8, 55.4]; scalars updated (bNH4, bNO3, bPO4)
3	pH Model SFM Init	Yes	bPOP0, bPON0, bPOC0 updated to [0.1, 0.07, 2.86], [0.36, 0.49, 4.22], [2.02, 2.8, 55.4]; scalars updated (bNH4, bNO3, bPO4)
4	SFM Init_po4_G2	No	bPOP0, bPON0, bPOC0 updated to [0.1, 764500, 2.86], [0.36, 0.49, 4.22], [2.02, 2.8, 55.4]; scalars updated (bNH4, bNO3, bPO4)
5	SFM Init_po4_G2_BPIE	No	bpiePO4 = 10.0 !partition coefficient of PO4 in Layer 2 (Kg-1.L)



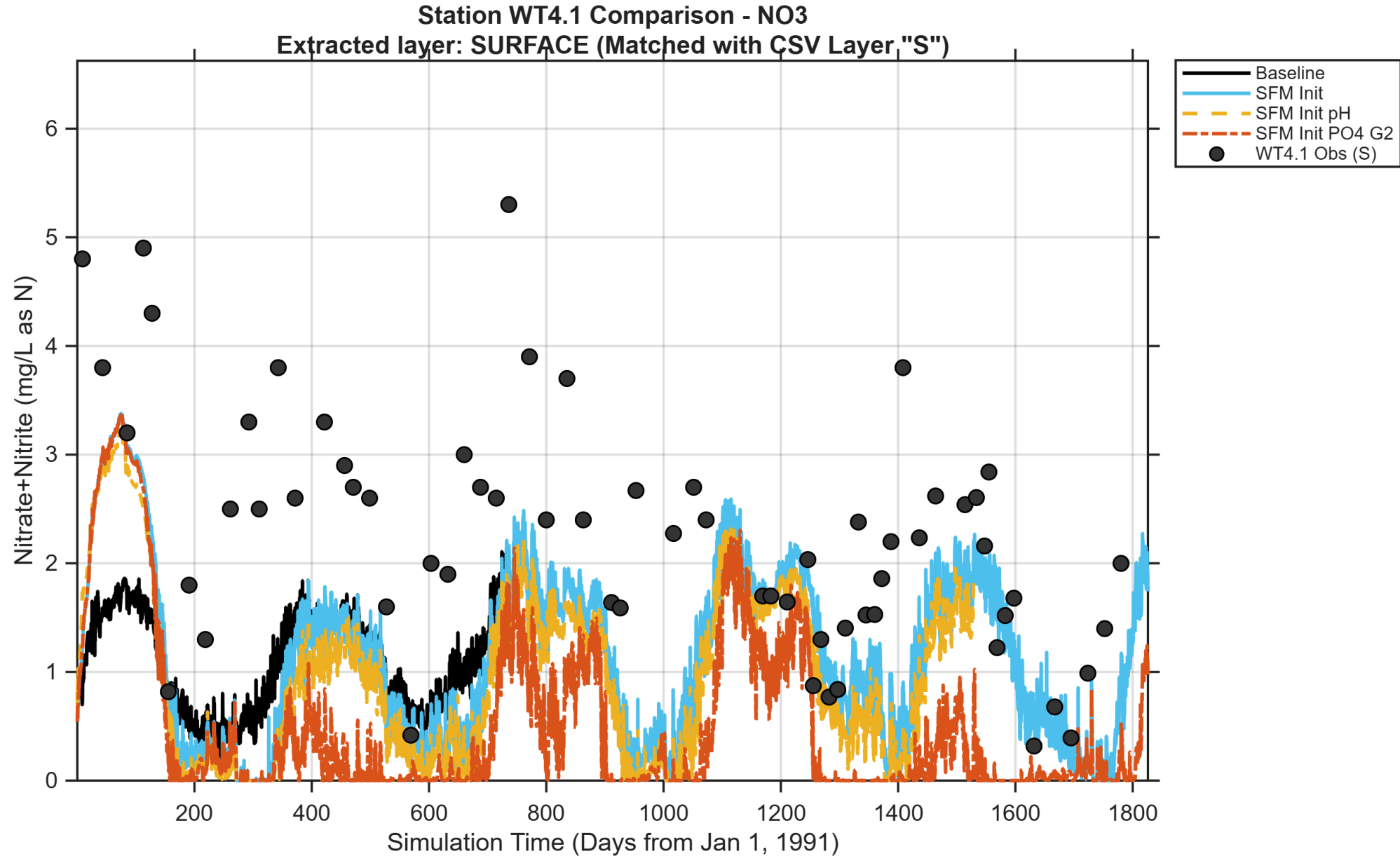
Addition of elevated initial conditions *increases* WC *particulate* N and P



