04/07/2026

Phase 7 WSM Progress – Moving towards completeness of the Dynamic Watershed Model (DWSM) development

Modeling Workgroup Quarterly Meeting – April 2026

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Presentation Outline

Phase 7 Dynamic Watershed Model (DWSM)

1. **Dynamic Watershed Model overview**
2. **Overview of prior model development progress**
3. **Moving towards completeness of the DWSM**
   - Extend calibration period to 2024 (1985 to 2024, i.e., 40 years!)
   - Monitoring and WRTDS-K data for model calibration & verification
   - Refine trend component of generalized stream network routing
4. **Summary and next steps**

Purpose

NHD Scale Dynamic Watershed Model (DWSM)

- Inputs for the estuarine models (MBM/MTMs)
- Watershed model calibration and scenario applications
- Support research and collaboration activities

Phase 7 Watershed Models and Structure

CAST – Chesapeake Assessment Scenario Tool

CalCAST

Average Load
+
Δ Inputs X Sensitivity
X
BMPs
X
Acres
X
Land to Water
X
River Delivery

Load by NHD catchment and land use

Tool for finding parameters that best match observations

Informs

Phase 7 CAST

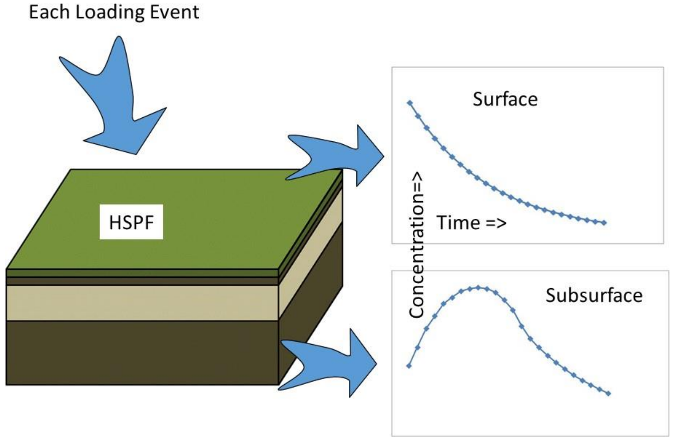
Average Load
+
Δ Inputs Sensitivity
X
BMPs
X
Acres
X
Land to Water
X
River Delivery

Finalize

Load by land-river segment and land use

CBP management model for running scenarios and supporting decision-making

Dynamic Watershed Model (DWSM)



Load by NHD catchment and land use

Tool for loading estuarine models, calibrating against monitoring data, and collaborative projects

Dynamic Watershed Model (DWSM) Development

- Year 2022: NHD-scale model structure and prototypes for hydrology, sediment, and nutrients.
- Year 2023: Incremental refinements of model prototypes in terms of model segmentation, CalCAST→DWSM linkage.
- Year 2024: stream water quality routing based on β parameters; refinements of small stream flow and water temperature routing modules; mechanics of riverine water quality calibrations.
- Year 2025: development and testing of DWSM and MBM linkage through beta versions; stream routing with RF model estimated β parameters, sediment routing, estimation of riverine transport parameters and further refinements of the DWSM calibration; organic scour in rivers, trend component in stream routing, BMPs, etc. Q4: P7 land use; extend simulation period to 2024; monitoring data; and GSN trends.
- **Year 2026:** Q1: improved calibration of 1985-2024 hydrology and sediment using initial P7 land use and mapping CalCAST data; refined simulations of small streams and improved water quality calibration of rivers;

CY2022
[1] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/progress-in-phase-7-wsm-development-1.4.2022-gopal_bhatt_penn_state.pdf
[2] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/progress_in_phase_7_wsm_development_4.5.2022_-_gopal_bhatt_penn_state.pdf
[3] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/progress_in_phase_7_wsm_development_-_gopal_bhatt_penn_state_7.12.22.pdf
[4] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-10.4.22-v2.pdf
[5] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-1.10.2023.pdf

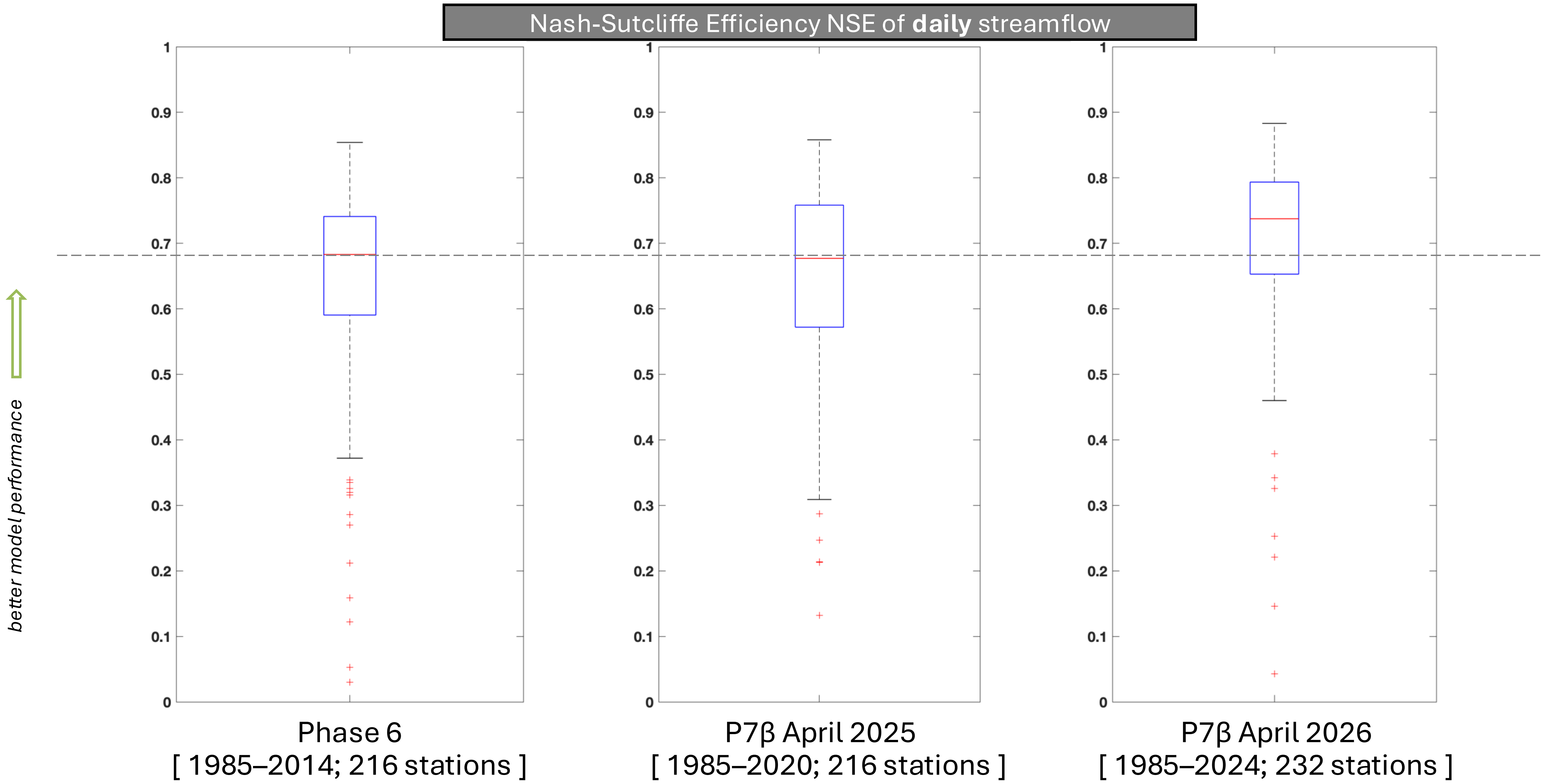
CY 2023
[1] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/20230404-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2023Q1.pdf
[2] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-6.20.2023.pdf
[3] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-10.17.2023.pdf
[4] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/20240109-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2023Q4.pdf

CY 2024
[1] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Progress-in-Phase-7-WSM-Development-Gopal-Bhatt-Penn-State-CBPO-4.2.2024.pdf
[2] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/Phase-7-WSM-Development-Modeling-WG-July-2024.pdf
[3] https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/3_1000_20241008-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2024Q3.pdf
[4] https://www.chesapeakebay.net/files/documents/1035-20250107-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2024Q4.pdf

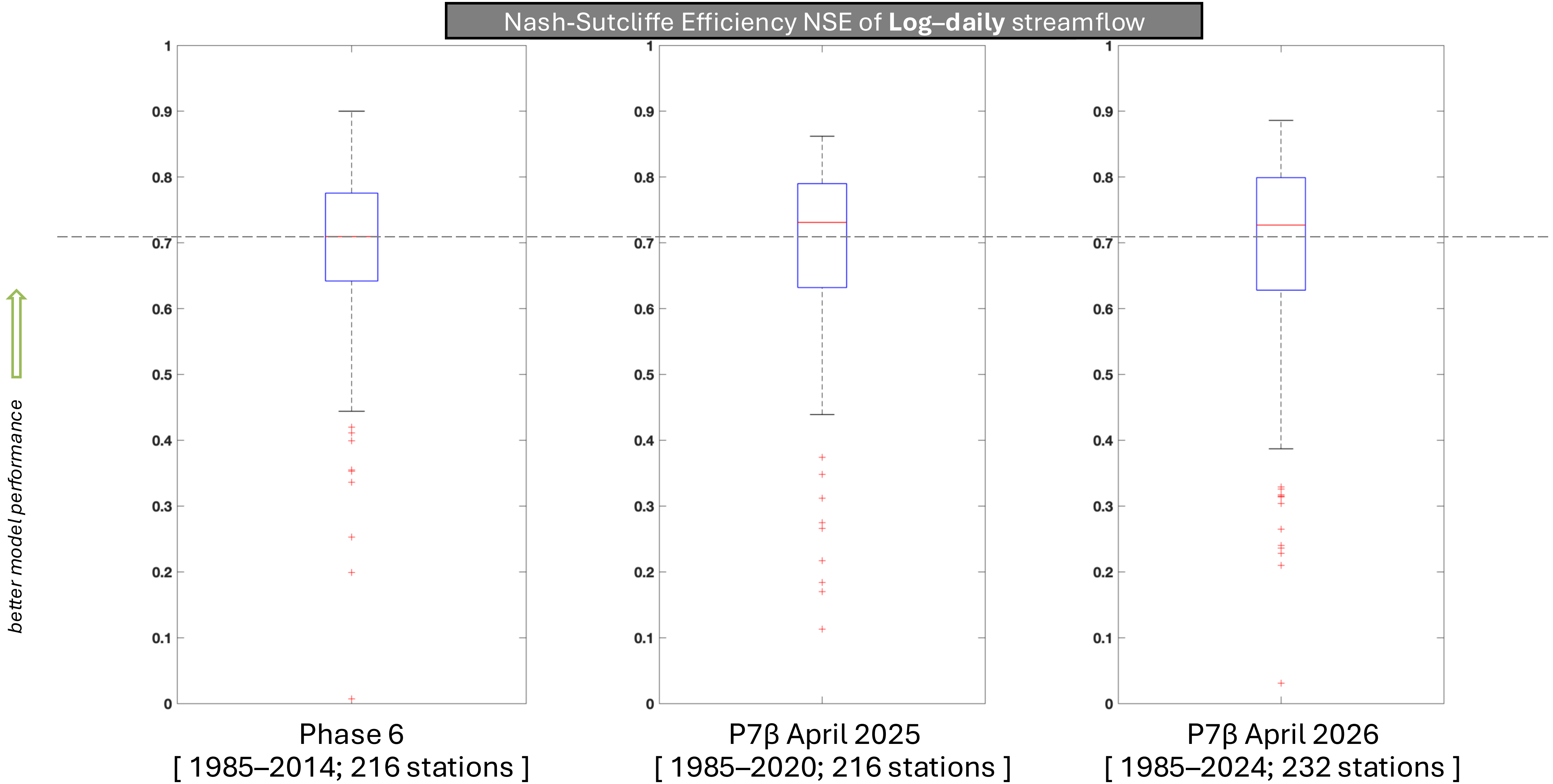
CY 2025
[1] https://www.chesapeakebay.net/files/documents/1025_20250401-BHATT-Phase-7-WSM-Development-Dynamic-Model-Development-2025Q1.pdf
[2a] https://www.chesapeakebay.net/files/documents/1010_Phase-7-Model-Review_Gopal-Bhatt.pdf
[2b] https://www.chesapeakebay.net/files/documents/1035_Phase-7-WSM-Development-Dynamic-Model-Development_Gopal-Bhatt.pdf
[3] https://www.chesapeakebay.net/files/documents/1005_Phase-7-Watershed-Model-Progress-Towards-Completeness-of-the-Dynamic-Watershed-Model-Development_Gopal-Bhatt.pdf
[4] https://www.chesapeakebay.net/files/documents/1000_Phase-7-Watershed-Model-Progress-Gopal-Bhatt.pdf

