Patuxent River Estuary Model

Progress in SCHISM–ICM Development and Validation

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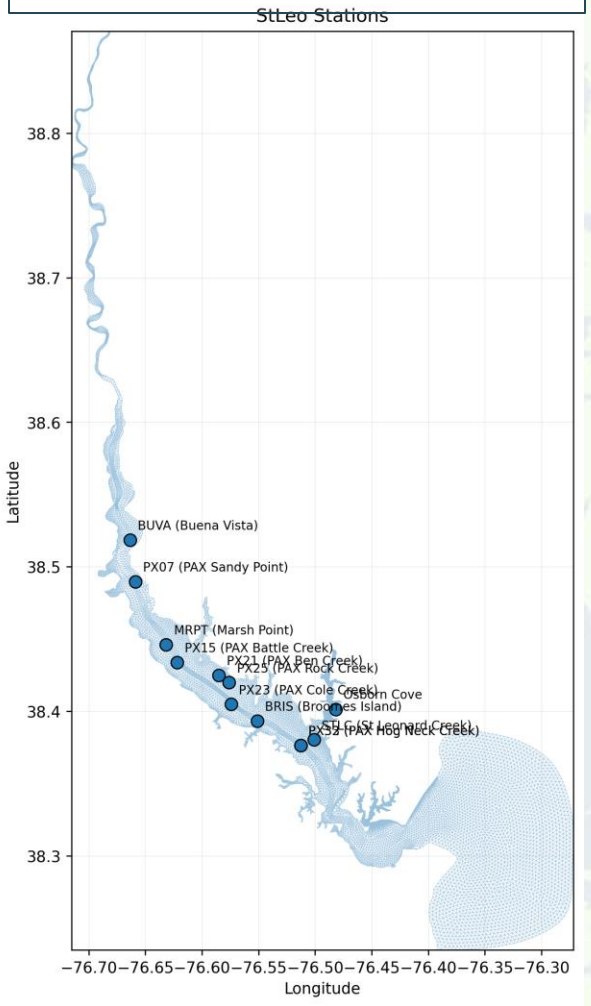
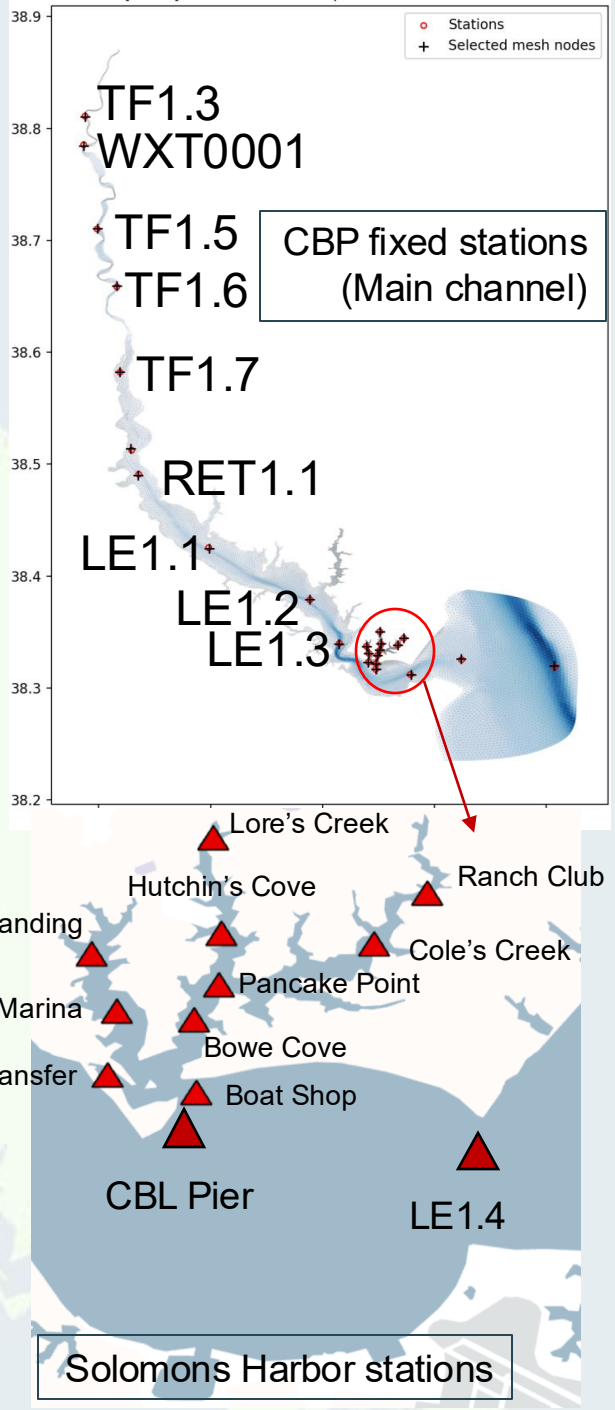
From Hydrodynamics to Water Quality

- 3-year sensitivity runs (1991-1993) to make decisions about the best I.C. for the longer run.
- Only ICM (NO external sediment model)
- 3 different sets of data in this period: CBP fixed stations, Solomons Harbor stations, Boynton et al. flux data
- Jeremy Testa's stand-alone SFM work on Patuxent stations used for I.C. (Sediment POC, PON, POP, NH4 and PO4)

Boynton et al. PAX sediment flux data stations





Three Challenges in Model Development

1) P sorption: How sensitive are phosphorus fluxes to initial sediment conditions?

Tests:

v1: bNH40 = 4.0, bNO30 = 1.0, bPO40 = 5.0, bpiePO4 = 180.0, bKOPO4f = 3000.0, bKOPO4s = 300.0

v5: bNH40 = -999, bNO30 = -999, bPO40 = -999, bpiePO4 = 10.0, bKOPO4f = 700.0, bKOPO4s = 150.0
POC(x9), PON(x3), POP(x3 to G1 and G3, a lot more to G2)

v6: bNH40 = -999, bNO30 = -999, bPO40 = -999, bpiePO4 = 100.0, bKOPO4f = 700.0, bKOPO4s = 150.0
POC(x9), PON(x3), POP(x3 to G1 and G3, a lot more to G2)

2) Sediment oxygen demand and bottom DO: How do initial sediment conditions affect sediment oxygen demand and bottom-water oxygen?

Tests:

v1: bNH40 = 4.0, bNO30 = 1.0, bPO40 = 5.0, bpiePO4 = 180.0, bKOPO4f = 3000.0, bKOPO4s = 300.0

v5: bNH40 = -999, bNO30 = -999, bPO40 = -999, bpiePO4 = 10.0, bKOPO4f = 700.0, bKOPO4s = 150.0
POC(x9), PON(x3), POP(x3 to G1 and G3, a lot more to G2)

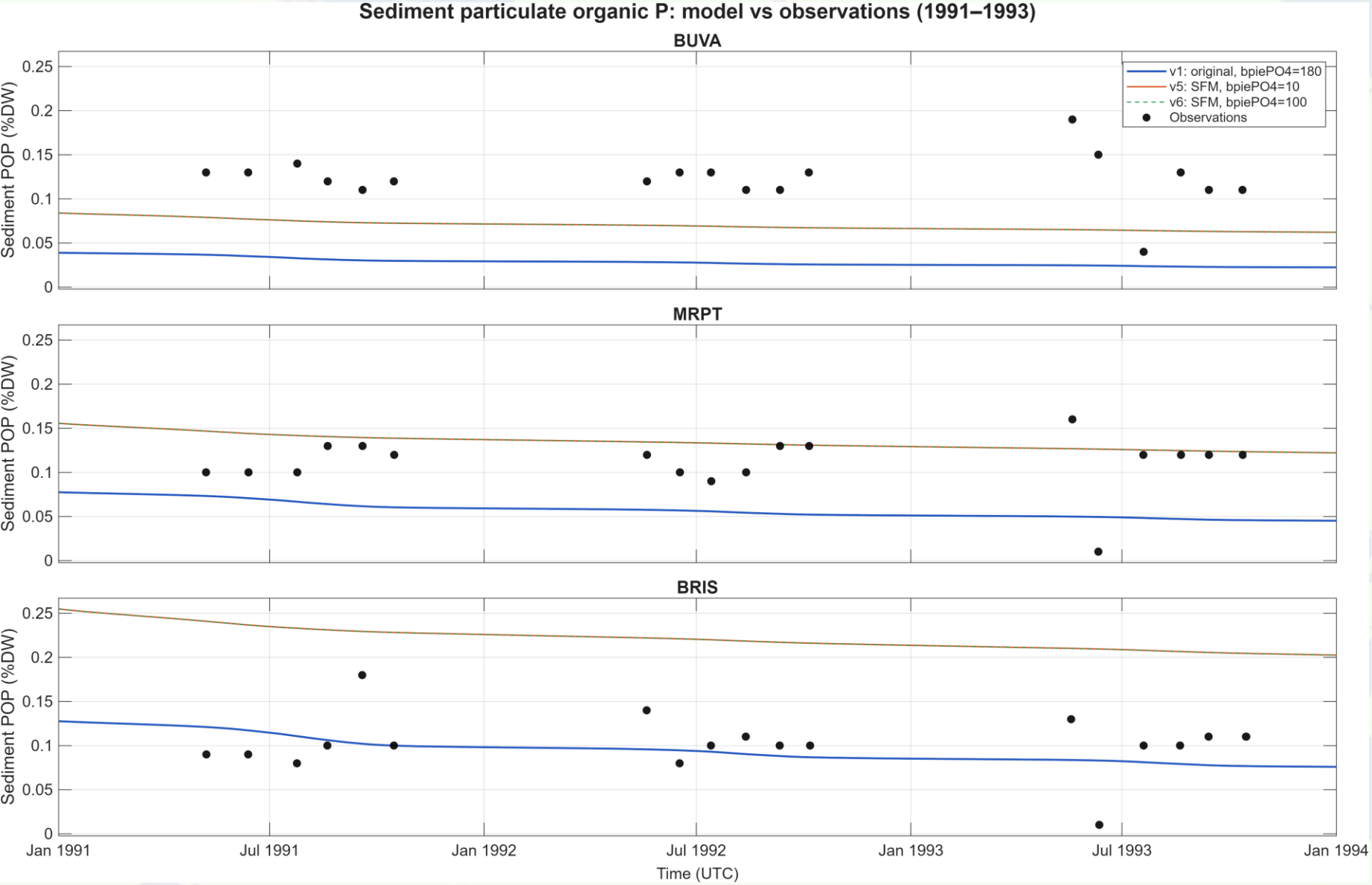
v6: bNH40 = -999, bNO30 = -999, bPO40 = -999, bpiePO4 = 100.0, bKOPO4f = 700.0, bKOPO4s = 150.0
POC(x9), PON(x3), POP(x3 to G1 and G3, a lot more to G2)