In “G2” simulation, sorbed P in sediment is added to G2 pool (sorbed P estimated from stand-alone SFM)



Addition of elevated initial conditions ***does not*** increase WC ***dissolved N*** and P

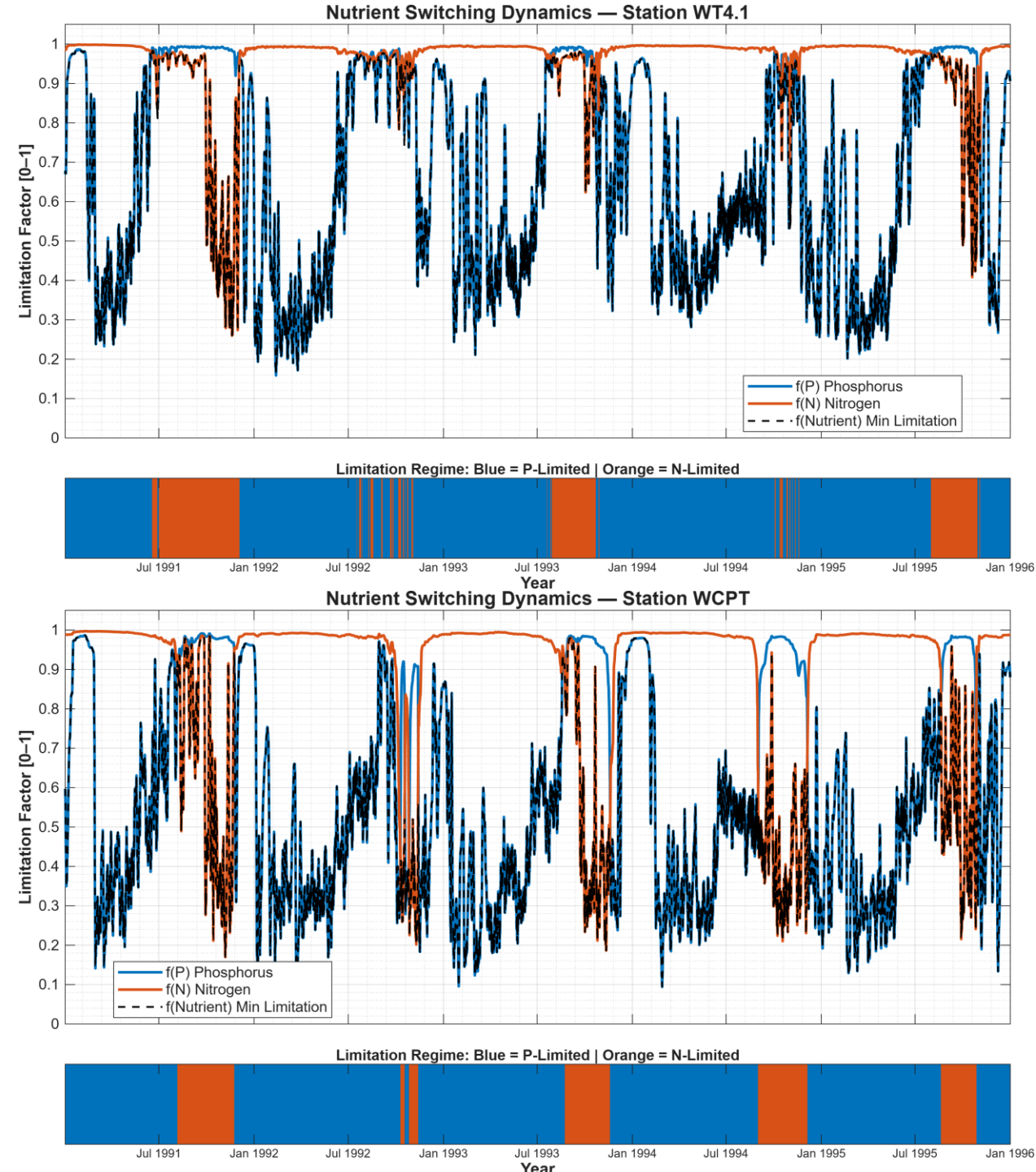


