

# Update on Main Bay Model (MBM) Progress

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# OUTLINE

- ❑ MBM results forced with **new WSM loading (Apr 2026 beta)**
  - Model performance are generally consistent in the main stem
  - Potential loading issues in some tributaries (Potomac & Patuxent)
  
- ❑ Implementation of **a new PIP module** in MBM (**ongoing**)
  - Improved PO4 near headwaters (main stem & tributaries)
  - Some local issues in Potomac & Patuxent (due to loading?)

## MBM forced with new WSM loading

- ❑ In overall, the model performance with Apr 2026 beta is comparable with the old run, except for some tributaries

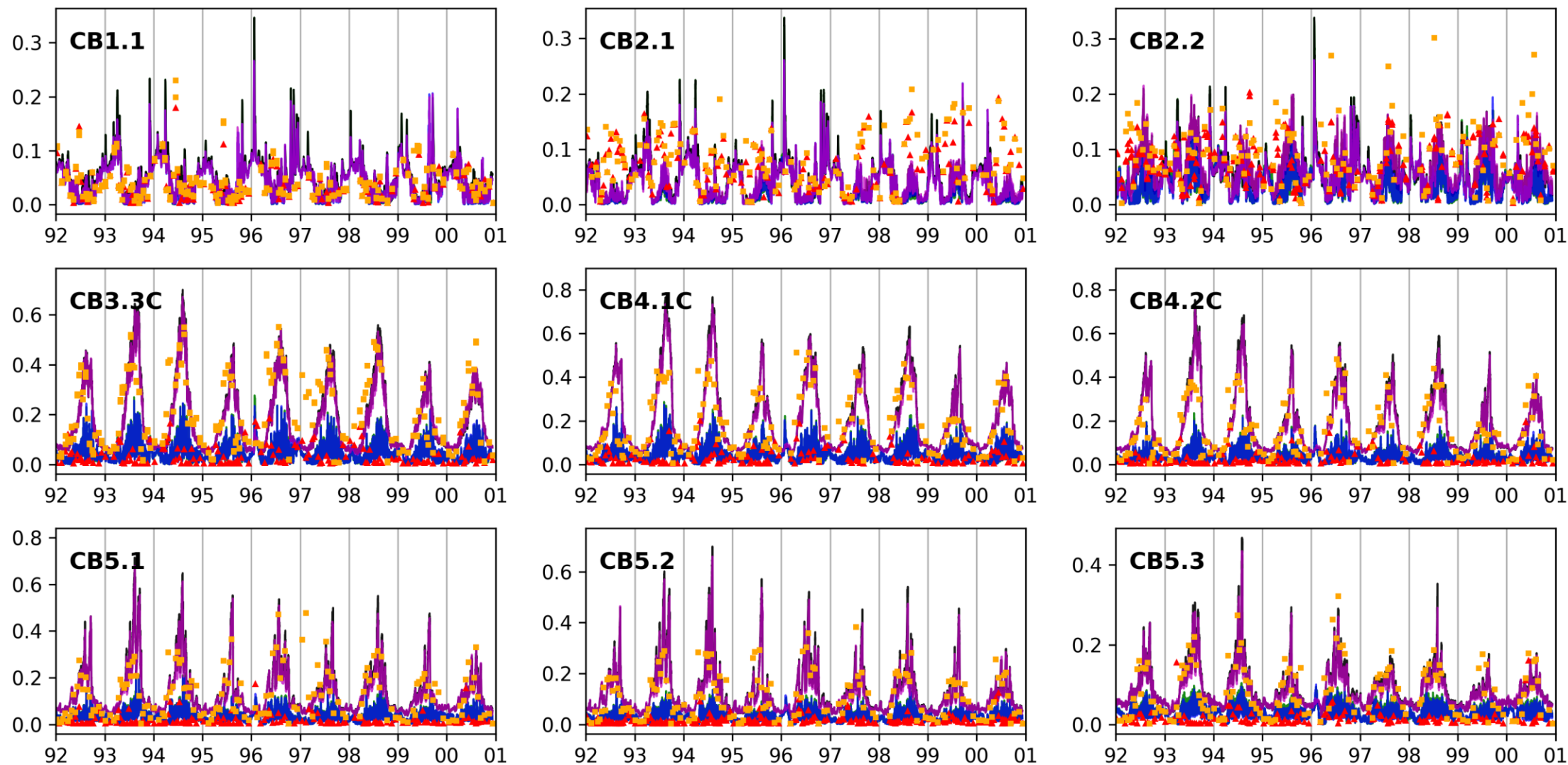
| Regions        | NH4    | NO3    | PO4   |
|----------------|--------|--------|-------|
| Main Channel   |        |        |       |
| Shoal          |        |        |       |
| WT             |        |        |       |
| ET             |        |        |       |
| James River    |        |        |       |
| Patuxent R     |        | worse  | worse |
| Potomac R      | better | worse  | worse |
| Rappahannock R | better | better |       |
| York R         |        | better |       |

**PS:** blank means comparable performance

# MBM forced with new WSM loading

Jun 2025 (surface)    Obs (surface)  
Jun 2025 (bottom)    Obs (bottom)  
Apr 2026 (surface)      
Apr 2026 (bottom)   