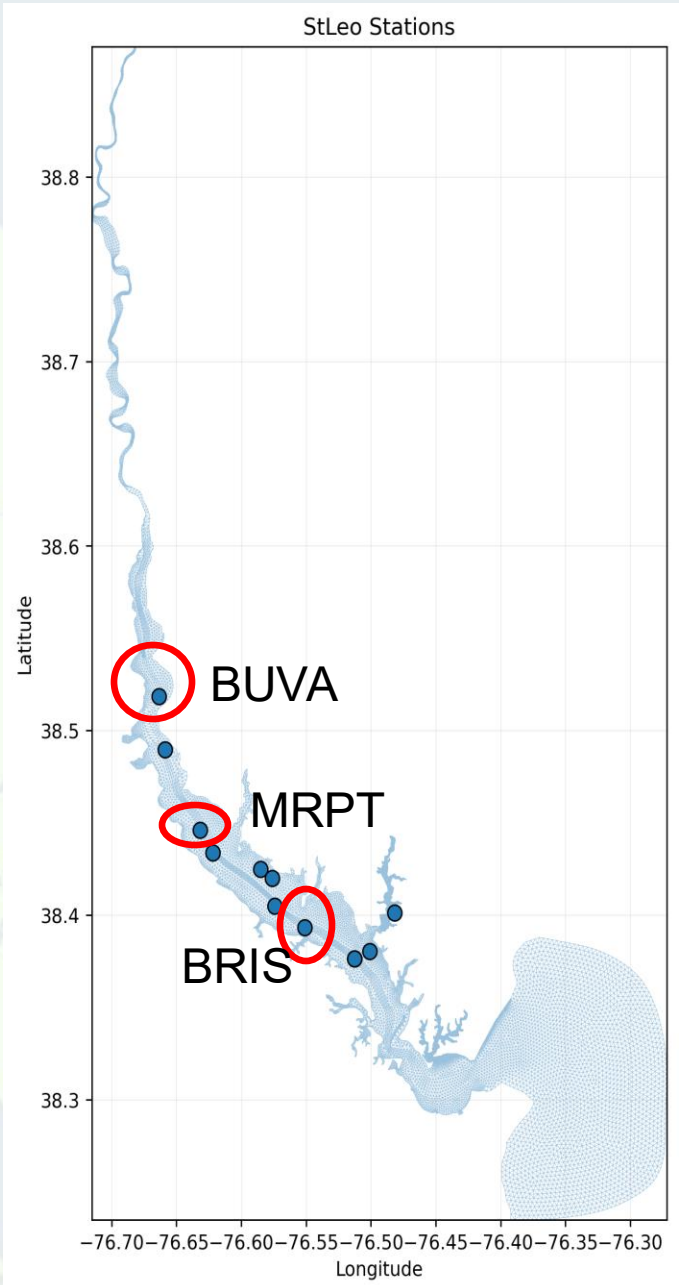
3) Solomons Harbor water-level issue

Tests:

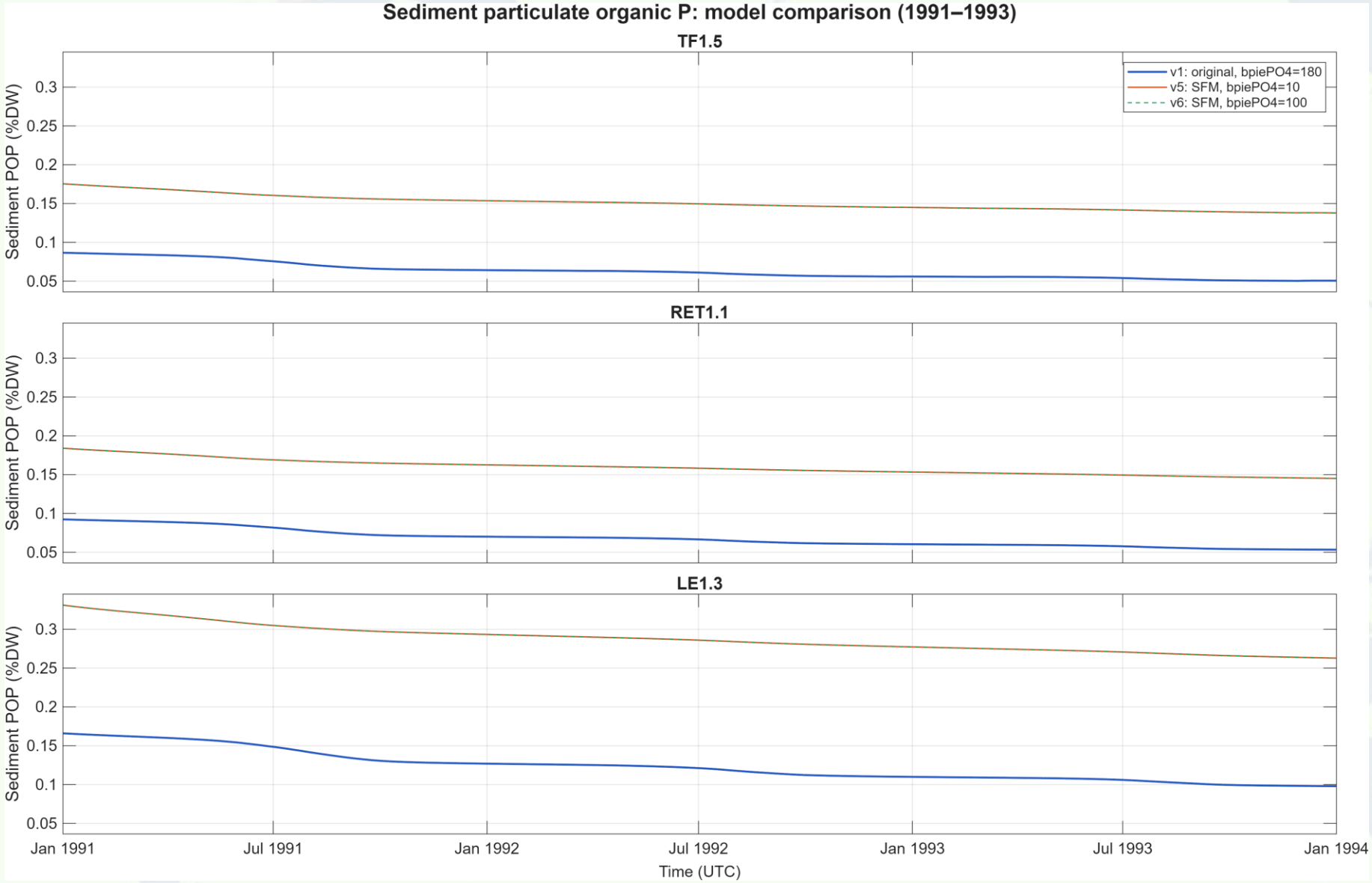
Distributed freshwater sources, reduced dt, increased minimum water depth for wetting/drying