Persistence of N and P limitation *Especially* P

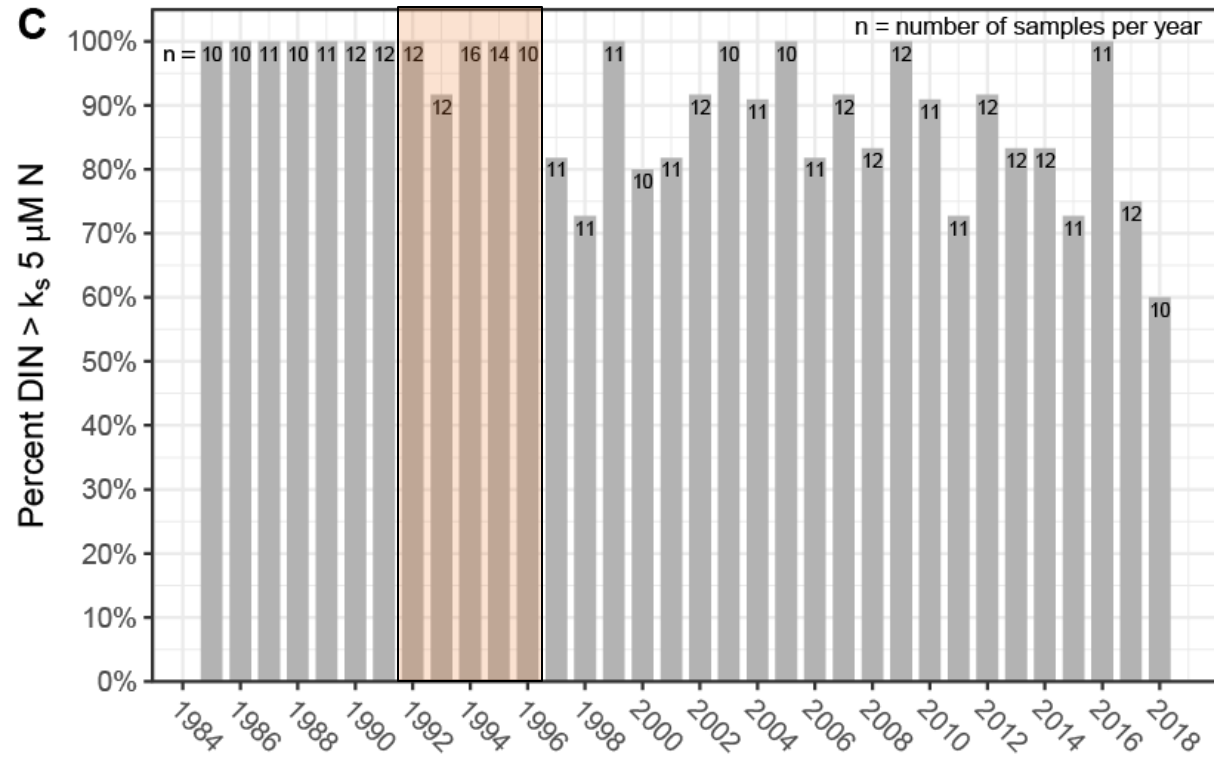
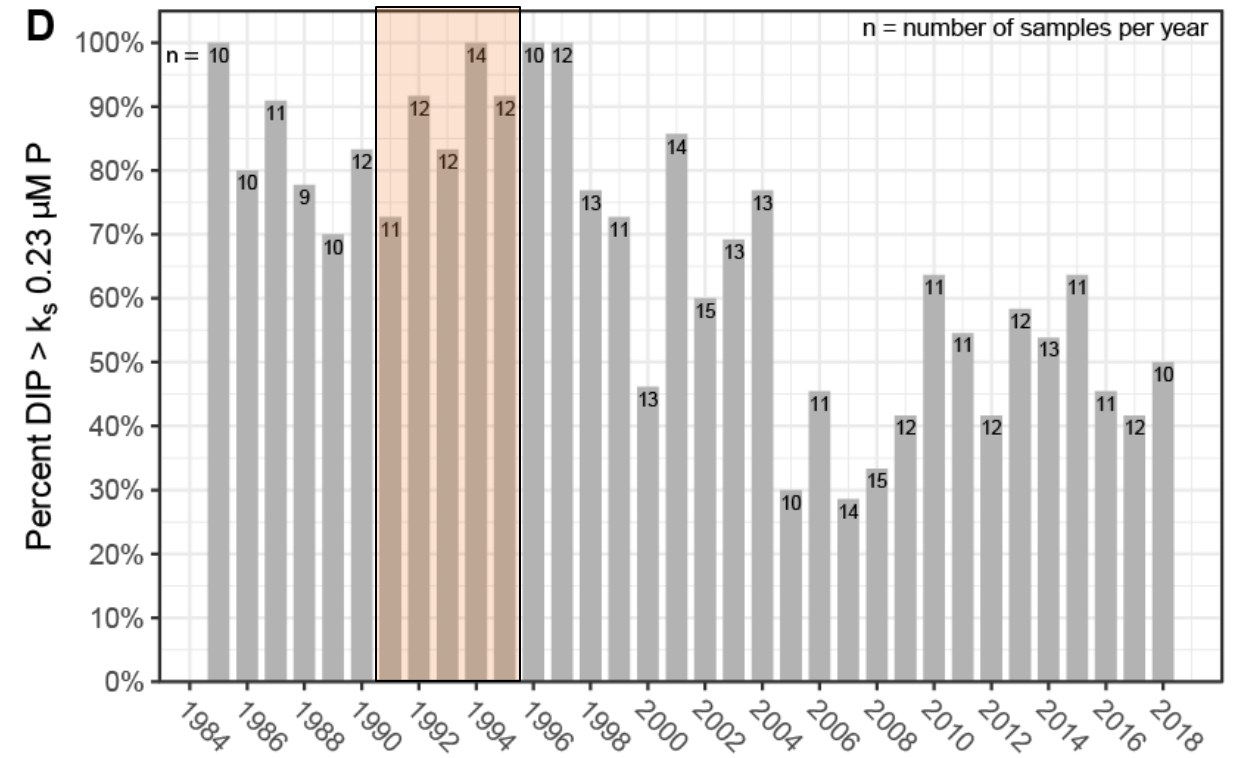
$$\text{Limitation factor} = \frac{\text{DIN}}{\text{Ks} + \text{DIN}}$$

