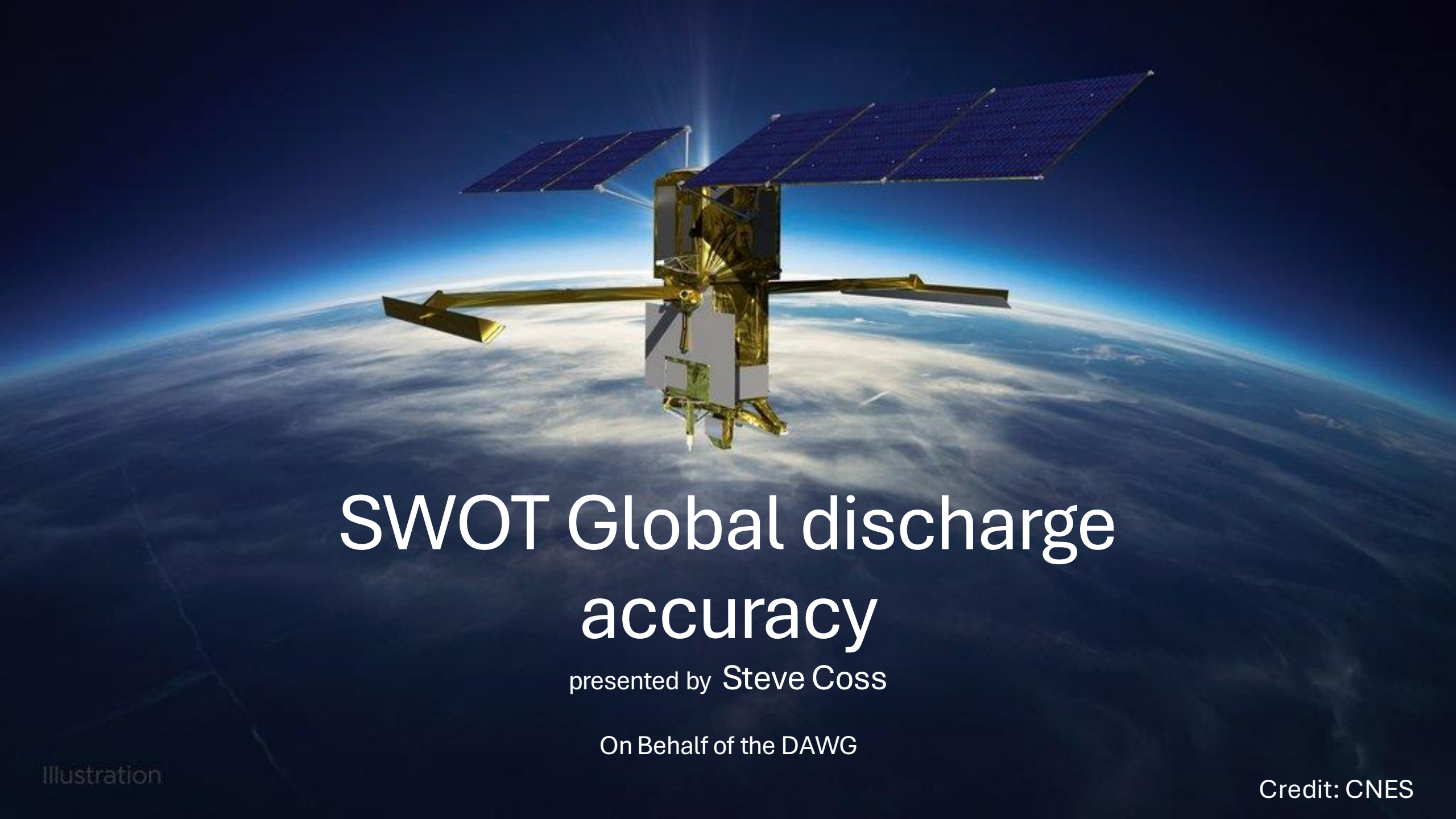


SWOT Global discharge accuracy

presented by Steve Coss

On Behalf of the DAWG

Illustration

Credit: CNES

The Run

- we have an unconstrained run on **1646** gaged reaches
- we created sets at each gaged reach, then filtered by whether SWOT data was available
- gages spanned **seven** different gage agencies on **four** continents
- **1492 gaged reaches** were ultimately evaluated in the run
- This run was completed on Monday, June 10