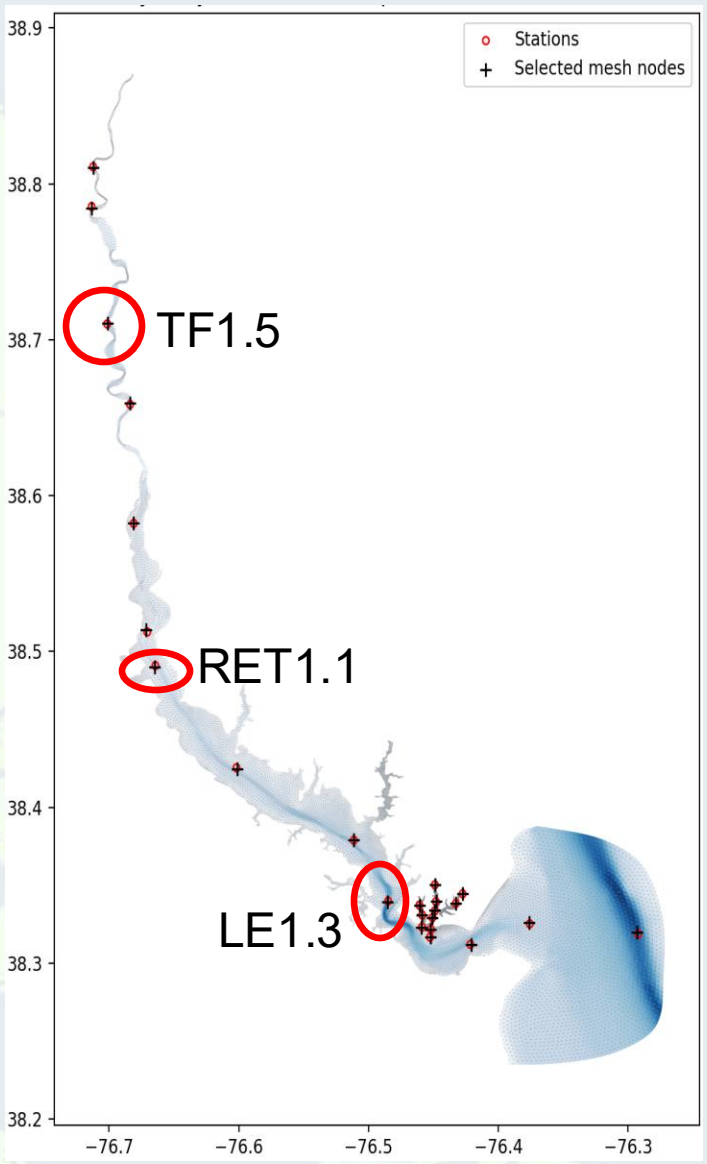
1) P sorption – Sediment PP



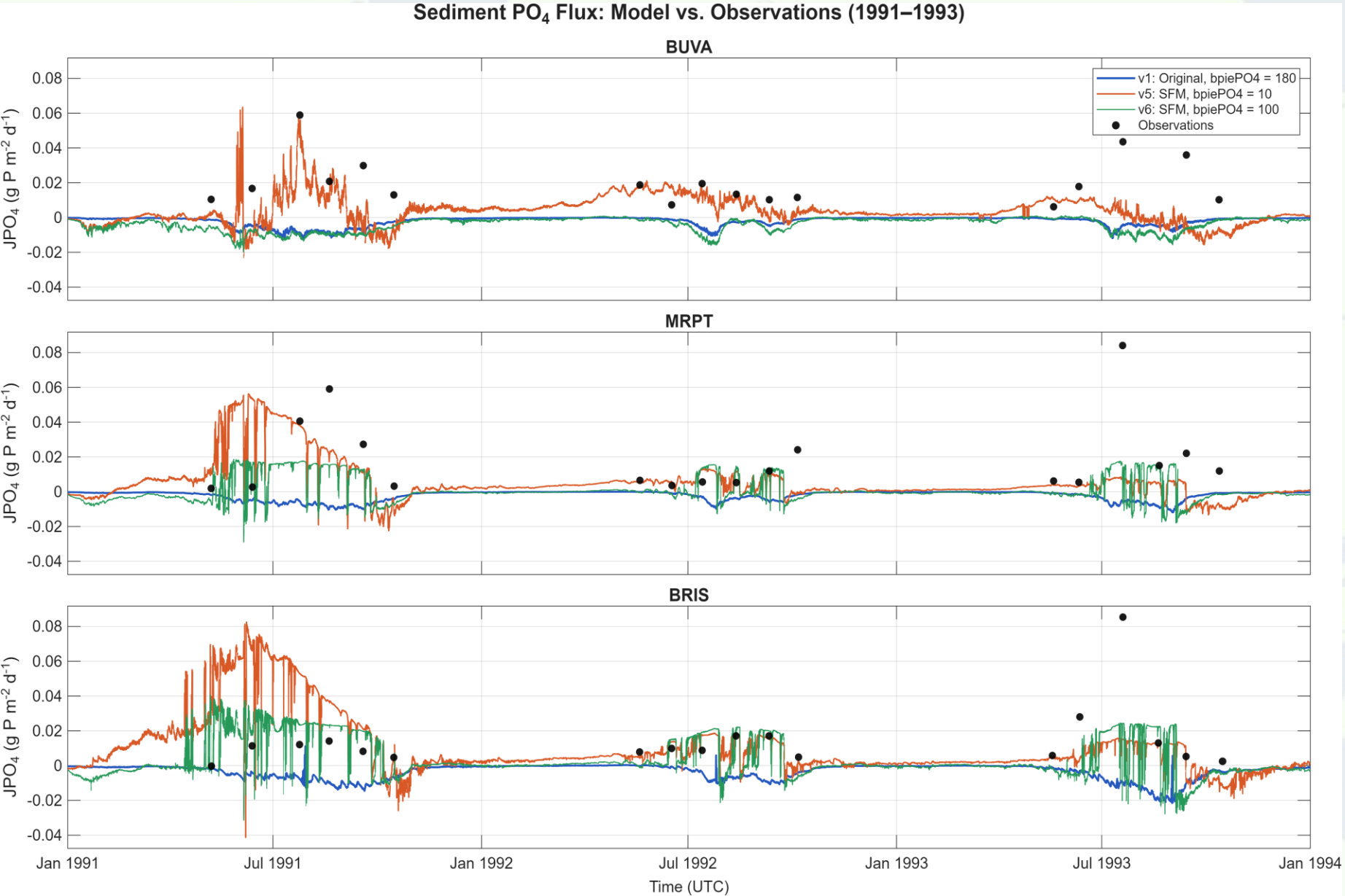


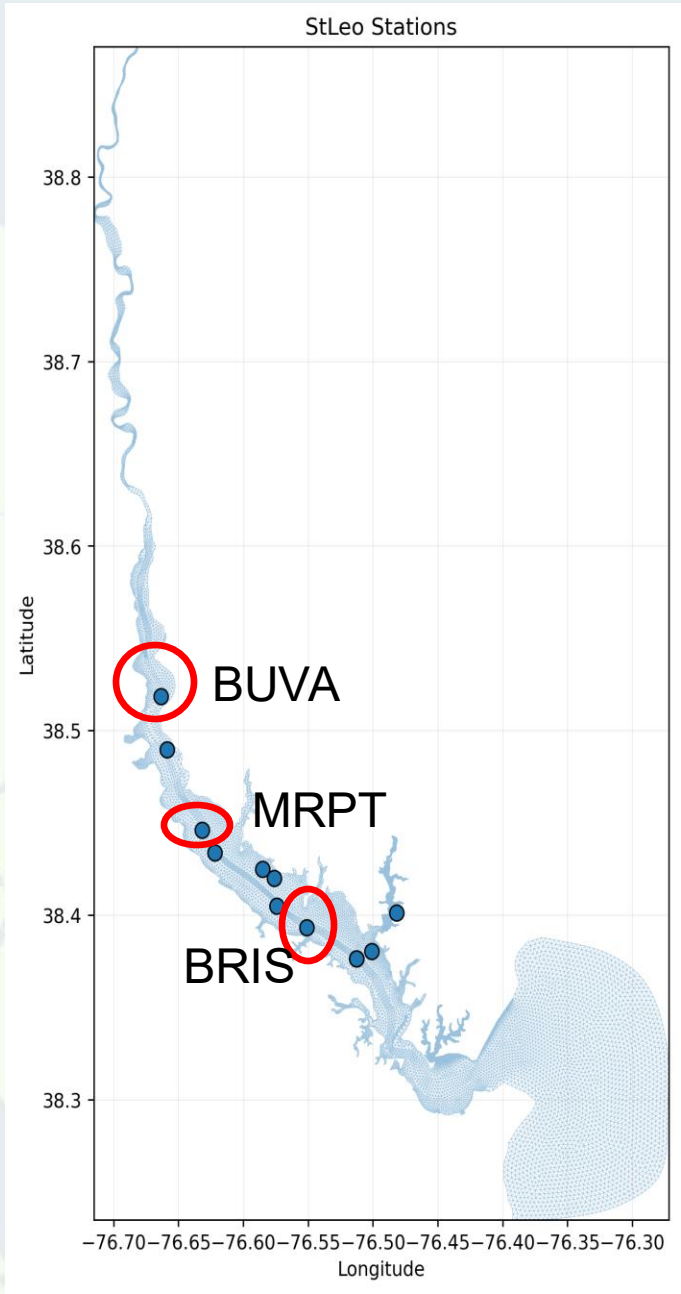
1) P sorption – Sediment PP





1) P sorption – Sediment PO_4 Flux





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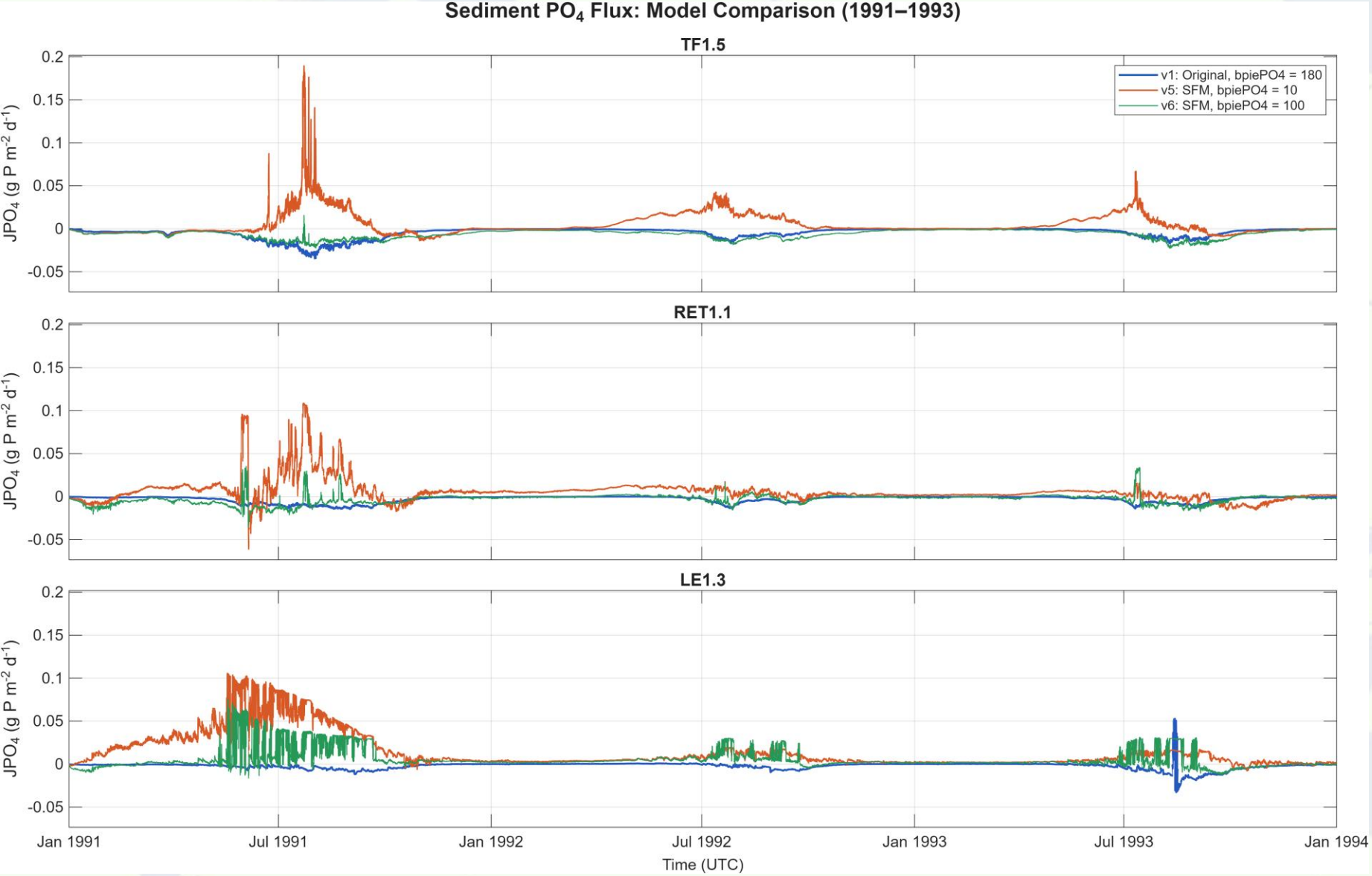
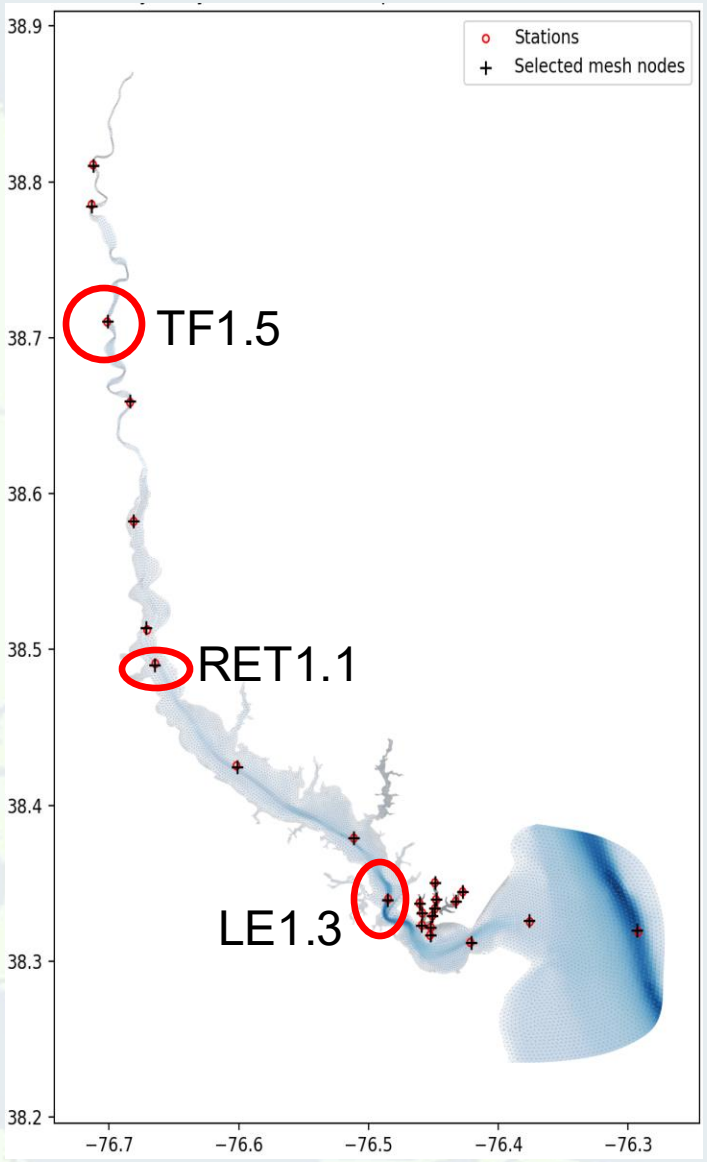
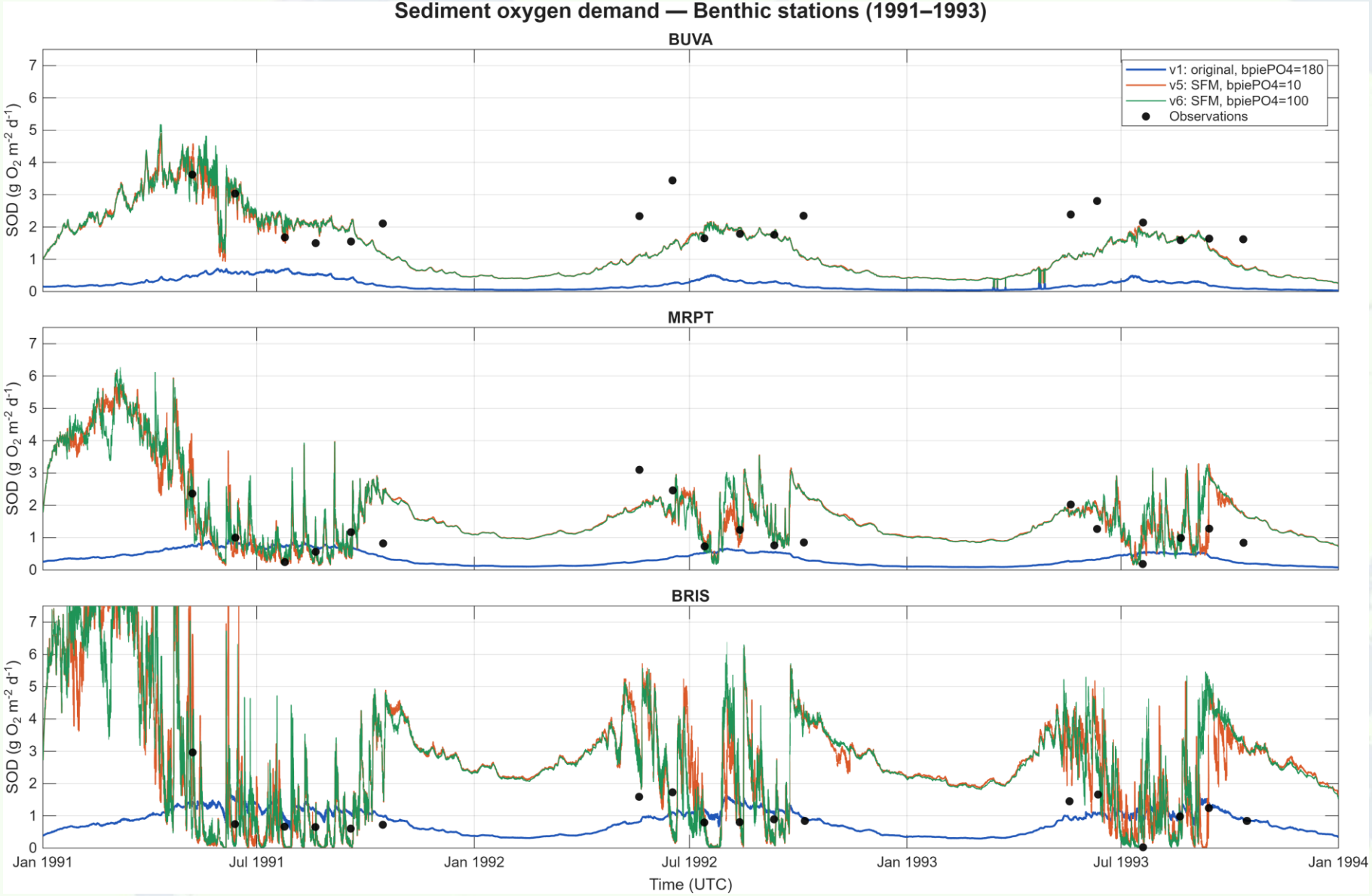
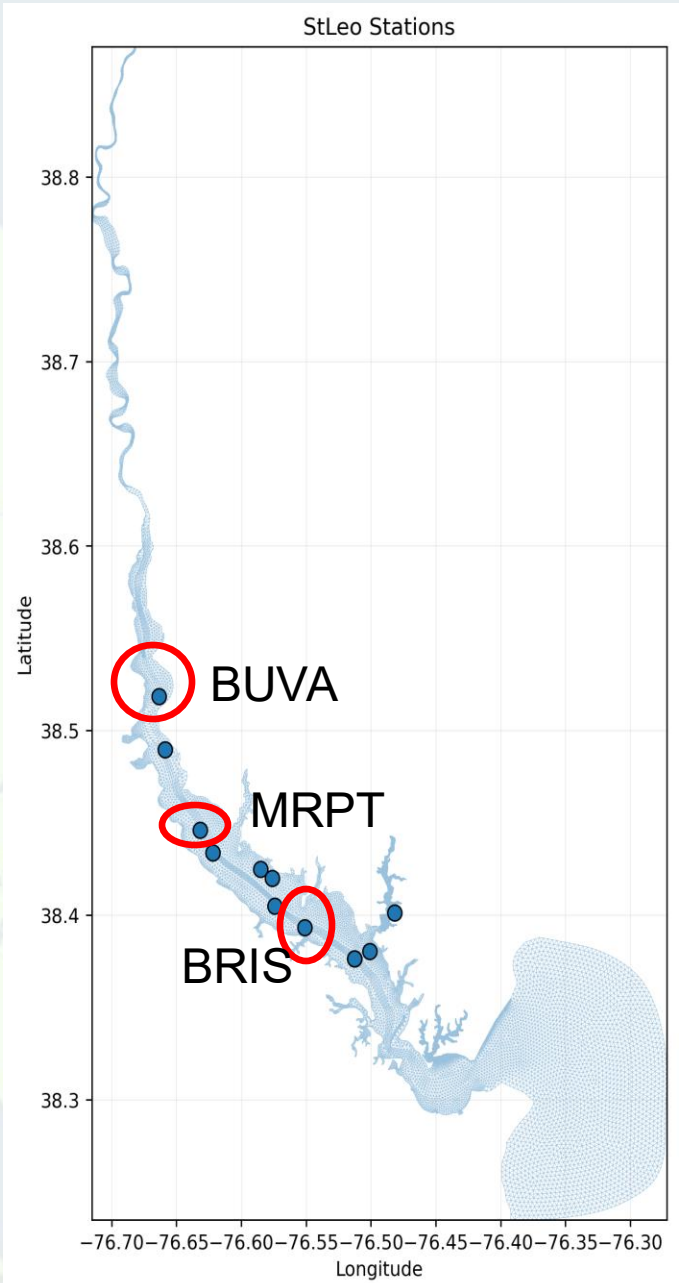