Next Steps:

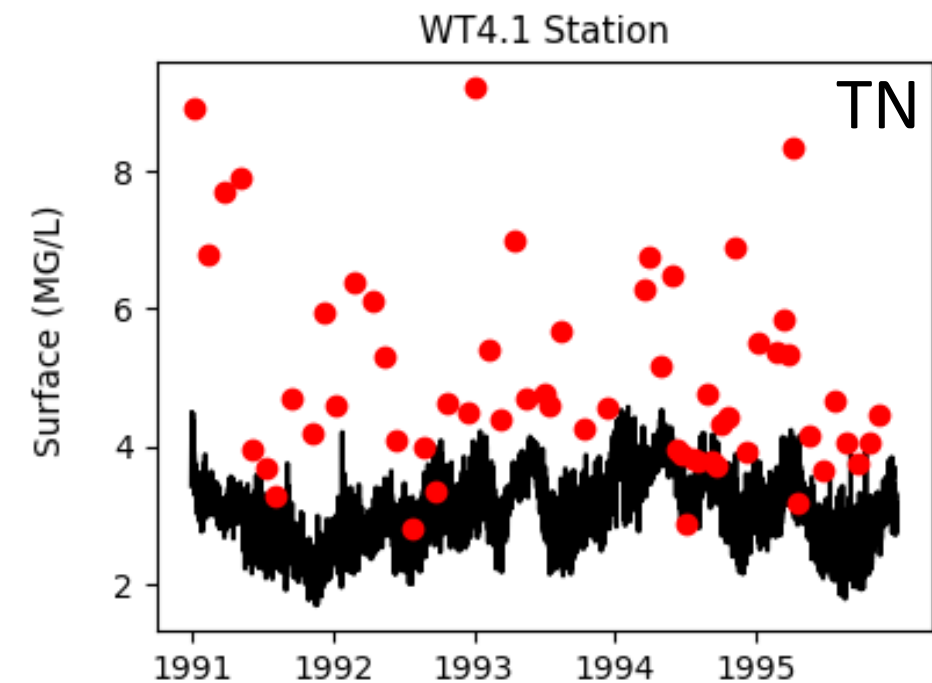
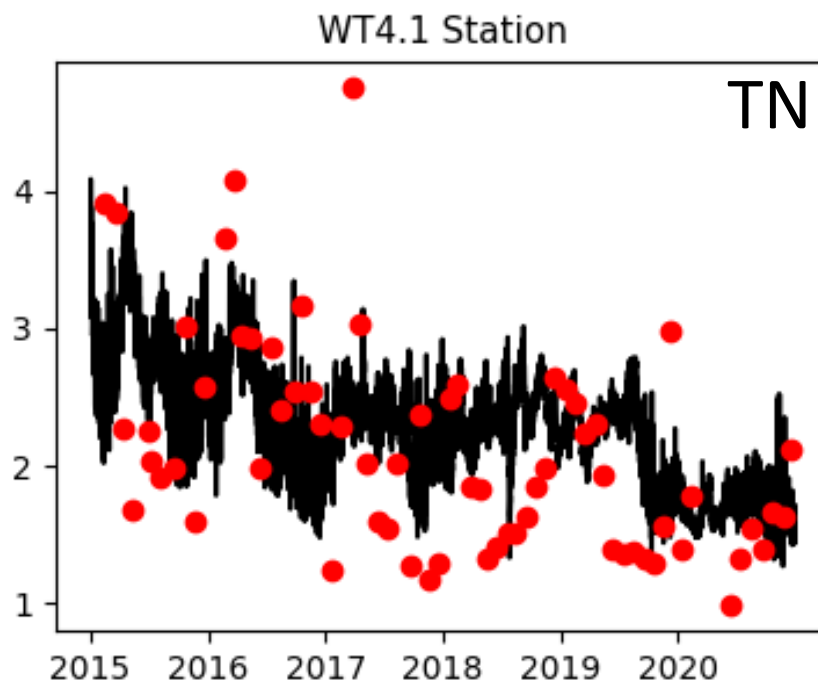
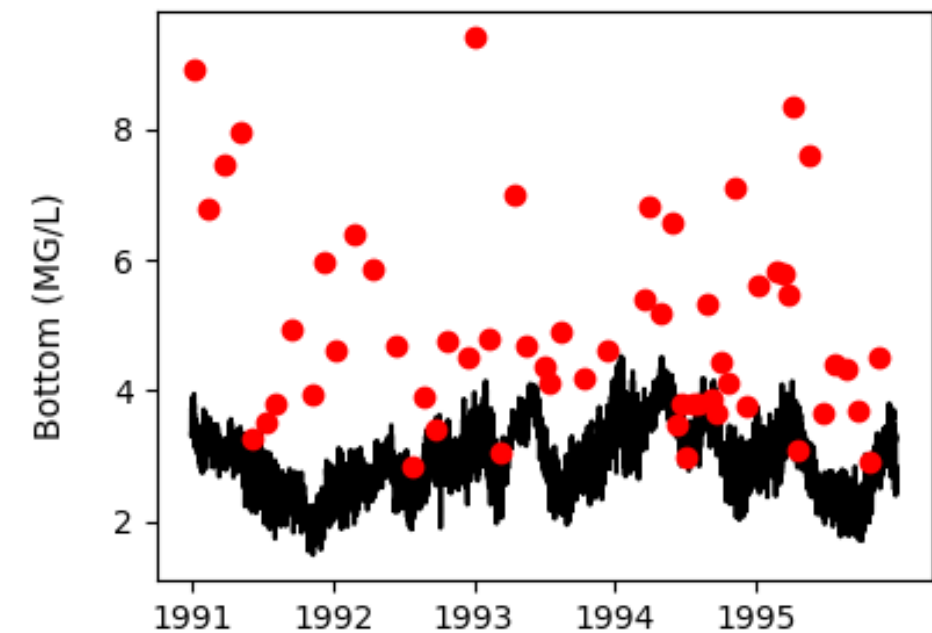