Yukon River: Outandacross.com

R^2=0.99

NSE=0.93

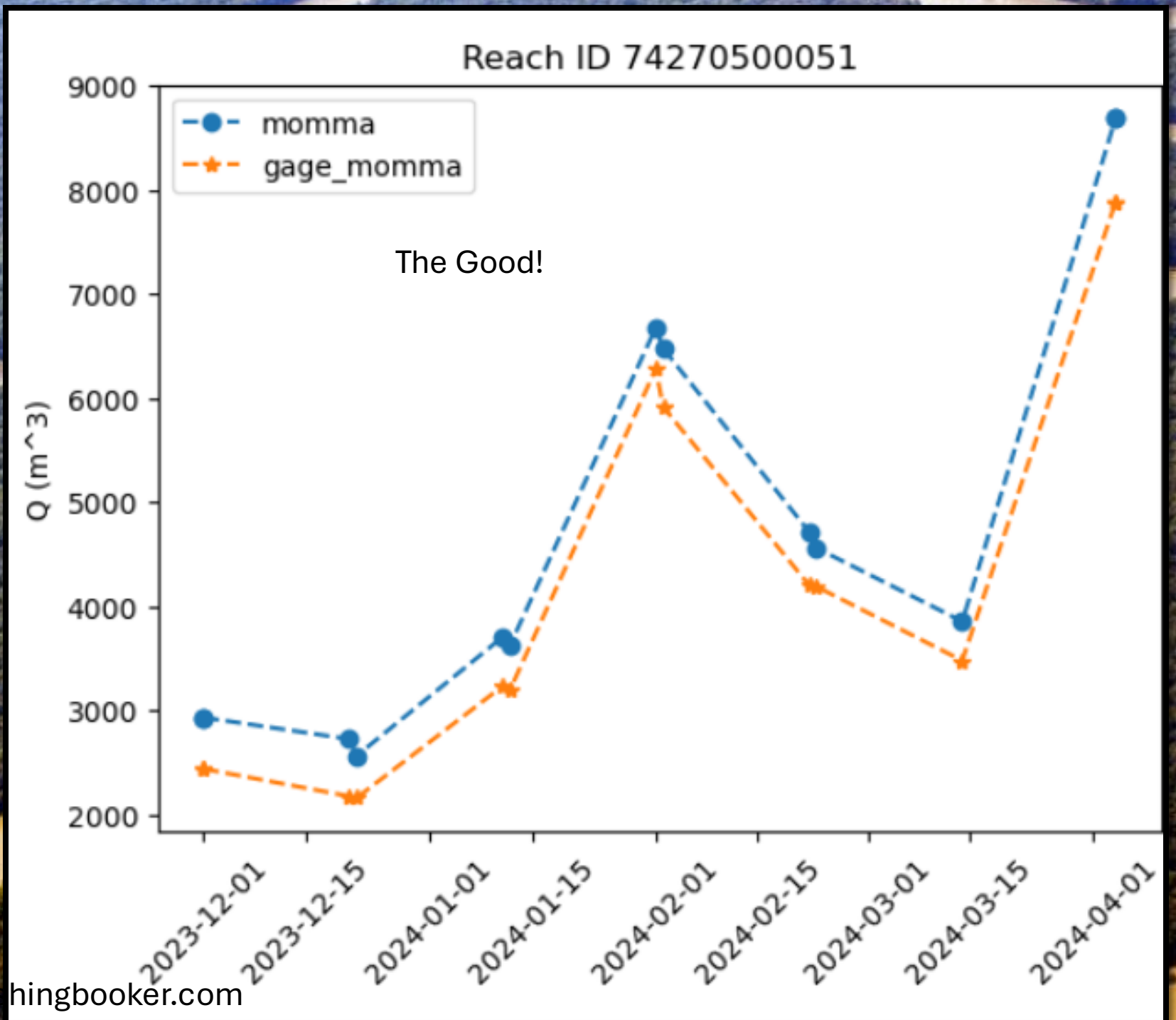
KGE=0.87

RMSE=531.01

nRMSE=0.12

nBIAS =0.12

n=13



Mississippi river: fishingbooker.com

R^2=0.88