CY 2026
[1] … this presentation …

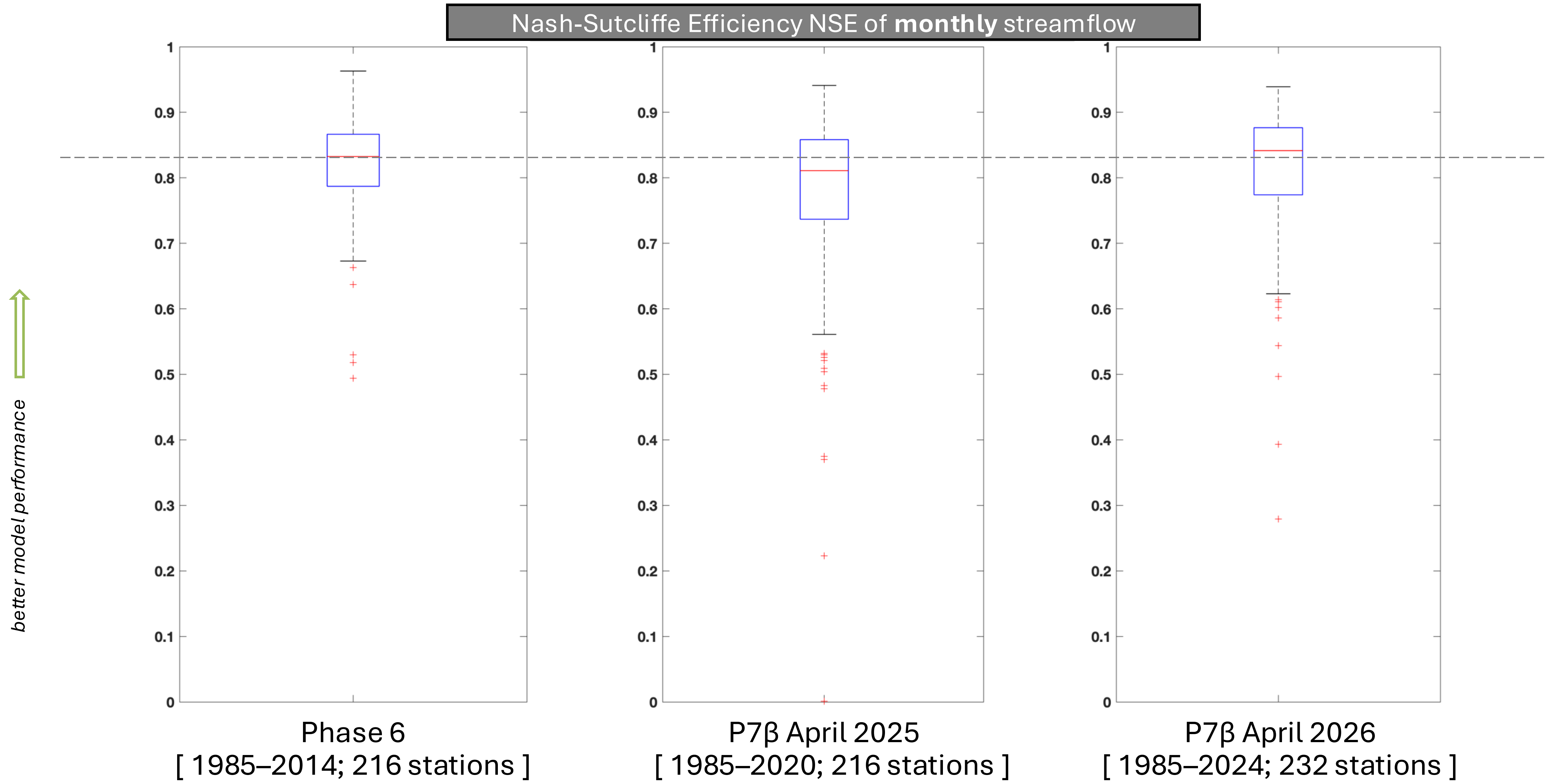
We have a ‘*as good or better’* hydrology calibration



We have a ‘*as good or better’* hydrology calibration

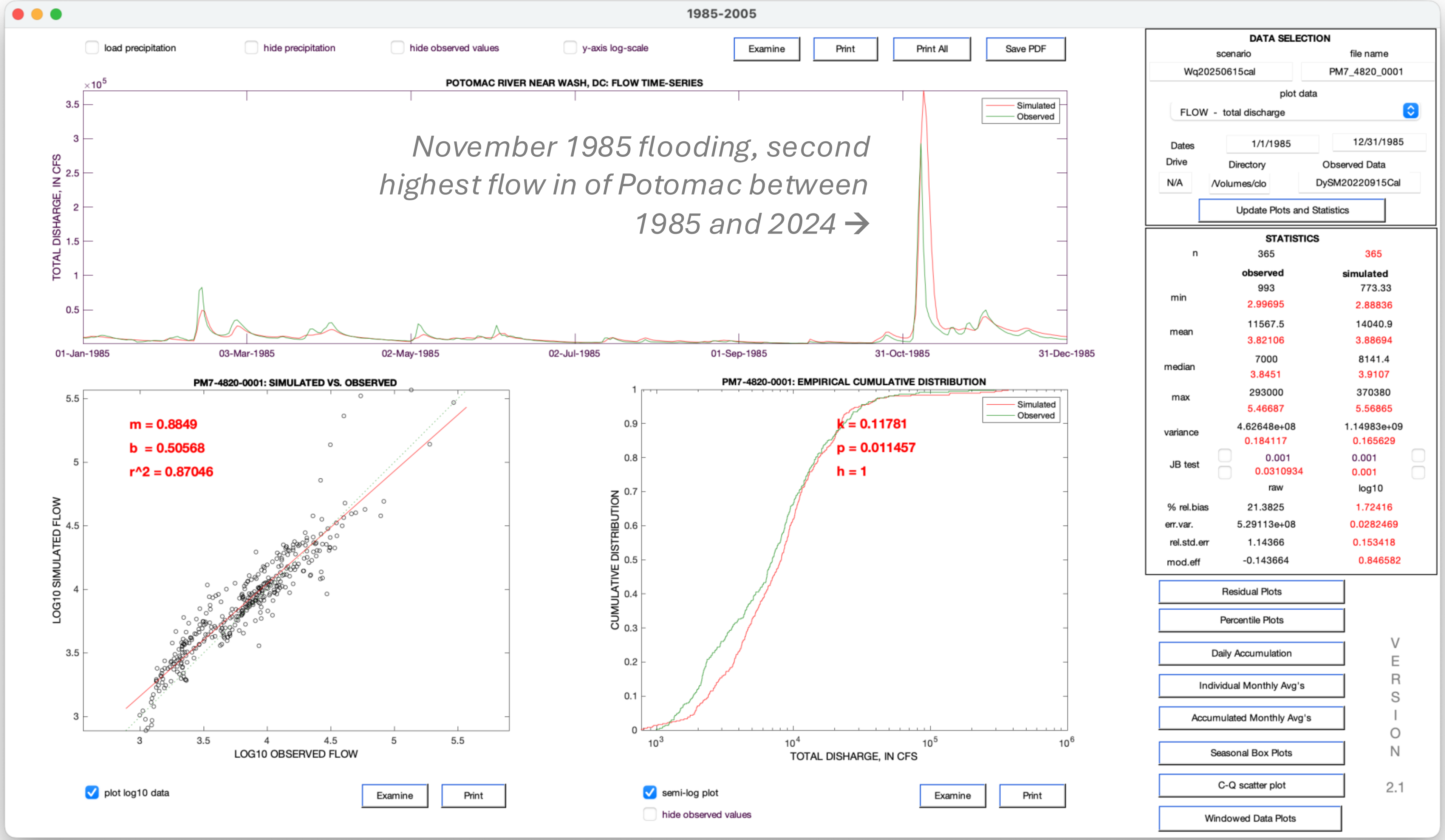


We have a '*as good or better*' hydrology calibration



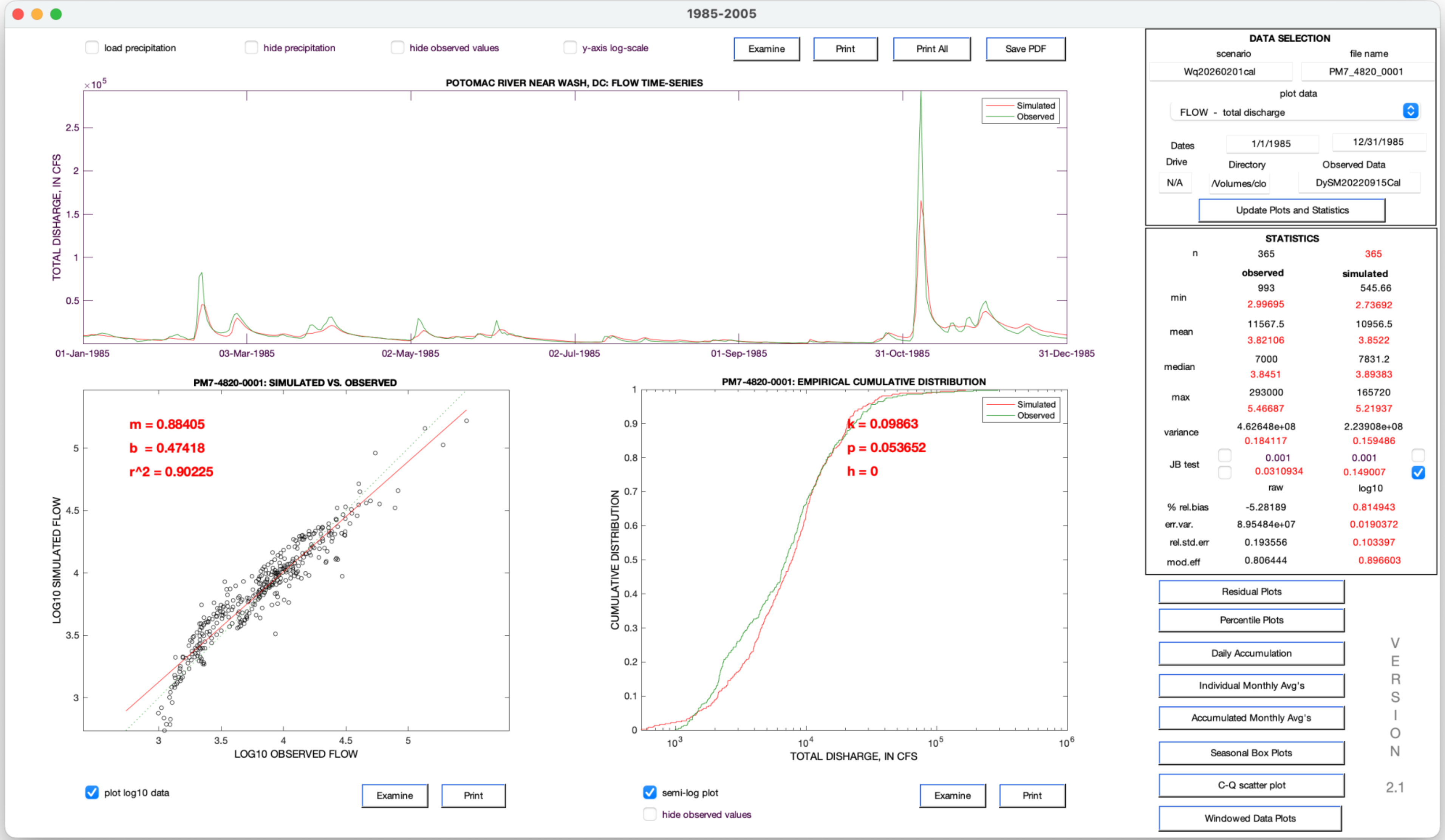
Streamflow | Potomac River Near Wash D.C. | P7β April 2025

November 1985 flooding, second highest flow in of Potomac between 1985 and 2024 →



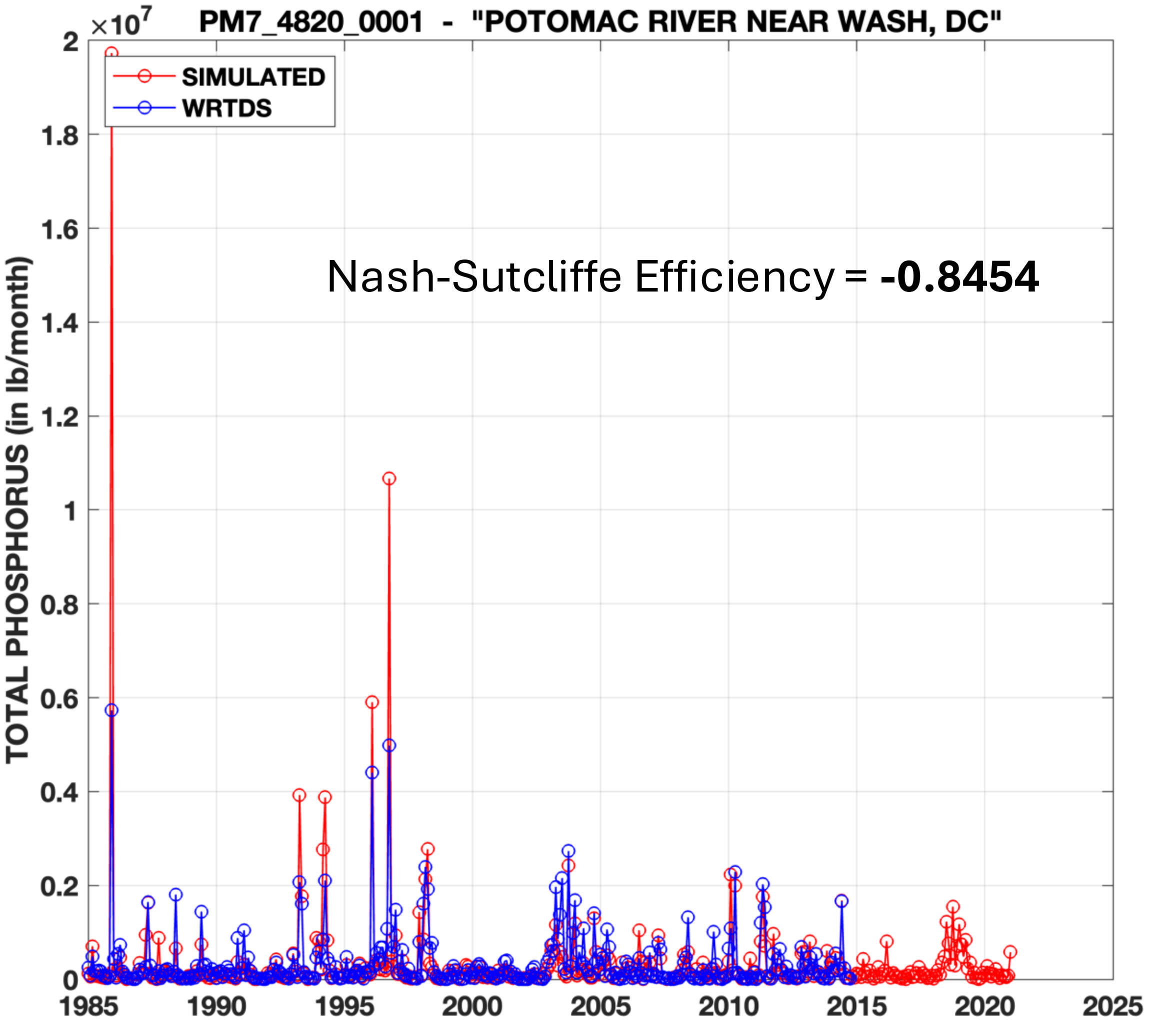
→ *Observation has flow greater than 200,000 ft^3/s on 1-day vs. 4-days in the April 2025 P7β hydrology calibration.*

