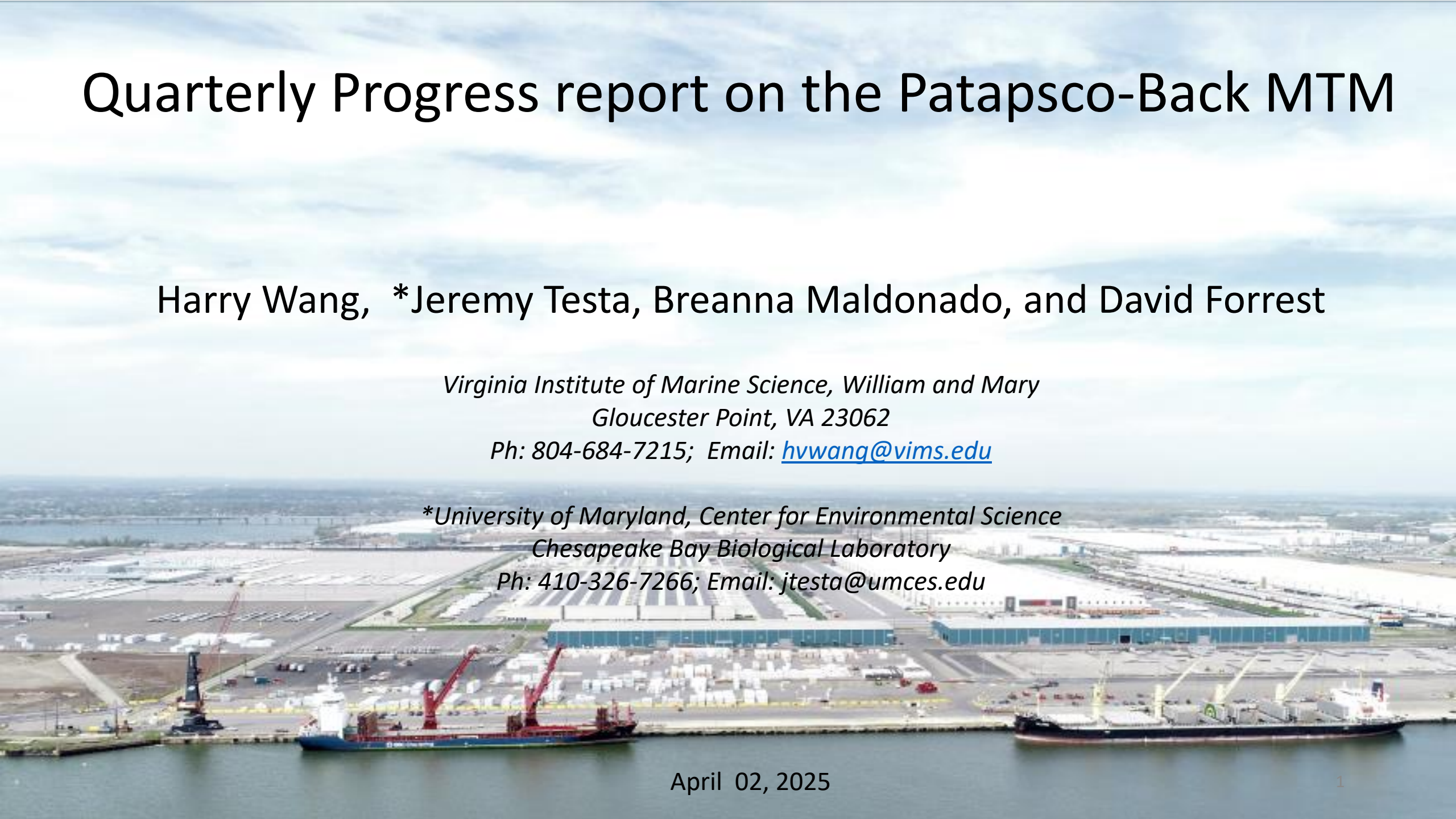
Quarterly Progress report on the Patapsco-Back MTM

Harry Wang, *Jeremy Testa, Breanna Maldonado, and David Forrest

Virginia Institute of Marine Science, William and Mary
Gloucester Point, VA 23062
Ph: 804-684-7215; Email: hvwang@vims.edu

**University of Maryland, Center for Environmental Science*
Chesapeake Bay Biological Laboratory
Ph: 410-326-7266; Email: jtesta@umces.edu



April 02, 2025

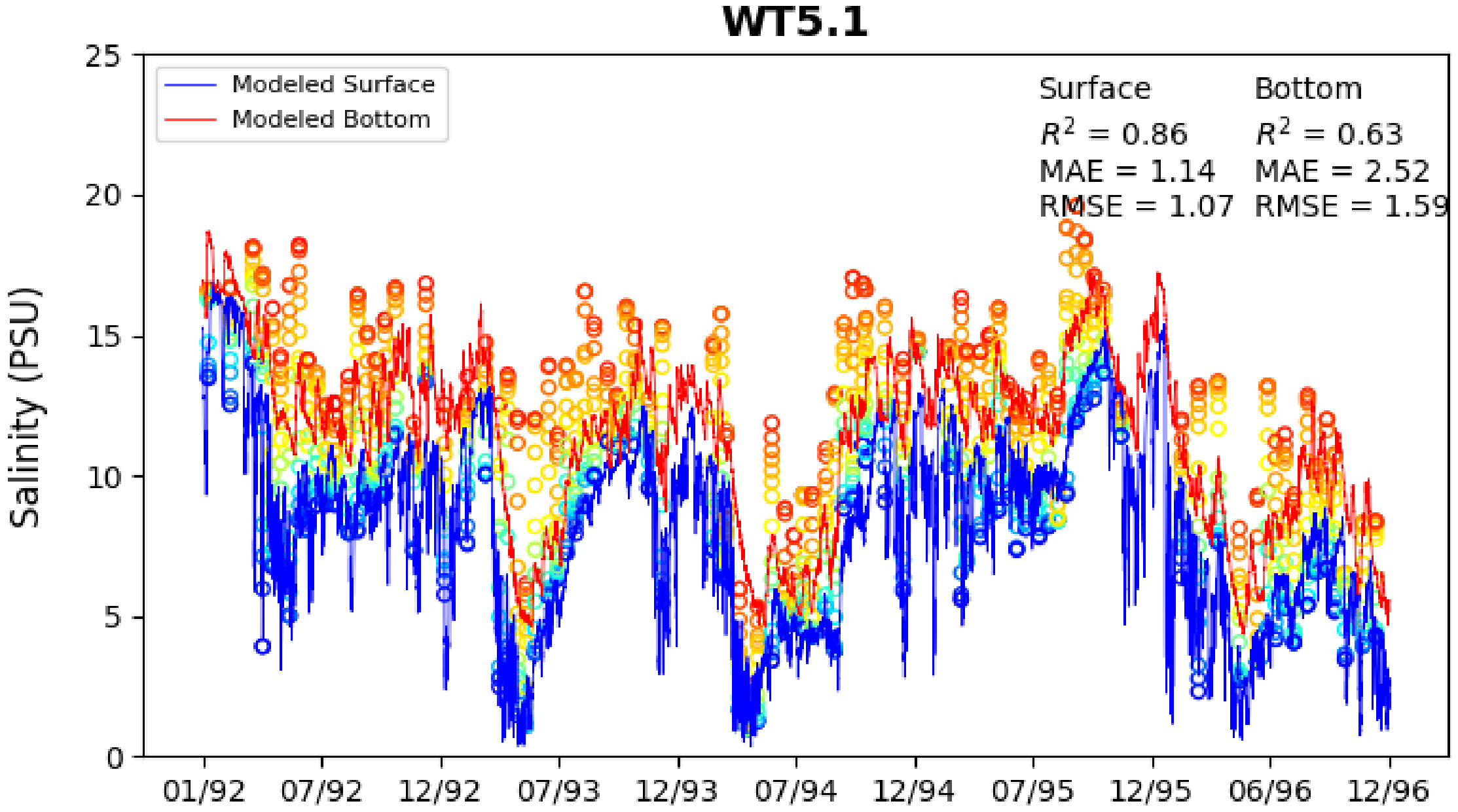
Outline:

I. Characterization of phase-7 non-point source loading

II. SCHISM-ICM Water quality modeling results

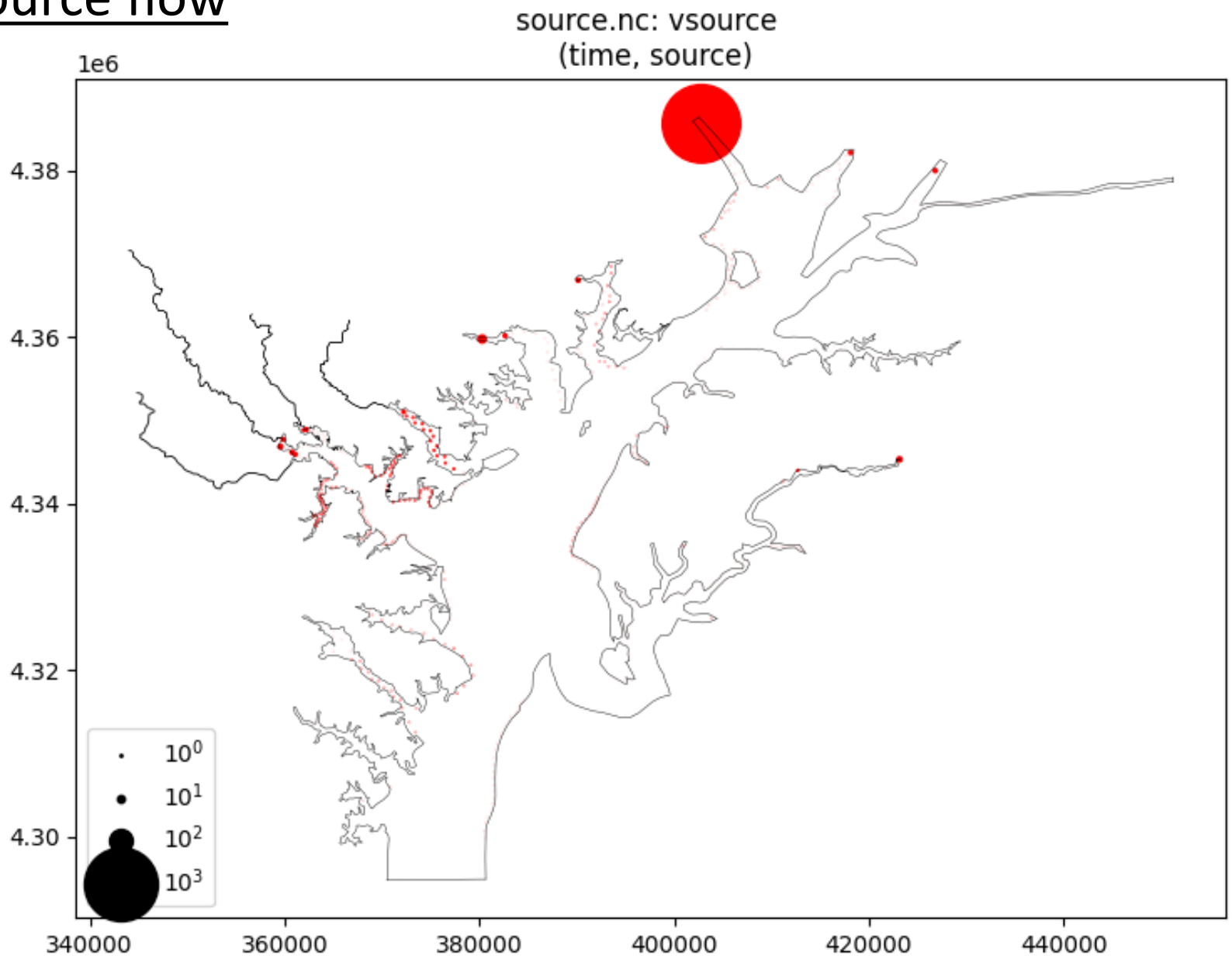
III. Dissolved oxygen in Patapsco River (Jeremy Testa)

IV. Summary and discussion


WT5.1
Modeled Surface
Modeled Bottom
Surface
Bottom
R^2 = 0.86
R^2 = 0.63
MAE = 1.14
MAE = 2.52
RMSE = 1.07
RMSE = 1.59
Salinity (PSU)
25
20
15
10
5
0
01/92
07/92
12/92
07/93
12/93
07/94
12/94
07/95
12/95
06/96
12/96