NSE=-5.53

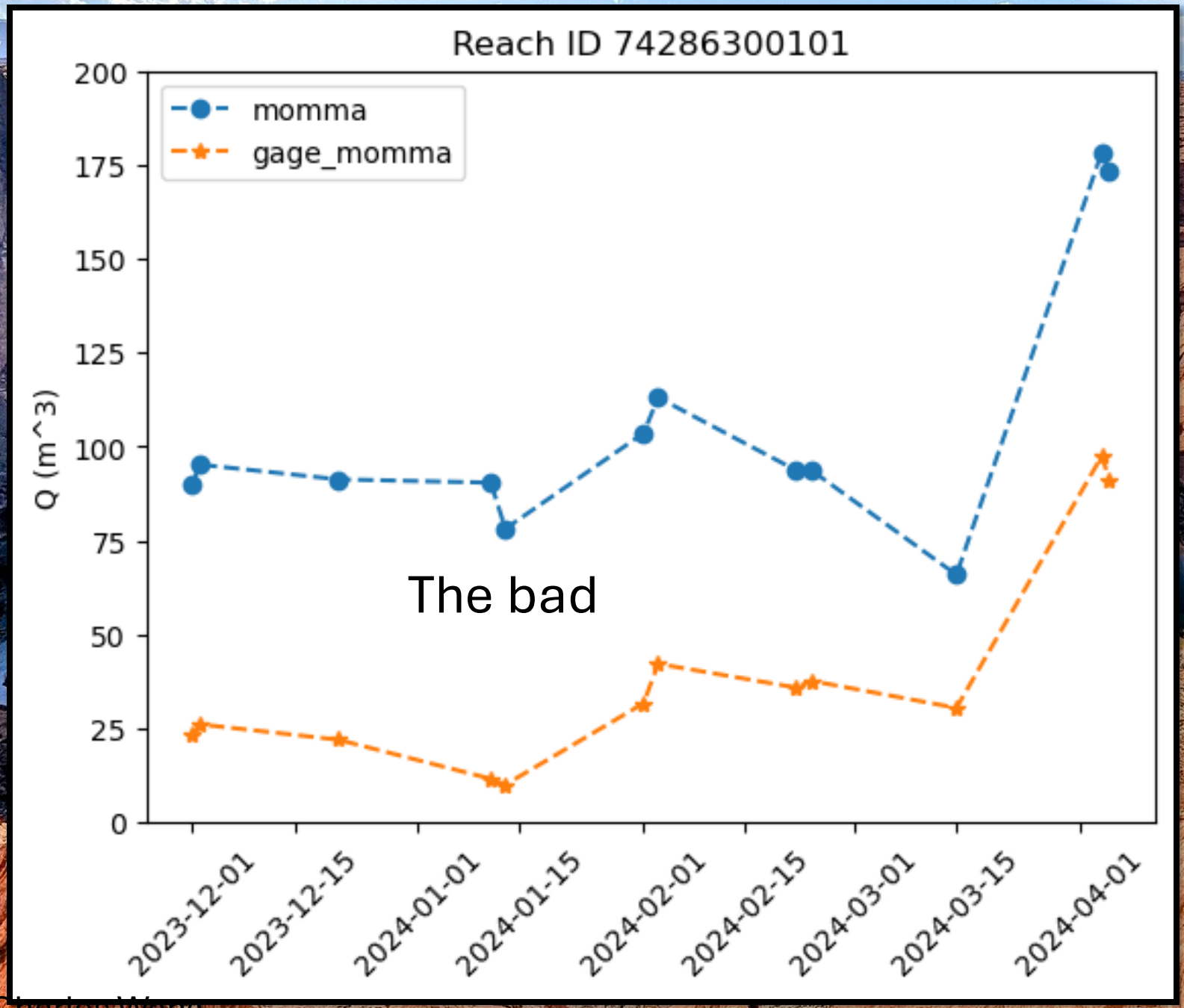
KGE=-0.77

RMSE=68.37

nRMSE=1.78

nBIAS =1.75

n=12



Colorado River: Charles Wang

R^2=0.0006

NSE=-3824.33

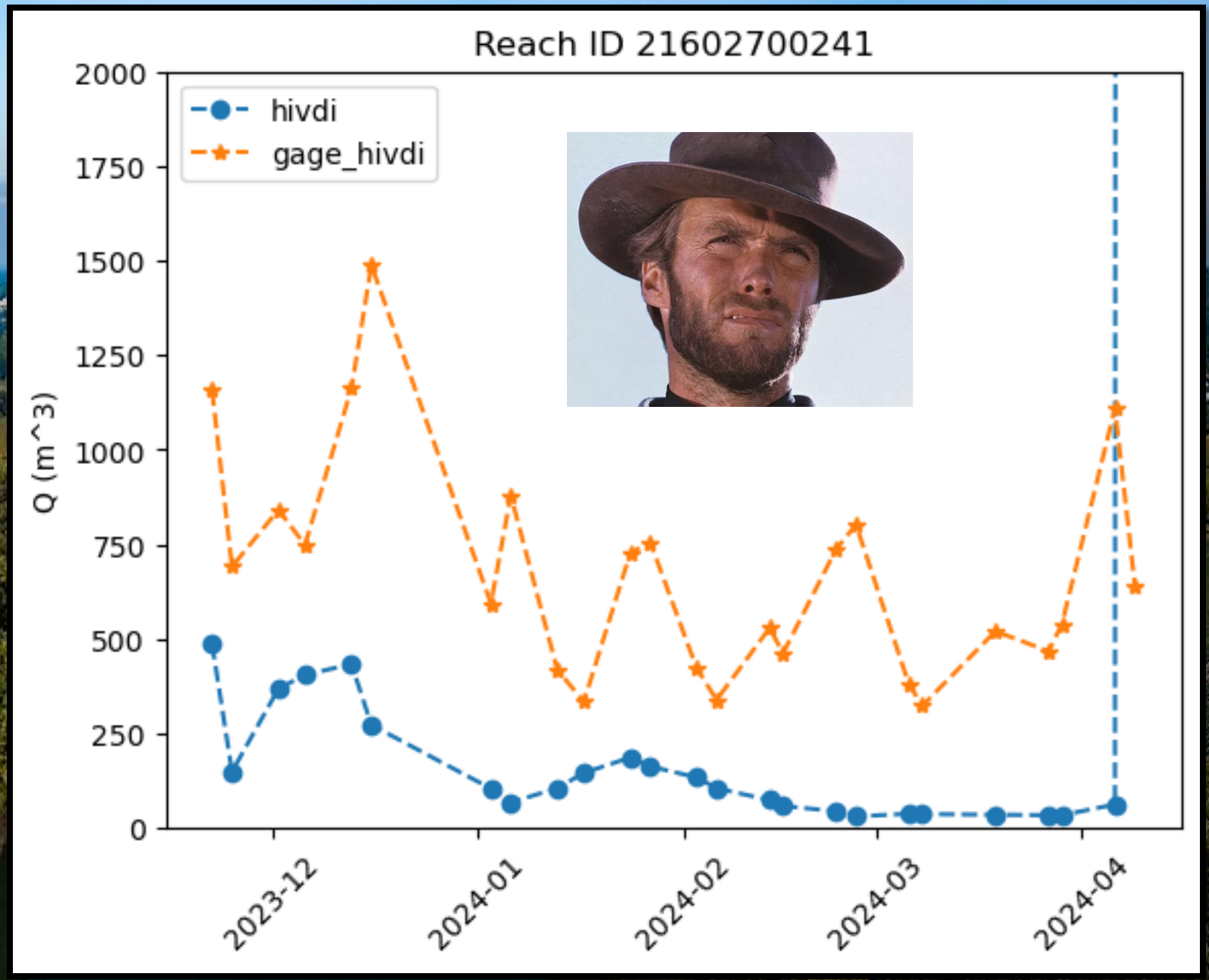