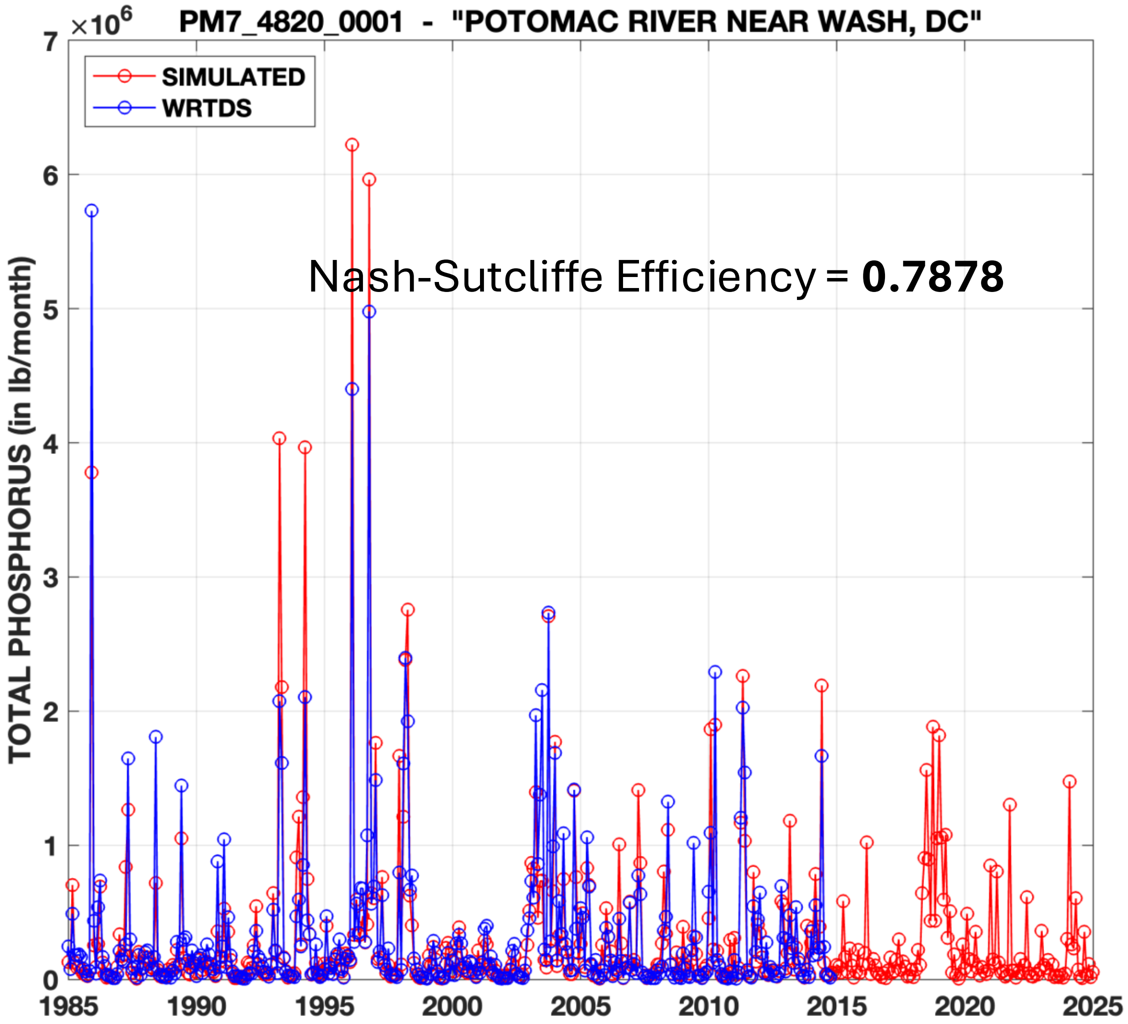
Streamflow | **Potomac River Near Wash D.C.** | **P7β April 2026**



→ *We are likely to end up with something like this.*

Improved flow resulted in better phosphorus loads…

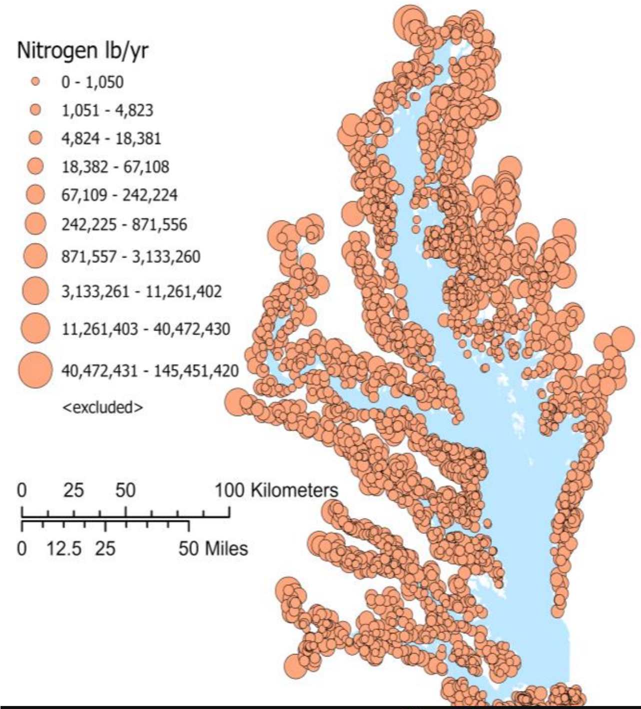


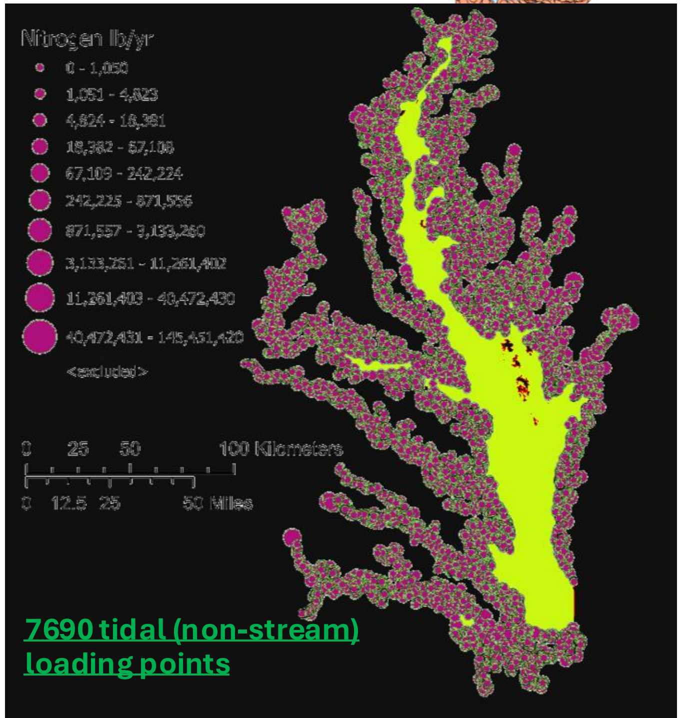


→ *November 1985 election day flooding, second highest flow in of Potomac between 1985 and 2024.*

P7 CAST land uses in DWSM

- We are working on the incorporation of P7 CAST land use data in the P7 DWSM
  - ‘Pre-BMP’ land use data for 1985-2024 is replacing the static 2013 P6 data.
  - Land use input is produced at 100K NHD+ catchment and land segment scale.
- We aggregated 51 P7 CAST land uses into 16 core land use types and feed-space
  - Aggregation into 17 land use types provides a computationally efficient model simulation as compared to that with 51 land uses – while maintaining the accuracy of loads at the catchment scale.





Proposed aggregation of P7 CAST land uses in DWSM

1. Impervious Roads
- MS4 Roads
- CSS Roads
- Non-Regulated Roads

2. Impervious Non-Roads
- MS4 Buildings and Other
- CSS Buildings and Other
- Non-Regulated Buildings and Other

3. Tree Canopy over Impervious
- MS4 Tree Canopy over Impervious
- CSS Tree Canopy over Impervious
- Non-Regulated Tree Canopy over Impervious

4. Turfgrass
- MS4 Turf Grass
- CSS Turf Grass
- Non-Regulated Turf Grass

5. Tree Canopy Over Turfgrass
- MS4 Tree Canopy over Turf Grass
- CSS Tree Canopy over Turf Grass
- Non-Regulated Tree Canopy over Turf Grass

6. Solar Infrastructure
- MS4 Solar Infrastructure
- CSS Solar Infrastructure
- Non-Regulated Solar Infrastructure

7. Solar Pervious
- MS4 Solar Pervious
- CSS Solar Pervious
- Non-Regulated Solar Pervious

8. Compacted Pervious
- MS4 Compacted Pervious
- CSS Compacted Pervious
- Non-Regulated Compacted Pervious

9. Construction
- Regulated Construction
- CSS Construction

10. Forest
- True Forest
- CSS Forest

11. Harvested Forest
- Harvested Forest
- CSS Harvested Forest

12. Floodplain Wetlands

13. Other Wetlands

14. Cropland
- Full Season Soybeans
- Grain with Manure
- Grain without Manure
- Silage with Manure
- Silage without Manure
- Small Grains and Grains
- Double Cropped Land
- Specialty Crop High
- Specialty Crop Low
- Other Agronomic Crops

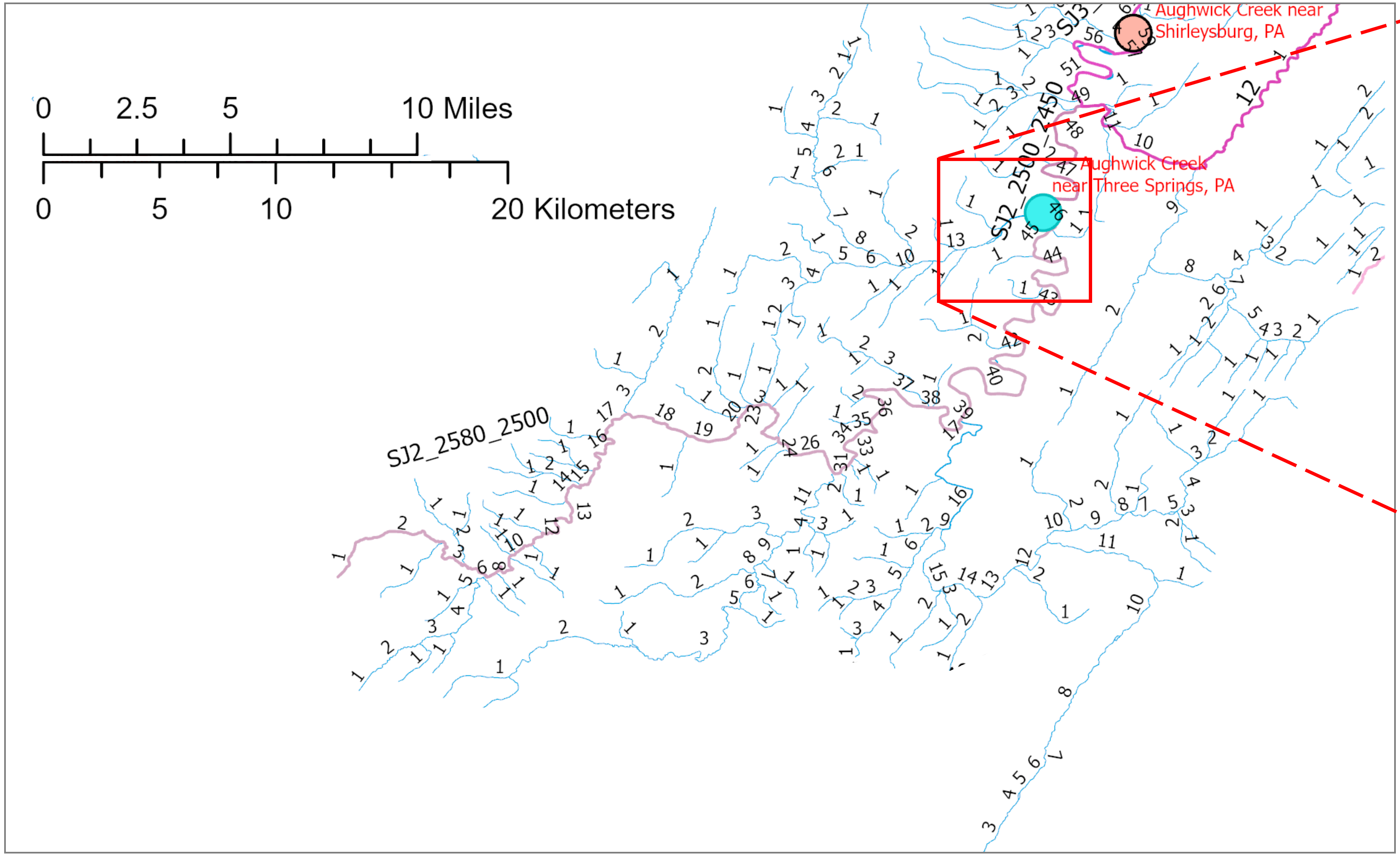
15. Pasture and Hay
- Ag Open Space
- Leguminous Hay
- Hay Low
- Pasture Low
- Hay High
- Pasture High