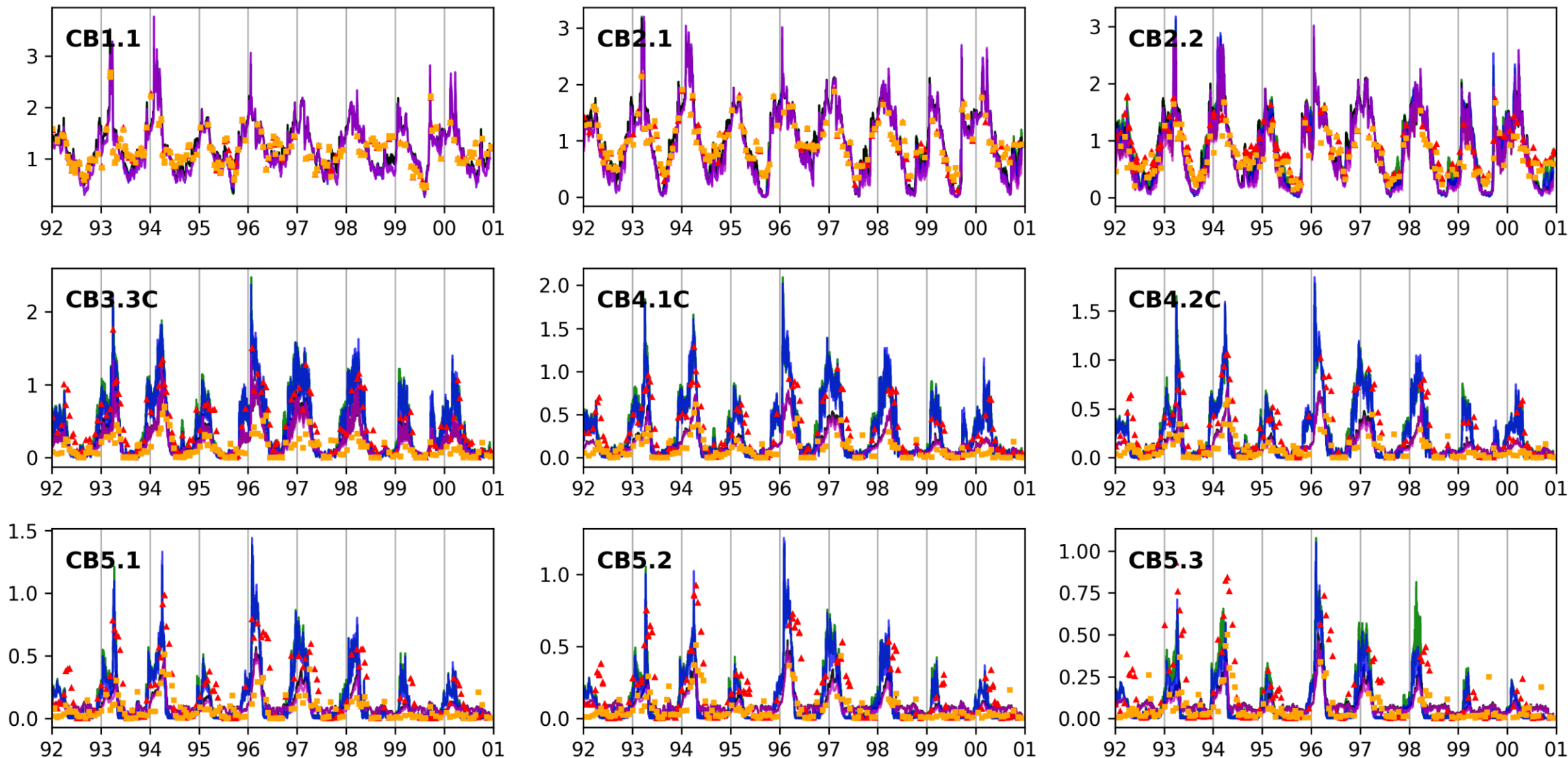
□ NH4 comparison in the main channel



# MBM forced with new WSM loading

Jun 2025 (surface)    Obs (surface)  
Jun 2025 (bottom)    Obs (bottom)  
Apr 2026 (surface)  
Apr 2026 (bottom)

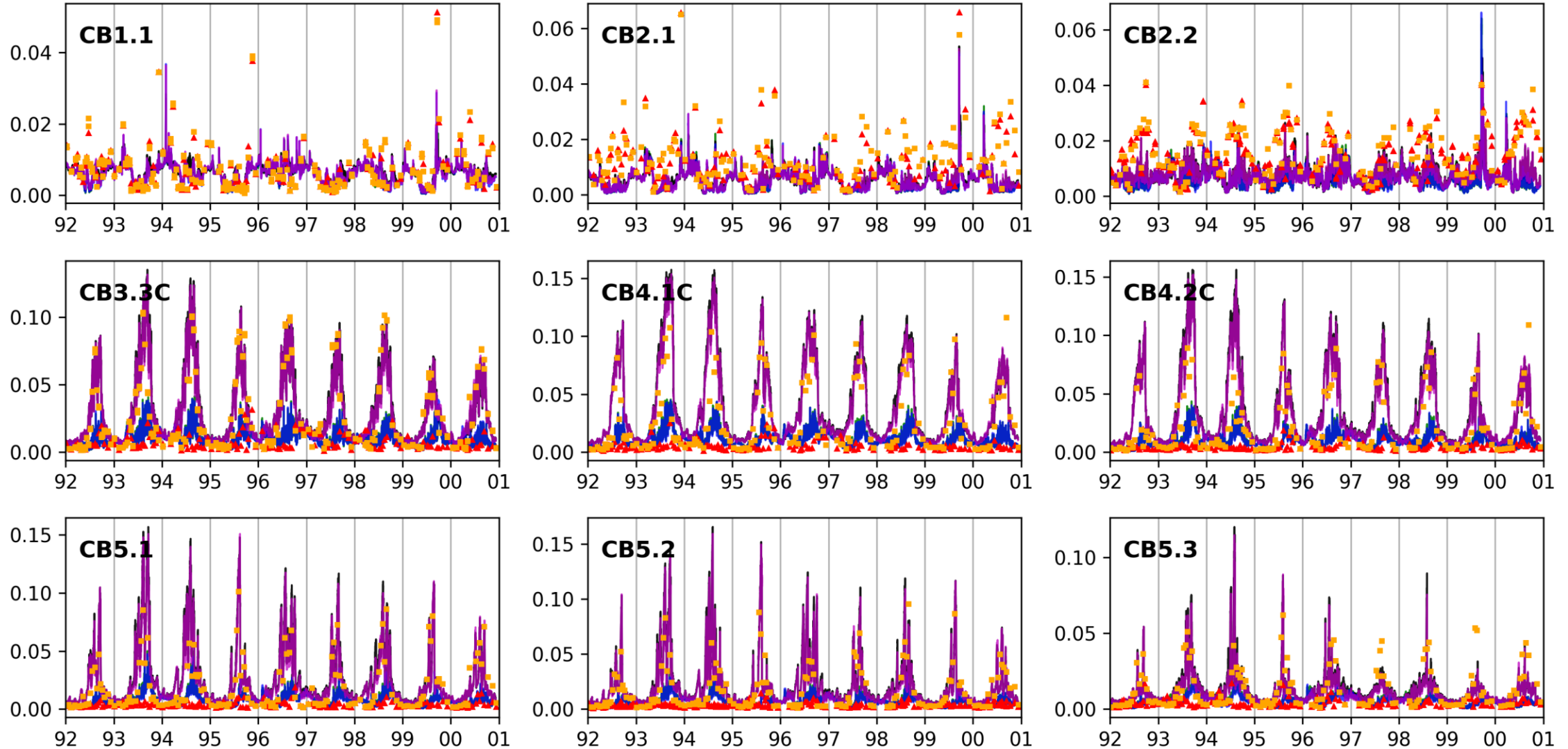
☐ NO3 comparison in the main channel



# MBM forced with new WSM loading

Jun 2025 (surface)    Obs (surface)  
Jun 2025 (bottom)    Obs (bottom)  
Apr 2026 (surface)  
Apr 2026 (bottom)