KGE=-59.08

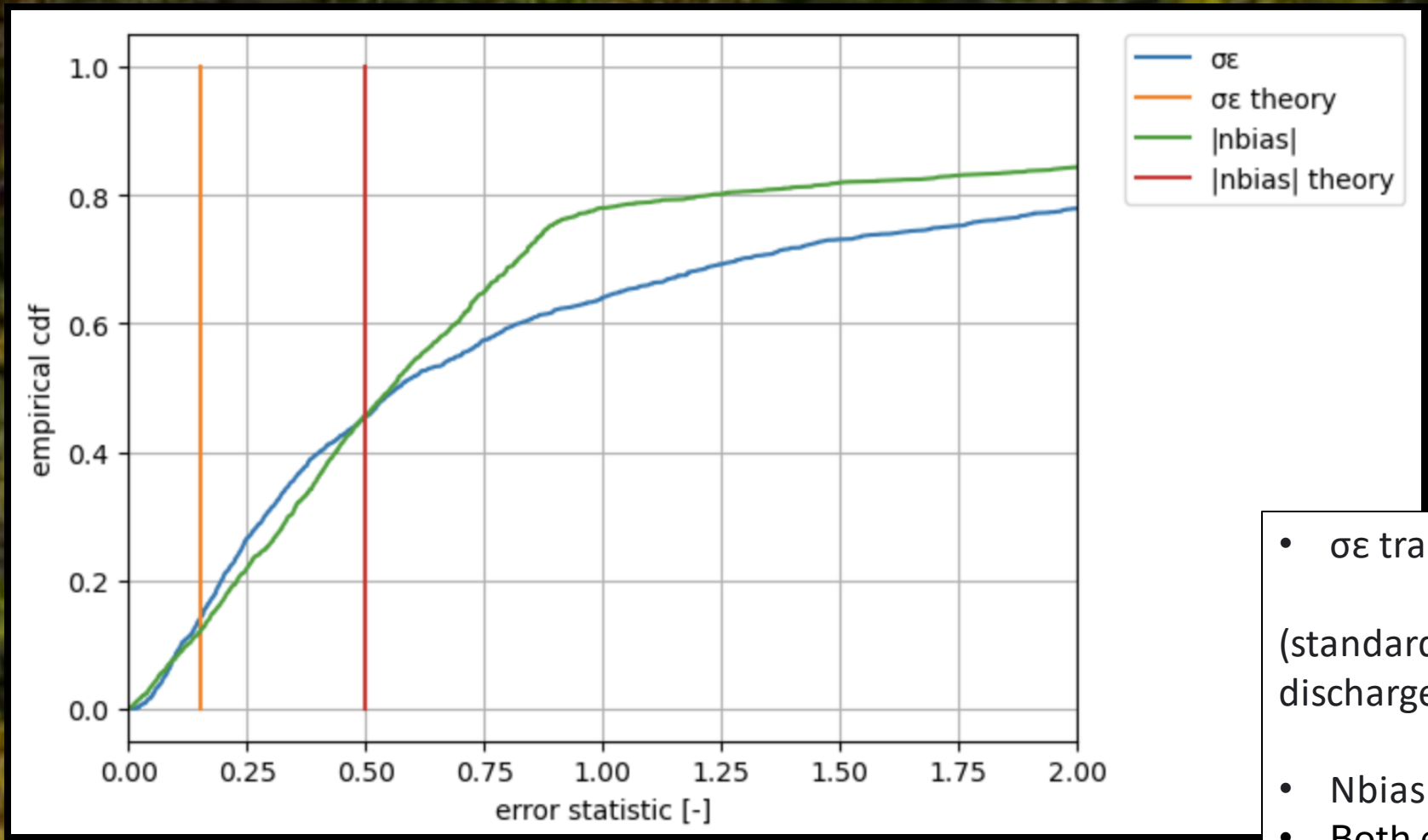
RMSE=18142.90

nRMSE=26.56

nBIAS =4.56

n=25





Durand e al

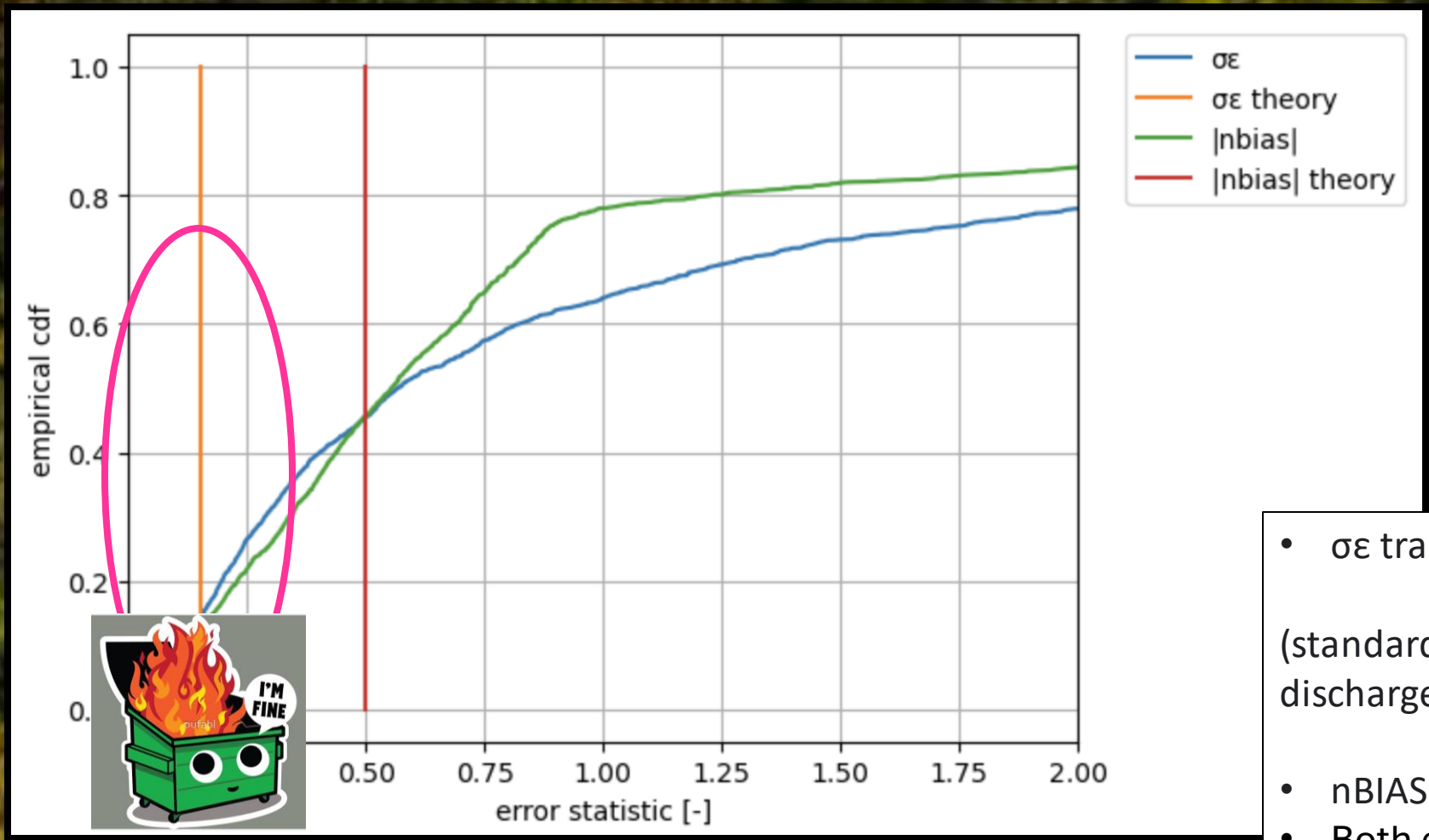
- σε tracks error in dynamics