I. Characterization of Phase-7 Non-point Source Loading

I-1 Non-point source flow

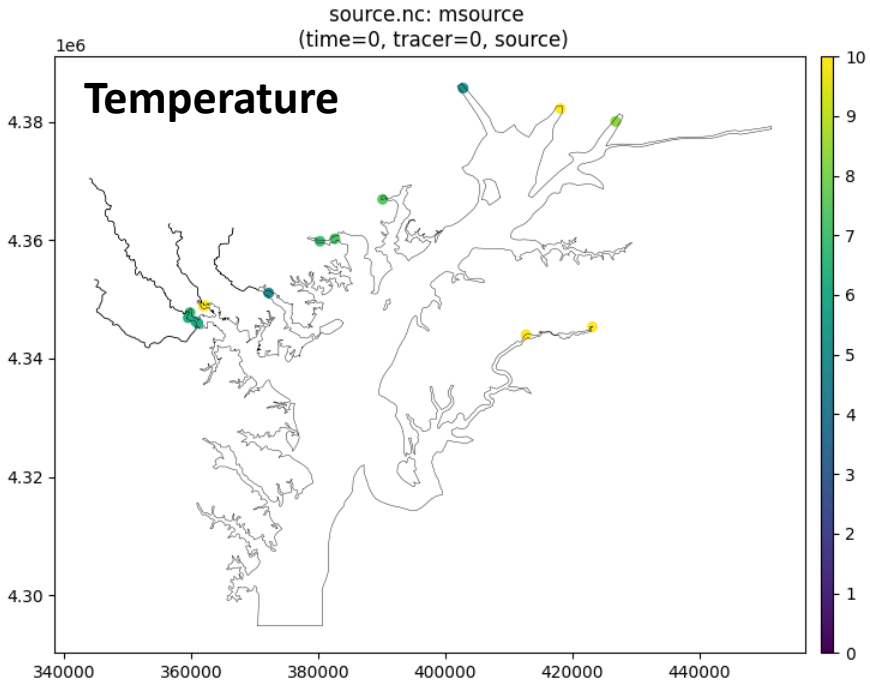


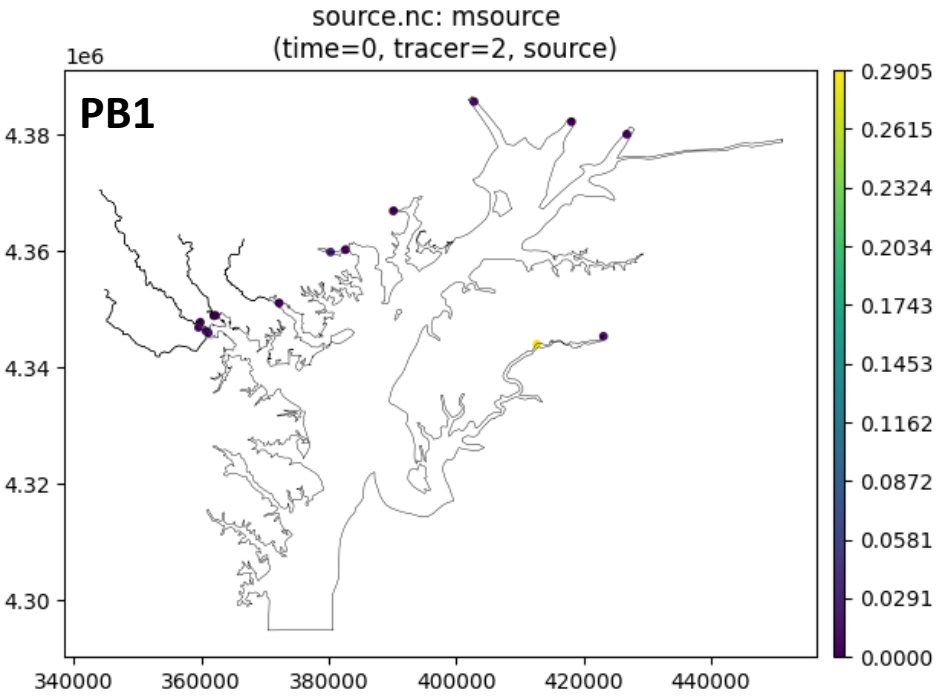
I-2 Non-point source concentration

Within the source.nc input file msource initial condition -- List of 23 variables:

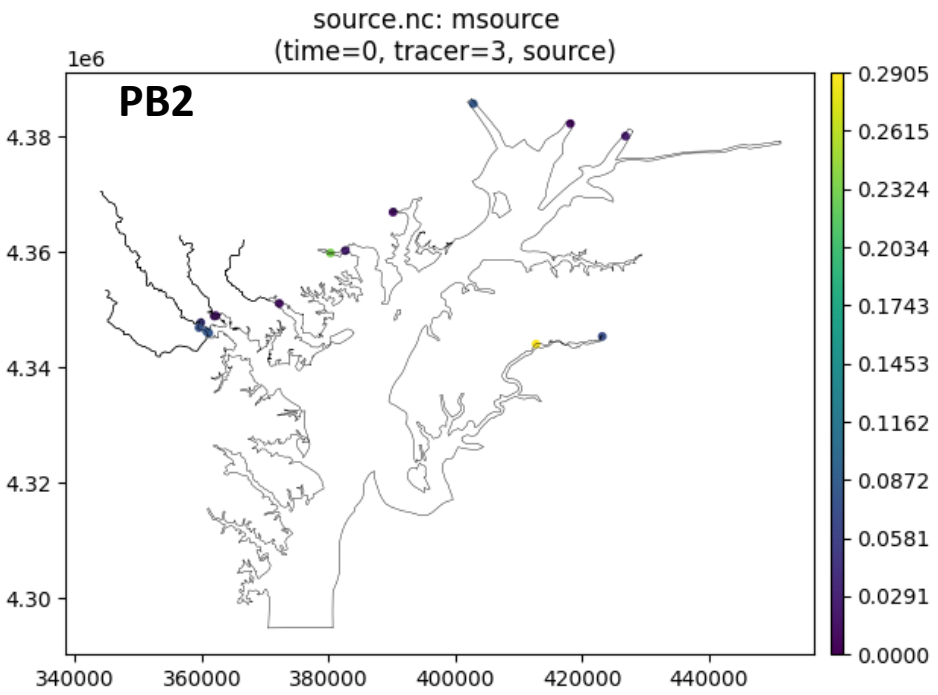
1. Temperature
2. Salinity
3. PB1 (Diatom)
4. PB2 (Green Algae)
5. PB3 (Cyanobacteria)
6. RPOC (Refractory Particulate Organic Carbon)
7. LPOC (Labile Particulate Organic Carbon)
8. DOC (Dissolved Organic Carbon)
9. RPON (Refractory Particulate Organic Nitrogen)
10. LPON (Labile Particulate Organic Nitrogen)
11. DON (Dissolved Organic Nitrogen)
12. NH4 (Ammonium Nitrogen)
13. NO3 (Nitrate Nitrogen)
14. RPOP (Refractory Particulate Organic Phosphorus)
15. LPOP (Labile Particulate Organic Phosphorus)
16. DOP (Dissolved Organic Phosphorus)
17. PO4 (Total Phosphate)
18. COD (Chemical Oxygen Demand)
19. DOX (Dissolved Oxygen)
20. SRPOC (Slow Refractory Particulate Organic Carbon)
21. SRPON (Slow Refractory Particulate Organic Nitrogen)
22. SRPOP (Slow Refractory Particulate Organic Phosphorus)
23. PIP (Particulate Inorganic Phosphate)