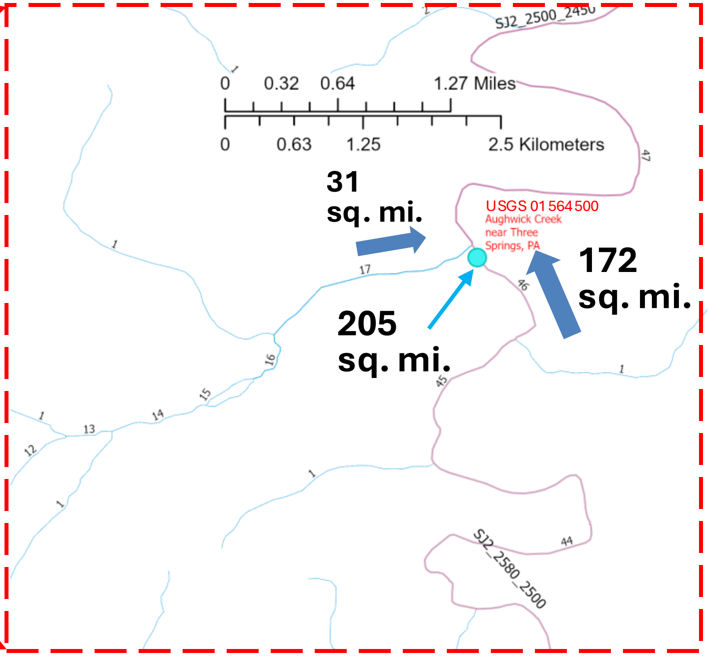
16. Water

17. Feed Space
- Permitted Feeding Space
- Non-Permitted Feeding Space

Thanks to Jess, Sarah, and Peter!

We revised mapping of monitoring stations and confluences

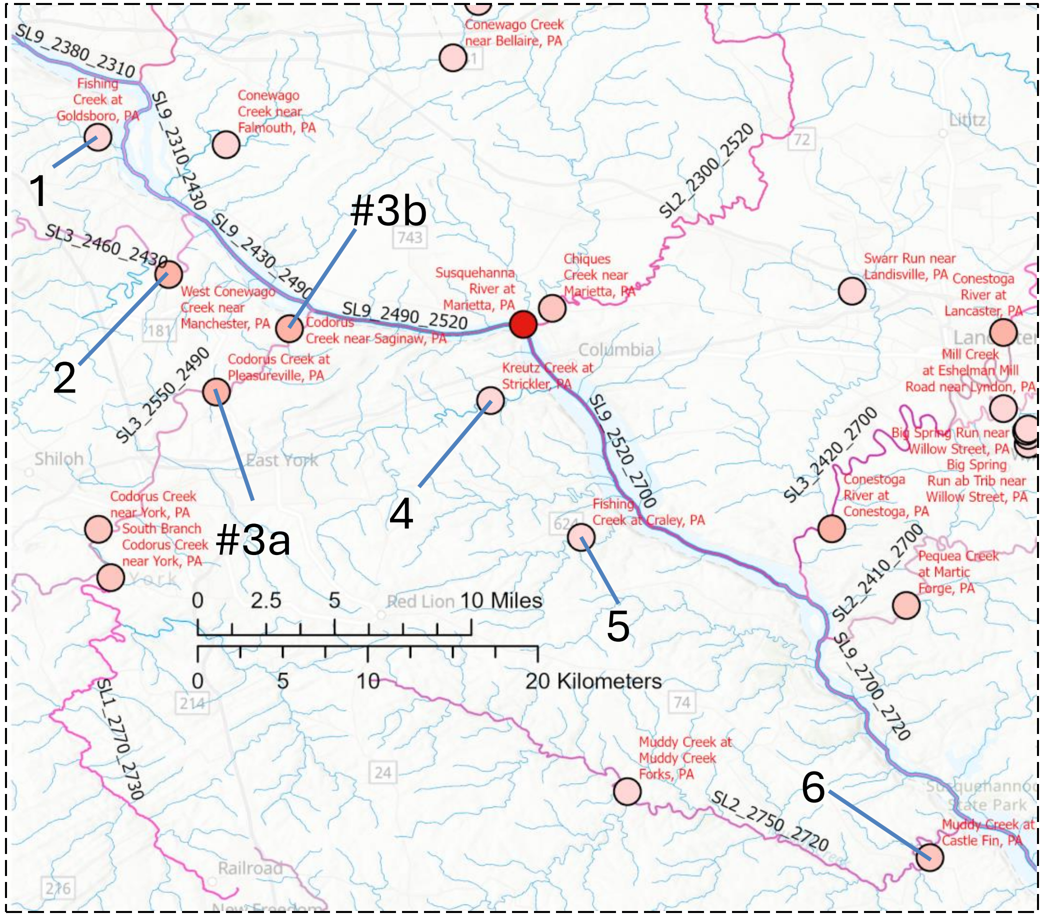


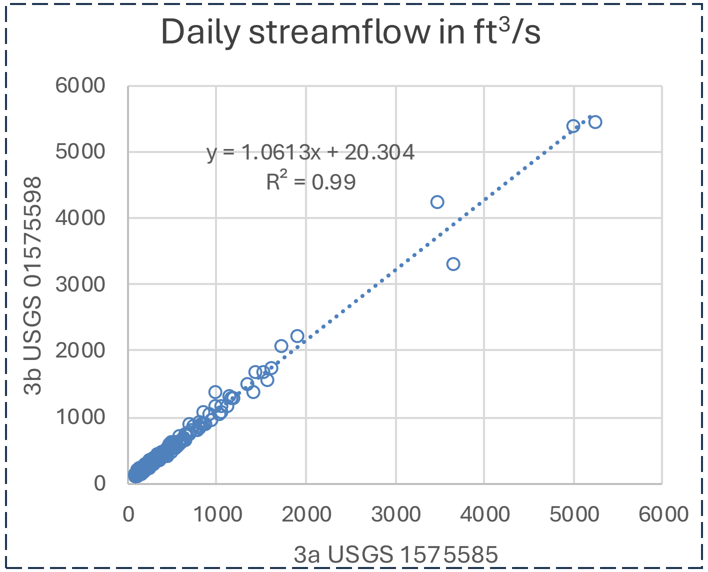


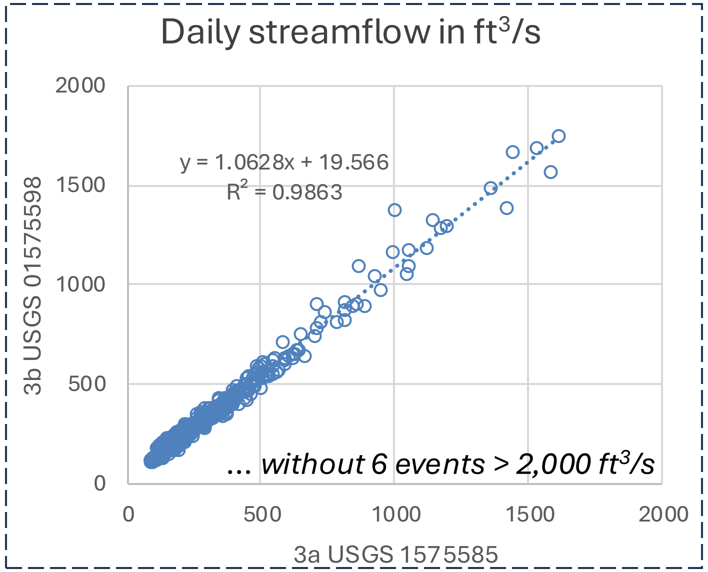
Before: Bias -20.4%; NSE 0.680
After: Bias -0.5% NSE 0.811

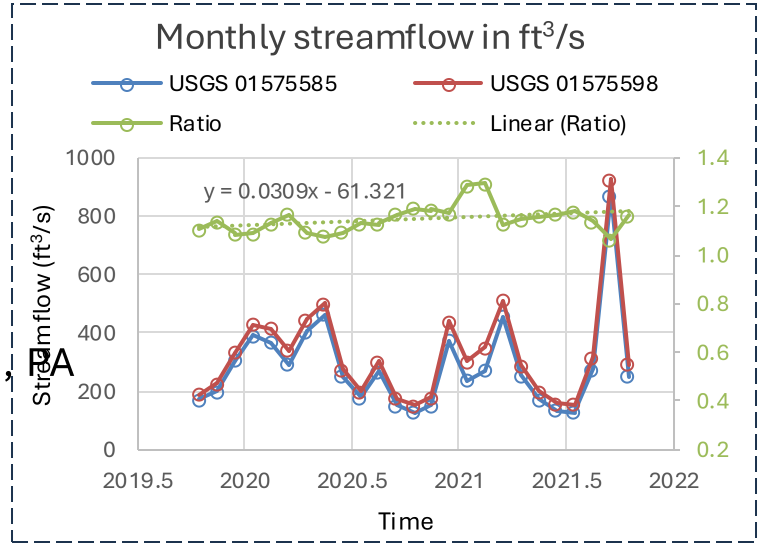
→ *We have a total of 78 monitored mainstem confluences with as many as 6 tributaries (as compared to 31 confluences in Phase 6).*

Codorus Creek in York County, PA









- At this station we have a +19.6% bias (Jan 1985 to Oct 2021) in April 2026 beta hydrology calibration.
- Q. Adjust #3a Jan 1985 to Dec 2018 streamflow data with equation in the scatter plot and append #3b from Jan 2019 onwards.

- #3a USGS 01575585 Codorus Creek at Pleasureville, PA
  [267 sq. mi; 1/1/1985 to **10/31/2021**]
- #3b USGS 01575598 Codorus Creek at Saginaw, PA
  [277 sq. mi; **1/1/2019** to present]

Drainage area of #3b is ~**1.04x** of #3a

Streamflow of #3b is ~**1.13x** of #3a

Monitoring and WRTDS-K data for calibration & verification

- We are currently calibrating the riverine water quality simulation to both concentrations data and WRTDS loads for the monitoring stations located on river mainstems.
- FluxMaster data for nitrogen, phosphorus, and sediment at 216, 196, and 146 monitoring stations, respectively, are used in the estimation $\beta 2$, $\beta 3$, and $\beta 4$ GSN routing parameters.
- We have processed the WRTDS-K loads data for calibrating the DWSM, and we are assessing its use in further fine-tuning of GSN routing as well.
- In Q2, we will start using concentrations data beyond 2014 for (a) riverine water quality calibration, and (b) verification in small streams.

More monitoring data is being used in Phase 7

DWSM Variable	#Stations in Phase 6	#Stations in Phase 7	#Observation in Phase 6	#Observation in Phase 7	Change
Streamflow	249	266	2,749,709	3,245,529	+18%
Nitrogen	184	223	48,634	66,393	+37%
Phosphorus	211	244	55,115	66,136	+20%
Nitrate	217	245	56,514	66,045	+17%
Ammonia	212	245	54,904	66,260	+21%
Dissolve Phosphate	172	204	43,777	59,088	+35%
Suspended Sediment	164	223	57,814	68,970	+19%

→ In Q2, we will start using concentrations data beyond 2014 for (a) riverine water quality calibration, and (b) verification in small streams.