(standard deviation of the unnormalized discharge error, divided by the mean flow)

- Nbias (gage mean normalized)
- Both error in dynamics and bias are exceeding expectations (parenthetical)

- 68%tile of σε at 100% (15%)

- 68%tile nBIAS at 75%(50%)



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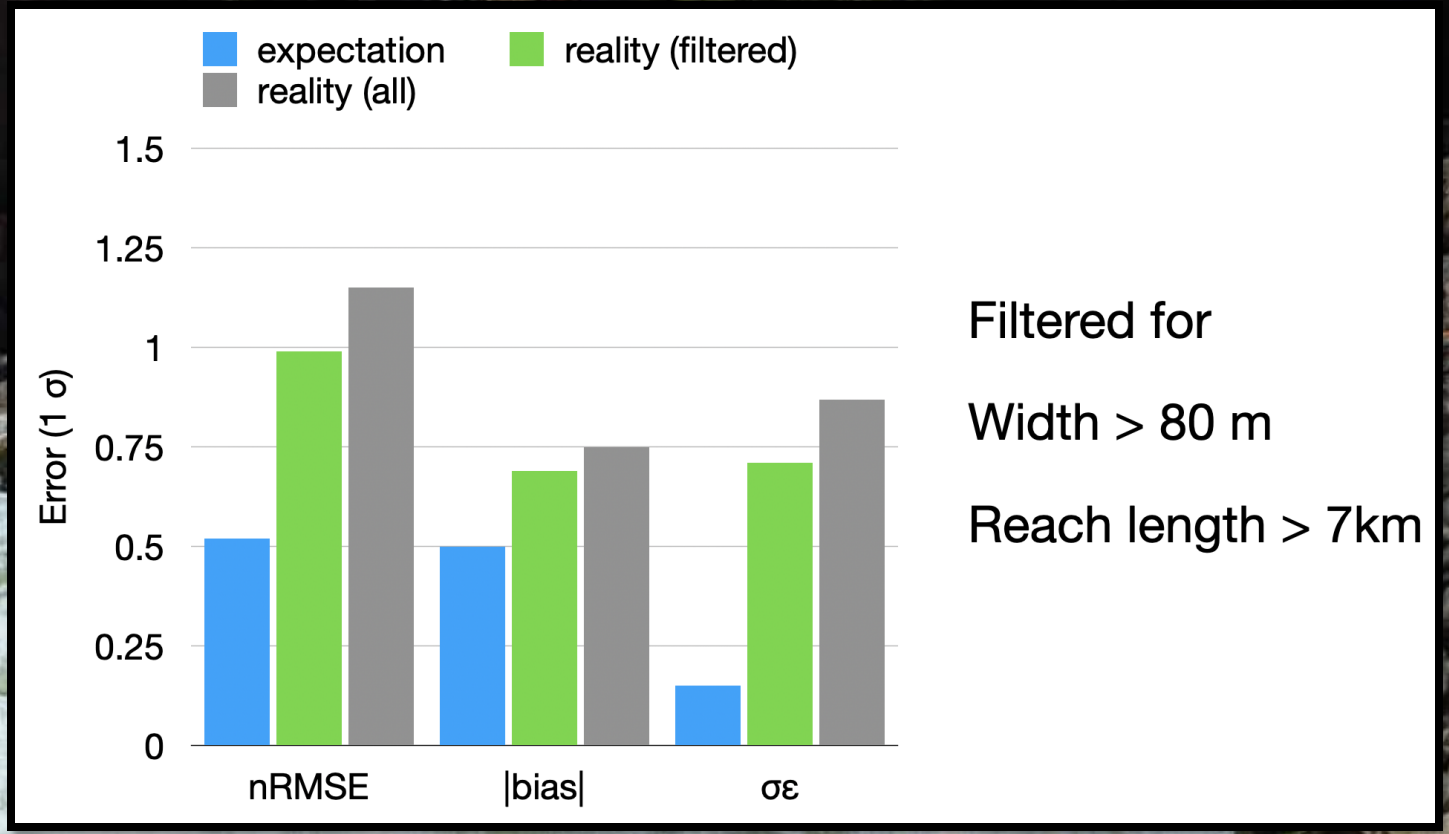
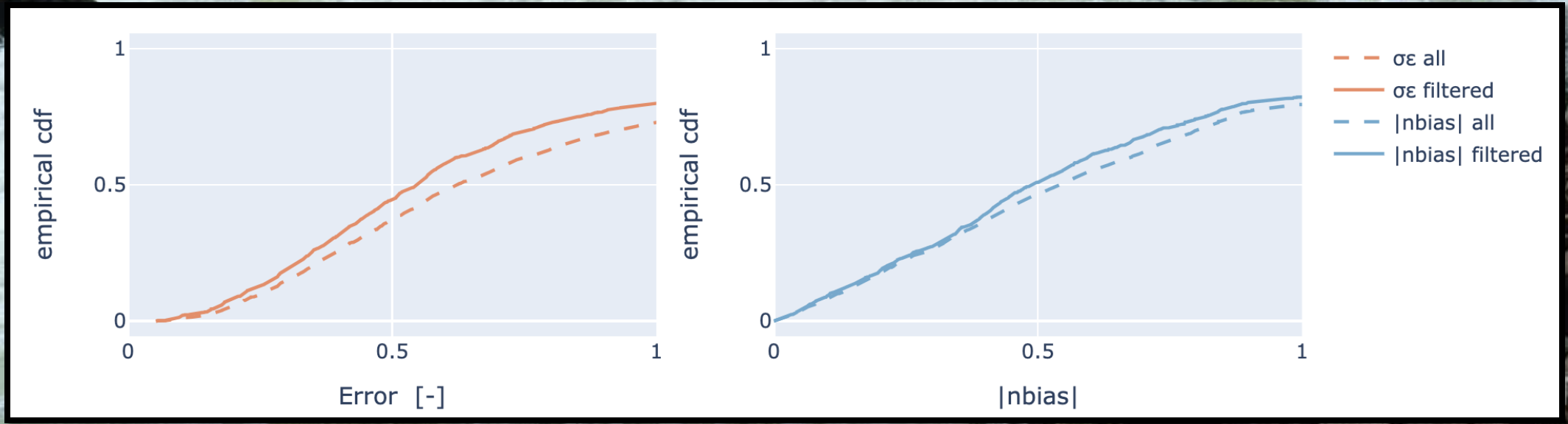
Error summary