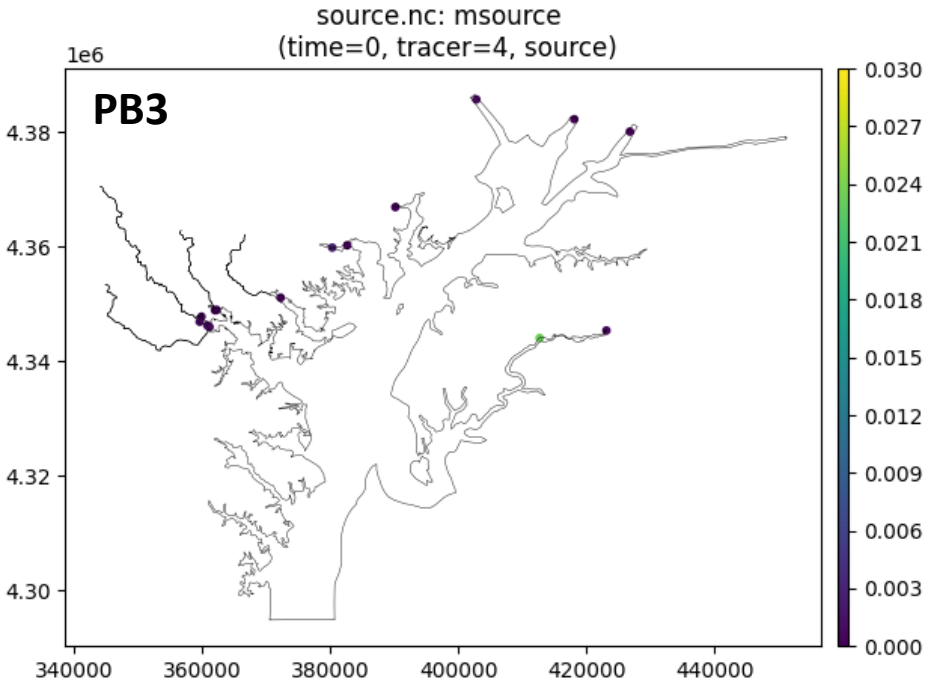
Spatial variation

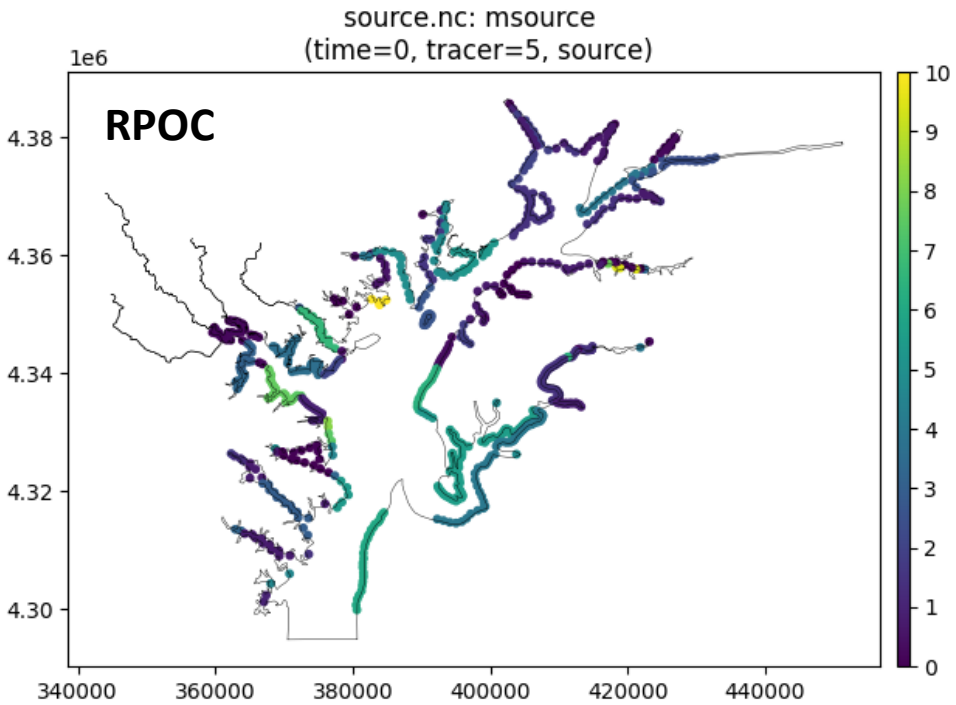




Salinity = 0 everywhere



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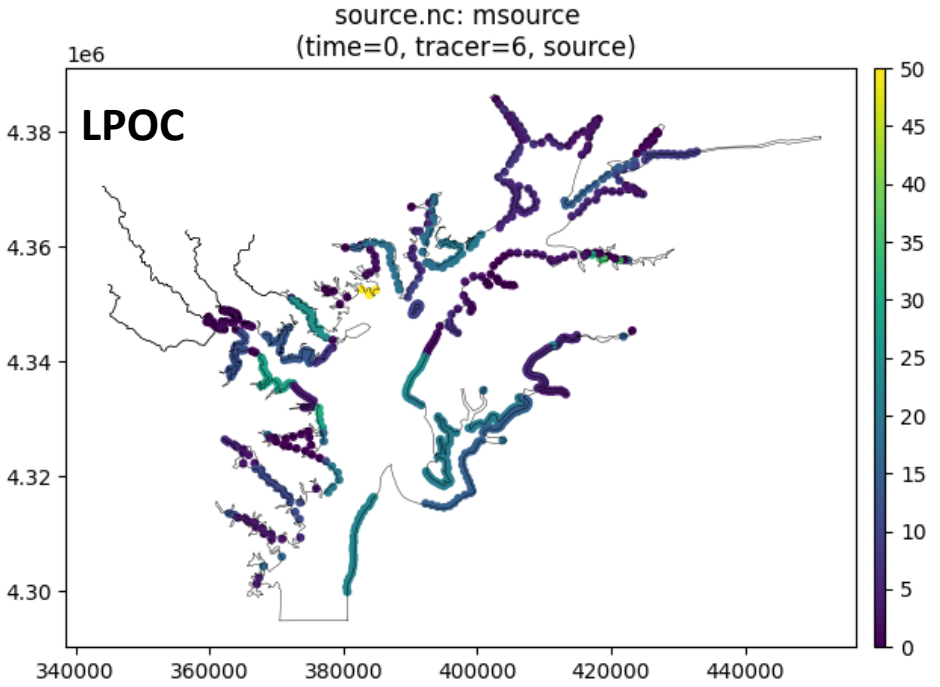
RPOC
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
10
9
8
7
6
5
4
3
2
1
0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LPOC
1e6
4.38
4.36
4.34
4.32
4.30
340000
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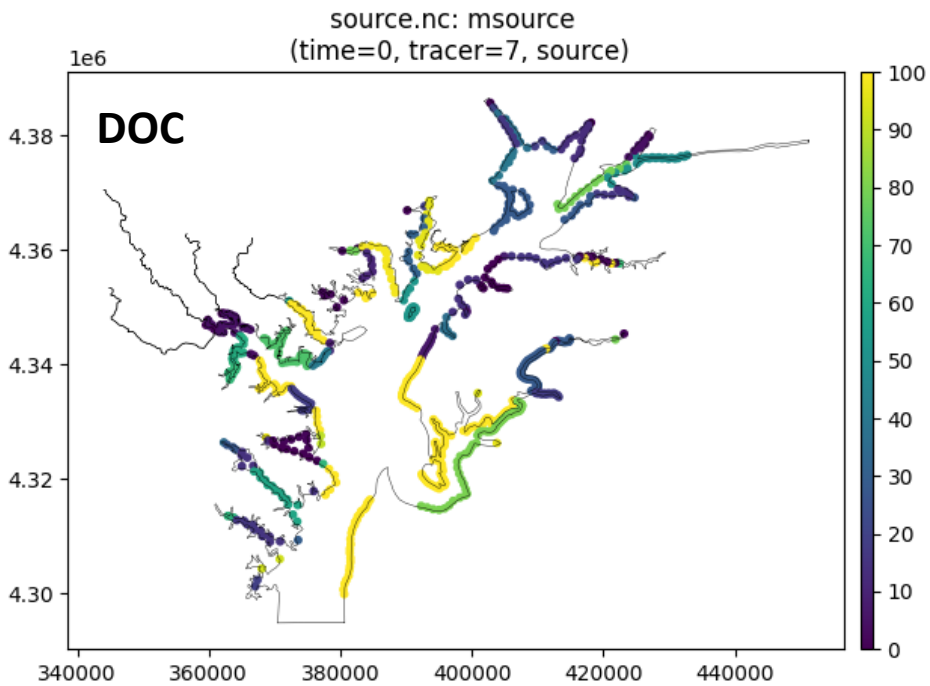
20
15
10
5
0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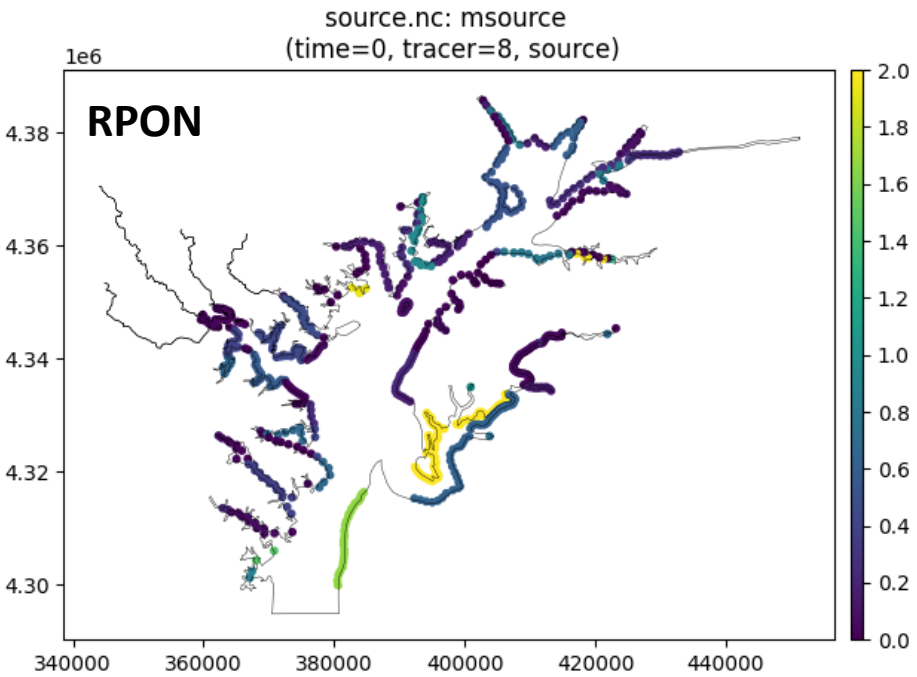
DOC
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
100
90
80
70
60
50
40
30
20
10
0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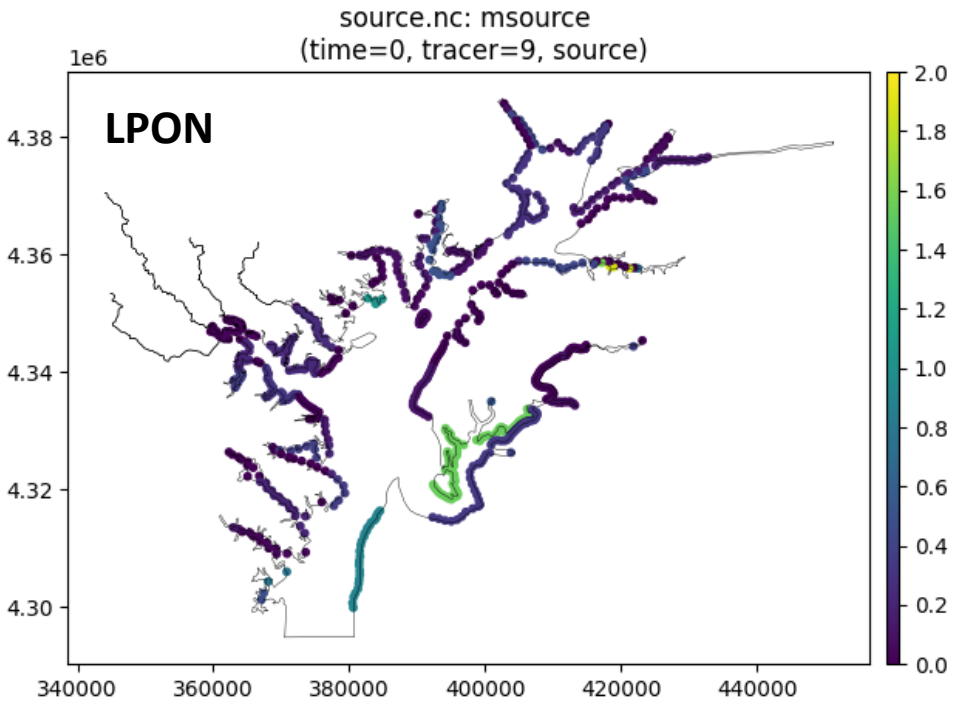
RPON
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0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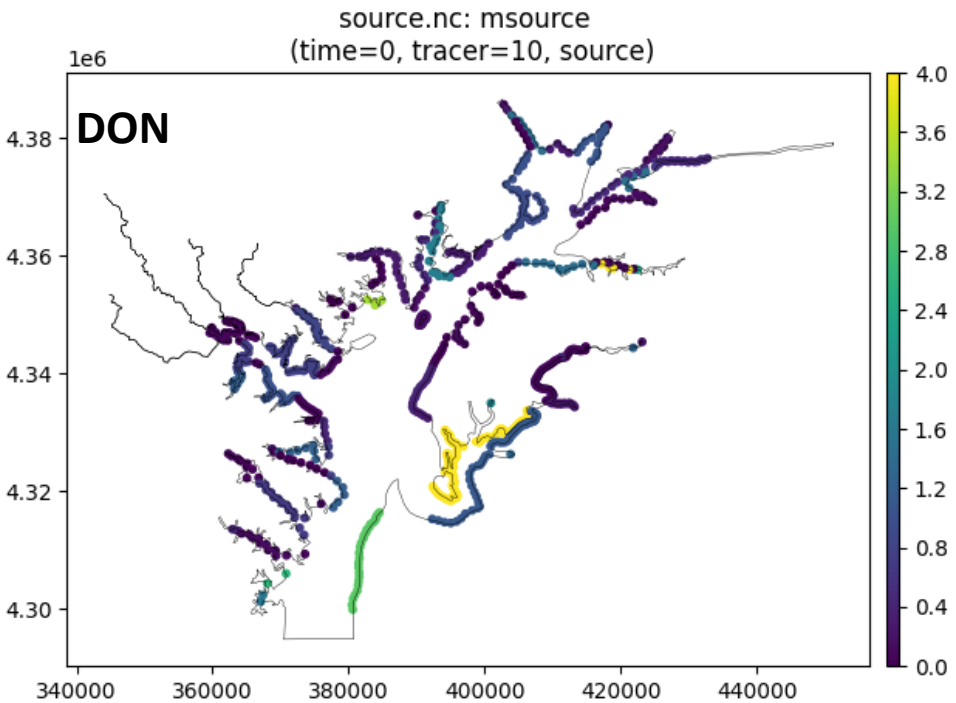
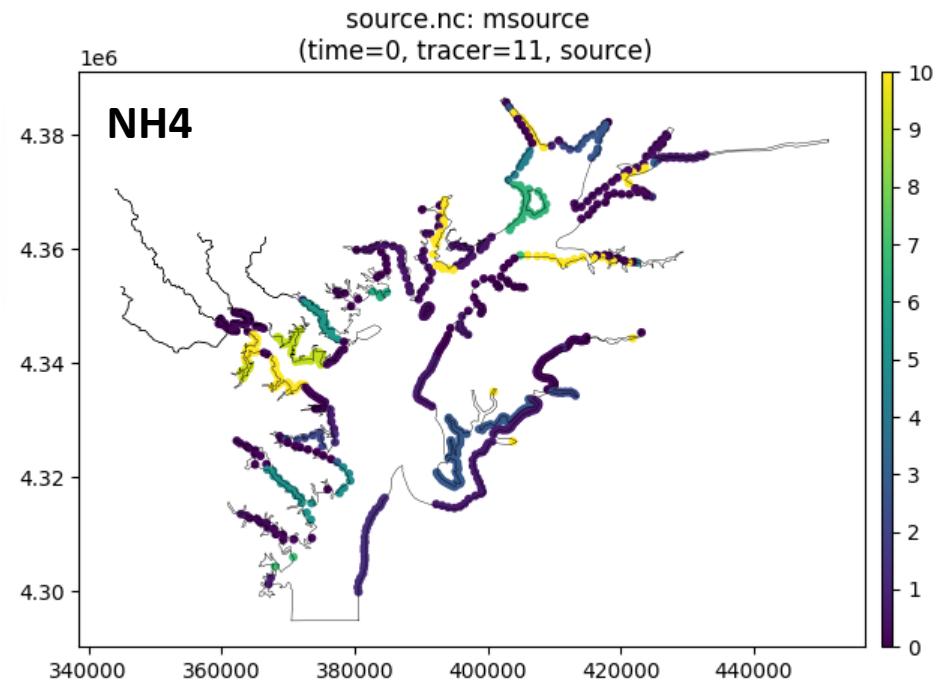
(time=0, tracer=9, source)
LPON
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0