Refining the trend component of GSN routing

$$ln(c) = \beta_o + \boldsymbol{\beta_1 t} + \boldsymbol{\beta_2} ln(Q) + \boldsymbol{\beta_3} sin(2\pi t) + \boldsymbol{\beta_4} cos(2\pi t) + \varepsilon$$

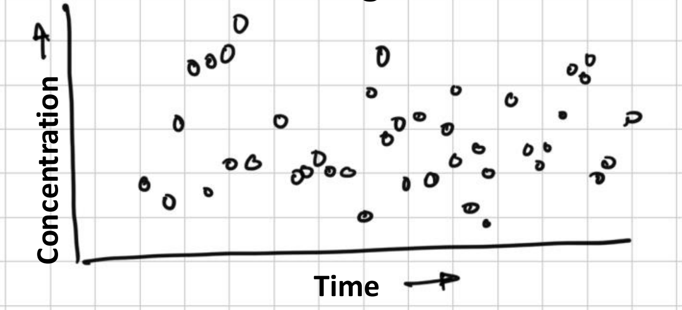
[FluxMaster]

1 trend

2 flow variability

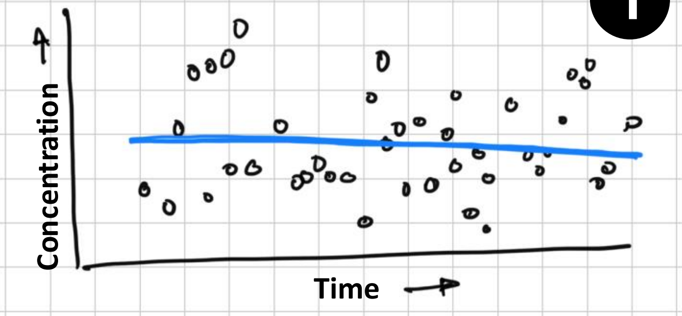
3 seasonal variability

> data at a monitoring station



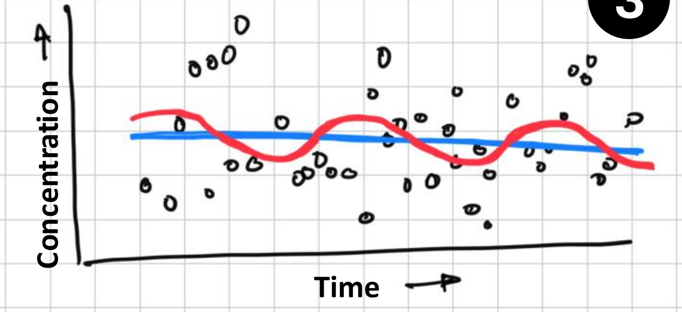
$ln(c_{trend}) = \beta_x + \boldsymbol{\beta_1} t$

1



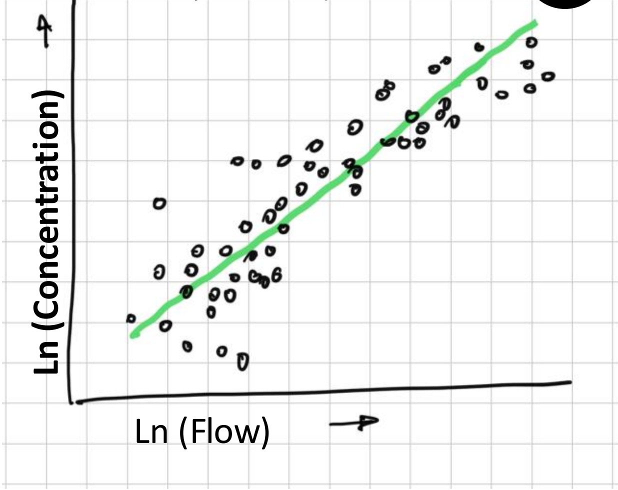
$ln(c_{season}) = \boldsymbol{\beta_3} sin(2\pi t) + \boldsymbol{\beta_4} cos(2\pi t)$

3



$ln(c_{flow}) = \beta_y + \boldsymbol{\beta_2}\, ln(Q)$

2

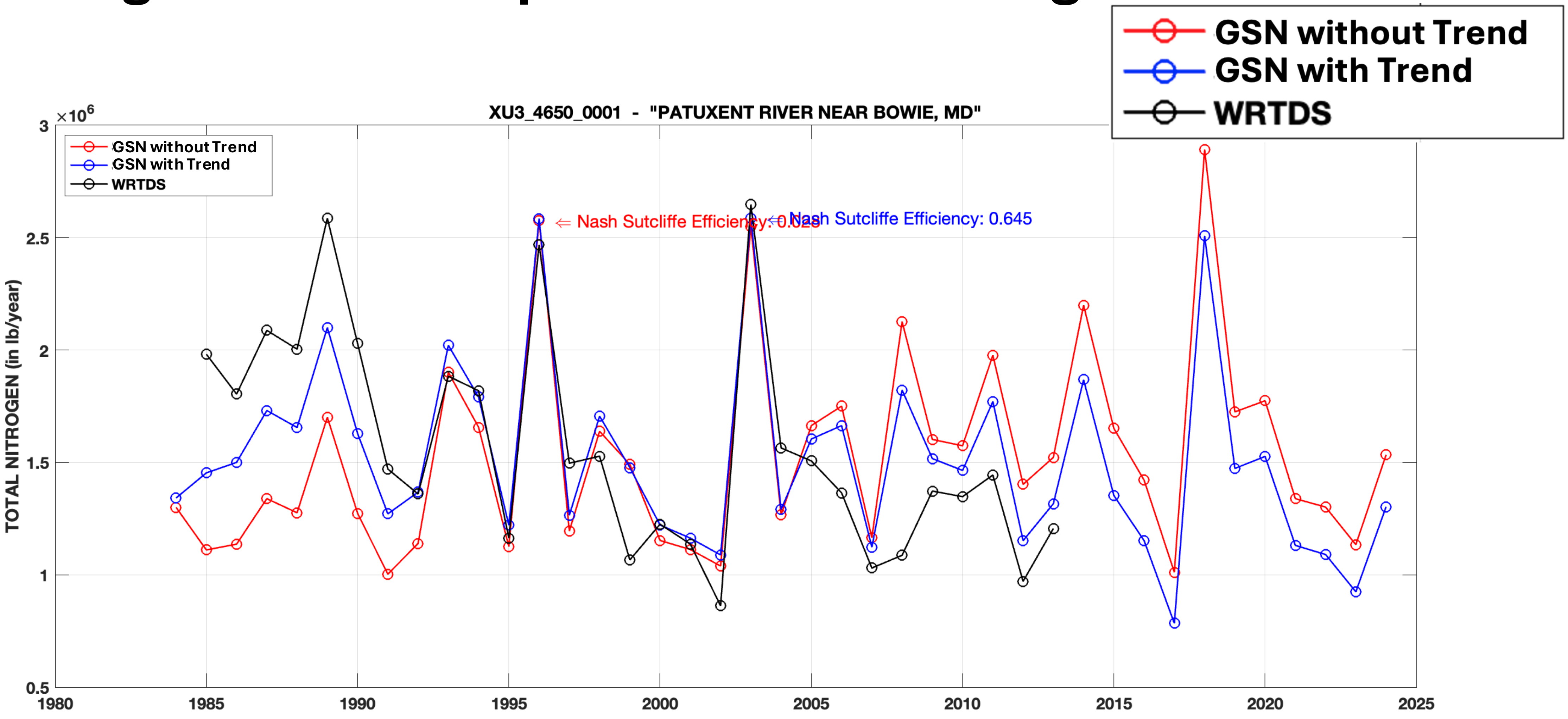


1 $\boldsymbol{\beta_1 t = ln(c_{in,yr} \times STF)}$

where, $\boldsymbol{c_{in,yr}}$ is annual EOS trend under a Normal hydrology, and $\boldsymbol{STF}$, stream transport factor is estimated in CalCAST

Random Forest models were developed for explaining variability in β_2, β_3 and β_4 parameters of the monitoring stations and for estimating the same for all NHD streams.

Refining the trend component of GSN routing



→ *Model simulation with annual EOS trend better captured the trend in WRTDS loads.*
→ *Annual EOS trend of a Normal hydrology is a function of history in inputs, land use, and lags.*

RIM stations: Phase 7 Flow simulated vs. observed

(a) biases in 1985-2014 average flows as compared to observed; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	Jan 2026 ⌘	April 2026
Susquehanna Marietta PA	-00.3% (+0.953)	-00.9% (+0.944)	-00.2% (+0.950)	-00.2% (+0.961)
Potomac Washington, DC	-04.3% (+0.913)	+00.8% (+0.929)	-00.6% (+0.930)	-00.6% (+0.929)
James Cartersville, VA	+00.0% (+0.887)	+04.8% (+0.904)	+04.9% (+0.895)	+04.8% (+0.869)
Rappa. Fredericksburg, VA	+00.5% (+0.913)	+00.1% (+0.931)	-03.5% (+0.923)	-03.5% (+0.911)
Appomattox Matoaca, VA	-04.3% (+0.897)	+00.8% (+0.826)	-01.6% (+0.814)	-01.7% (+0.814)
Pamunkey Hanover, VA	-03.9% (+0.822)	+03.6% (+0.807)	-01.3% (+0.799)	-01.3% (+0.803)
Mattaponi Beulahville, VA	-01.6% (+0.771)	+09.3% (+0.789)	+07.5% (+0.797)	+08.2% (+0.792)
Patuxent Bowie, MD	-03.0% (+0.948)	+04.0% (+0.870)	+06.5% (+0.857)	+06.5% (+0.867)
Choptank Greensboro, MD	-03.5% (+0.752)	-05.3% (+0.721)	-12.3% (+0.600)	-12.4% (+0.634)

⌘ **we incorporated P7 pre-BMP land use data <u>without</u> a hydrology recalibration**

RIM stations: Phase 7 Nitrogen loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	October 2025	P7 pre-BMP LU	GSN trend
Susquehanna Marietta PA	+00.9% (+0.694)	+01.1% (+0.776)	+01.8% (+0.489)	+00.9% (+0.749)	-00.2% (+0.723)
Potomac Washington, DC	-03.1% (+0.797)	-01.6% (+0.817)	+00.2% (+0.693)	-02.5% (+0.933)	-02.3% (+0.935)
James Cartersville, VA	+00.2% (+0.731)	**-01.2% (+0.902)**	**+00.9% (+0.241)**	**-01.4% (+0.923)**	**-01.4% (+0.921)**
Rappa. Fredericksburg, VA	+01.1% (+0.595)	-05.8% (+0.854)	-06.4% (+0.813)	-06.2% (+0.847)	-07.0% (+0.850)
Appomattox Matoaca, VA	+03.2% (+0.285)	-12.0% (+0.755)	-13.2% (+0.663)	-10.8% (+0.776)	-10.1% (+0.783)
Pamunkey Hanover, VA	+03.1% (+0.338)	-07.4% (+0.771)	-06.8% (+0.670)	-08.1% (+0.752)	-08.7% (+0.720)
Mattaponi Beulahville, VA	+06.8% (+0.511)	-10.2% (+0.655)	-13.0% (+0.270)	-05.8% (+0.676)	-09.7% (+0.425)
Patuxent Bowie, MD	+04.1% (+0.721)	-04.0% (+0.300)	+00.1% (+0.619)	-04.5% (+0.028)	+00.1% (+0.645)
Choptank Greensboro, MD	-04.7% (+0.565)	-04.4% (+0.722)	-04.2% (+0.660)	-03.9% (+0.751)	-05.6% (+0.697)

→ some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period

RIM stations: Phase 7 Phosphorus loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

Rivers	Phase 6	July 2025	October 2025	P7 pre-BMP LU	GSN trend
Susquehanna Marietta PA	+04.2% (+0.858)	+04.4% (+0.840)	+06.0% (+0.641)	+04.0% (+0.870)	+05.1% (+0.886)
Potomac Washington, DC	+01.0% (+0.877)	+06.9% (+0.226)	+06.4% (+0.336)	-00.4% (+0.862)	+01.6% (+0.860)
James Cartersville, VA	-04.7% (+0.558)	+01.9% (+0.850)	+04.1% (+0.481)	-00.1% (+0.916)	+02.0% (+0.879)
Rappa. Fredericksburg, VA	-03.6% (+0.309)	-03.4% (+0.680)	-05.2% (+0.496)	-05.7% (+0.850)	-03.8% (+0.806)
Appomattox Matoaca, VA	-01.5% (+0.678)	-06.2% (+0.739)	-10.2% (+0.039)	-07.0% (+0.786)	-07.7% (+0.715)
Pamunkey Hanover, VA	+00.0% (+0.622)	-02.0% (+0.243)	-00.1% (+0.275)	-03.8% (+0.396)	-00.9% (+0.416)
Mattaponi Beulahville, VA	+01.6% (+0.214)	-07.3% (+0.237)	-11.2% (-0.234)	-06.5% (+0.363)	-08.7% (+0.218)
Patuxent Bowie, MD	+02.5% (+0.688)	-07.0% (-0.015)	-06.0% (-0.058)	-07.5% (+0.096)	-03.3% (+0.427)
Choptank Greensboro, MD	-01.7% (+0.395)	-02.3% (+0.501)	+01.5% (+0.298)	-02.1% (+0.529)	-00.9% (+0.483)

→ some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period

RIM stations: Phase 7 Sediment loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses;