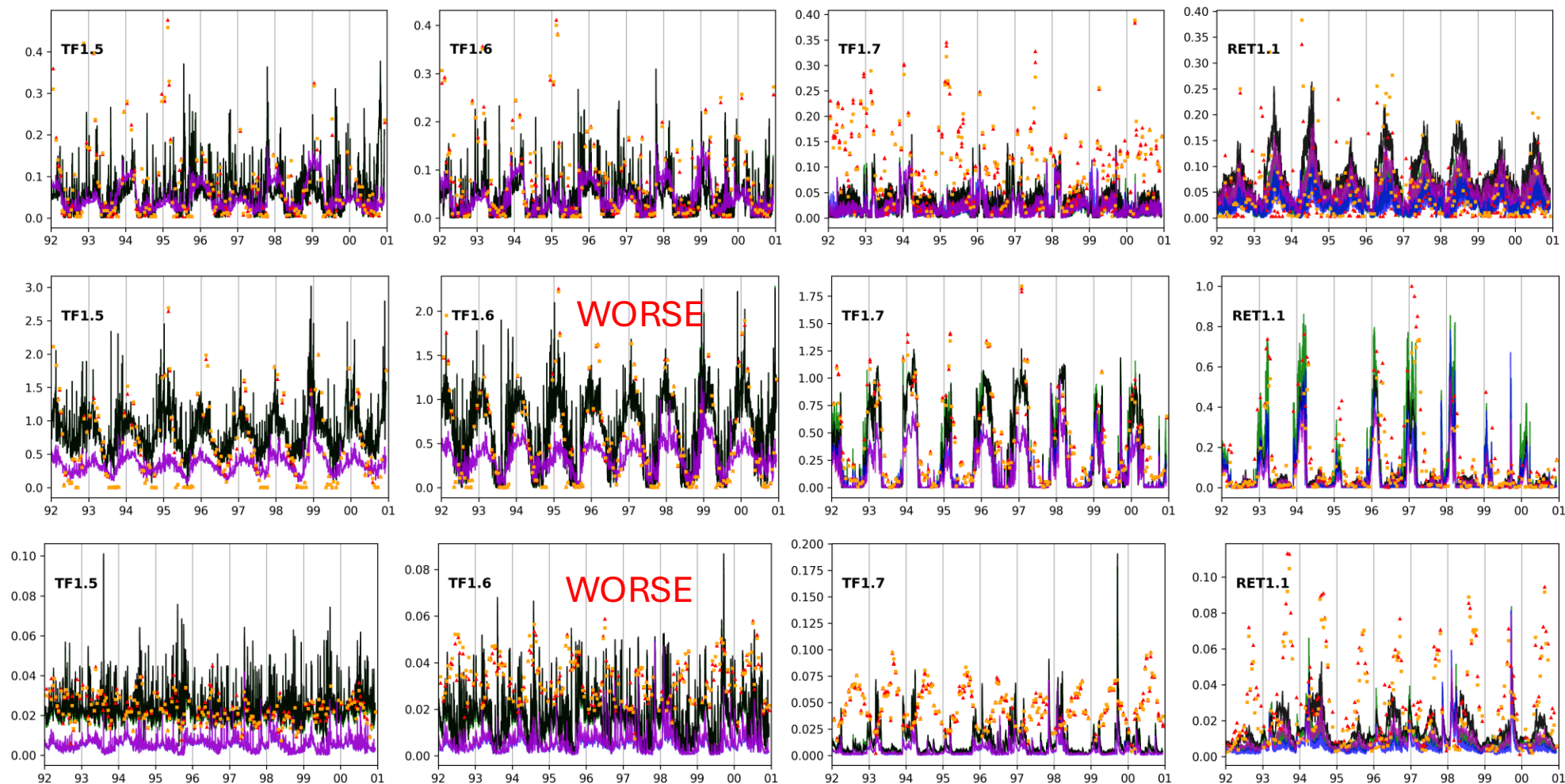
□ PO4 comparison in the main channel



# MBM forced with new WSM loading

Jun 2025 (surface)    Obs (surface)  
Jun 2025 (bottom)    Obs (bottom)  
Apr 2026 (surface)  
Apr 2026 (bottom)

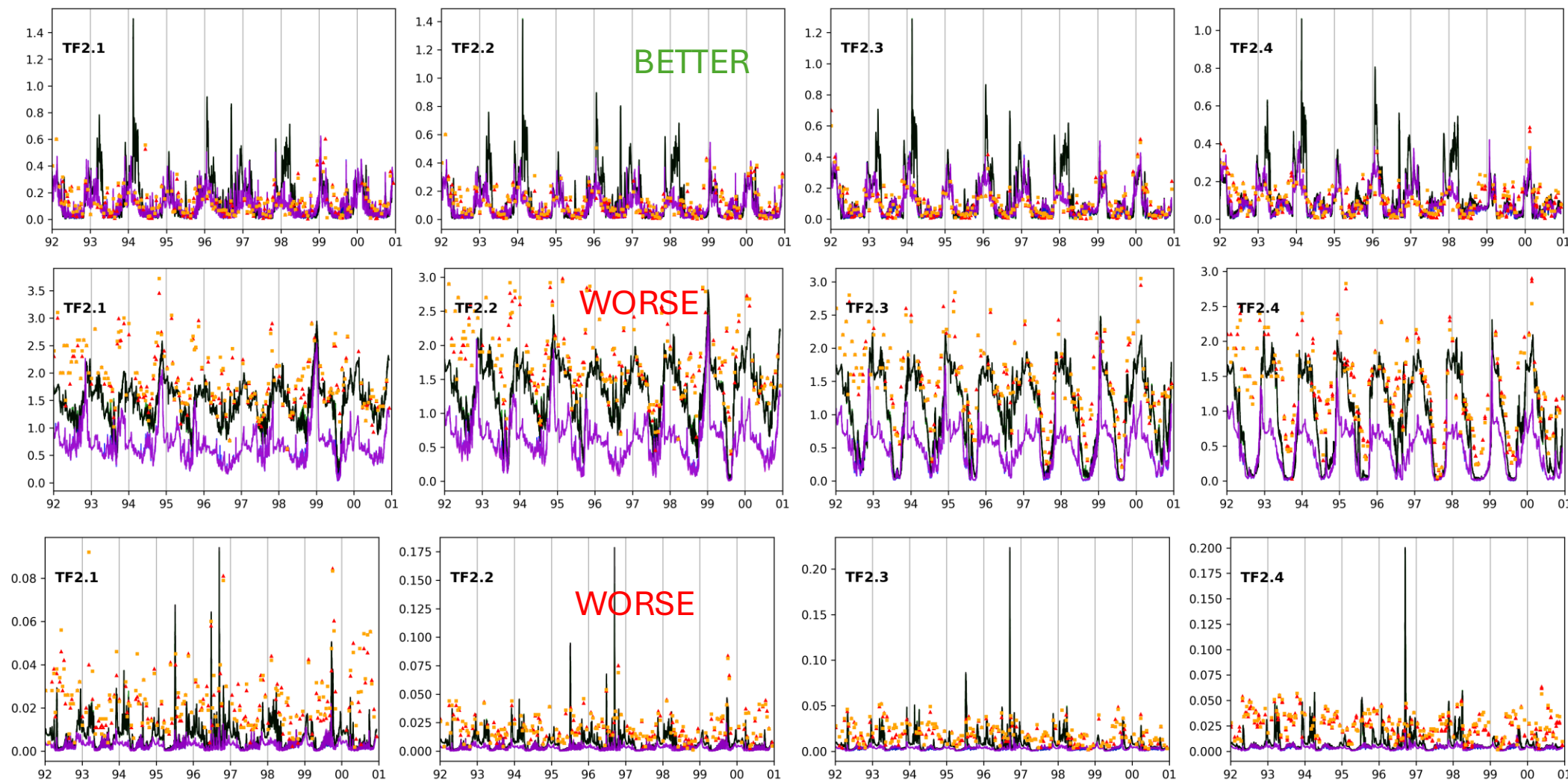
## Loading issue in Patuxent River?