2) Sediment oxygen demand





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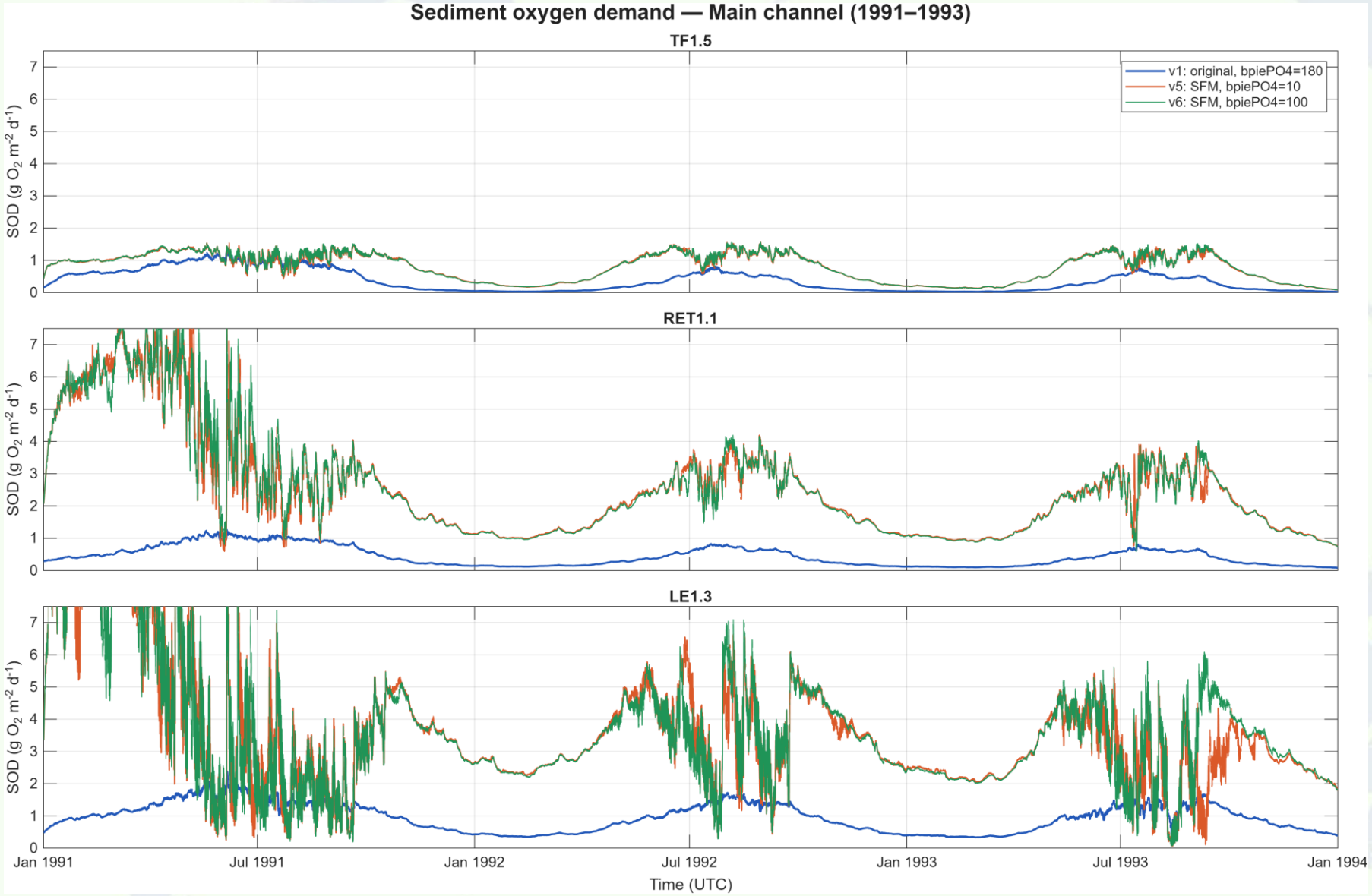