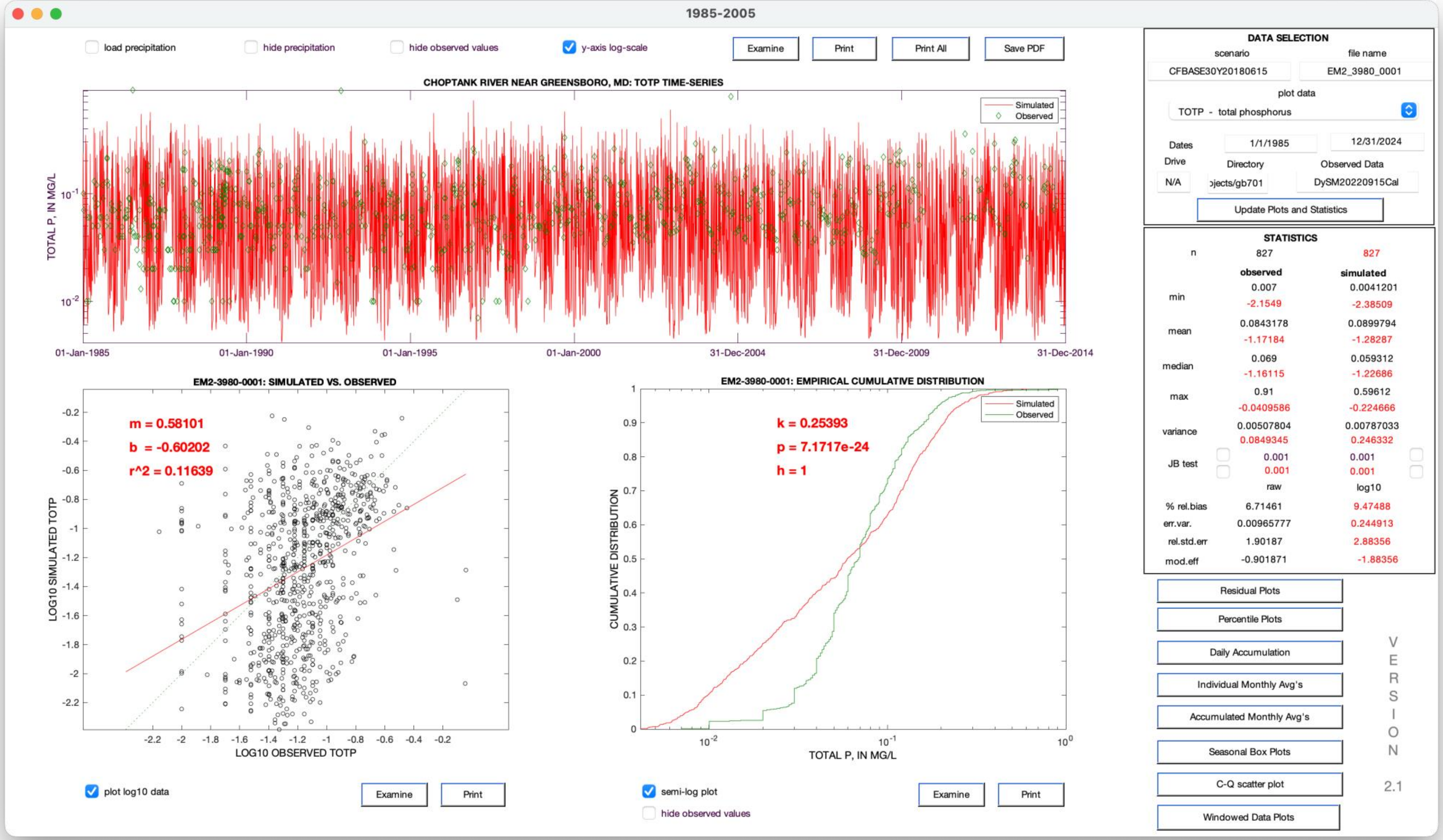
Rivers	Phase 6	July 2025	October 2025	P7 pre-BMP LU	GSN trend
Susquehanna Marietta PA	-00.9% (+0.833)	+07.9% (-0.047)	+11.7% (-0.903)	+07.5% (+0.132)	+09.1% (+0.160)
Potomac Washington, DC	+03.2% (+0.827)	+10.1% (-0.623)	+09.2% (-0.713)	+03.6% (-0.061)	+03.4% (-0.092)
James Cartersville, VA	+01.1% (+0.384)	+08.0% (-2.613)	+02.9% (-0.674)	-03.7% (+0.806)	-03.6% (+0.808)
Rappa. Fredericksburg, VA	+00.1% (-0.356)	-04.1% (+0.474)	-04.9% (+0.329)	-05.9% (+0.649)	-07.1% (+0.656)
Appomattox Matoaca, VA	+13.8% (-0.567)	-06.4% (+0.449)	-12.3% (-0.181)	-10.1% (+0.546)	-09.7% (+0.534)
Pamunkey Hanover, VA	+01.7% (-1.143)	-02.4% (-0.024)	-02.3% (-0.034)	-04.6% (+0.047)	-04.7% (+0.071)
Mattaponi Beulahville, VA	-00.9% (-0.120)	-09.4% (-0.533)	-11.7% (-0.769)	-08.1% (-0.338)	-07.7% (-0.350)
Patuxent Bowie, MD	+10.3% (+0.678)	-11.0% (-0.134)	-14.0% (-0.283)	-08.9% (+0.493)	-13.5% (+0.458)
Choptank Greensboro, MD	+15.9% (+0.424)	+01.5% (-0.805)	+10.0% (-2.118)	+01.3% (-0.329)	+08.4% (-0.632)

→ *some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period*

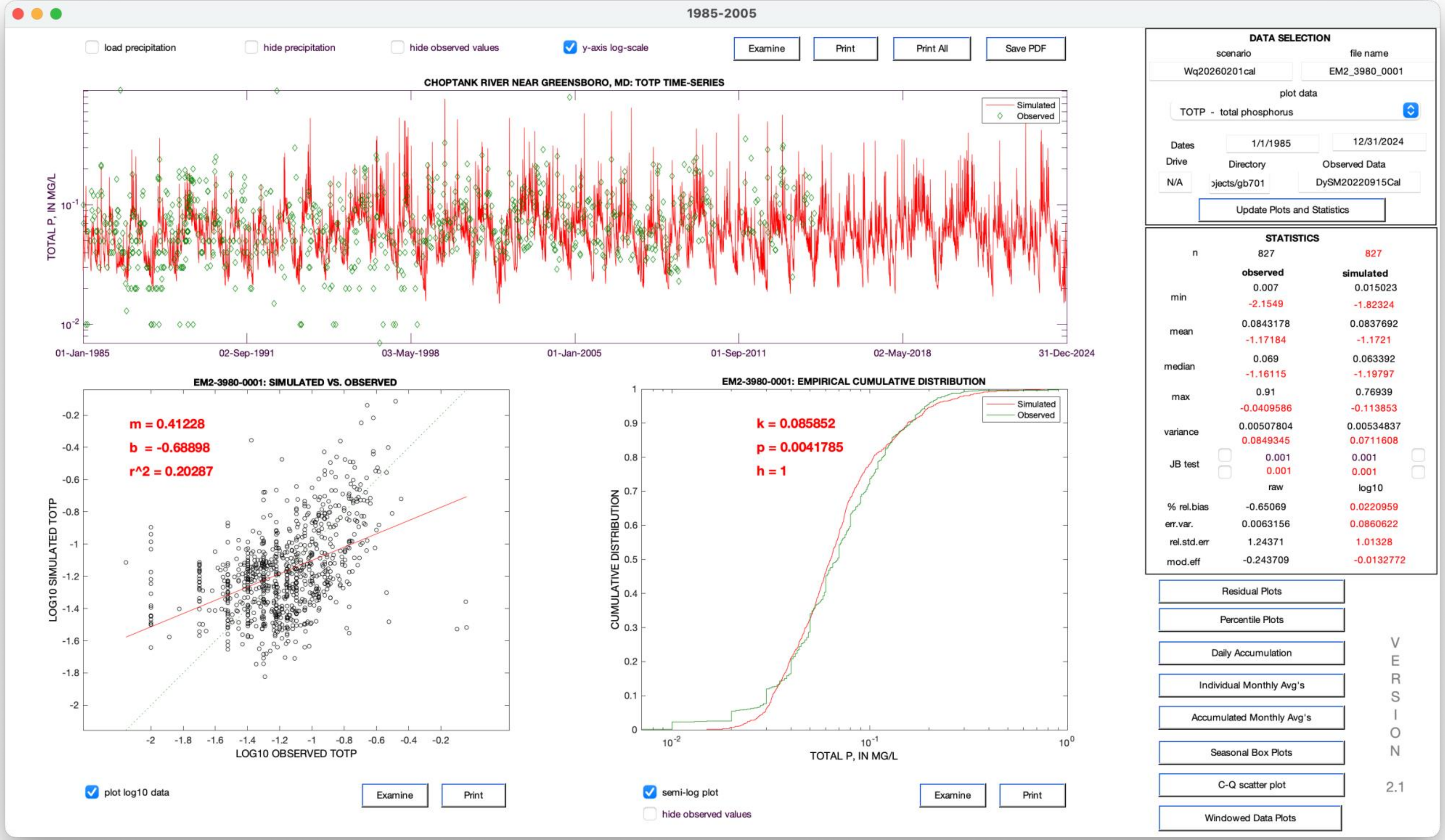
Phosphorus

Choptank River near Greensboro, MD

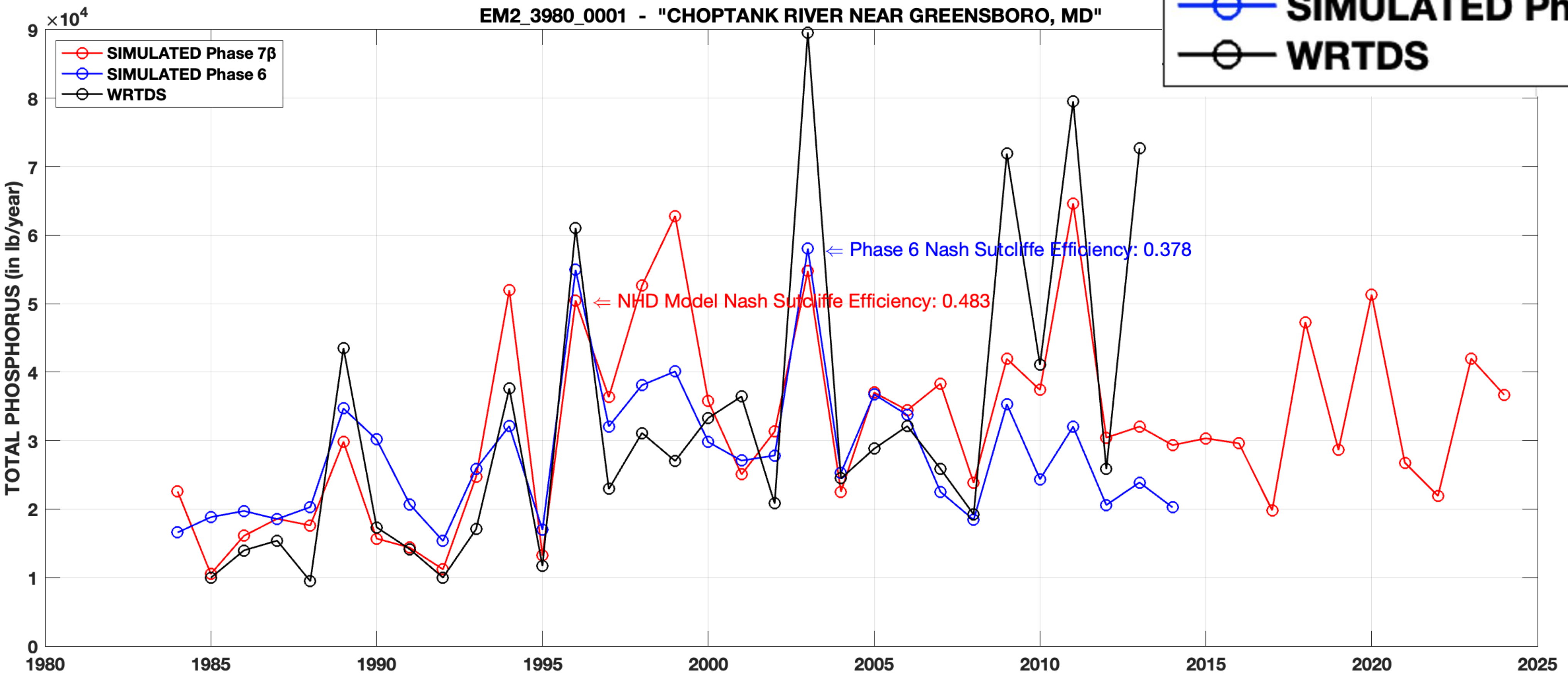
PHASE 6



Phosphorus | **Choptank River near Greensboro, MD** | **PHASE 6**



An example of improved model performance



→ *WRTDS loads will be replaced by improved and up to recent (most likely CY 2022) WRTDS-K loads.*

→ .

Summary and next steps

1. We have a 1985–2024 calibration of hydrology that is *as good or better* to that of Phase 6.

2. We will perform an update with final CalCAST flow and sediment and CAST land use data and carry out a targeted examination of a few stations with slightly week model performance.