# MBM forced with new WSM loading

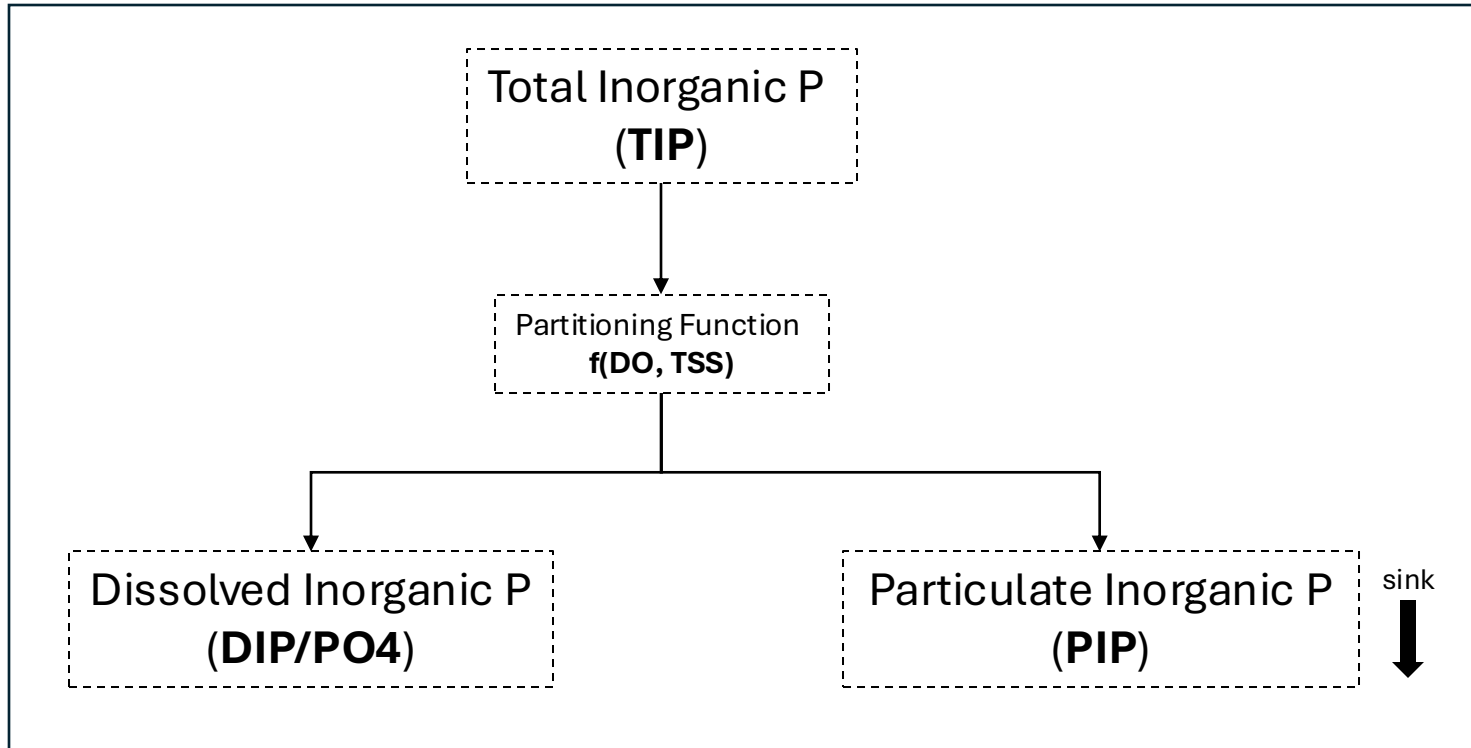
Jun 2025 (surface)    Obs (surface)  
Jun 2025 (bottom)    Obs (bottom)  
Apr 2026 (surface)     
Apr 2026 (bottom)

## Loading issue in Potomac River?



# Implementation of new PIP module

- ❑ A dynamic equilibrium PIP module based on Freundlich isotherm (**ongoing**)