source.nc: msource
(time=0, tracer=10, source)
DON
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0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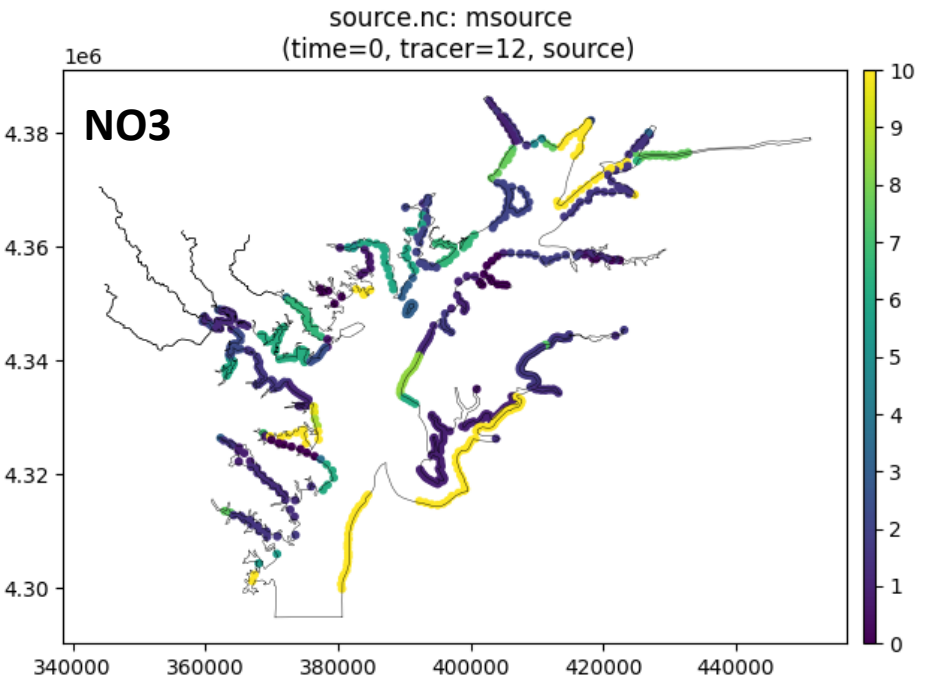
NH4
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
10
9
8
7
6
5
4
3
2
1
0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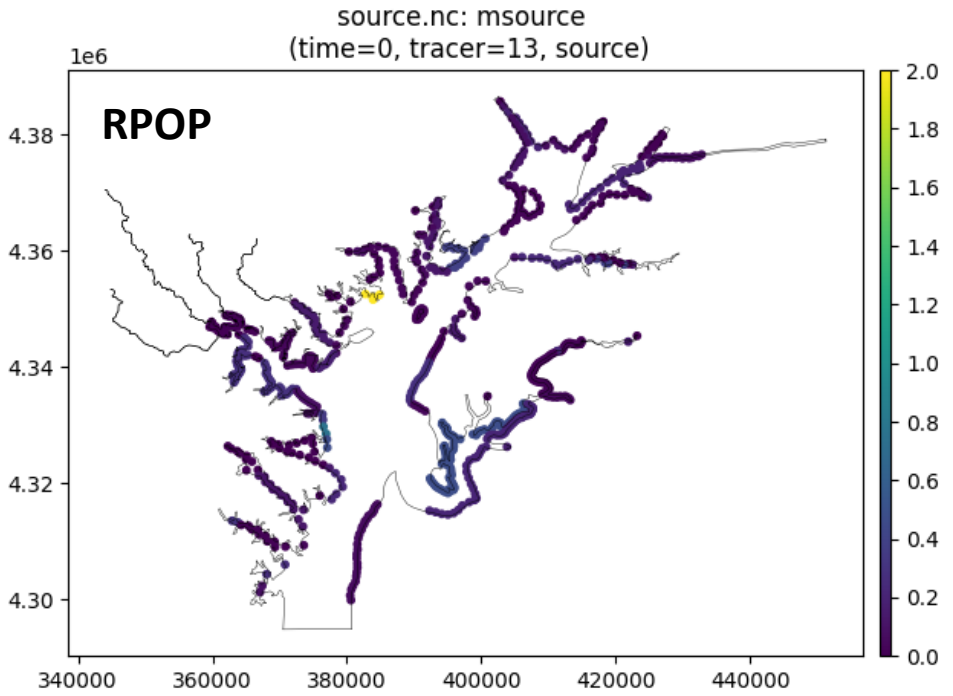
NO3
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
10
9
8
7
6
5
4
3
2
1
0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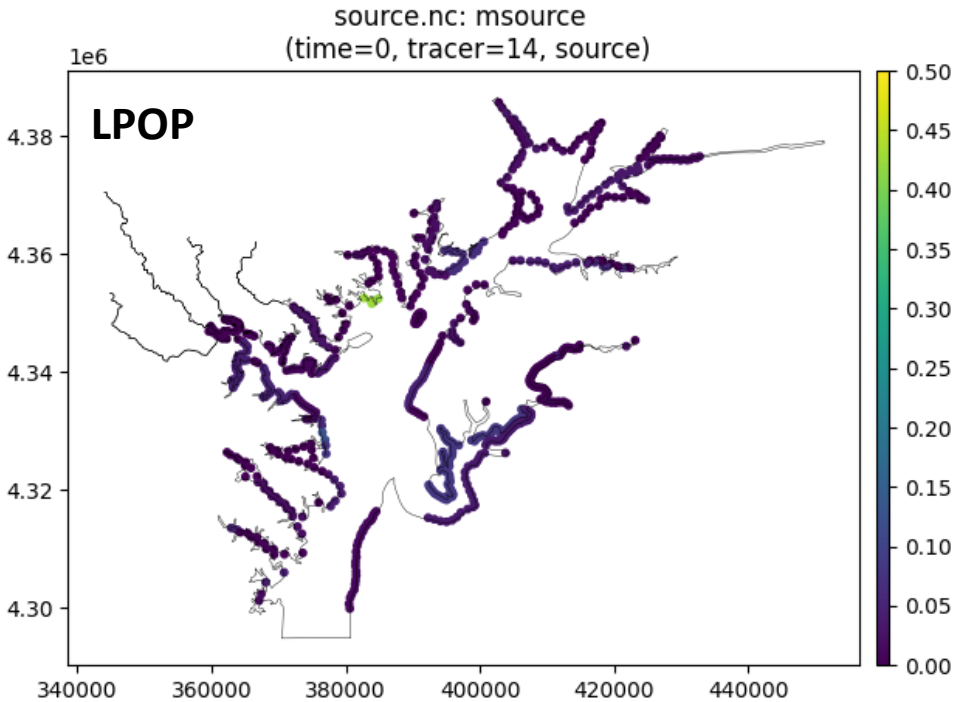
RPOP
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0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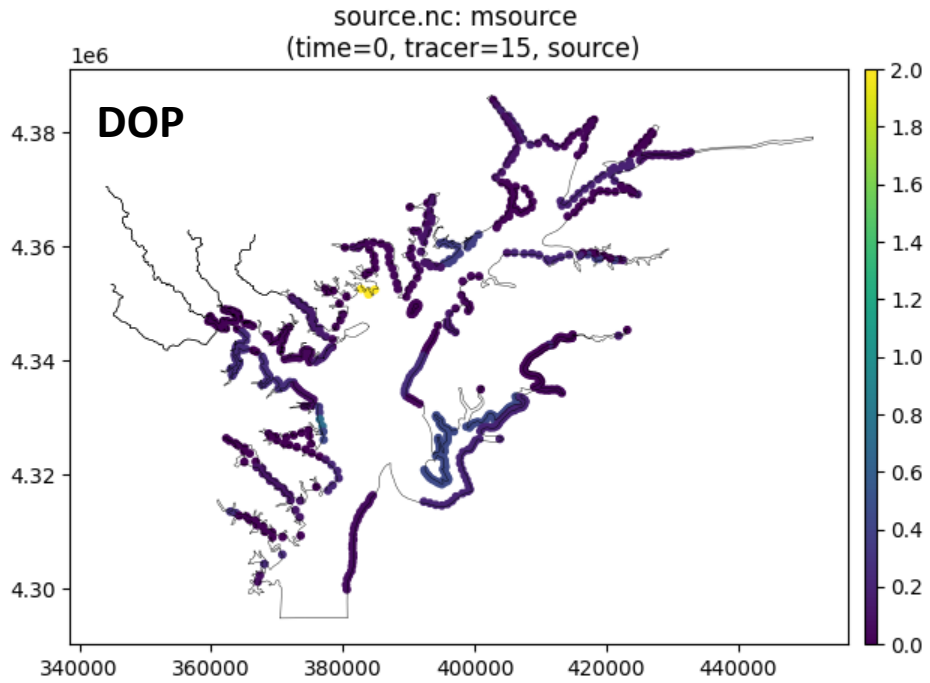
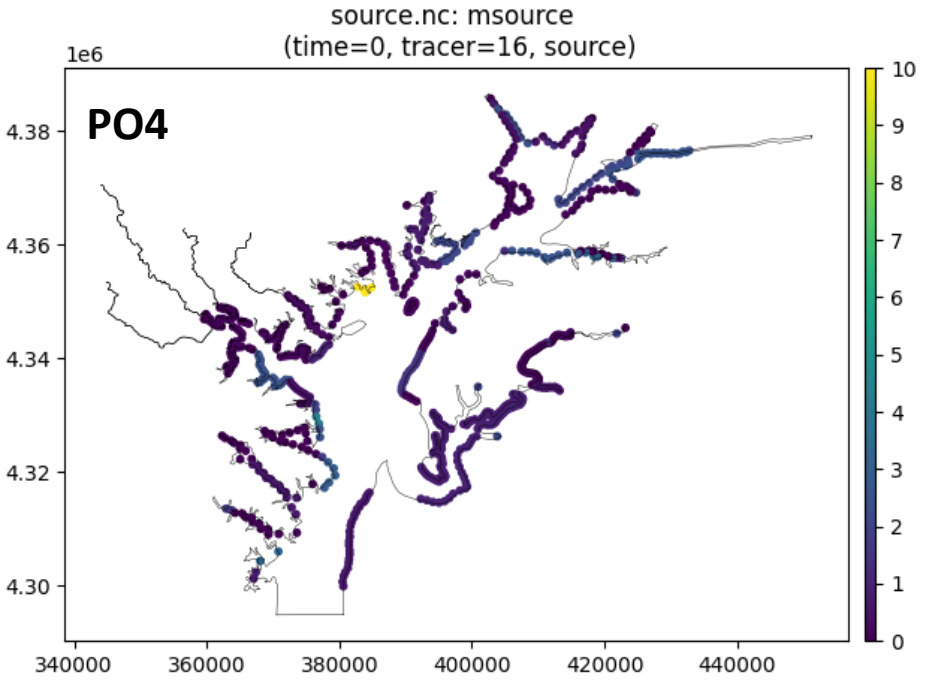
LPOP
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00