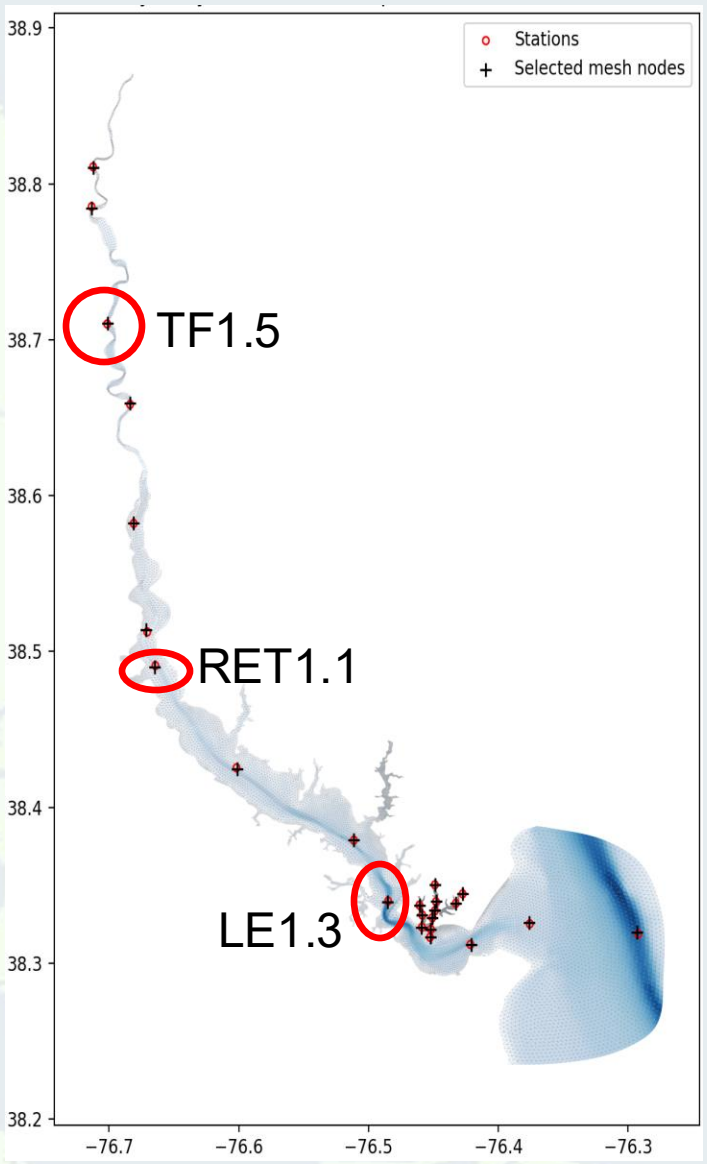

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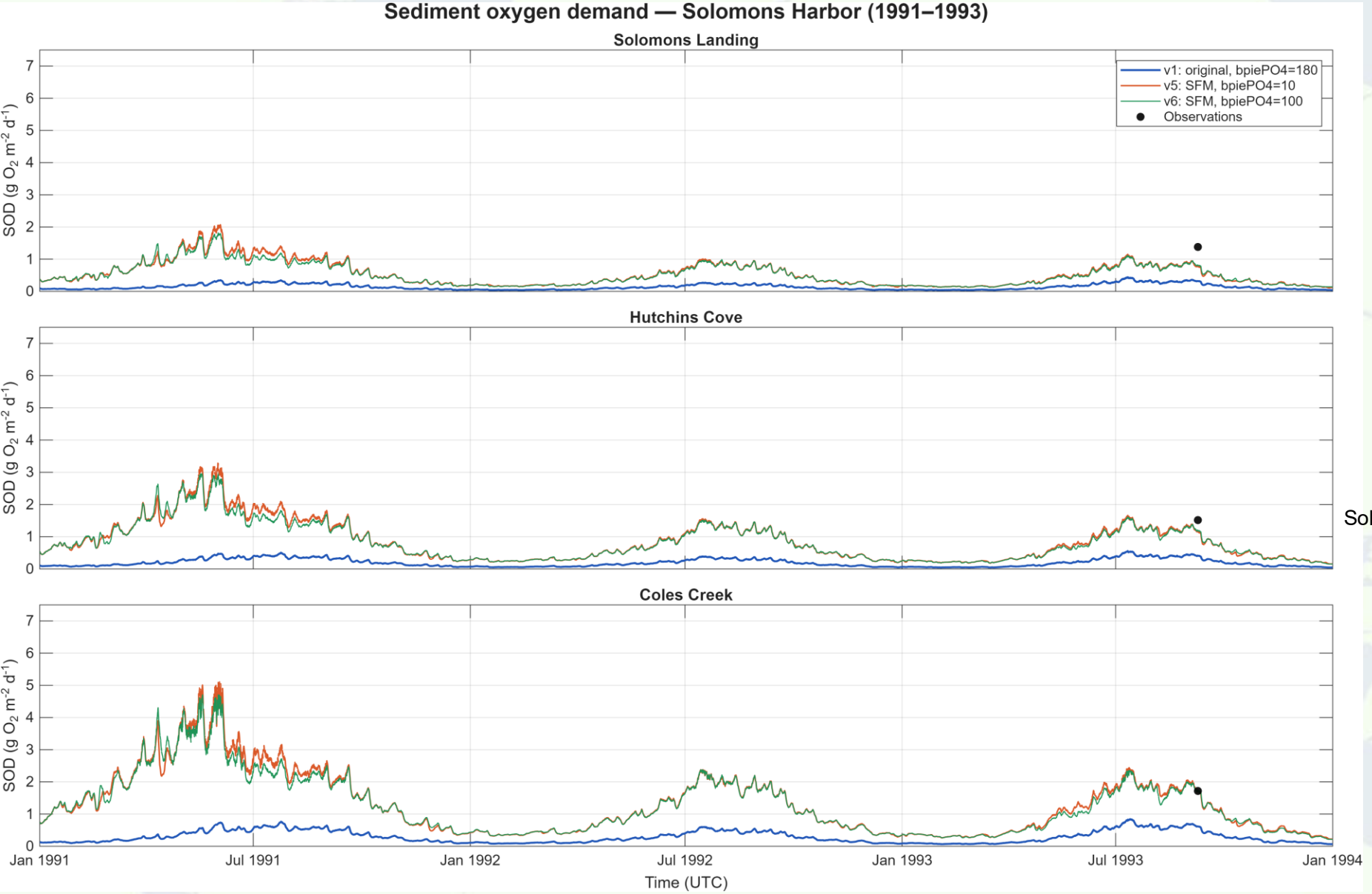
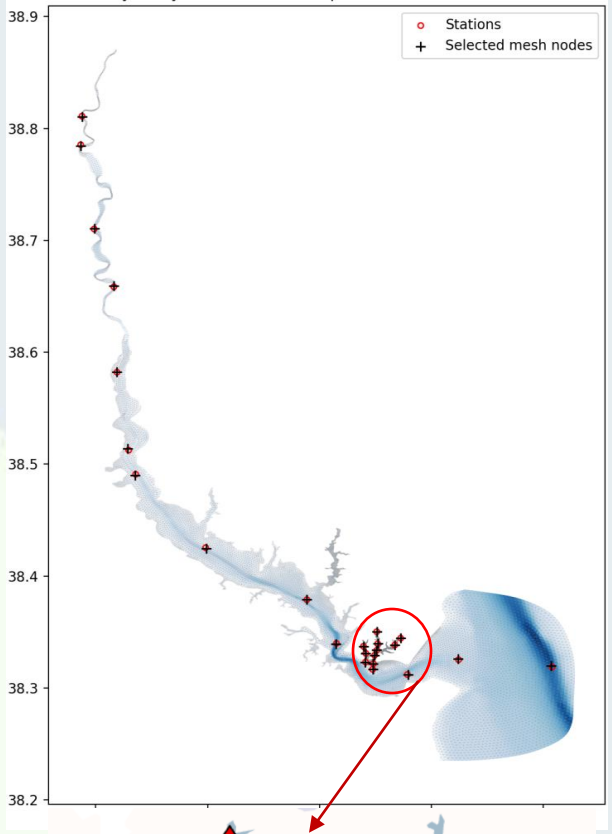
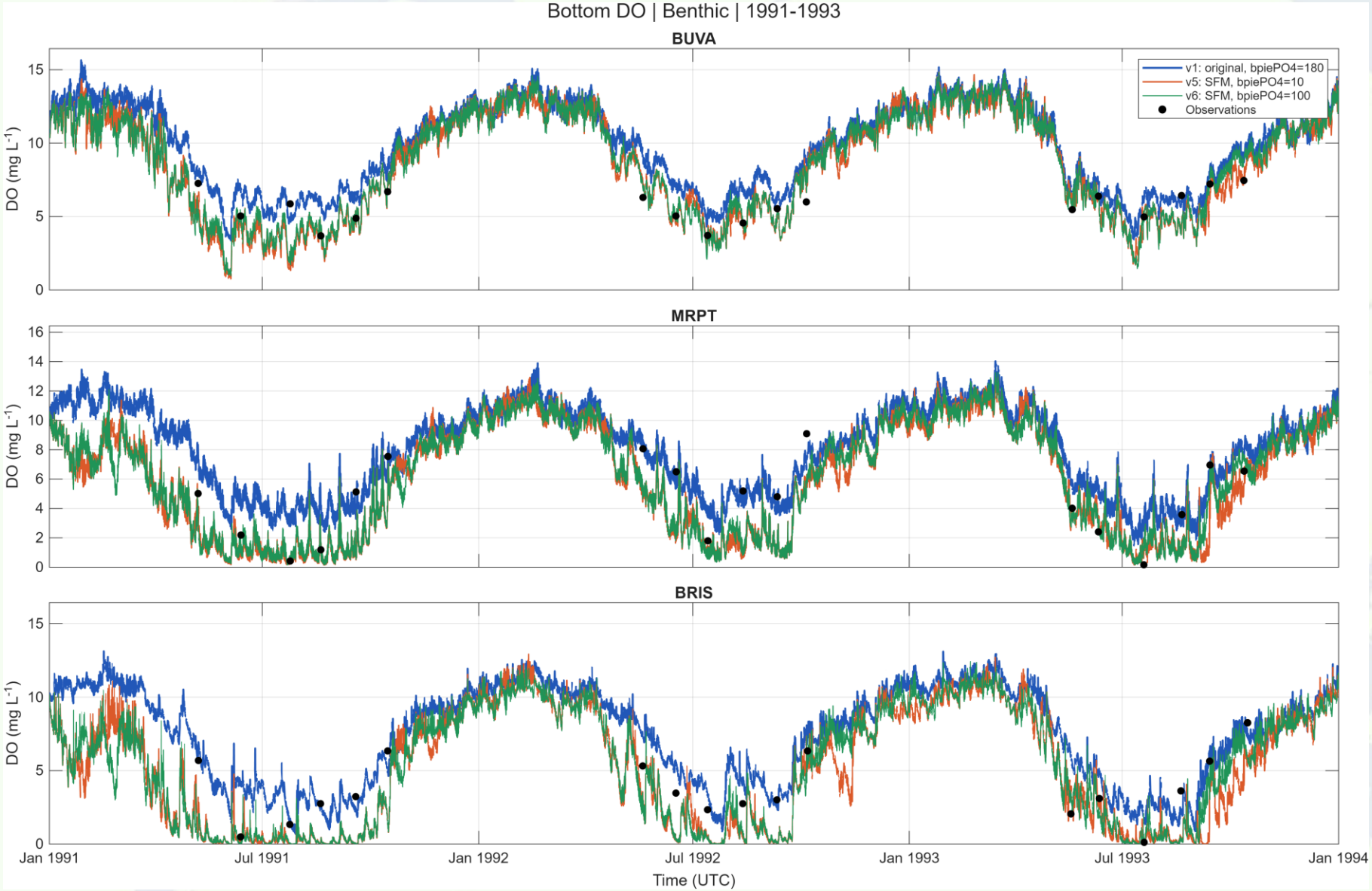
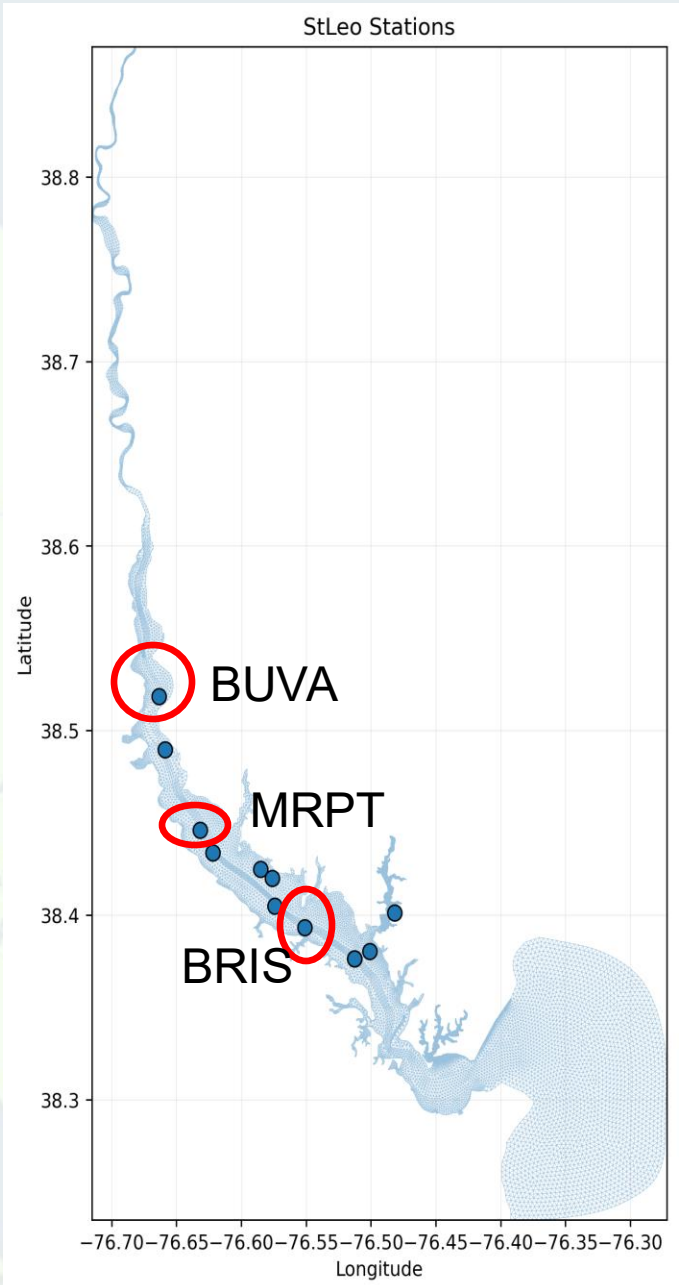