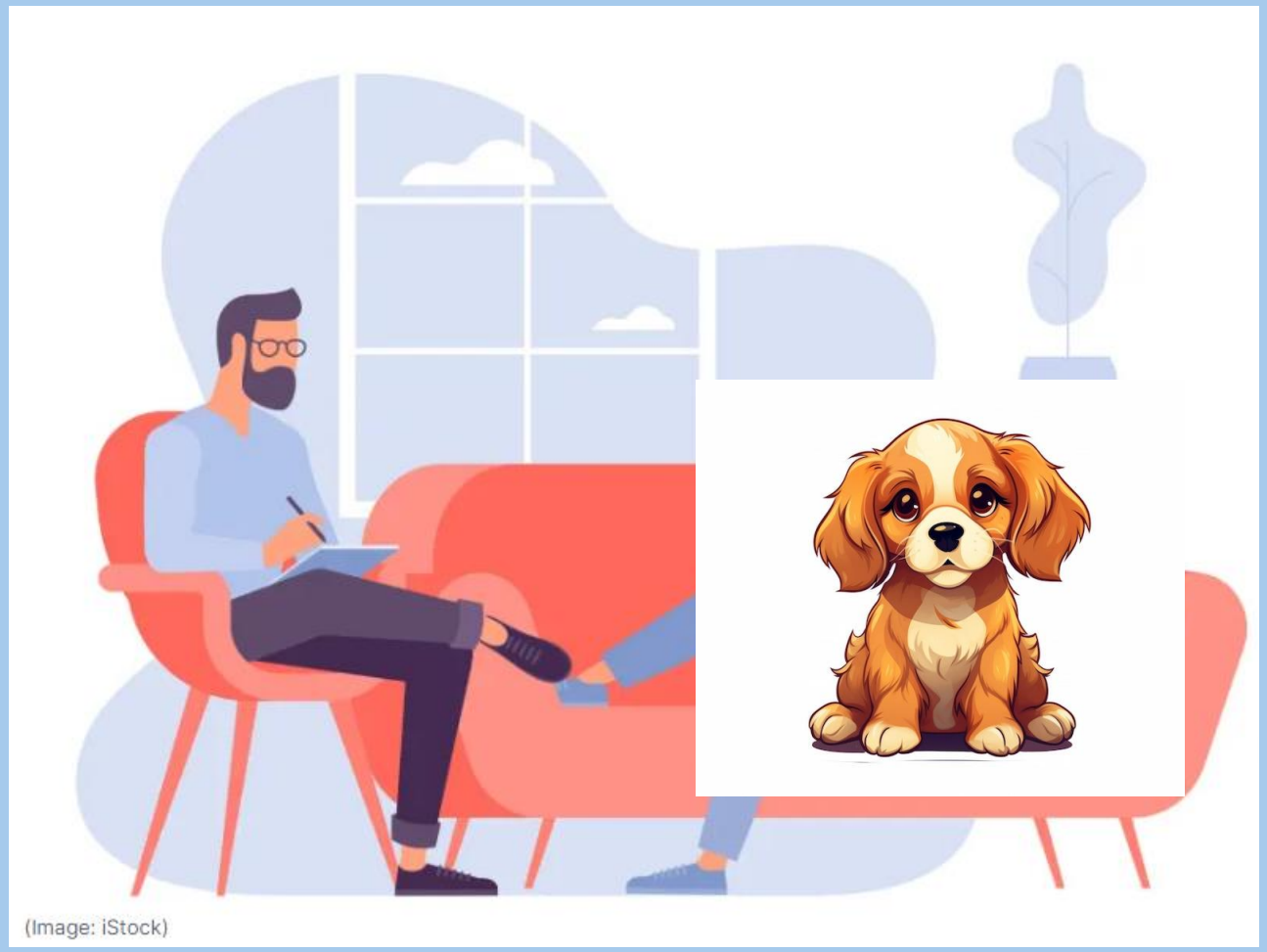
Filtered for

Width > 80 m

Reach length > 7km



Something worth deep consideration

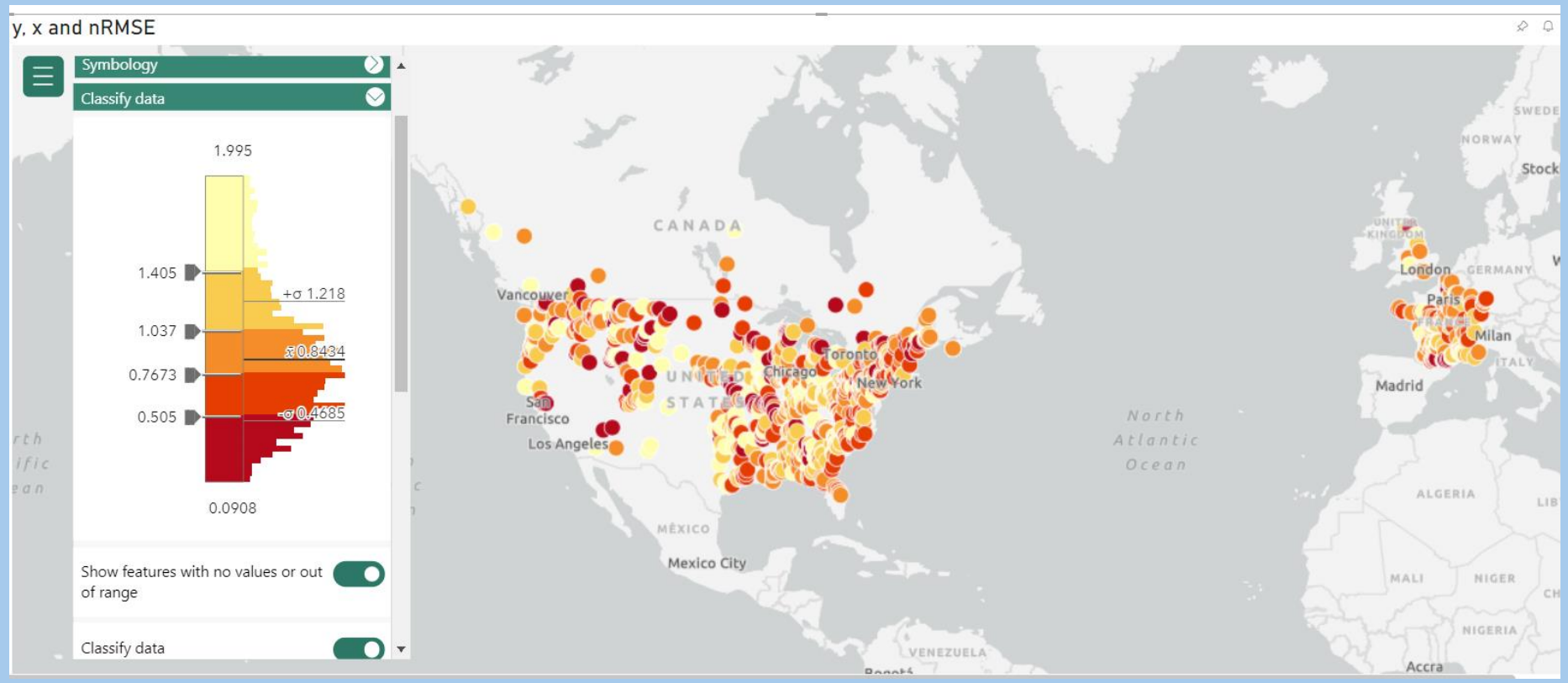


- As this is an unconstrained (no integrator) run stats that include bias are not expected to be all that great
- We are concerned about stats that should preclude bias being as impacted as they were
- We need to better understand underlying causes for why we are not tracking discharge variation

Thanks everyone who came to the workshop Sunday!

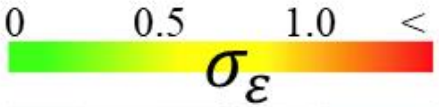
We searched for correlation in error with.....