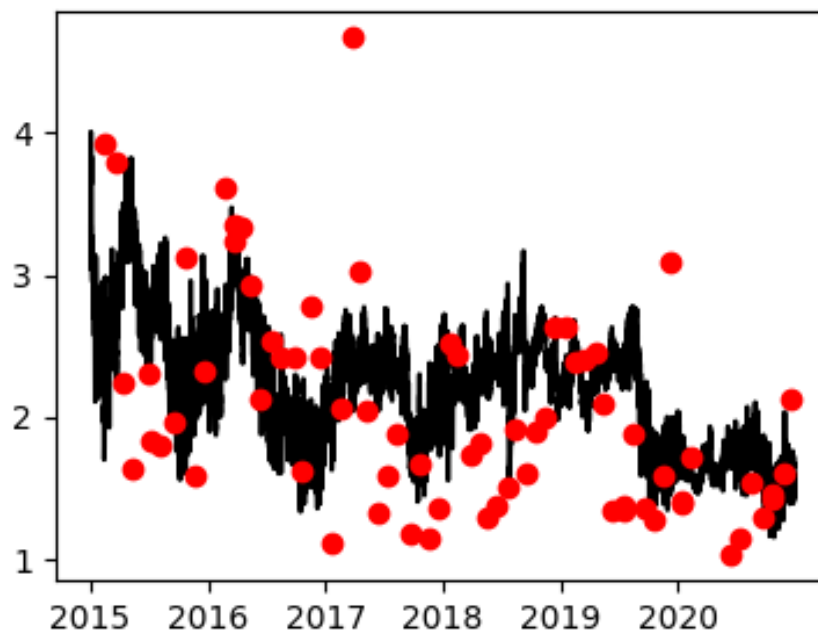
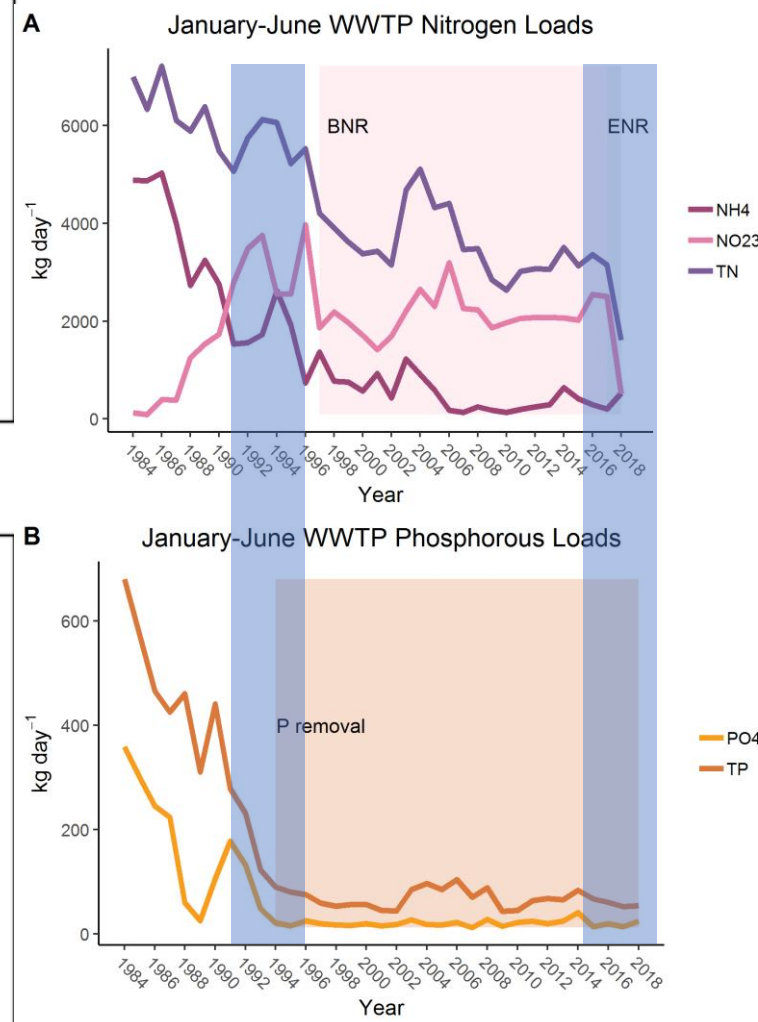
- (1) Adding additional P and N to sediments results in odd behavior, seems unrealistic
- (2) Currently verifying the loads are correct – the fact that TN and TP and too low suggests a missing external source