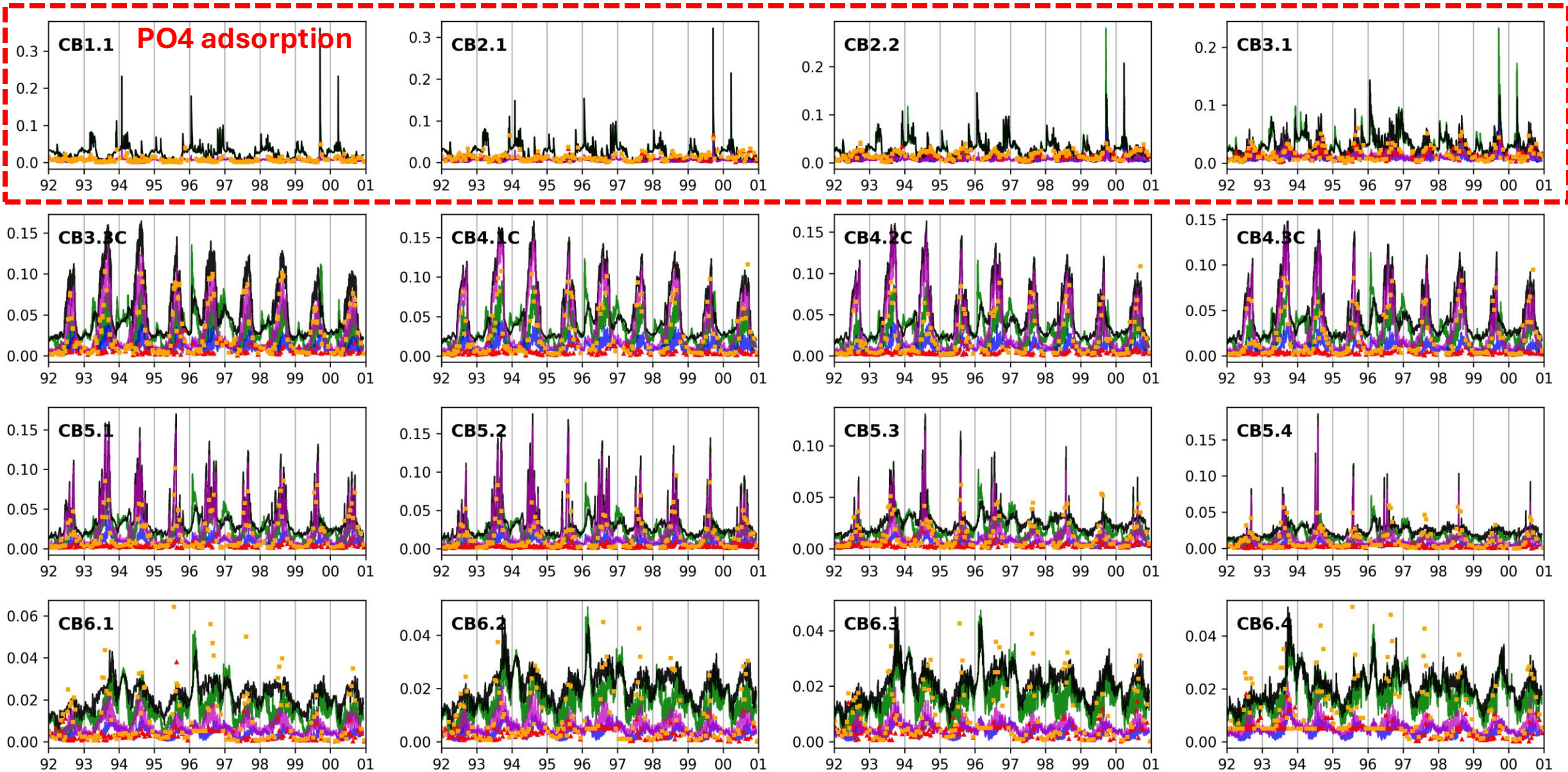


- Phase partitioning is diagnosed at each time step based on the suspended sediment concentration, and oxygen conditions.
- This formulation enables dynamic redistribution between dissolved and particulate pools while strictly conserving inorganic phosphorus.
- Low DO will facilitate the PIP desorption.

# Implementation of new PIP module

❑ New PIP module systematically improved the simulate PO4 in the main channel

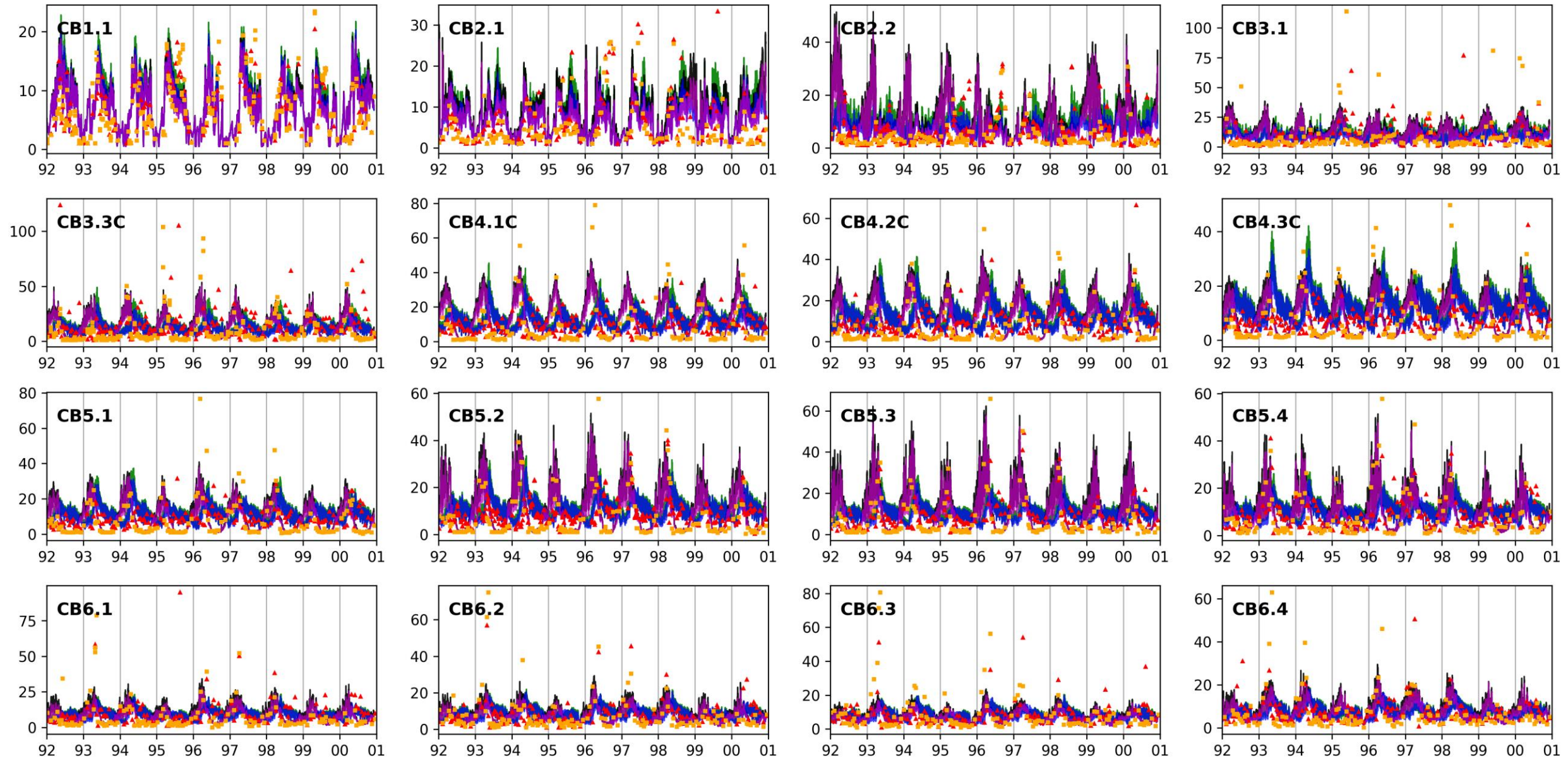
w/o PIP (surface)   Obs (surface)  
w/o PIP (bottom)   Obs (bottom)  
w/ PIP (surface)     
w/ PIP (bottom)