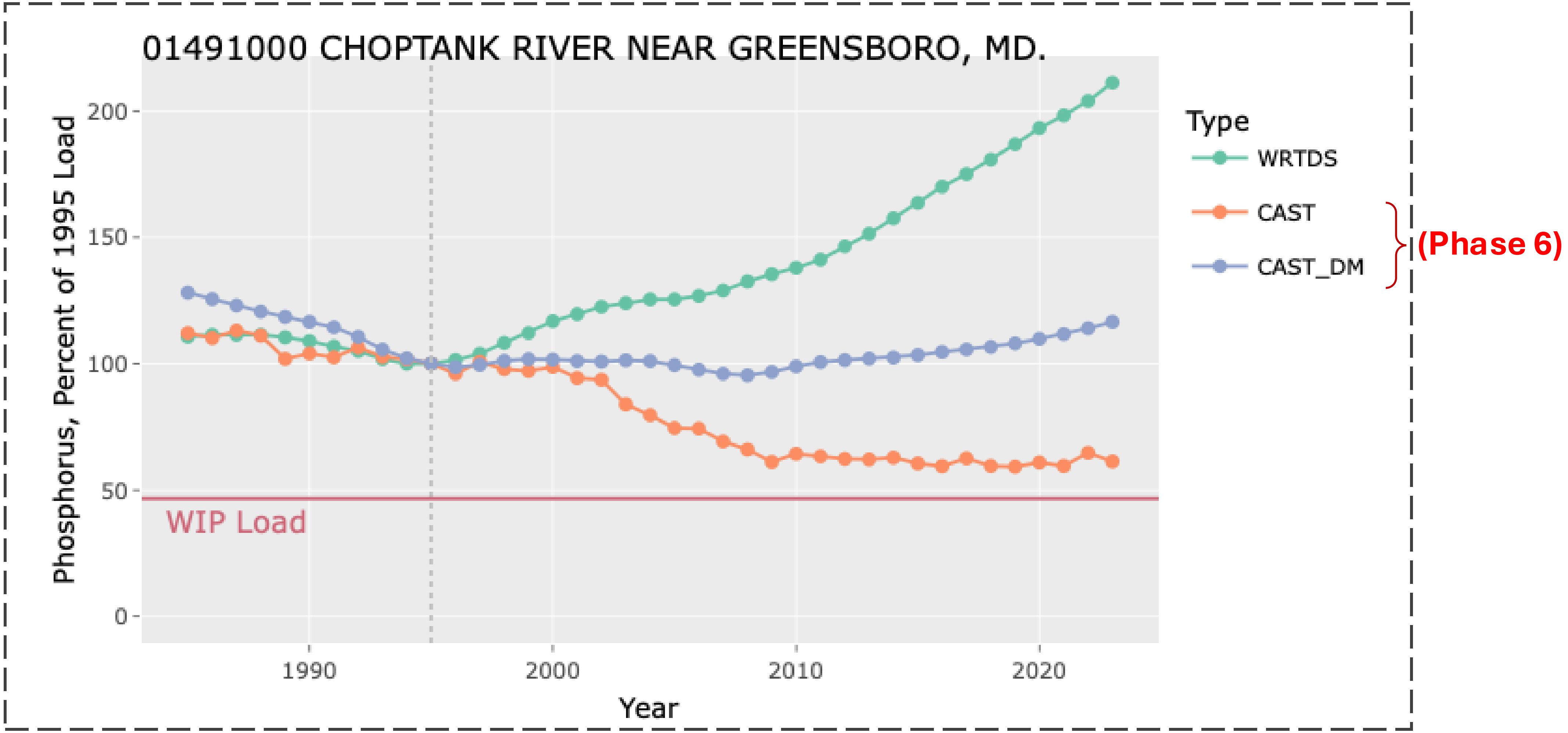
3. Generate April 2026 Phase 7 beta outputs for potential testing in MBM.

4. We will continue making further updates and model refinements as P7 inputs become available –
    - treatment of water diversions in tidal sub-watersheds; incorporate new P7 direct loads (e.g., SSEs, bed/bank loads); perform water quality calibration using updated monitoring data; update solar infrastructure to an impervious land use; islands; treatment and linkage of point source loads that discharge directly to tidal waters; etc.

Adding a trend component to generalized stream network routing

Monitored and **E**xpected **T**otal **R**eduction **I**ndicator for the **C**hesapeake (METRIC)
https://metric.chesapeakebay.net/metric/

>> for comparing the monitored load trend and CAST-estimated load trend



Adding a trend component to generalized stream network routing

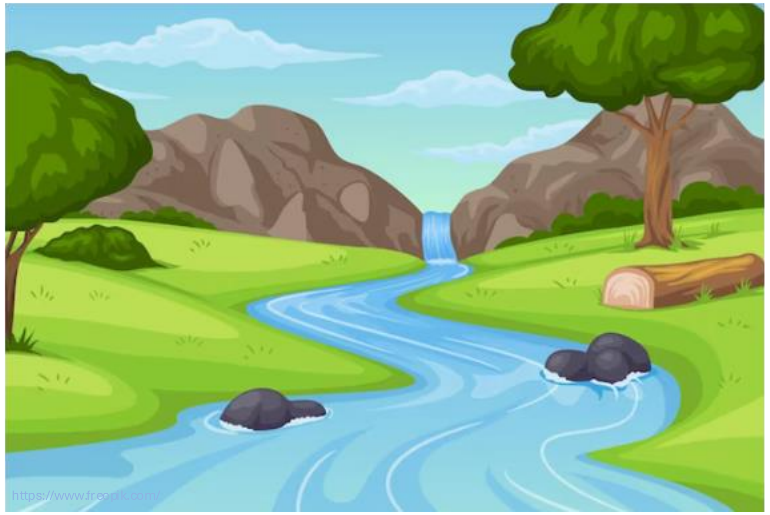
agricultural

natural

developed

HSPF model: <u>hourly</u> surface and groundwater hydrology of land uses

UNEC model: <u>annual</u> surface and groundwater concentrations as a function of input history and estimates of lag-times



Biogeochemical processing, Storage/deposition, Scour, etc.
➔ Fate and Transport

We are testing approaches for best representing the trend component in the GSN routing.

Trend component is linked to trend in inputs to a stream segment (i.e., loads from both EOS and upstream).

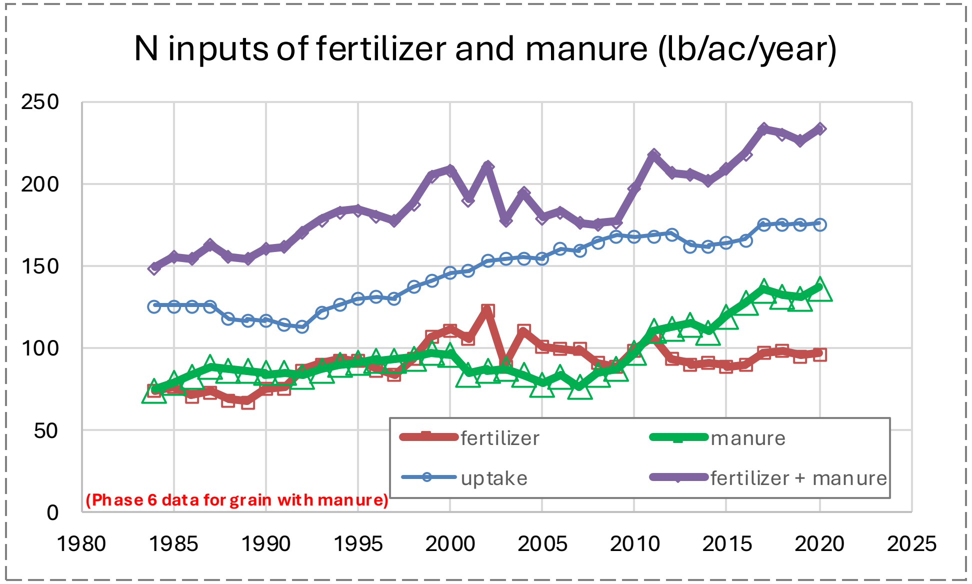
$$ln(c) = \beta_o + ln\left(c_{in,yr} \times STF\right) + \beta_2 ln(Q) + \beta_3 sin(2\pi t) + \beta_4 cos(2\pi t) + \varepsilon$$

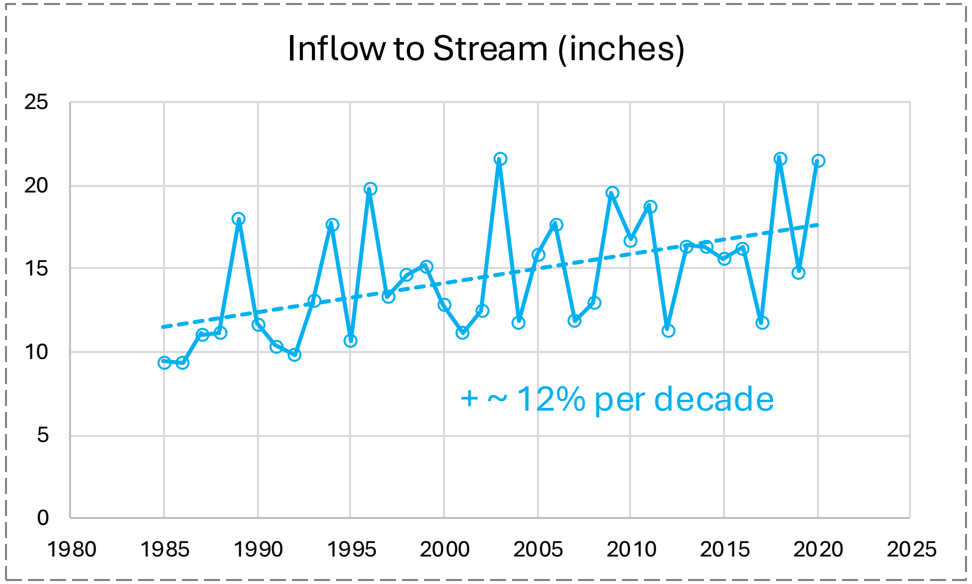
where, $c_{in,yr}$ vary annually, and STF, stream transport factor is estimated in CalCAST

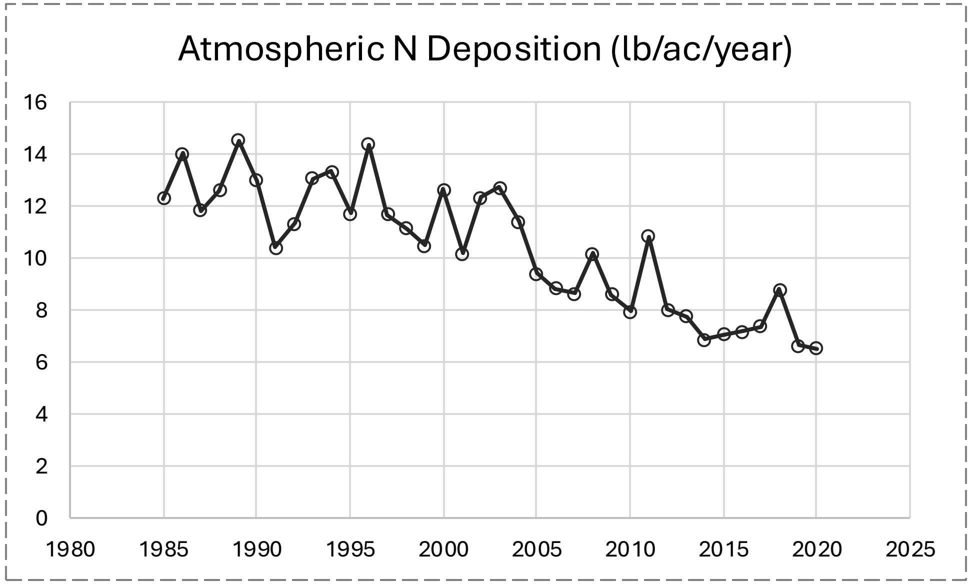
A 1st order NHD MR stream EM2_009405936

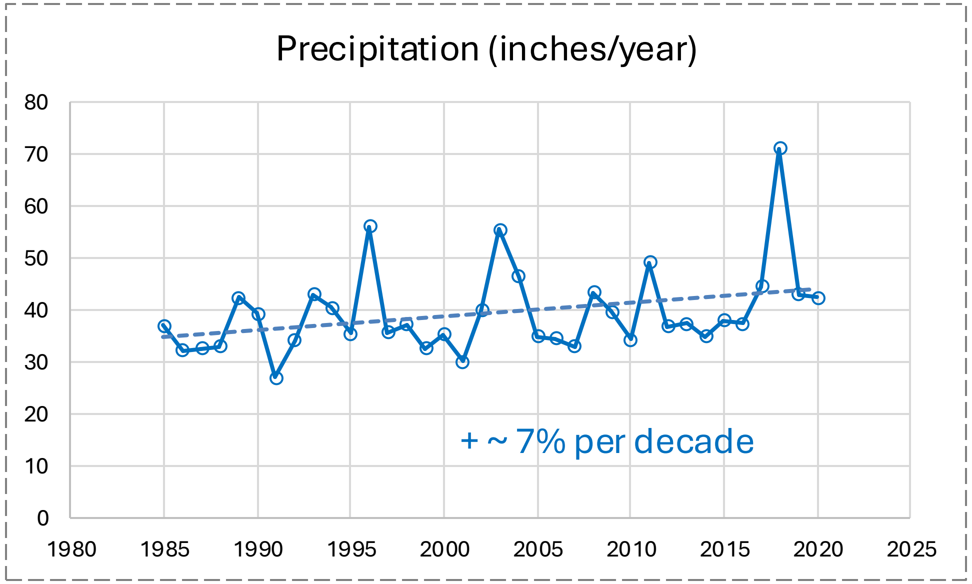
(0.6 sq. miles)

(58% Crops)