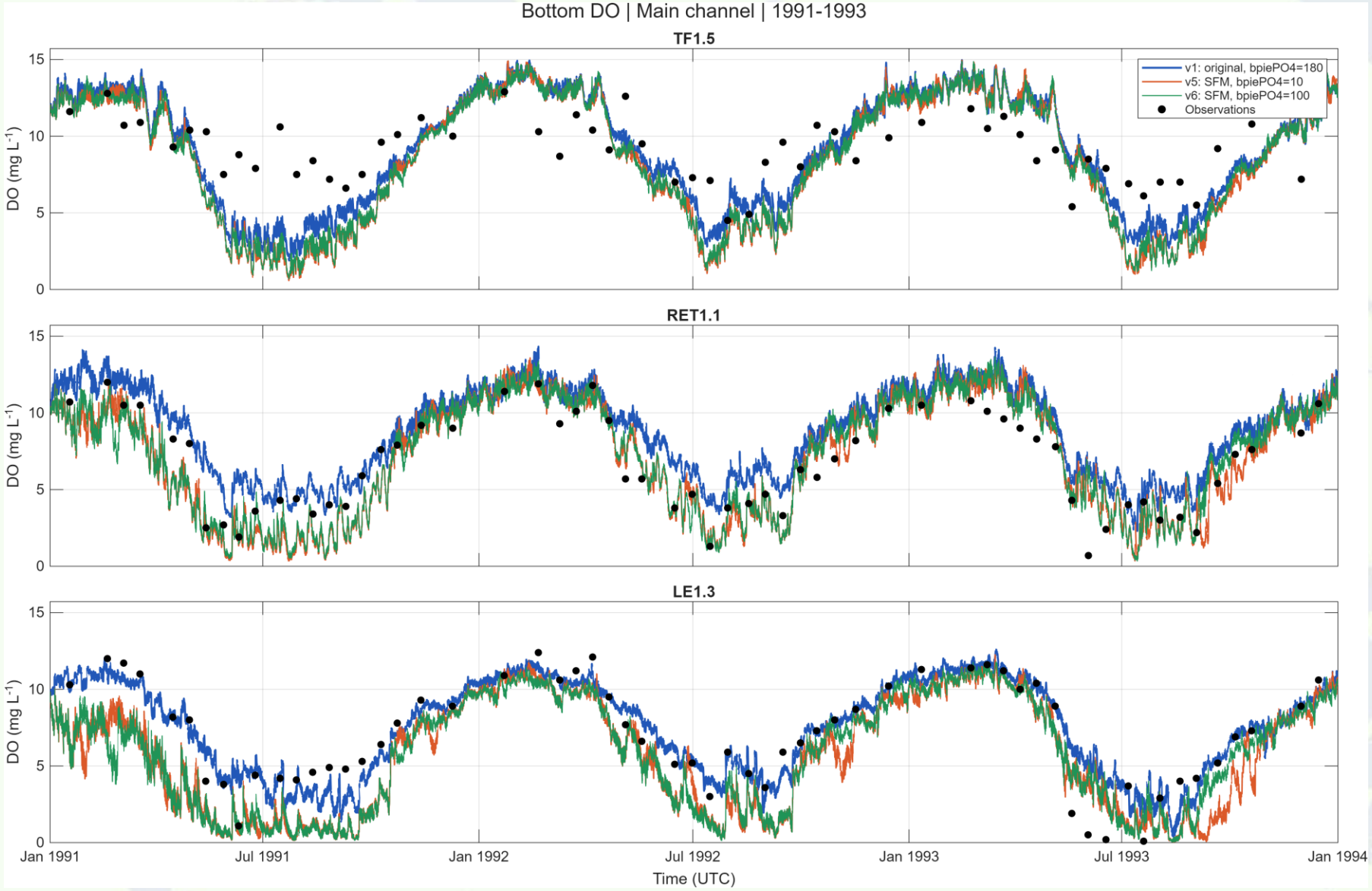


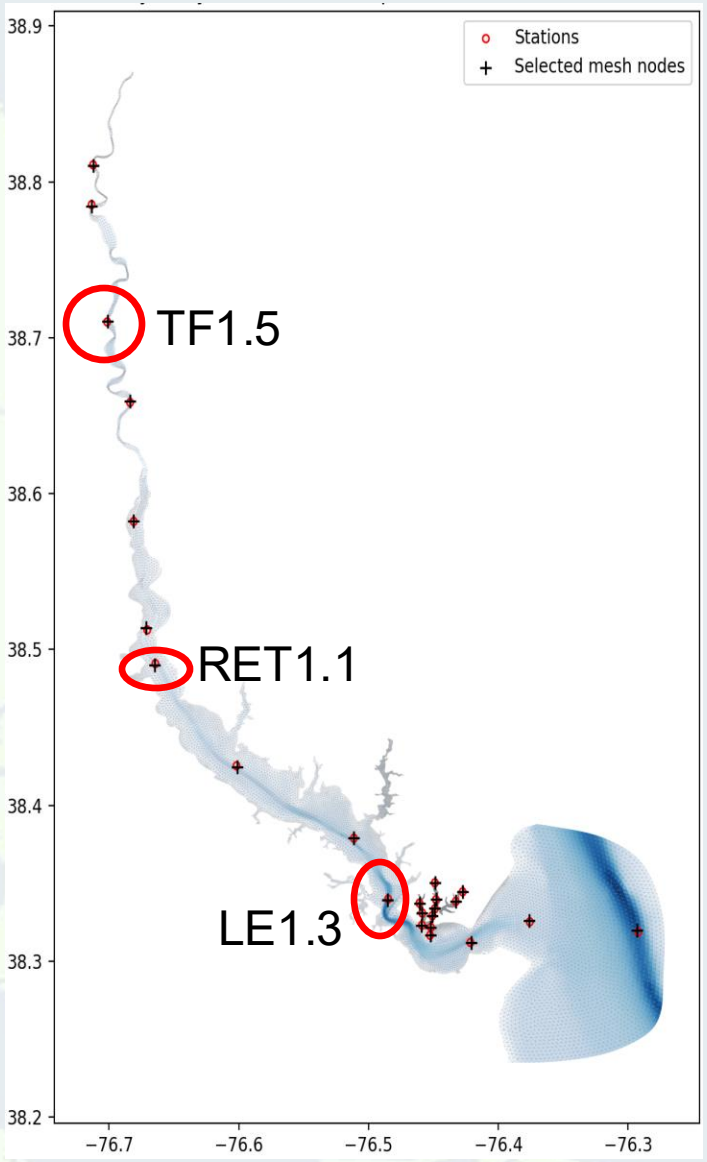
2) Bottom DO


Bottom DO | Benthic | 1991-1993
BUVA
MRPT
BRIS
v1: original, bpiePO4=180
v5: SFM, bpiePO4=10
v6: SFM, bpiePO4=100
Observations
DO (mg L-1)
Jan 1991
Jul 1991
Jan 1992
Jul 1992
Jan 1993
Jul 1993
Jan 1994
Time (UTC)

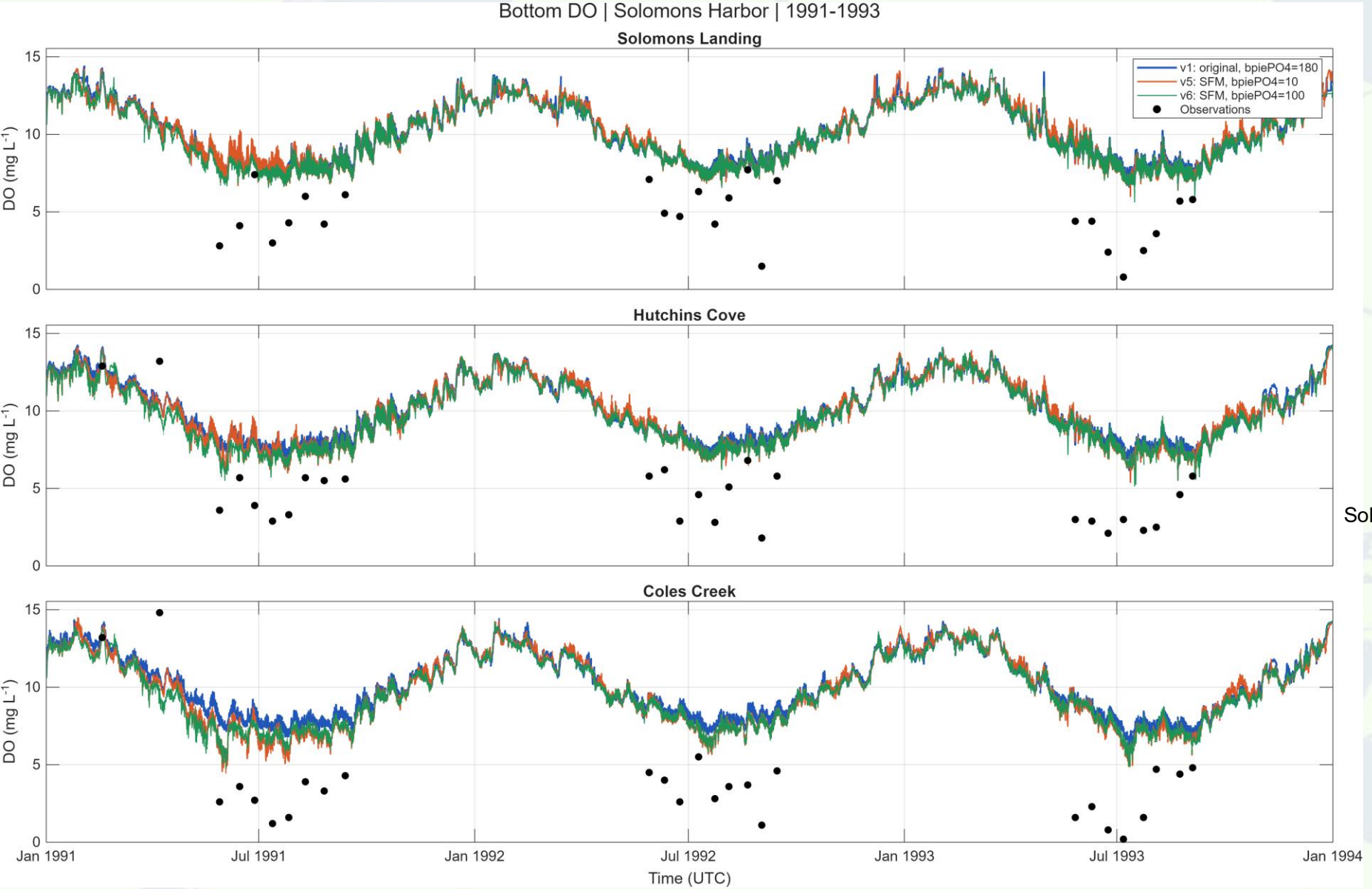

StLeo Stations
BUVA
MRPT
BRIS
Latitude
Longitude
38.8
38.7
38.6
38.5
38.4
38.3
−76.70 −76.65 −76.60 −76.55 −76.50 −76.45 −76.40 −76.35 −76.30

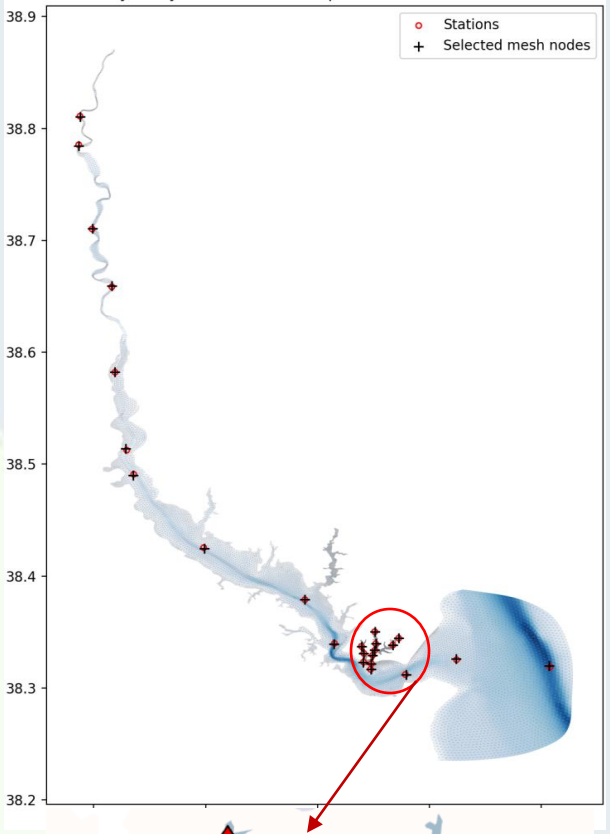
2) Bottom DO

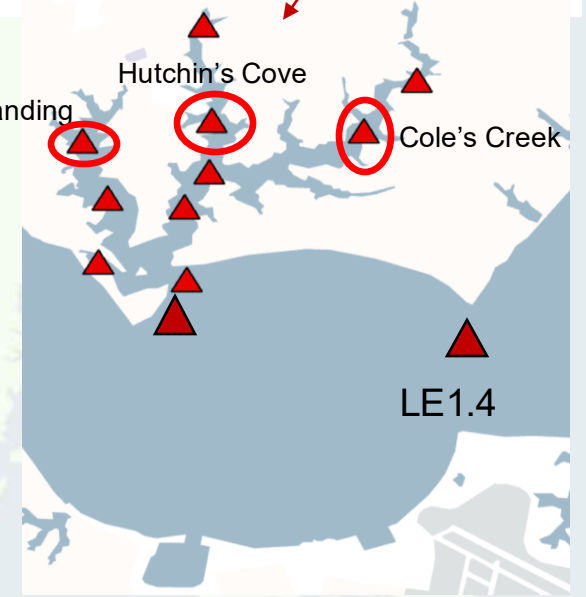

Bottom DO | Main channel | 1991-1993
TF1.5
RET1.1
LE1.3
v1: original, bpiePO4=180
v5: SFM, bpiePO4=10
v6: SFM, bpiePO4=100
Observations
DO (mg L-1)
0
5
10
15
Jan 1991
Jul 1991
Jan 1992
Jul 1992
Jan 1993
Jul 1993
Jan 1994
Time (UTC)