# Implementation of new PIP module

❑ **CHLA** & DO still show good performance in the main channel

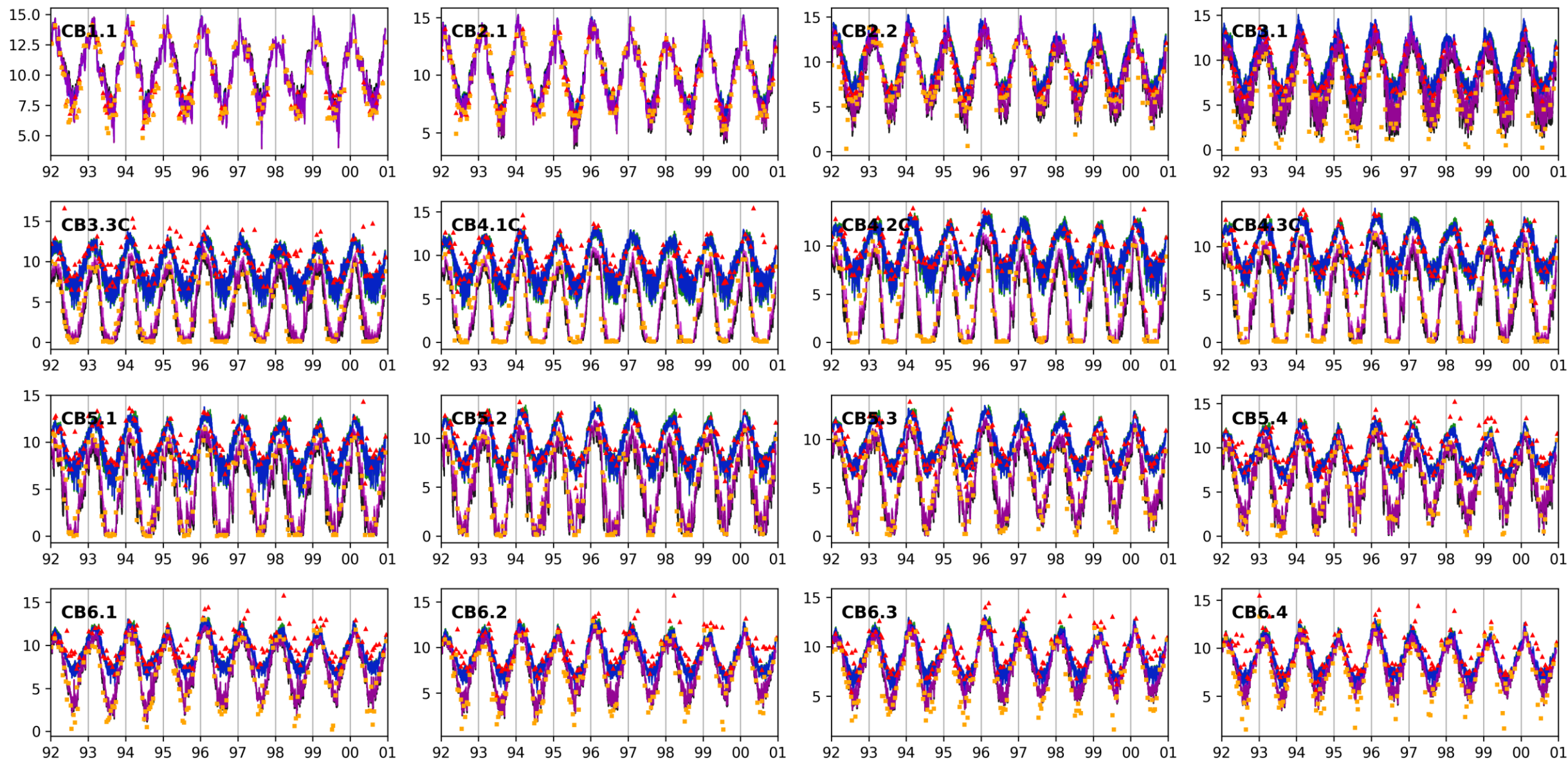
w/o PIP (surface)   Obs (surface)  
w/o PIP (bottom)   Obs (bottom)  
w/ PIP (surface)   w/ PIP (bottom)



# Implementation of new PIP module

❑ CHLA & **DO** still show good performance in the main channel

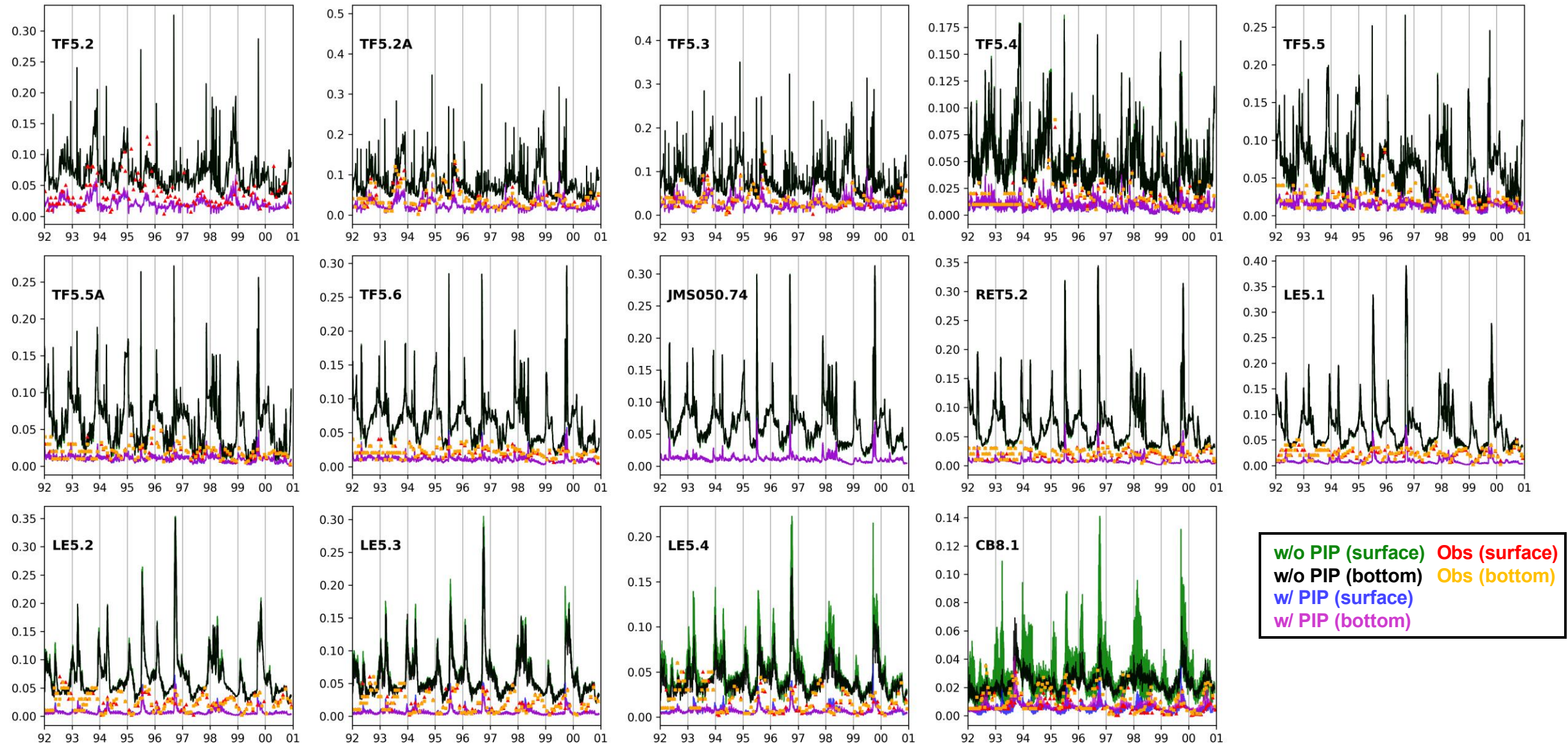
w/o PIP (surface)   Obs (surface)  
w/o PIP (bottom)   Obs (bottom)  
w/ PIP (surface)  
w/ PIP (bottom)