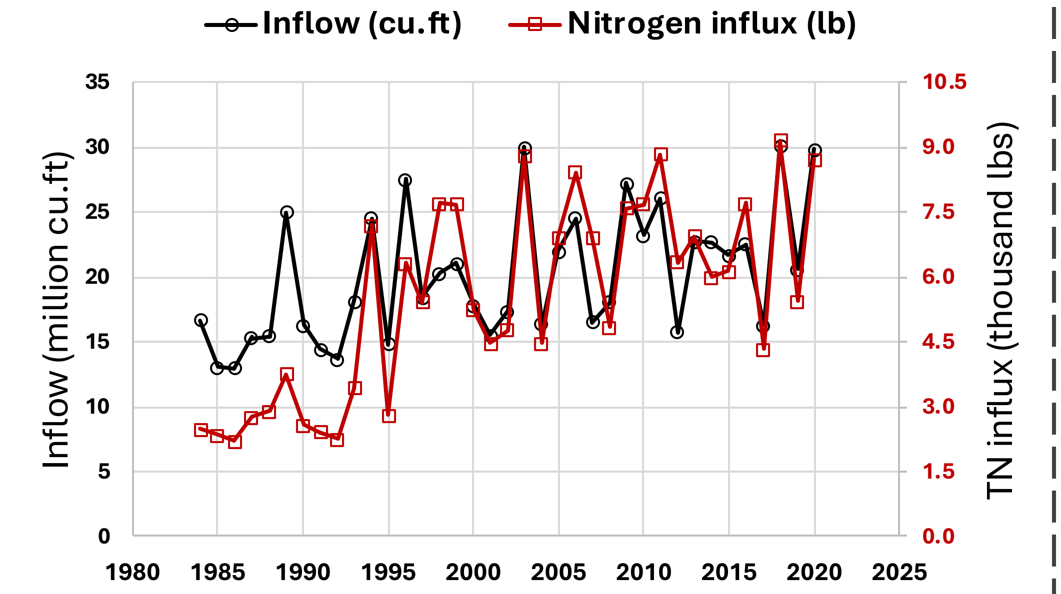


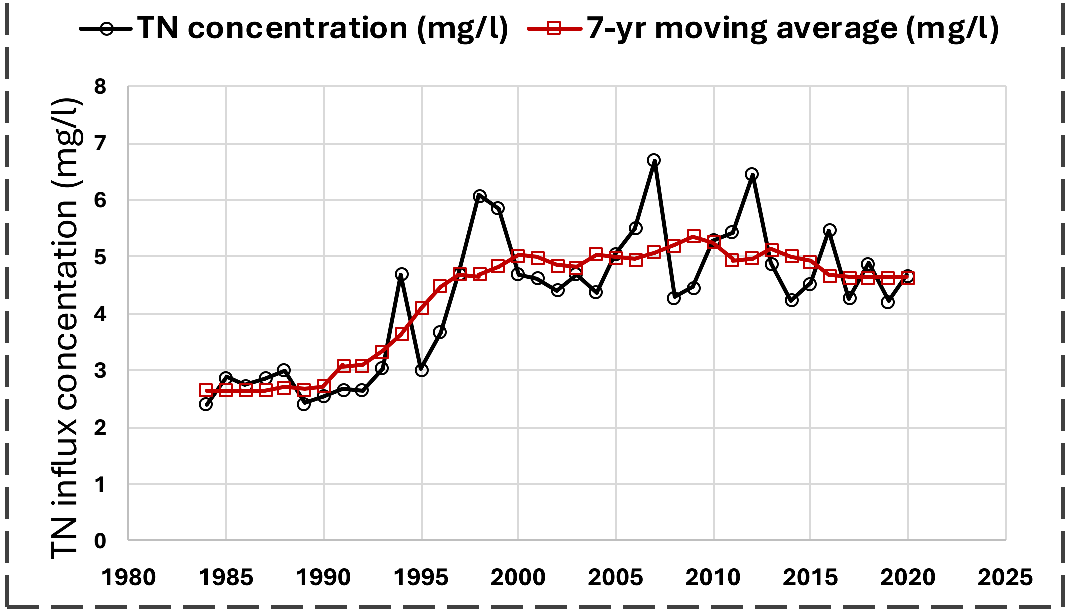




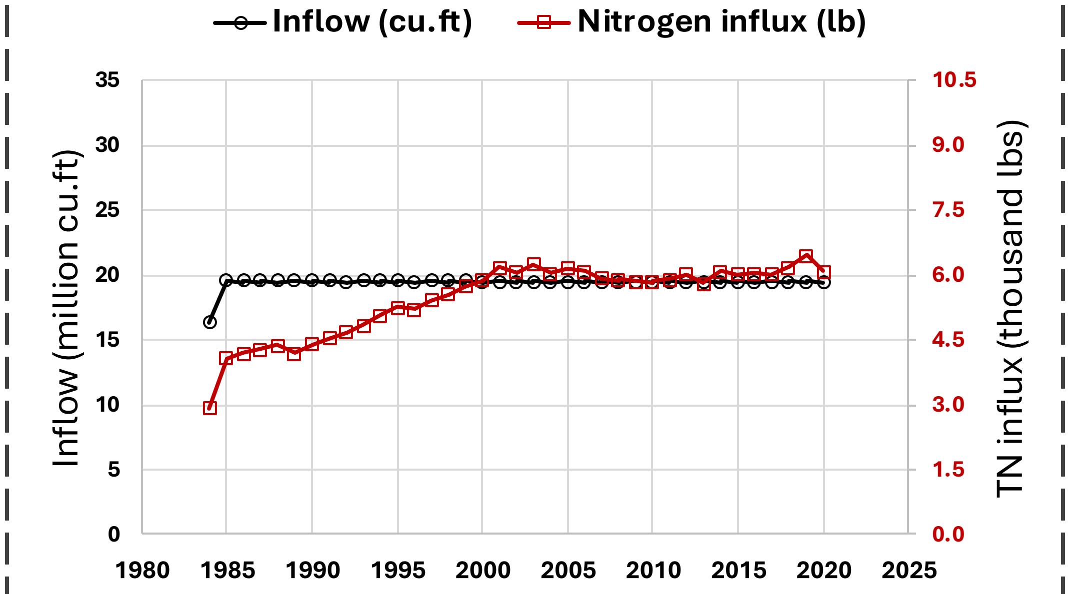


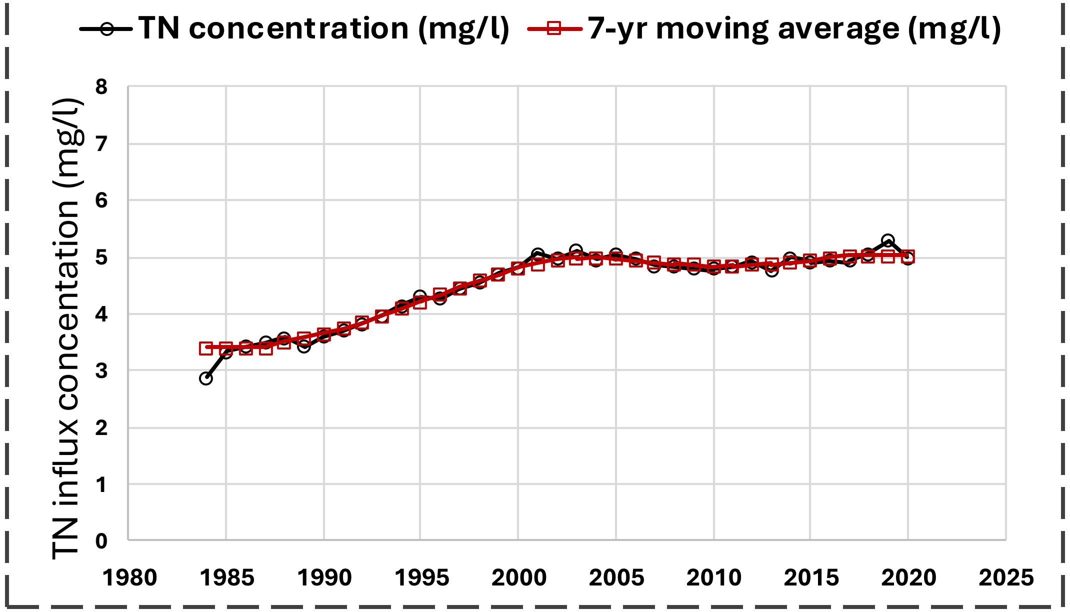
Dynamic Hydrology





~ *steady-state* Hydrology

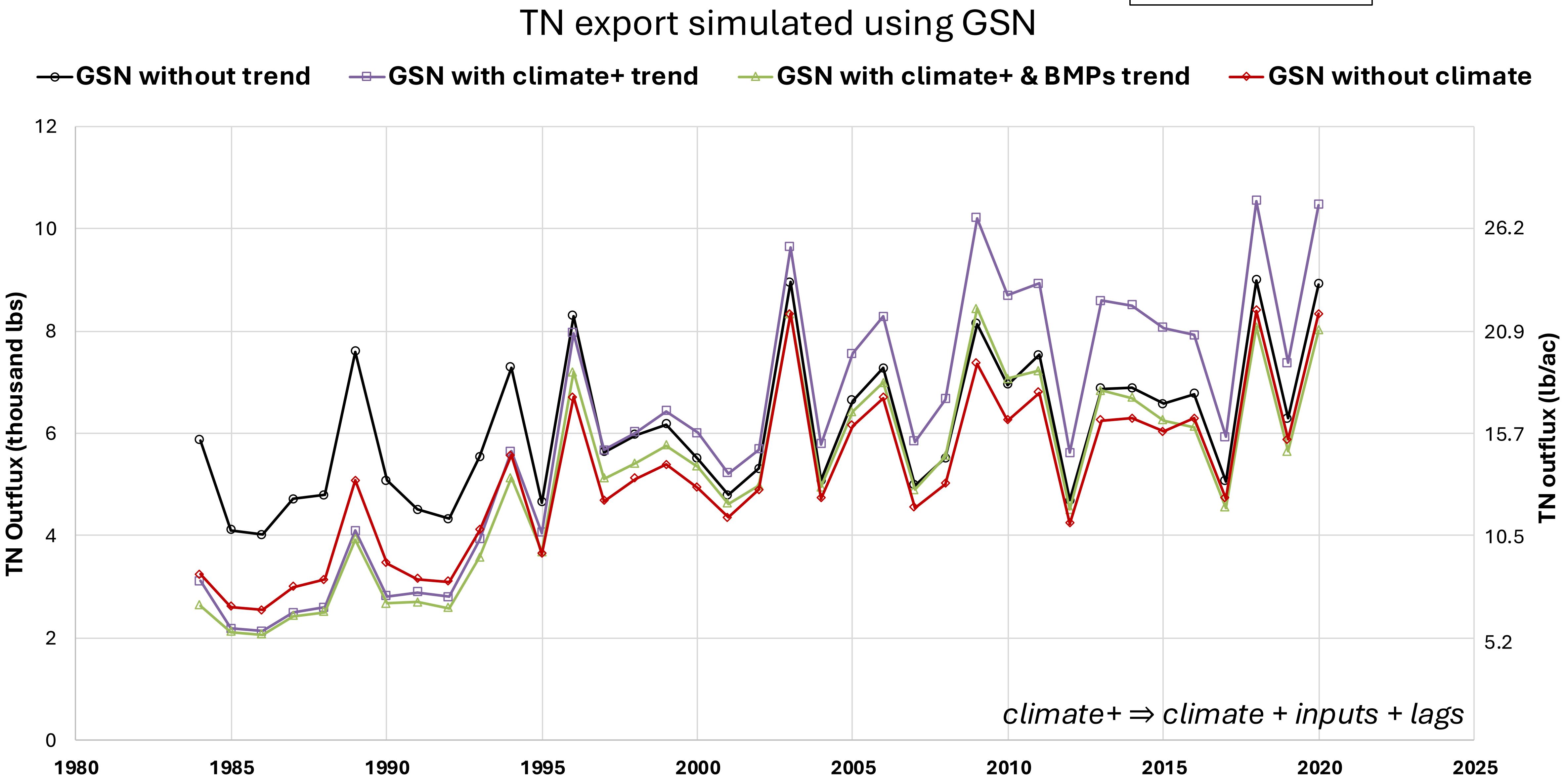




Trend is an integration of history of inputs, sensitivities, lags, climate/hydrology, BMPs, and land use change …

A 1st order NHD MR stream EM2_009405936

(0.6 sq. miles)
(58% Crops)



Trend is an integration of history of inputs, sensitivities, lags, climate/hydrology, BMPs, and land use change ...

RIM stations: Phase 7 Nitrogen loads vs. WRTDS

(a) biases in 1985-2014 average loads as compared to WRTDS; (b) NSE of annual loads in parentheses ;

Rivers	Phase 6	July 2025	October 2025	^GSN trend	P7 pre-BMP LU
Susquehanna Marietta PA	+00.9% (+0.694)	+01.1% (+0.776)	+01.8% (+0.489)	+02.1% (+0.701)	+03.1% (+0.699)
Potomac Washington, DC	-03.1% (+0.797)	-01.6% (+0.817)	+00.2% (+0.693)	+00.8% (+0.678)	+**.*% (+*.***)
James Cartersville, VA	+00.2% (+0.731)	-01.2% (+0.902)	+00.9% (+0.241)	+00.4% (+0.510)	+00.8% (+0.714)
Patuxent Bowie, MD	+04.1% (+0.721)	-04.0% (+0.300)	+00.1% (+0.619)	+01.0% (+0.678)	+01.1% (+0.528)
Choptank Greensboro, MD	-04.7% (+0.565)	-04.4% (+0.722)	-04.2% (+0.660)	-04.5% (+0.704)	-03.0% (+0.690)

→ some differences from CalCAST can be attributed to WRTDS method and DWSM loads for the 1985-2014 averaging period