Stations
Selected mesh nodes
TF1.5
RET1.1
LE1.3
38.9
38.8
38.7
38.6
38.5
38.4
38.3
38.2
−76.7
−76.6
−76.5
−76.4
−76.3

2) Bottom DO

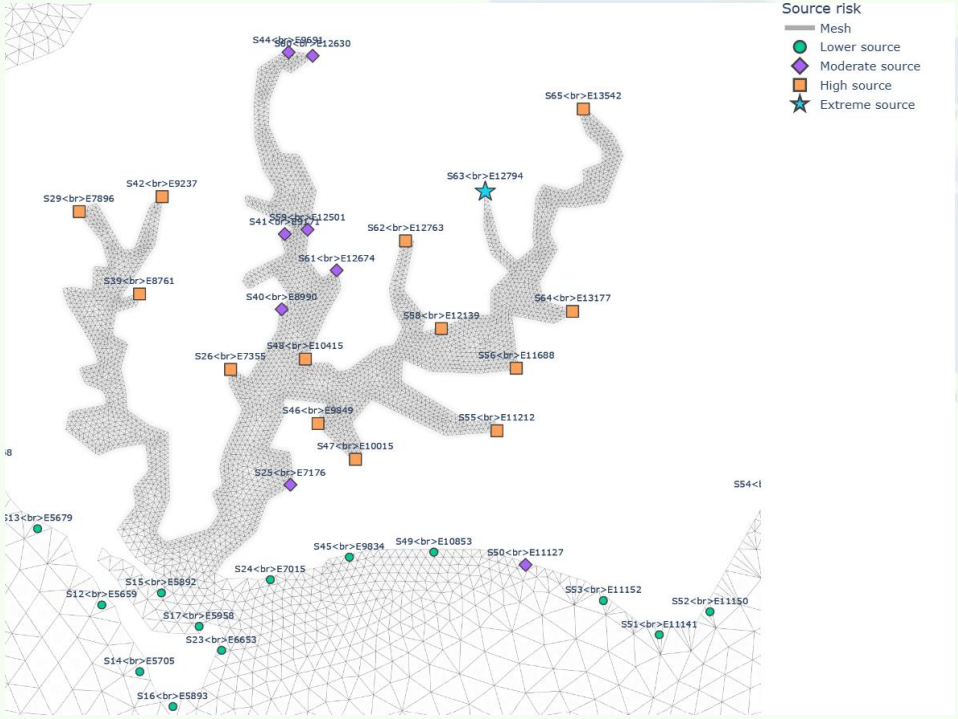

Bottom DO | Solomons Harbor | 1991-1993
Solomons Landing
Hutchins Cove
Coles Creek
v1: original, bpiePO4=180
v5: SFM, bpiePO4=10
v6: SFM, bpiePO4=100
Observations
DO (mg L-1)
0
5
10
15
Jan 1991
Jul 1991
Jan 1992
Jul 1992
Jan 1993
Jul 1993
Jan 1994
Time (UTC)