# Implementation of new PIP module

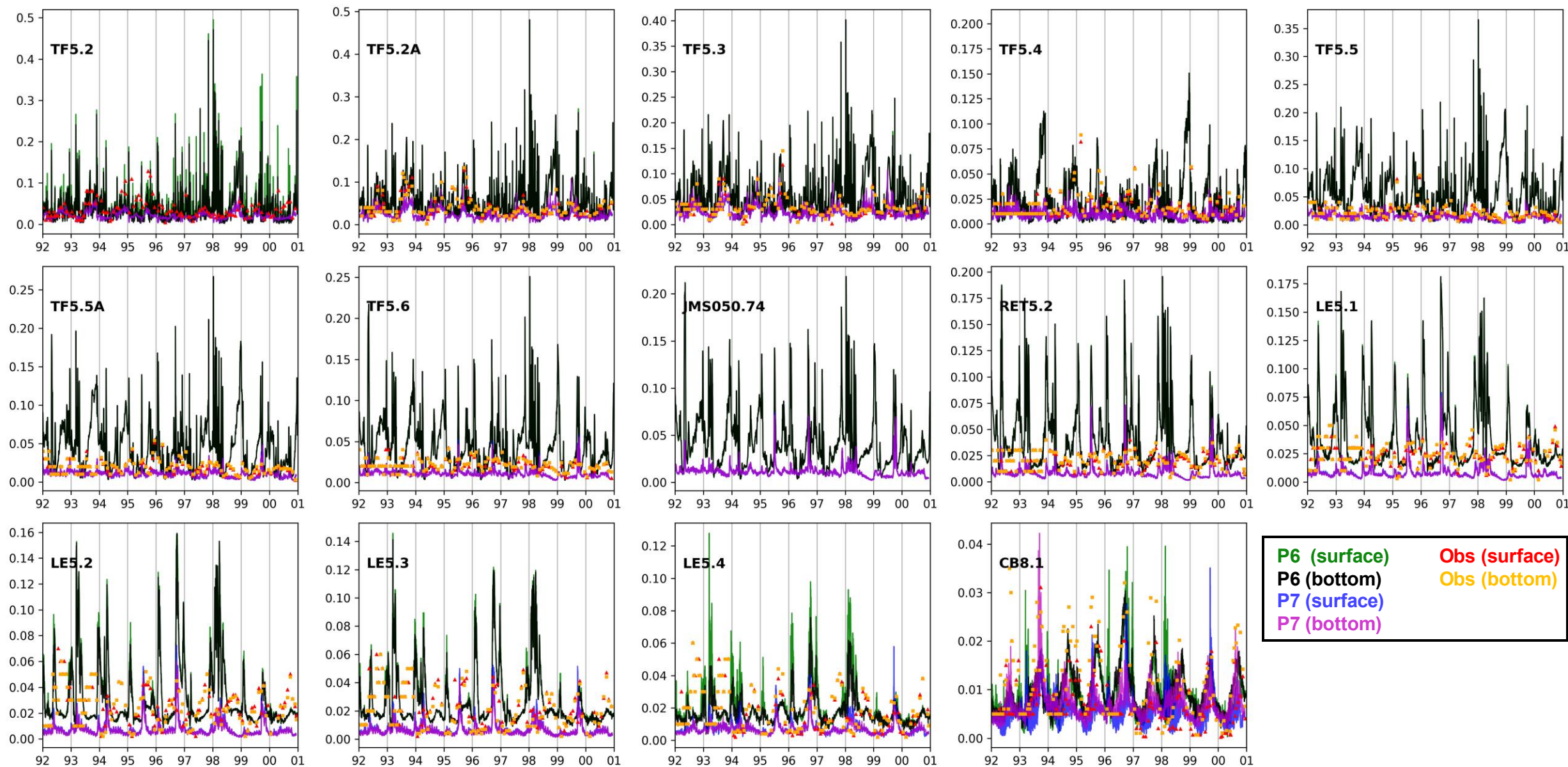
**PS:** the old results are comparable with **Phase-6**

❑ Notable PO4 improvements also occur in some tributaries (e.g., **James River**)