source.nc: msource
(time=0, tracer=15, source)
DOP
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0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PO4
1e6
4.38
4.36
4.34
4.32
4.30
340000
360000
380000
400000
420000
440000
10
9
8
7
6
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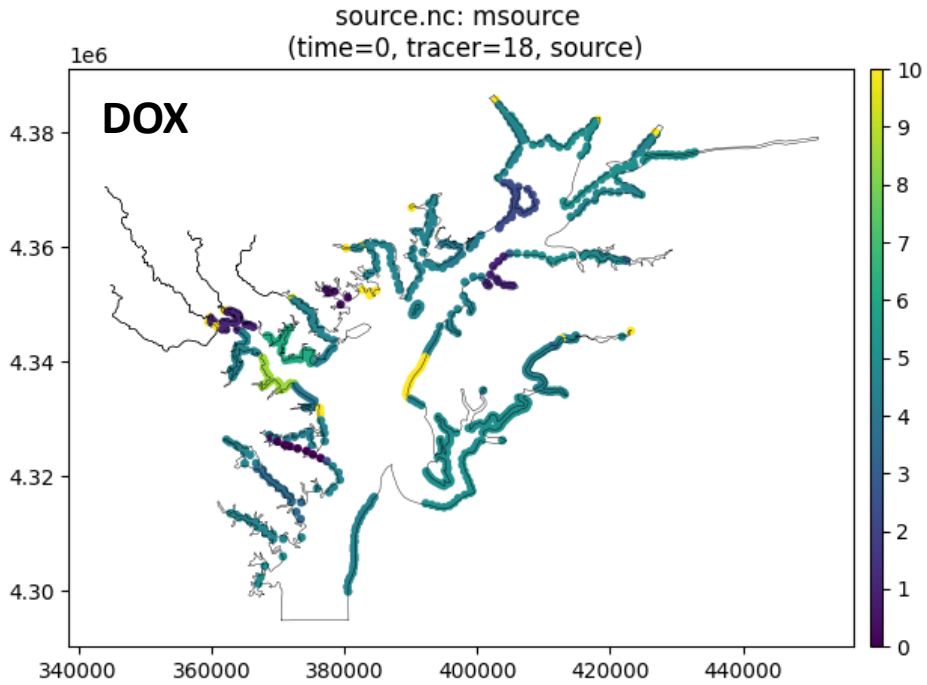
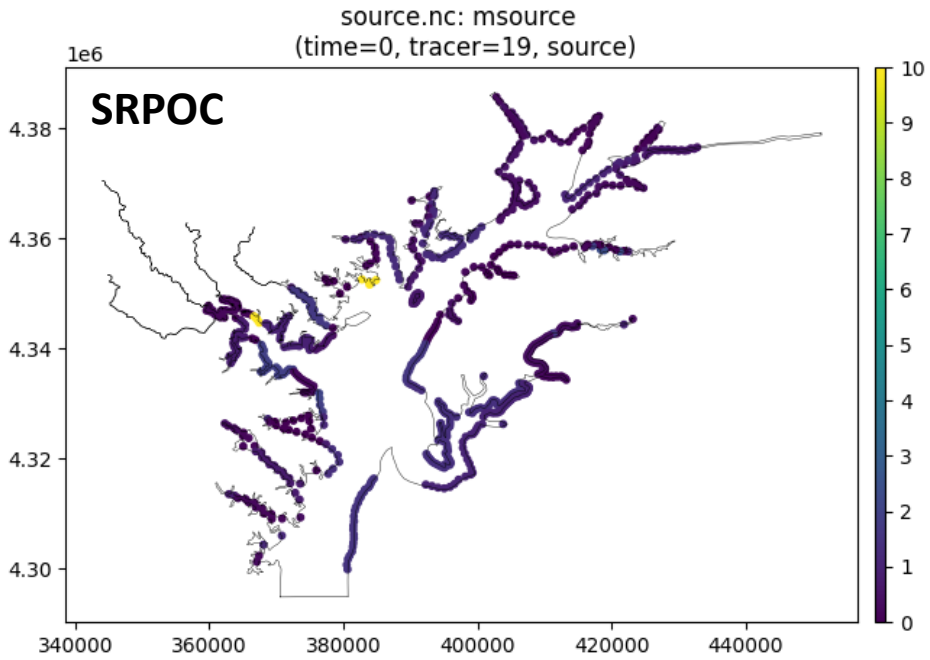
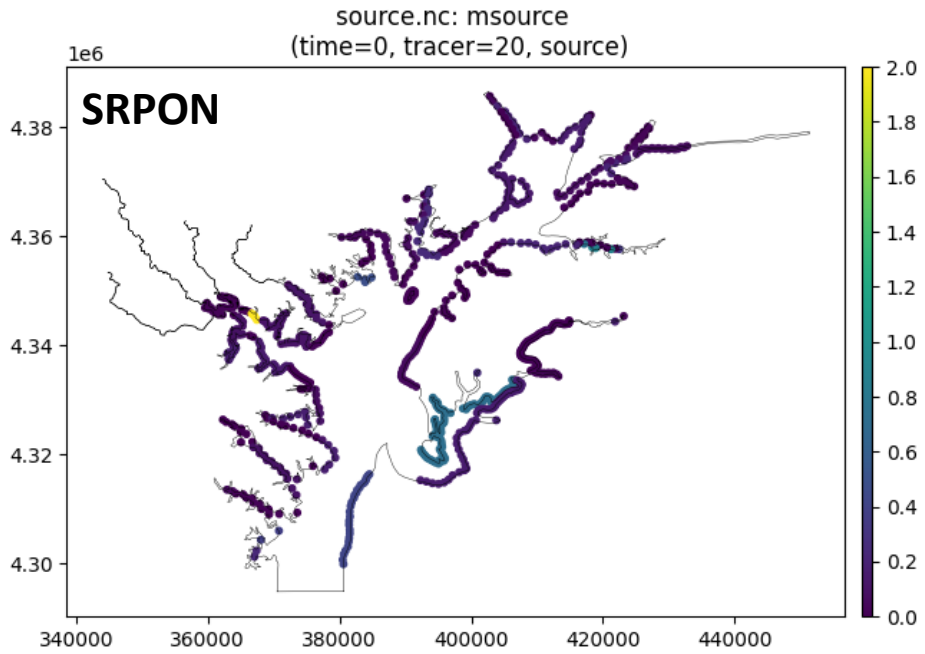
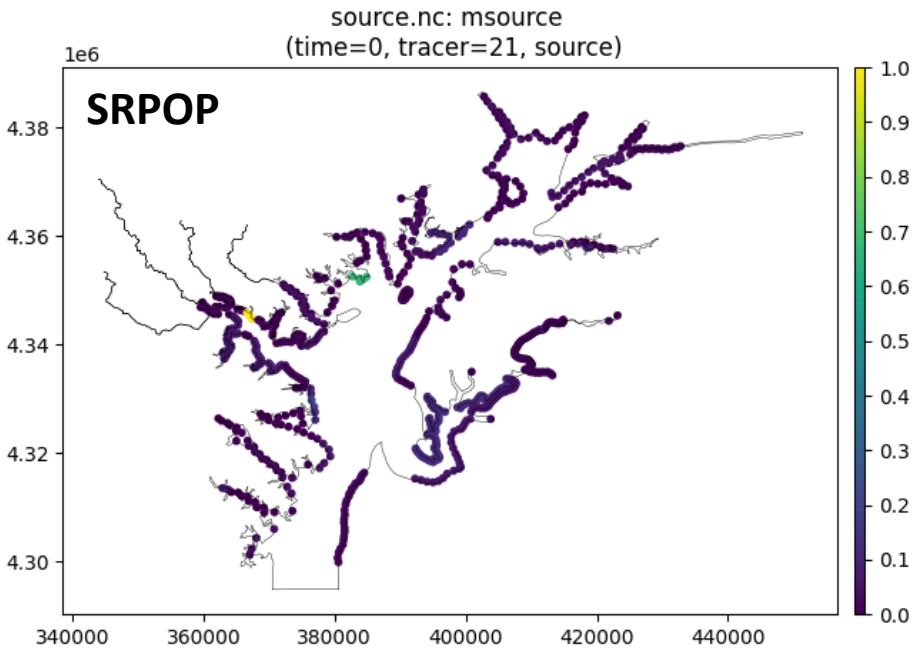
4
3
2
1
0

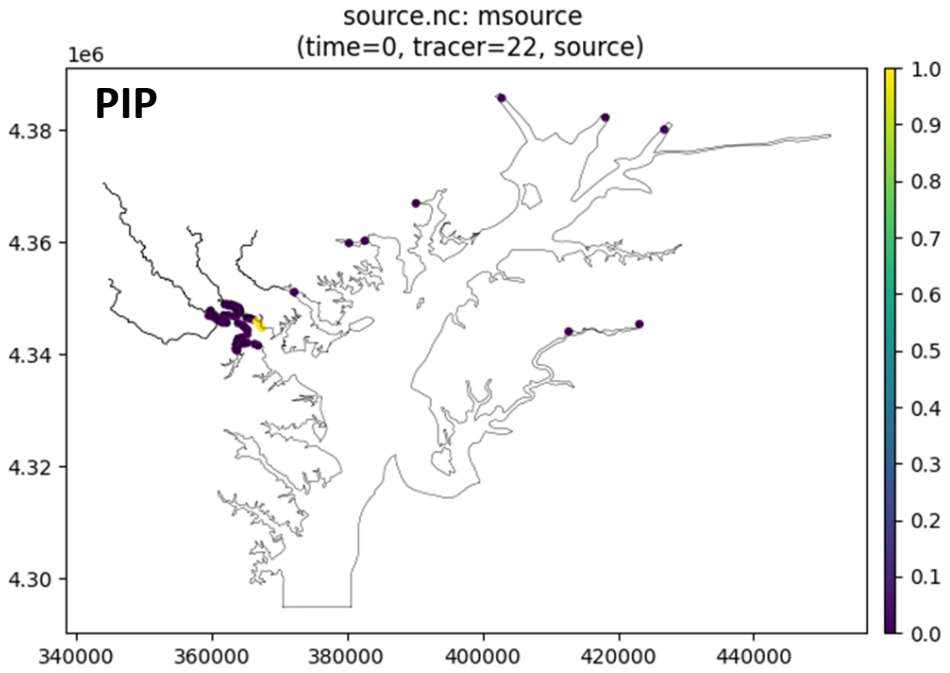








COD = 0 everywhere

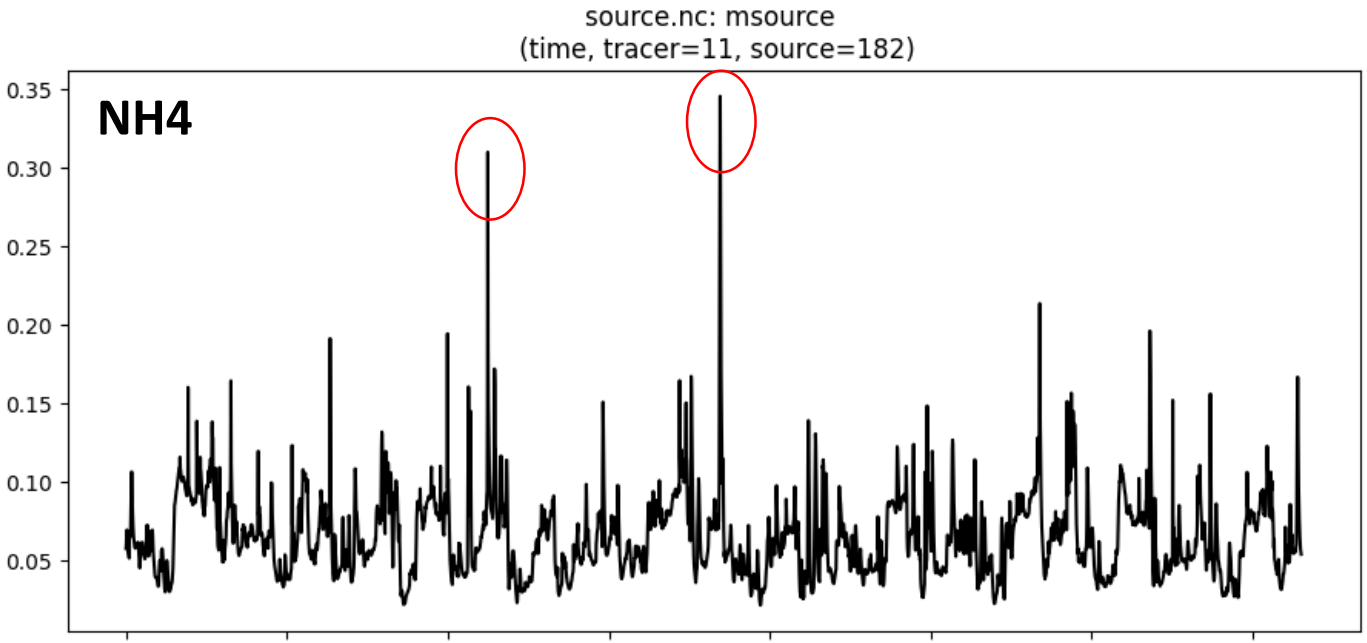


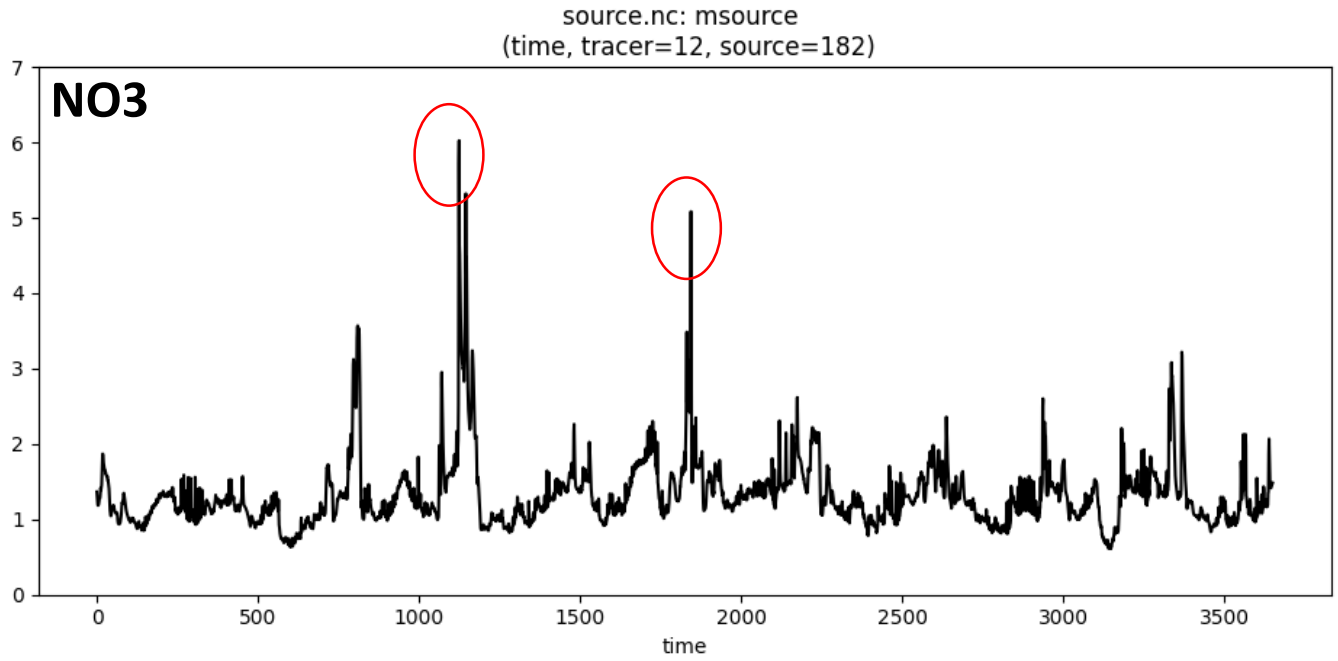
Comments:

1. No source information from Hart-Miller Island (yet Pooles Island does)
2. No Source information from C&D canal (beyond MD portion)

Temporal variation (for nitrogen and phosphorus loading)

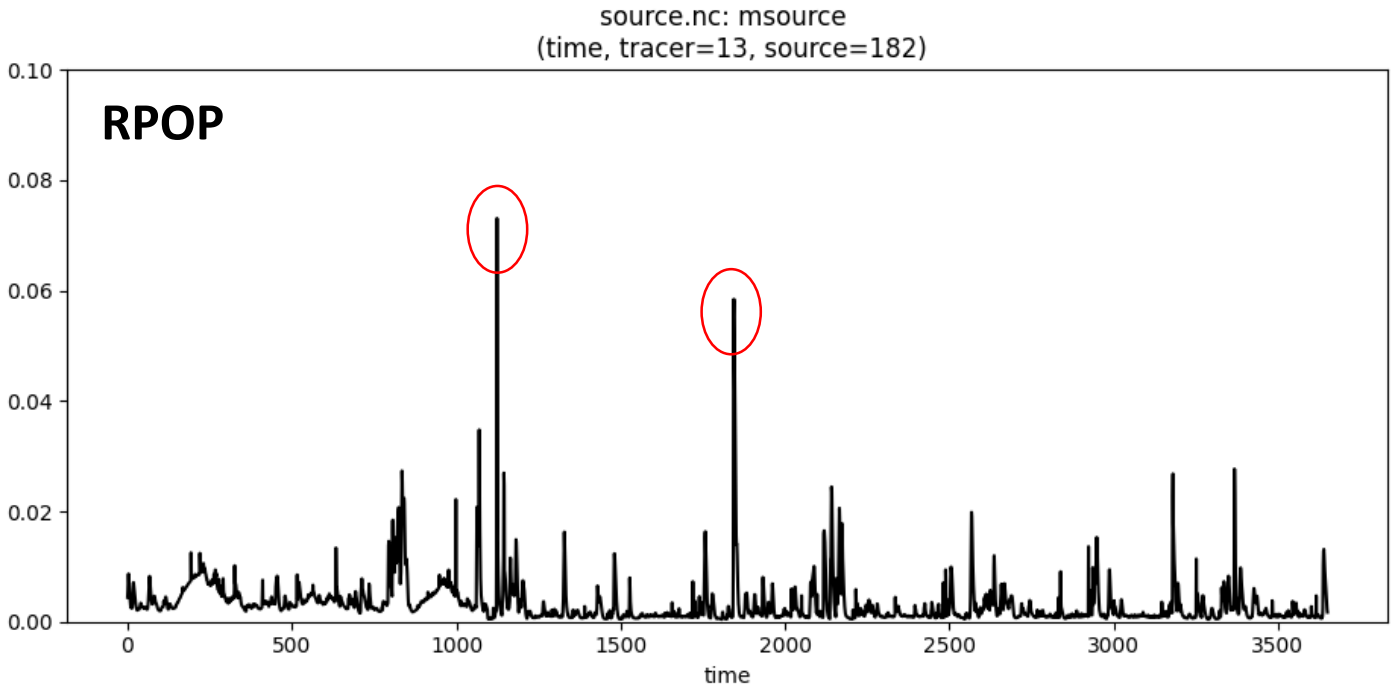
Susquehanna River (X axis = time in days; Y axis = g/m^3)