Stations
Selected mesh nodes
38.9
38.8
38.7
38.6
38.5
38.4
38.3
38.2

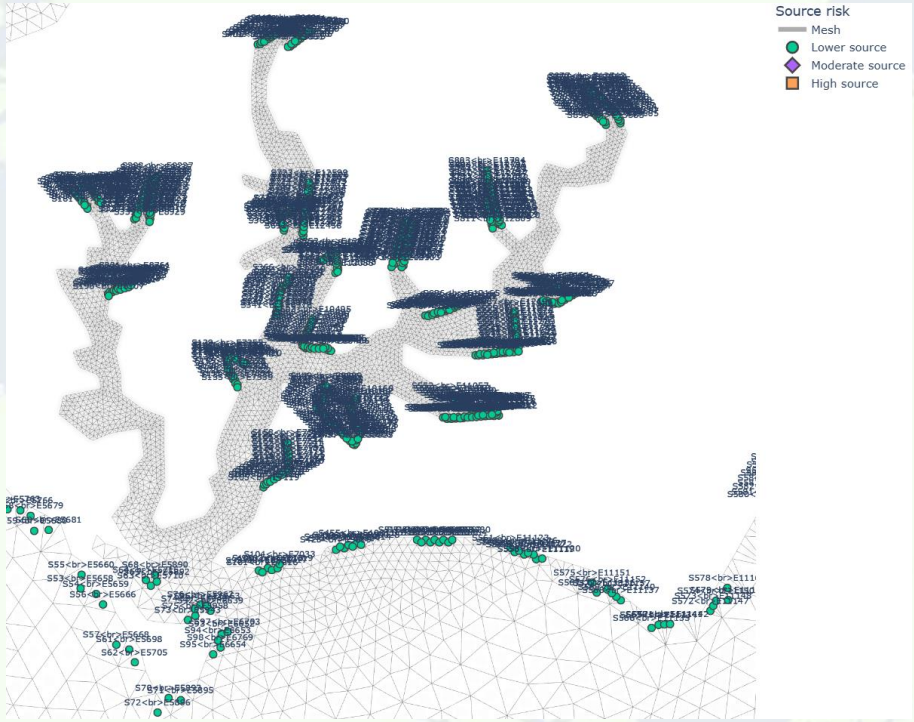

Hutchin's Cove
Solomons Landing
Cole's Creek
LE1.4

3) Solomons Harbor Water Level – in progress

Before

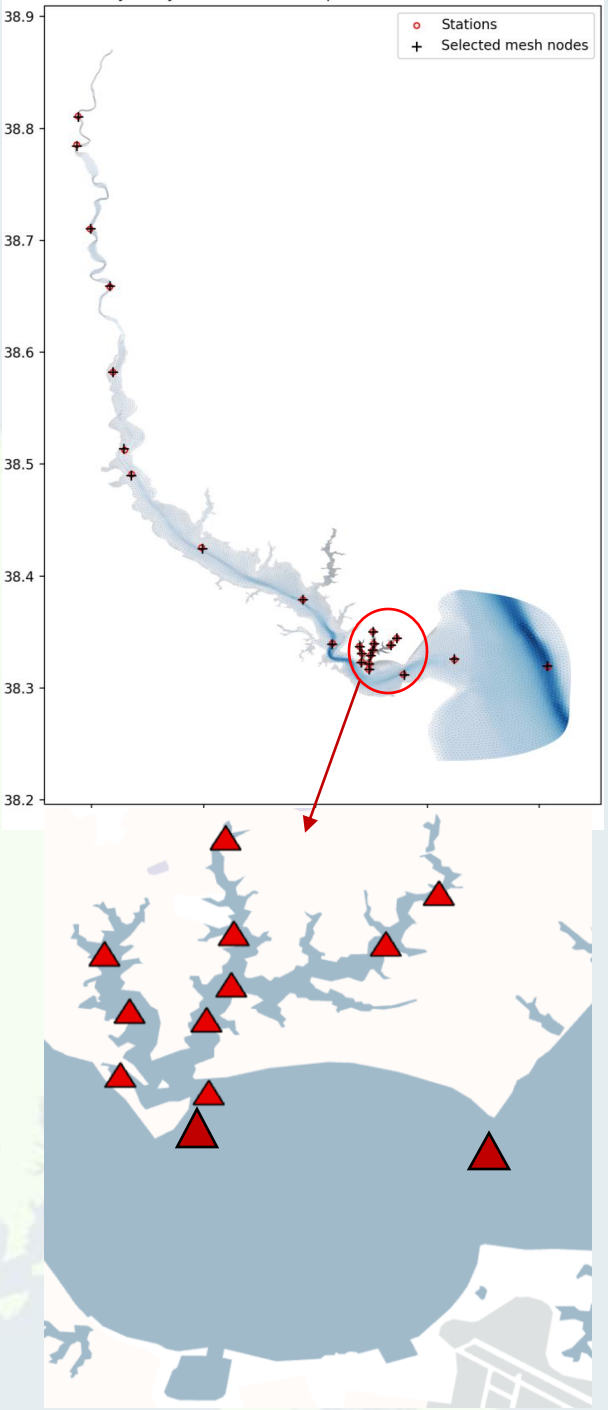


After

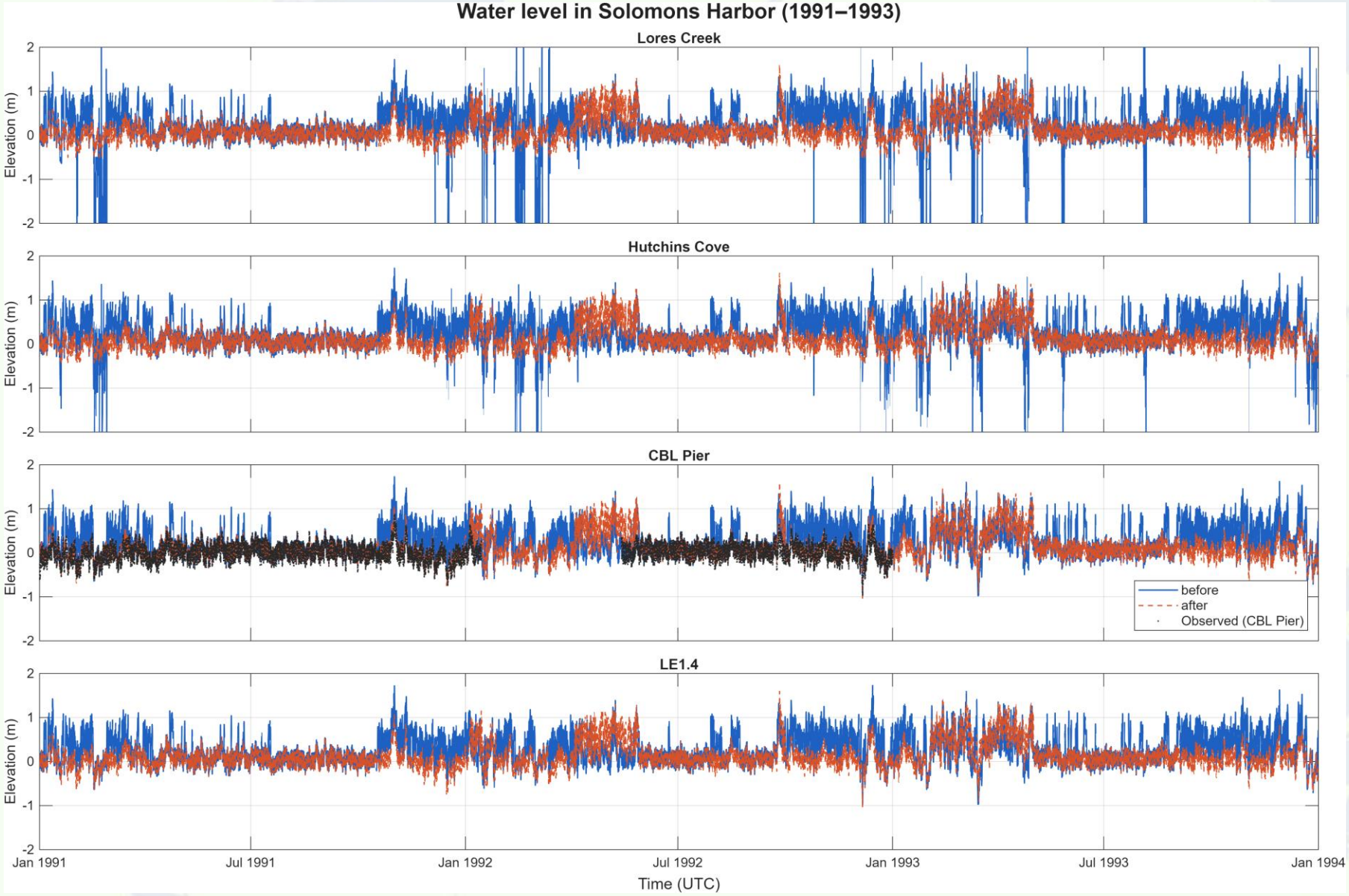


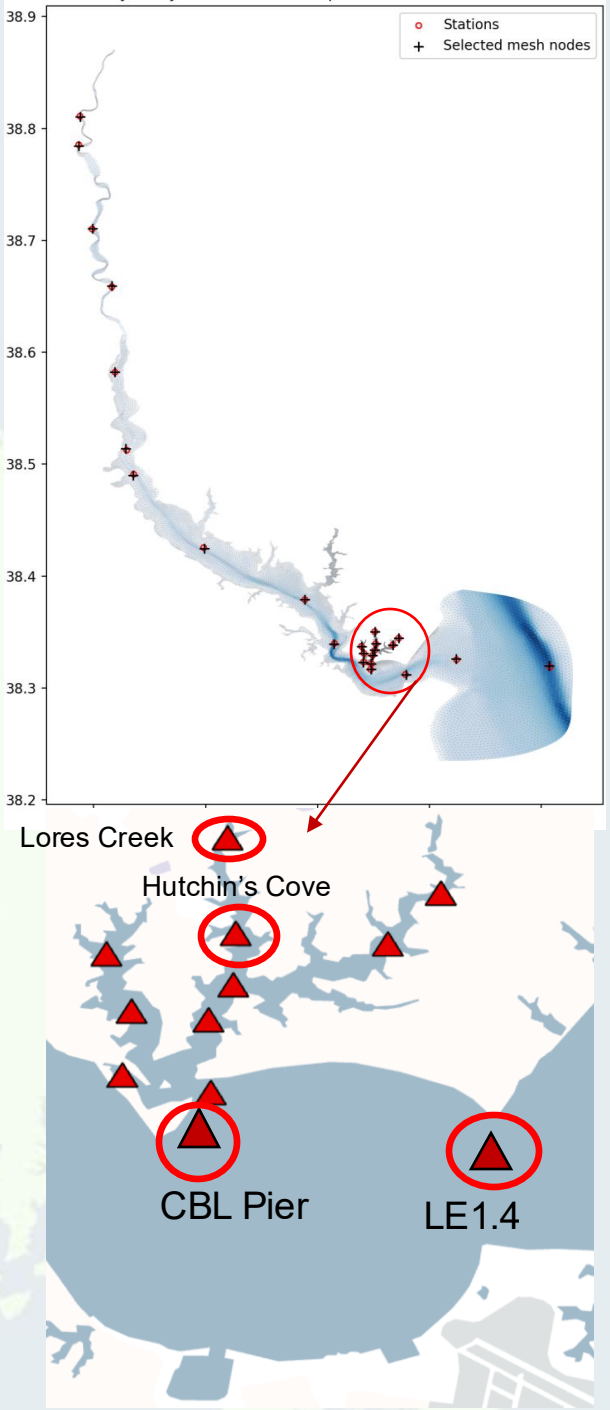
dt = 150
h0 = 5 cm

dt = 75
h0 = 7.5 cm



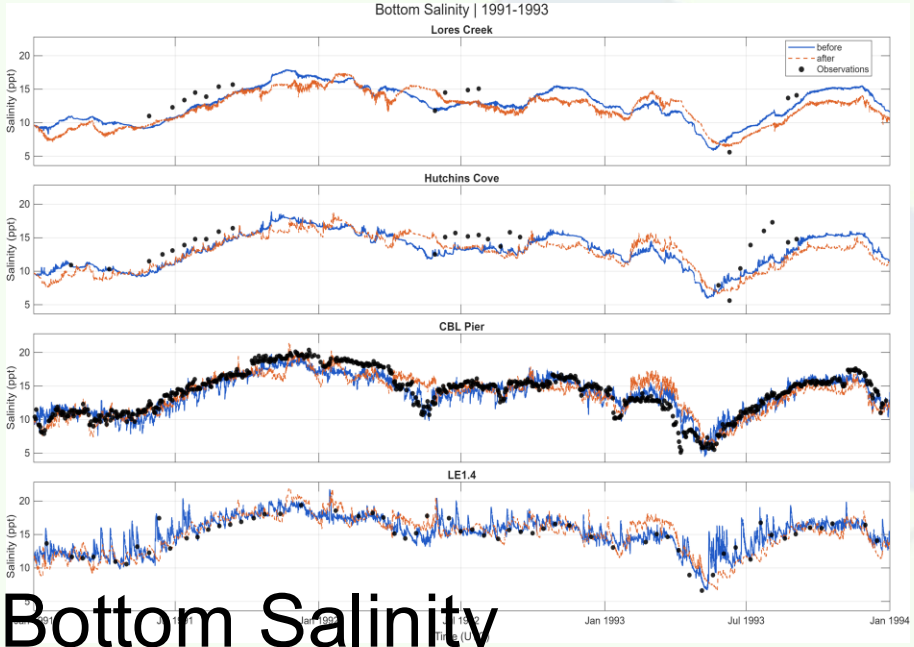
3) Solomons Harbor Water Level – in progress



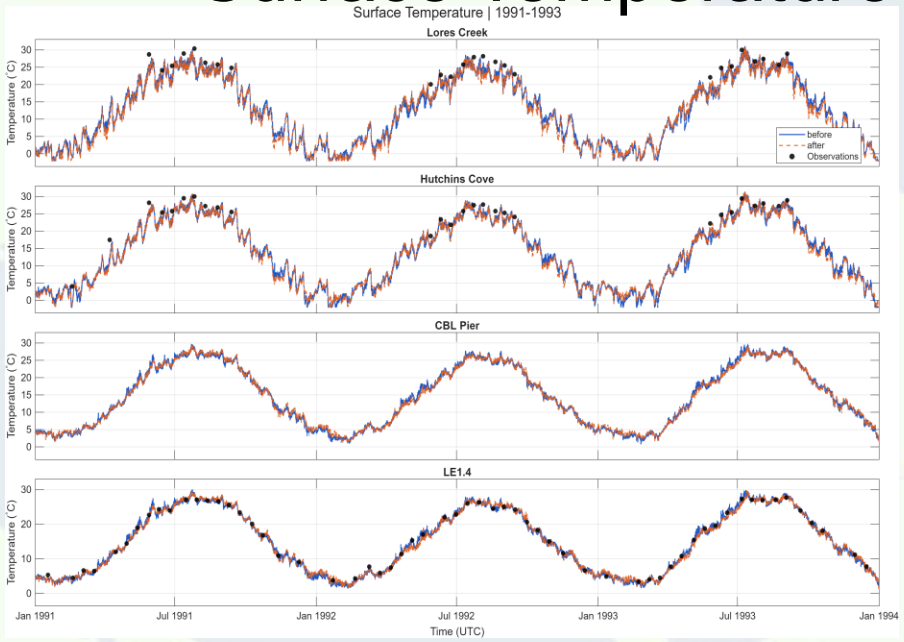


Solomons Harbor

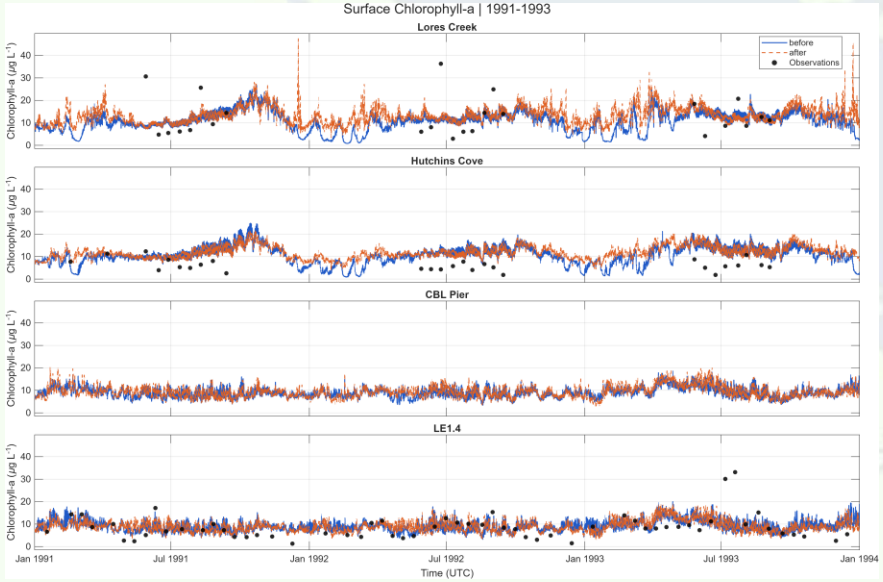
Bottom Salinity

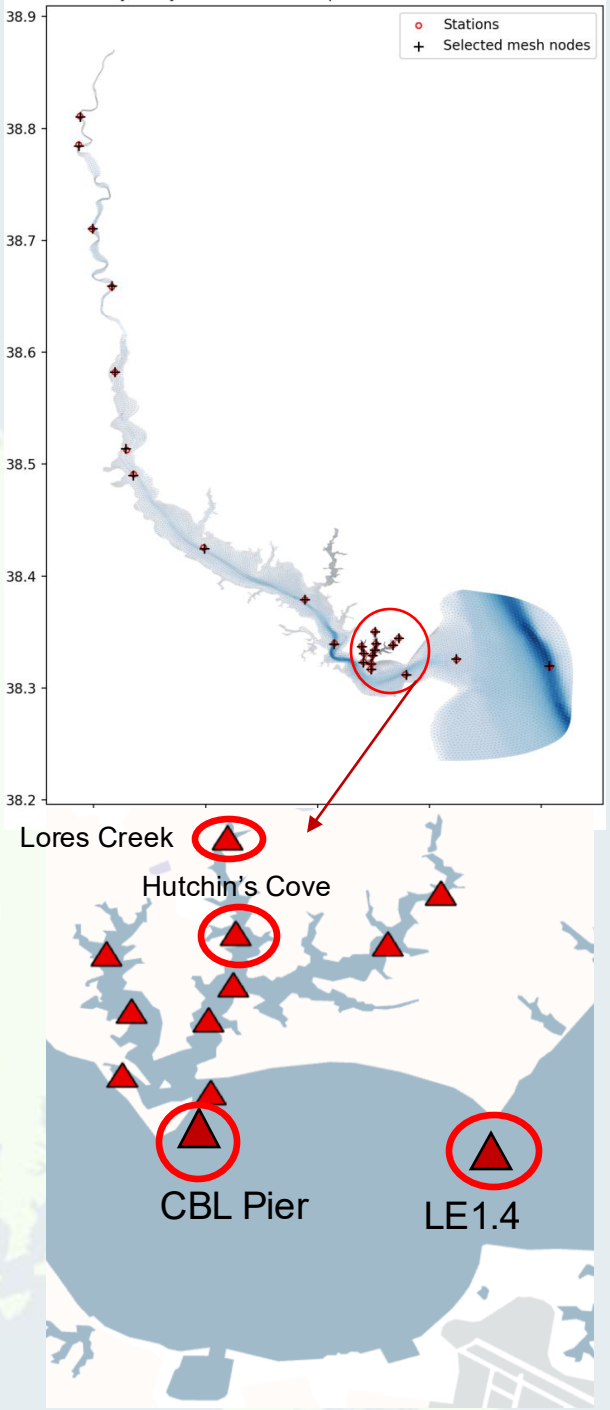


Surface Temperature



Surface Chl-a





Thank you