# Implementation of new PIP module

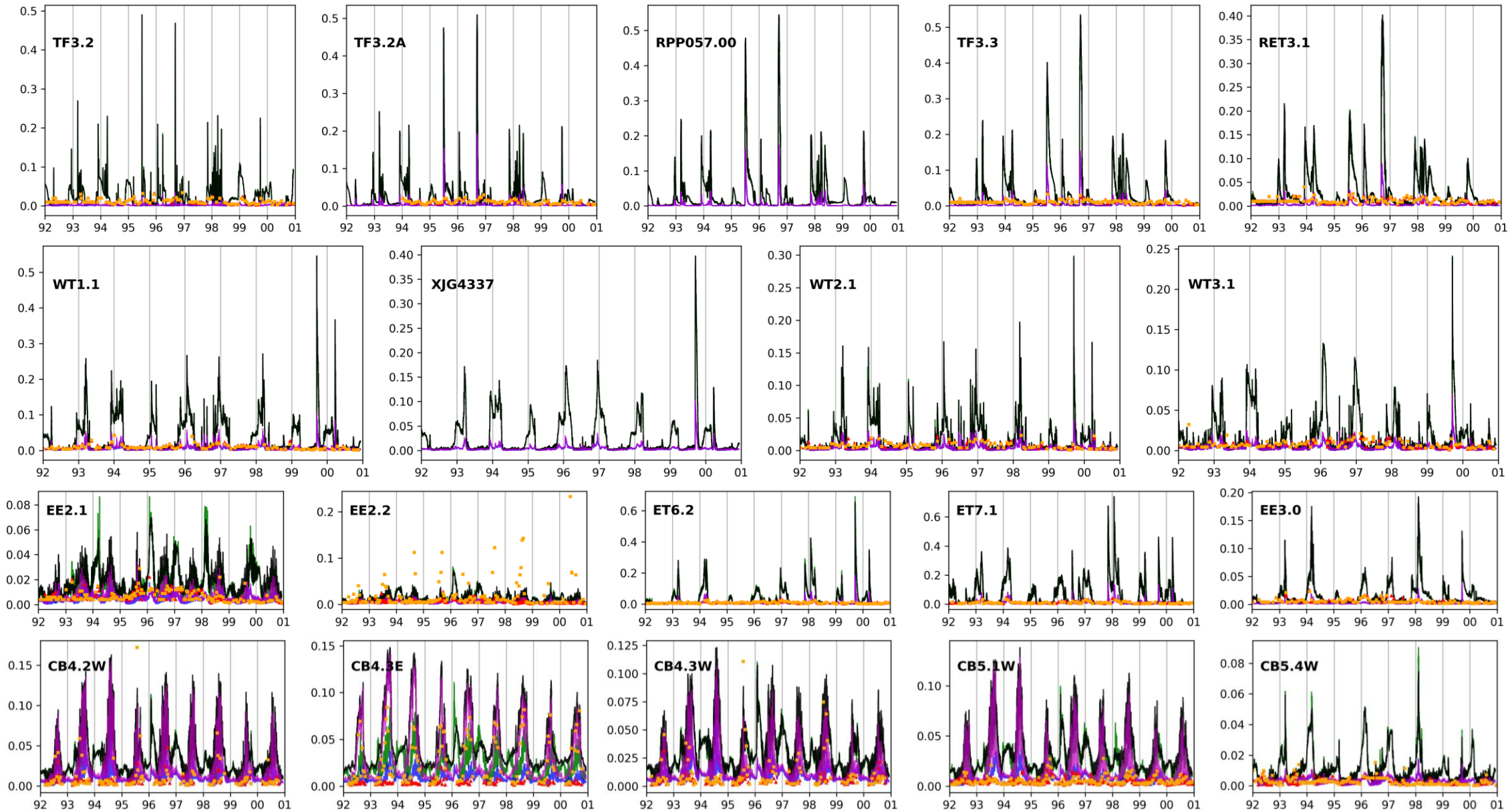
❑ The missing of PIP representation may be **a common issue** in Phase-6 and Phase-7



# Implementation of new PIP module



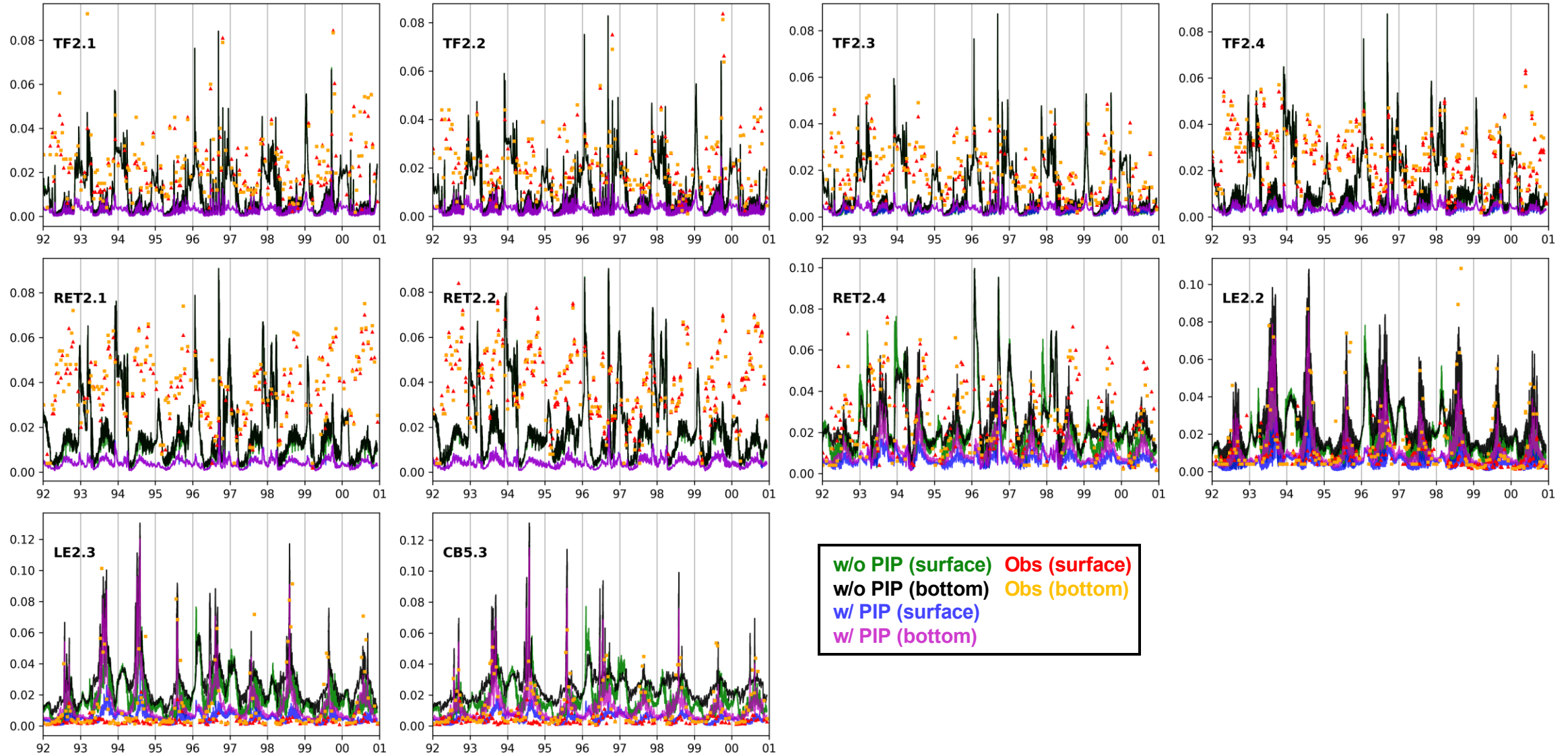
☐ The PO4 improvement happens in most headwaters



# Implementation of new PIP module

Loading or TSS issue?

- ❑ PO4 s worse in some tributaries (e.g., **Potomac**, Patuxent)



# Summary

- ✓ The MBM with new WSM loading (**Apr 2026 Beta**) delivers comparable performance with before, but some tributaries may have loading issues (Potomac & Patuxent).
- ✓ New PIP module delivers promising results to improve PO<sub>4</sub> in most headwaters, but some local issues (e.g., Potomac and Patuxent) need to be further checked.