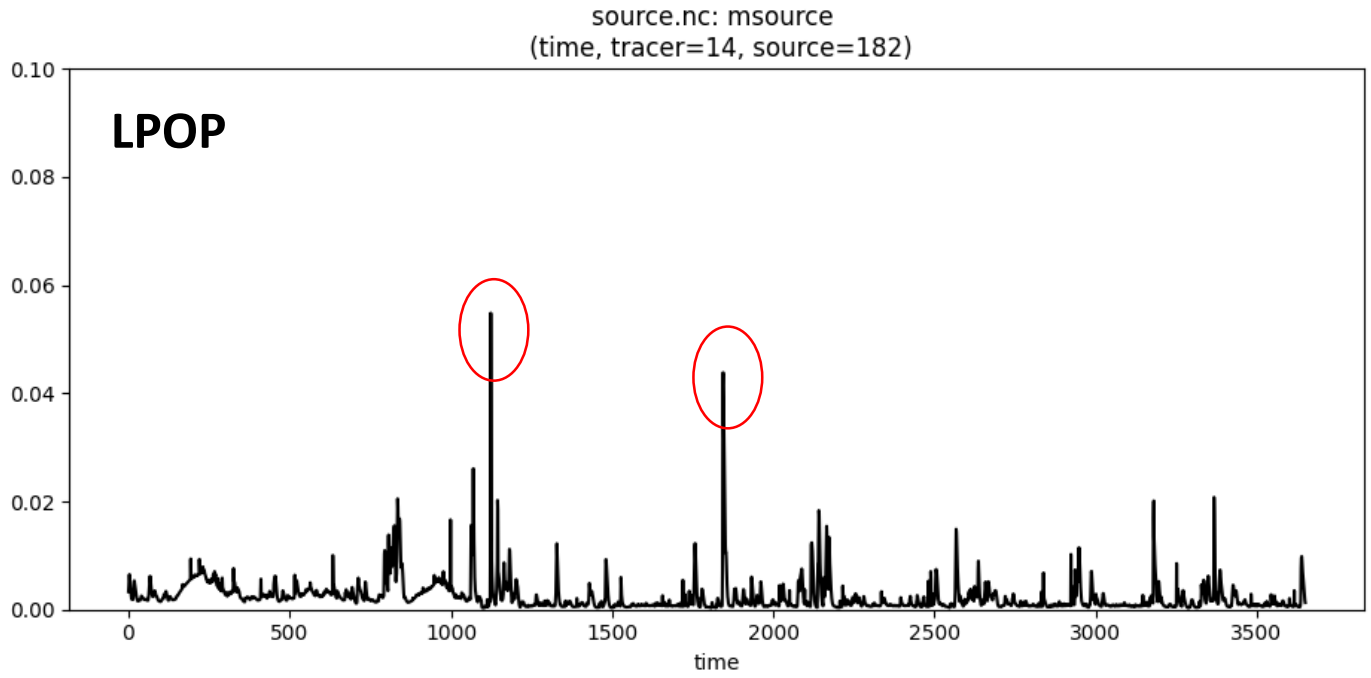




Susquehanna River

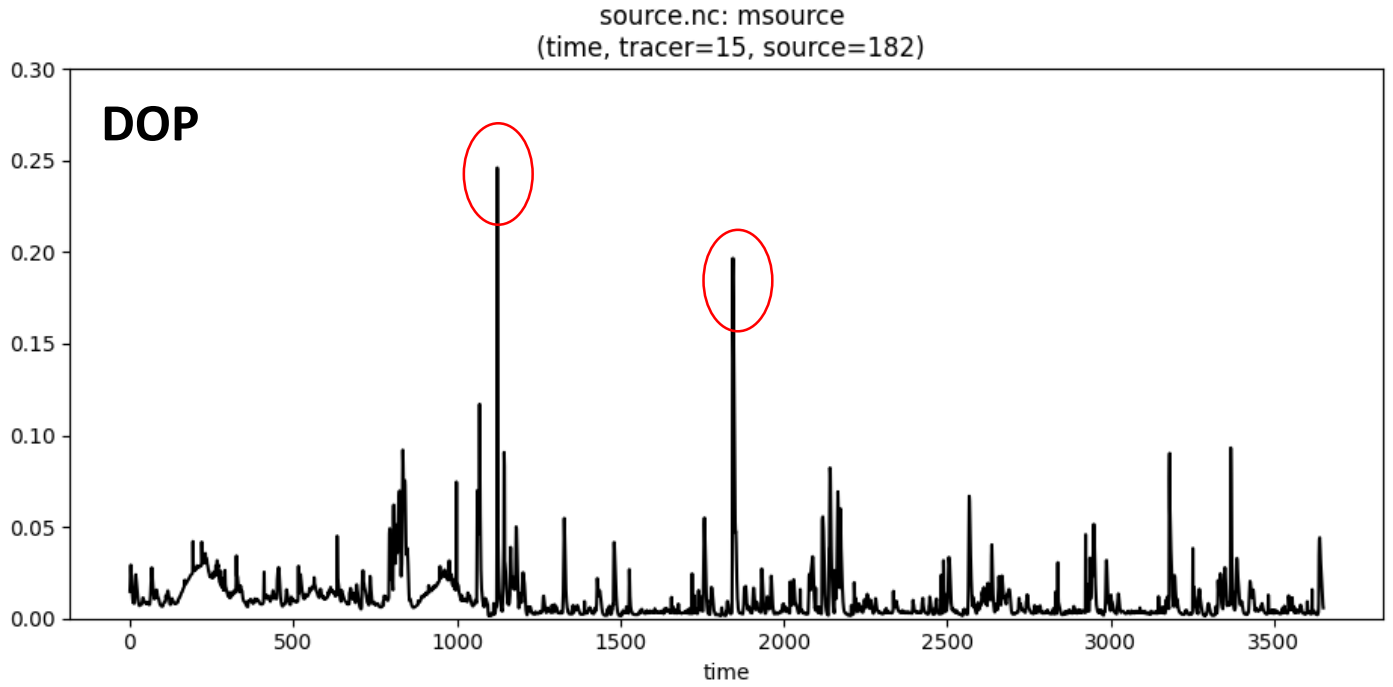
X axis = time in days
Y axis = g/m^3





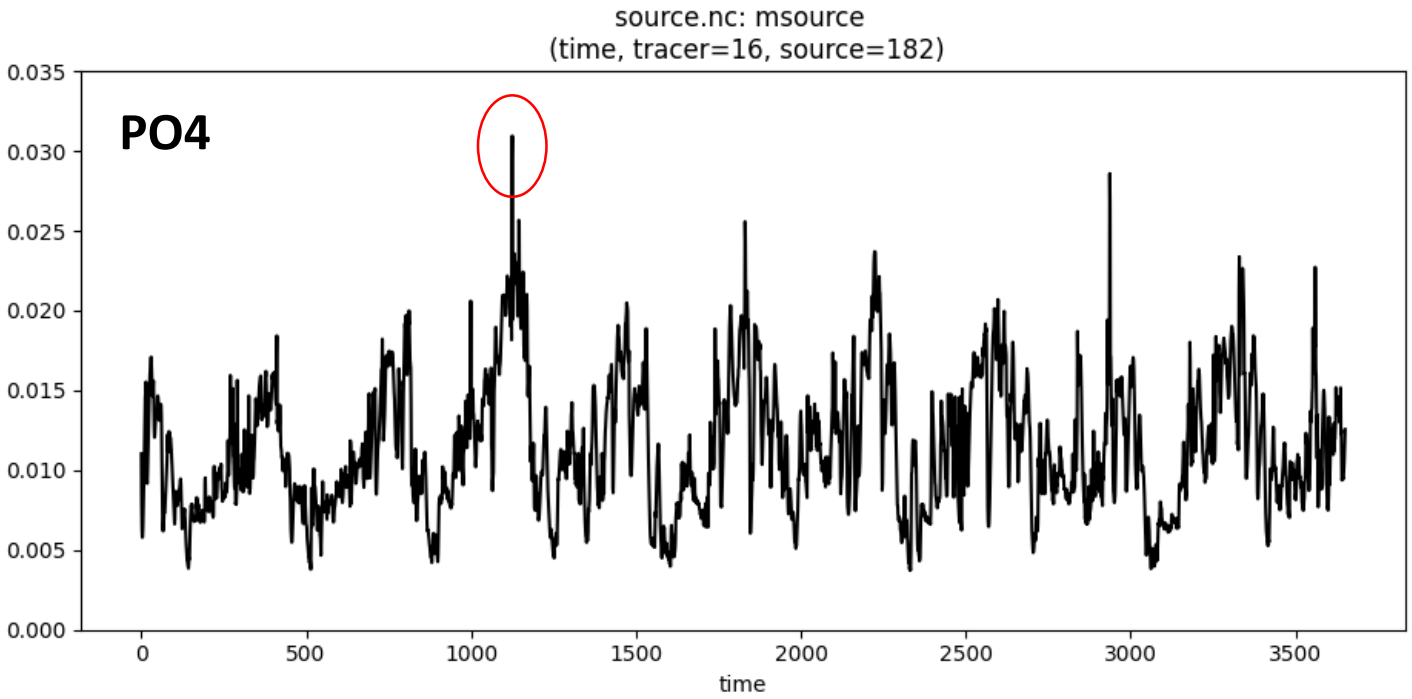
Susquehanna River

X axis = time in days
Y axis = g/m^3



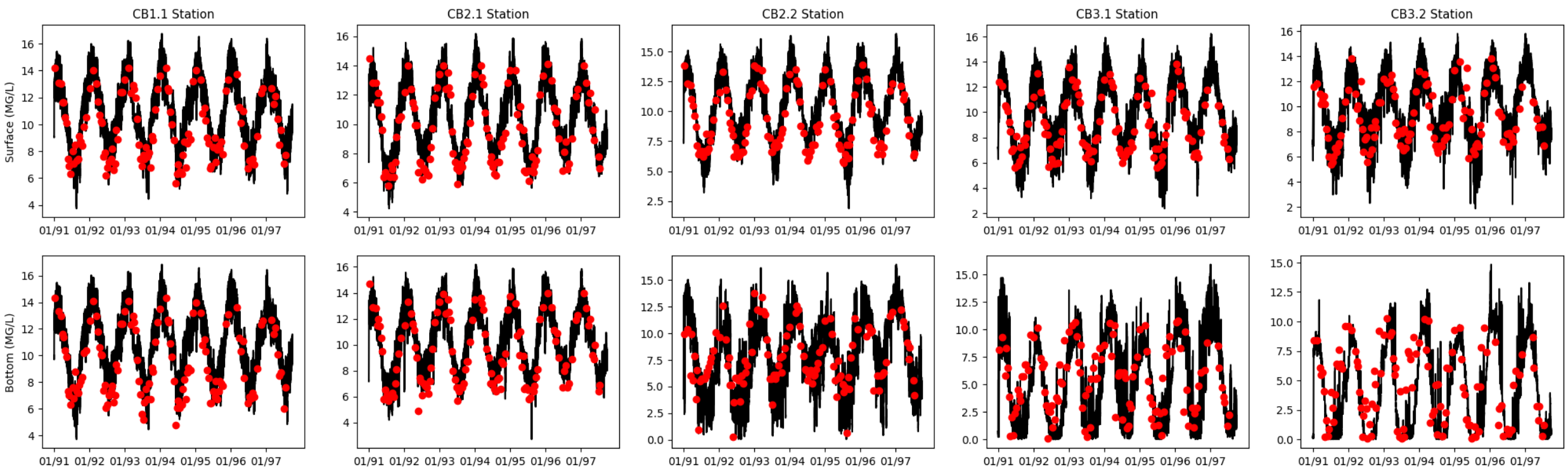
Comments:

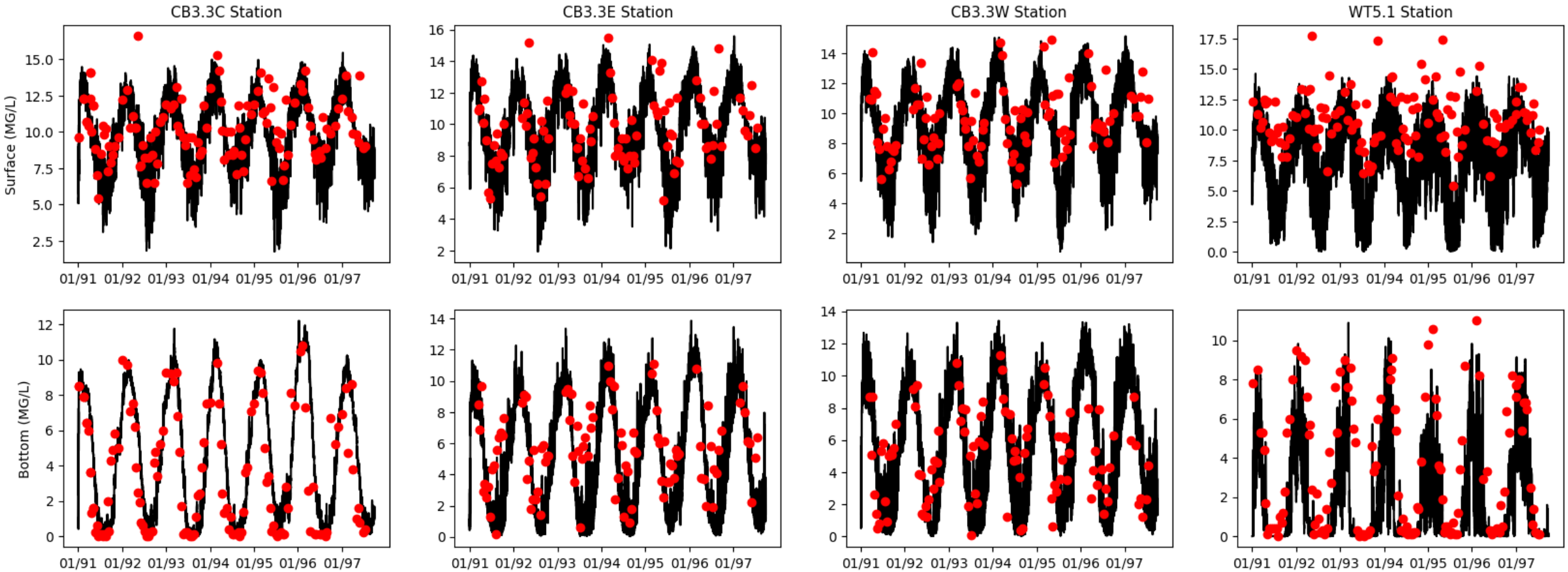
1. Do 1994 and 1996 increase of TN and TP concentration verified?



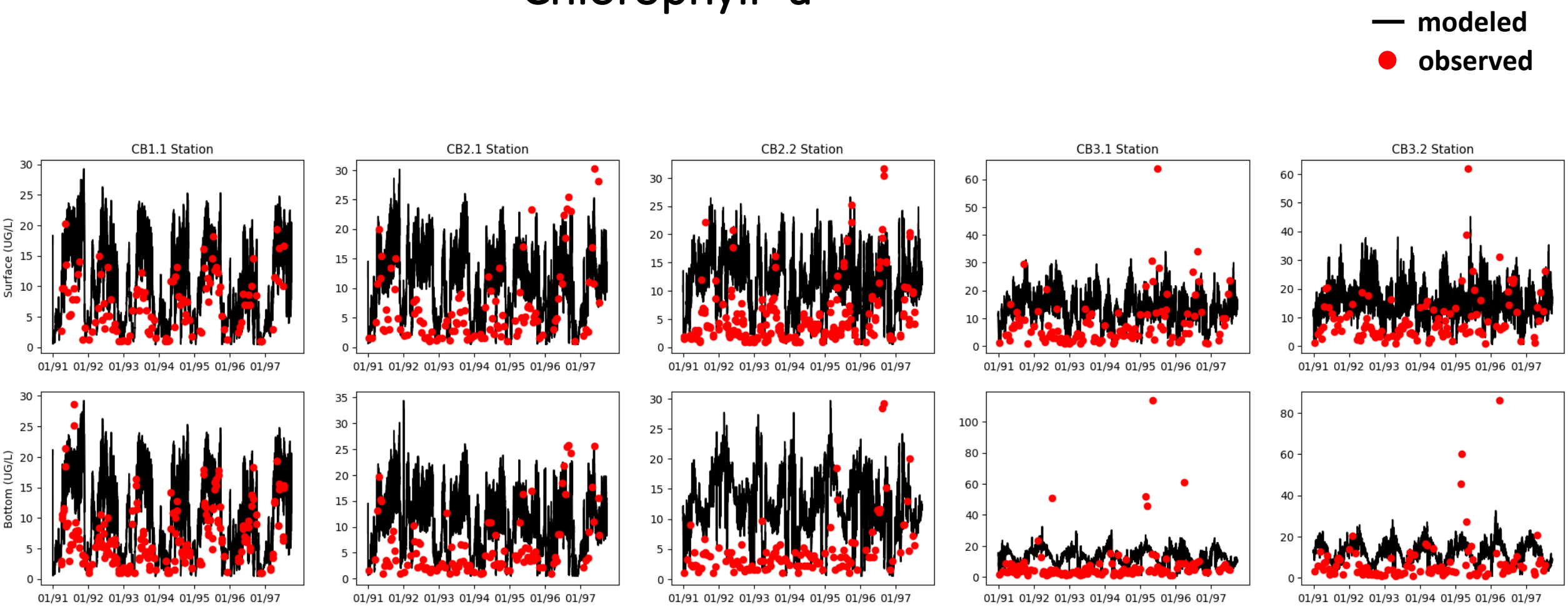
II.. SCHISM-ICM Water Quality Modeling Results

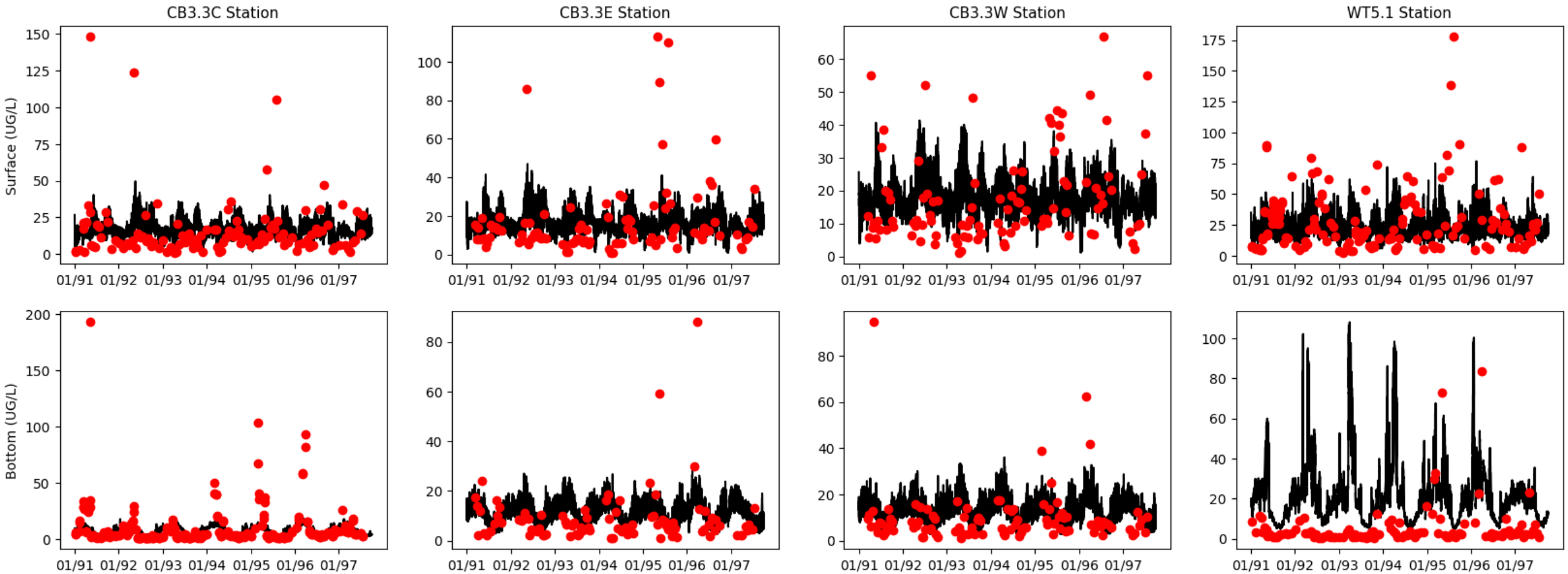
Dissolved Oxygen




CB3.3C Station
CB3.3E Station
CB3.3W Station
WT5.1 Station
Surface (MG/L)
Bottom (MG/L)
01/91 01/92 01/93 01/94 01/95 01/96 01/97