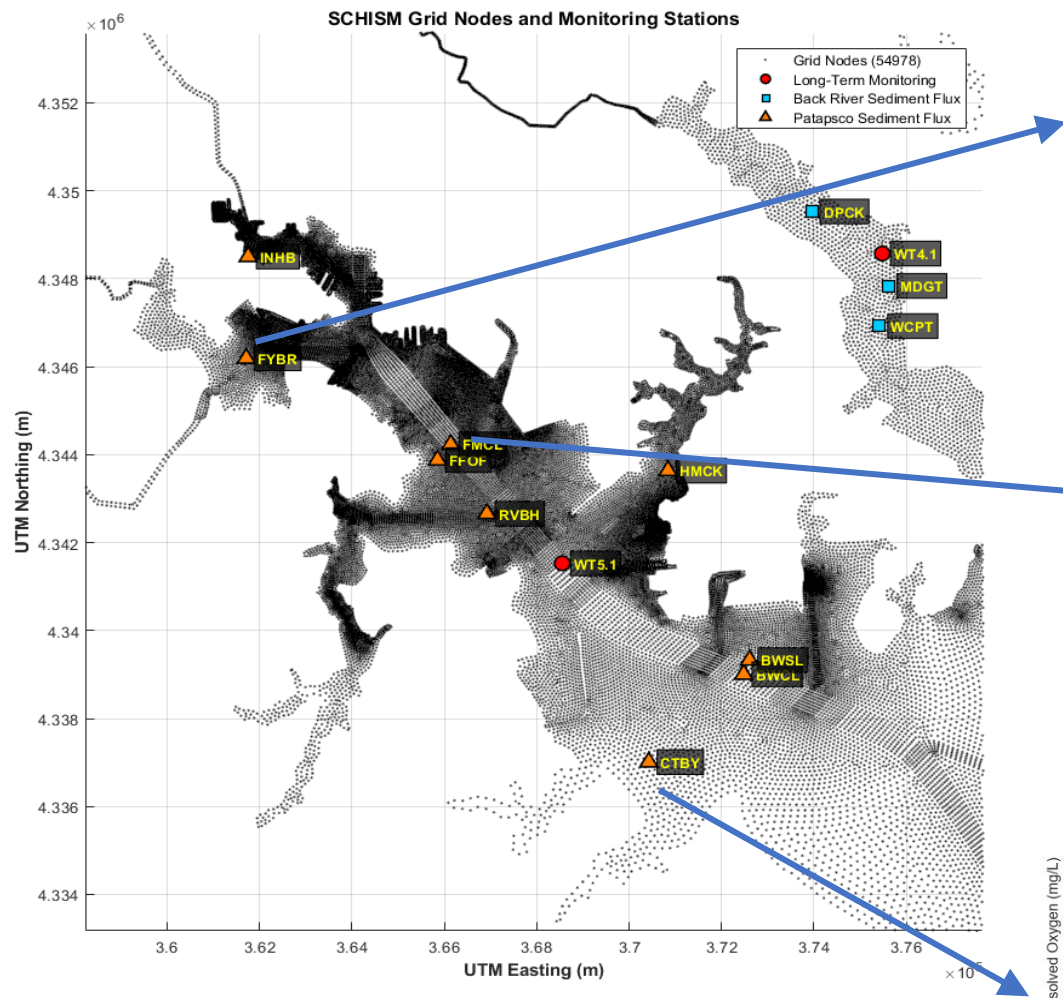
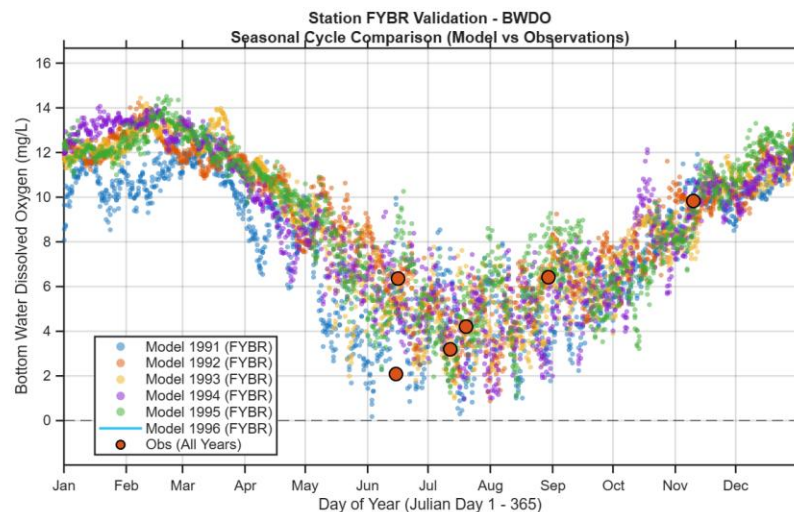
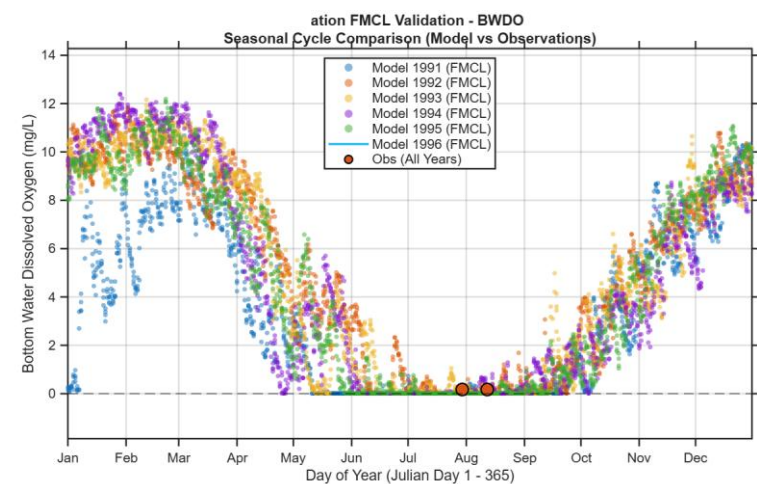
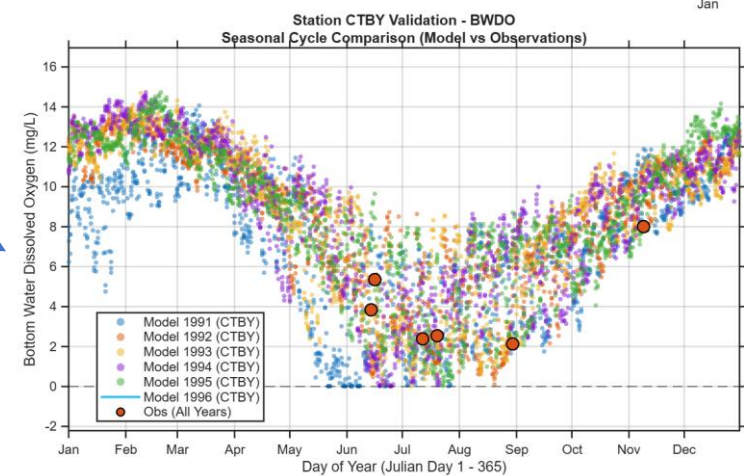
“Observations” of N and P limitation



Ongoing Work



Ongoing Work



Summary

Increasing Initial N and P to reflect legacy sediments improves simulation, but only slightly – still a missing nutrient source

Modern simulation period (2015-2020) shows better representation of TN and TP – WWTP load has declined

Next quarter goals:

- a. Finalize Back River validation
- b. Examine Patapsco DO in more details
- c. Understand changes from 1990s to late 2010s