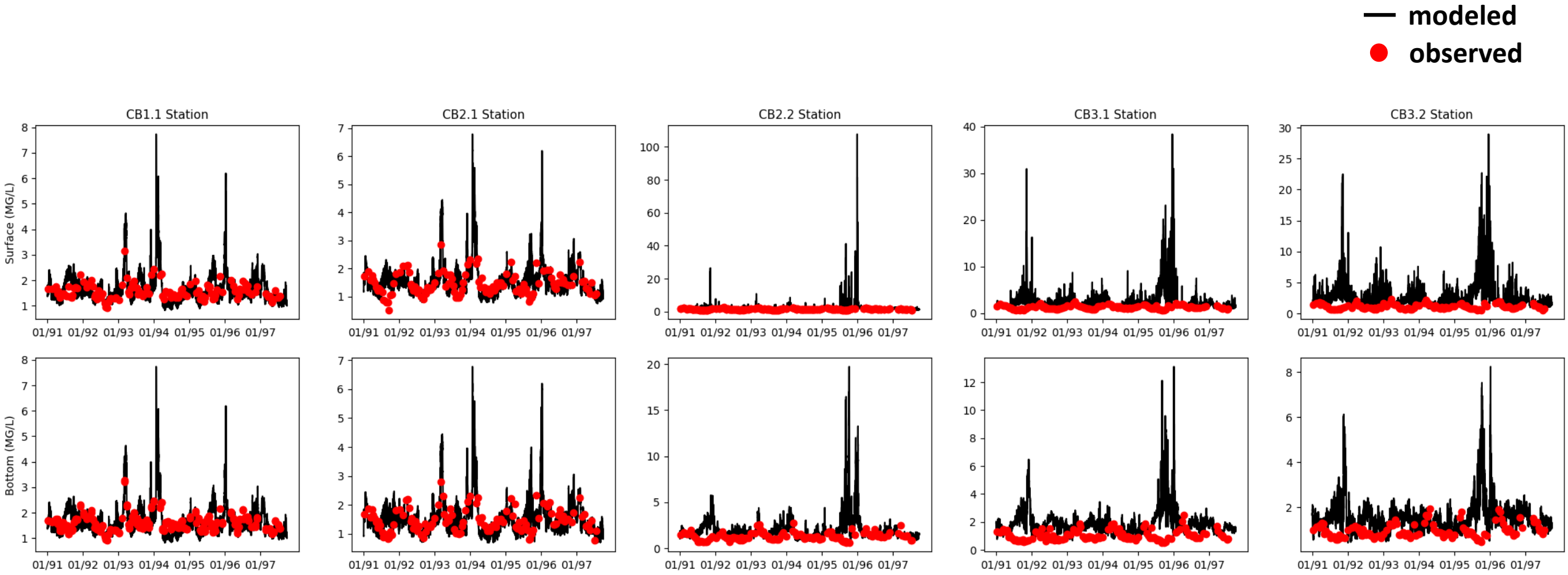
Chlorophyll -a

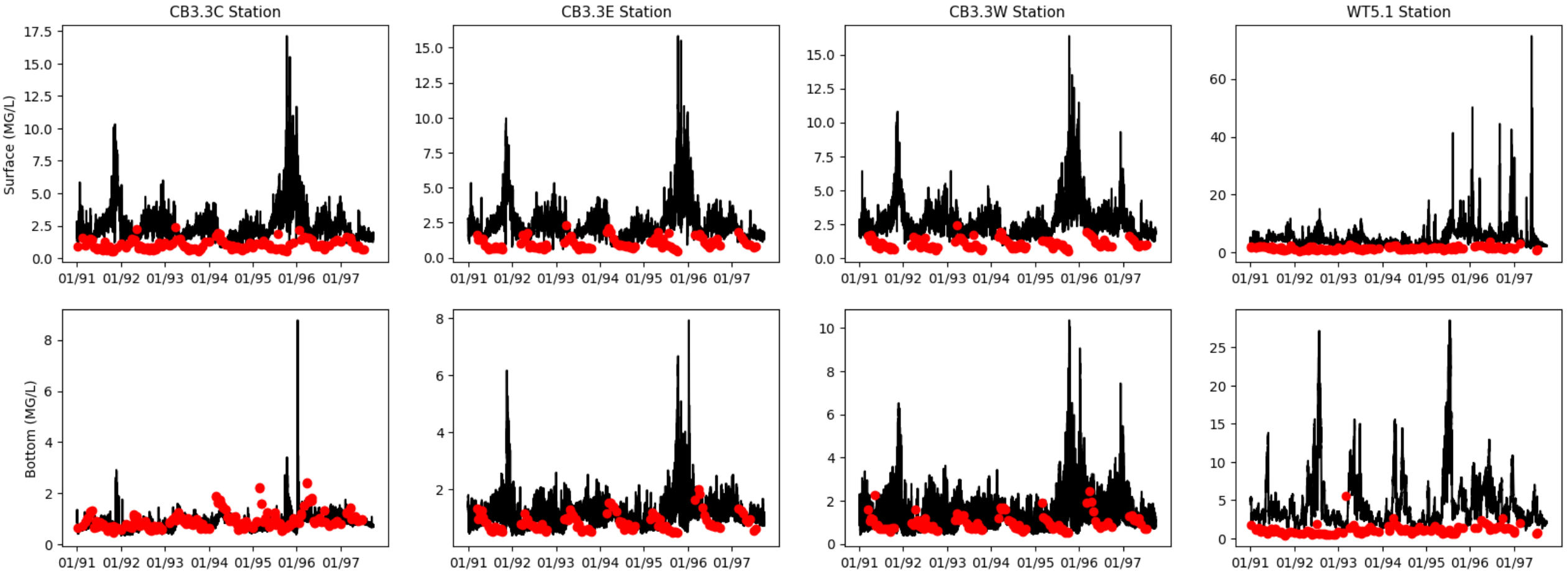



CB3.3C Station
CB3.3E Station
CB3.3W Station
WT5.1 Station
Surface (UG/L)
Bottom (UG/L)
01/91 01/92 01/93 01/94 01/95 01/96 01/97

Total Nitrogen

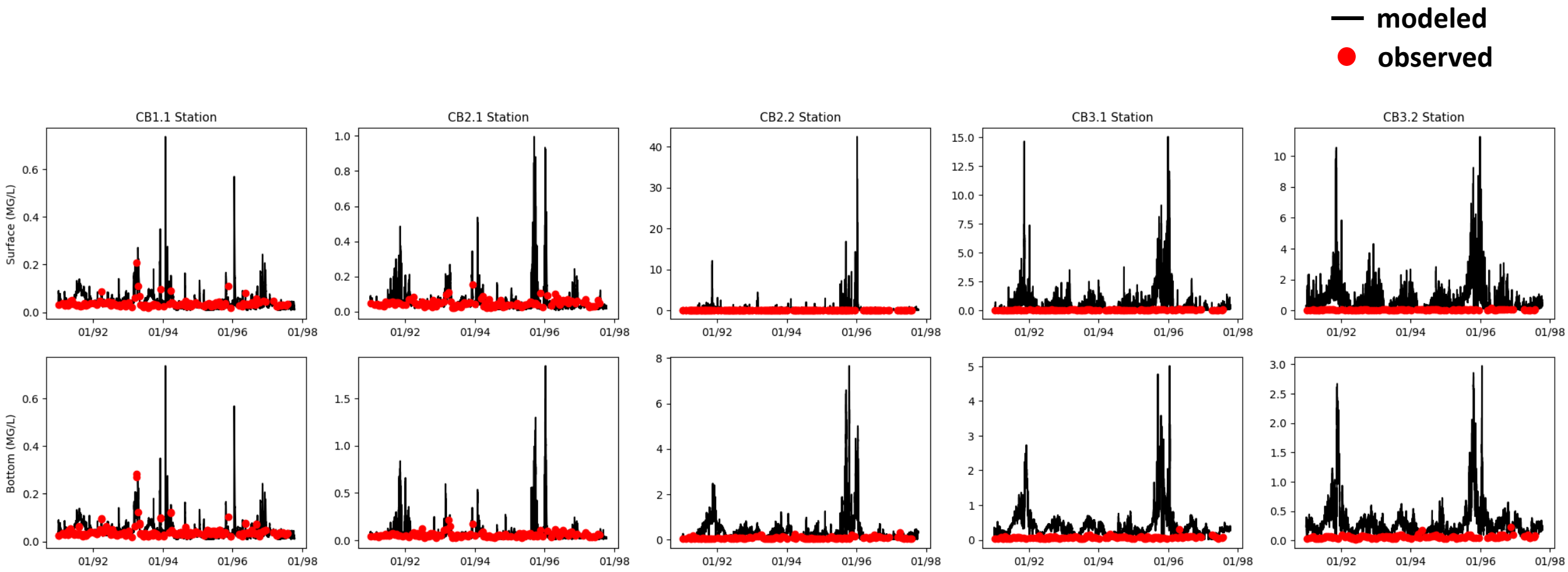
=RPON + LPON + SRPON + DON + NH4 + NO3

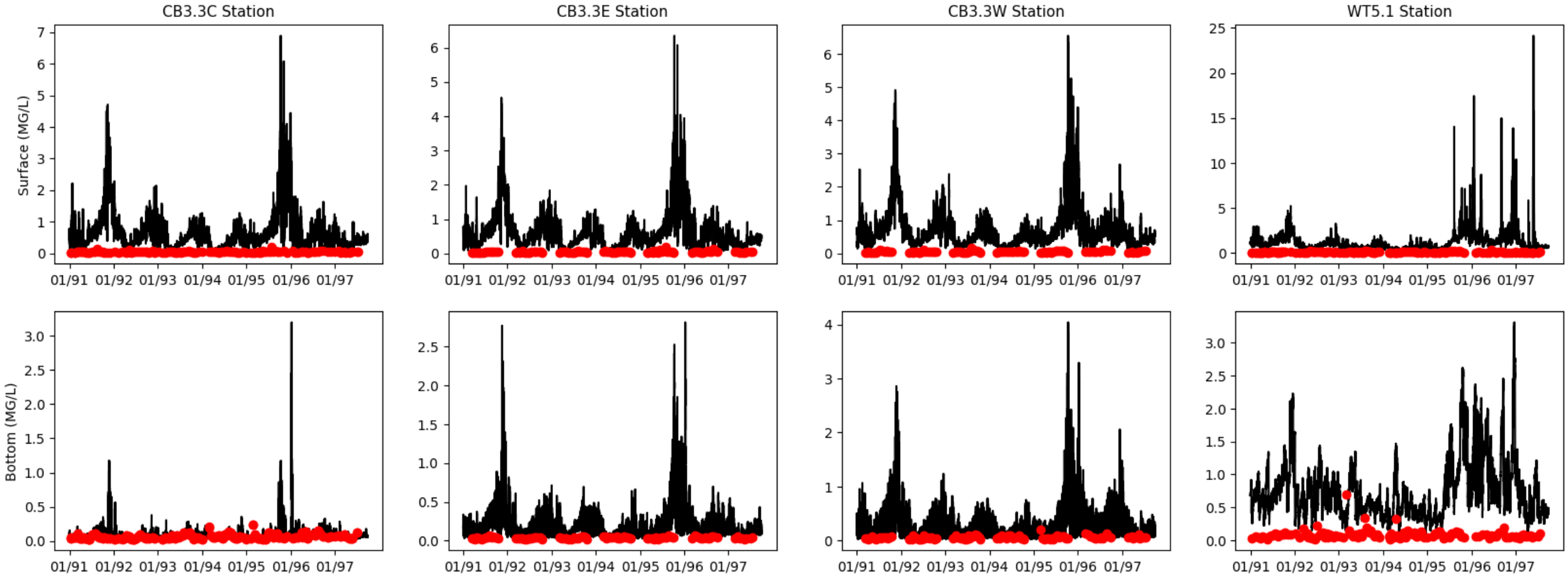



CB3.3C Station
CB3.3E Station
CB3.3W Station
WT5.1 Station
Surface (MG/L)
Bottom (MG/L)
01/91 01/92 01/93 01/94 01/95 01/96 01/97

Total Phosphorus

= RPOP + LPOP + SRPOP + DOP + PO4 + PIP




CB3.3C Station
CB3.3E Station
CB3.3W Station
WT5.1 Station
Surface (MG/L)
Bottom (MG/L)
01/91 01/92 01/93 01/94 01/95 01/96 01/97

III.. Dissolved Oxygen in Patapsco River

(To be presented by Dr. Jeremy Testa)

IV. Summary and Discussion

1. The Phase-7 non-point source load was successfully linked to the Patapsco/Back MTM SCHISM-ICM model

2. The non-point source spatial distribution indicated that no source information from Hart-Miller Island (yetPooles Island does) and C&D canal (beyond MD portion). Temporal distribution pointed a sudden increase of TN and TP in 1994 and 1996.

3. Overall, the skills for water quality modeling results are satisfactory given the LPON + SRPON and LPOP + SRPOP be excluded from TN and TP calculation.