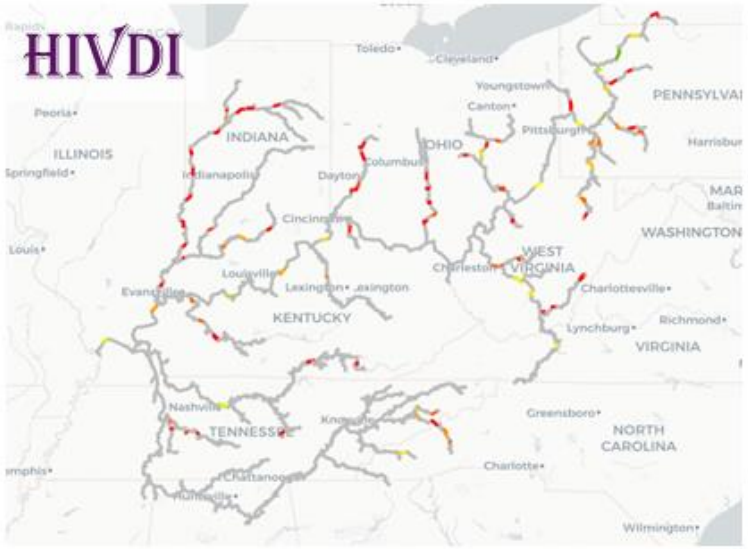
We were able to eliminate a few possibilities

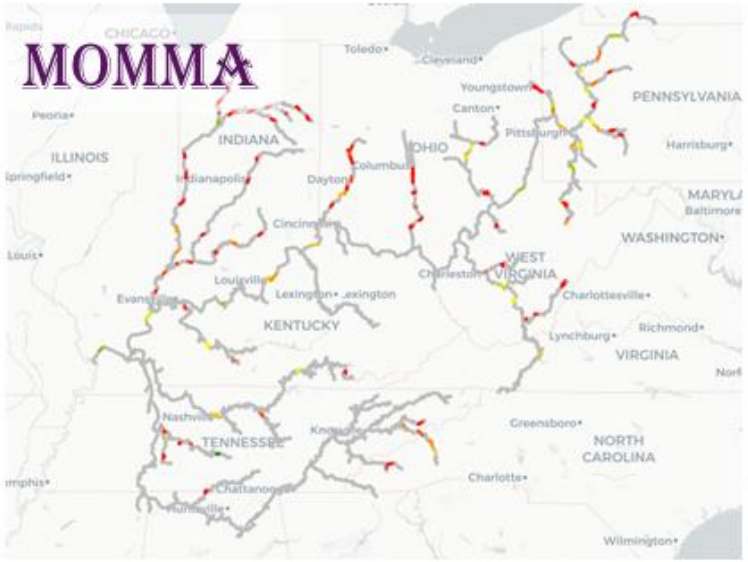


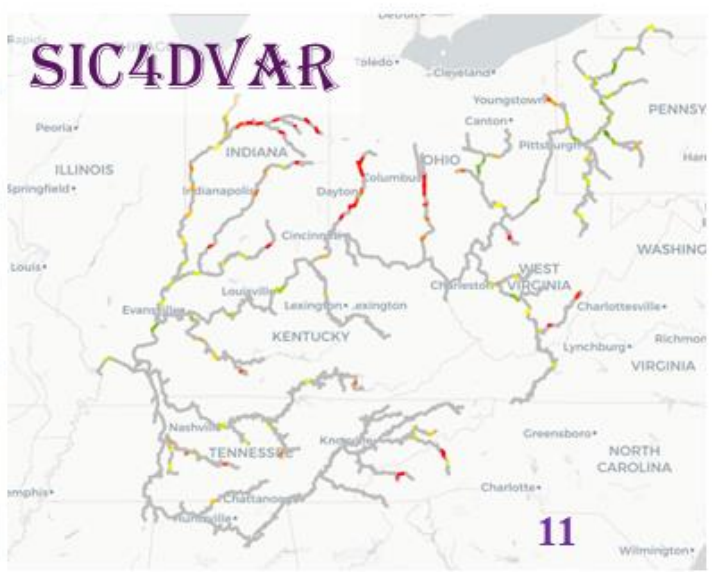
No obvious spatial pattens in nRMSE

No obvious spatial pattens in σε

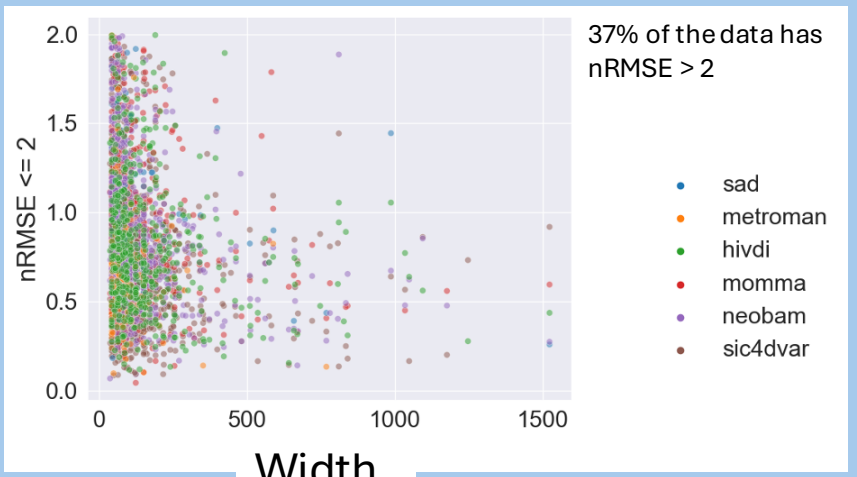


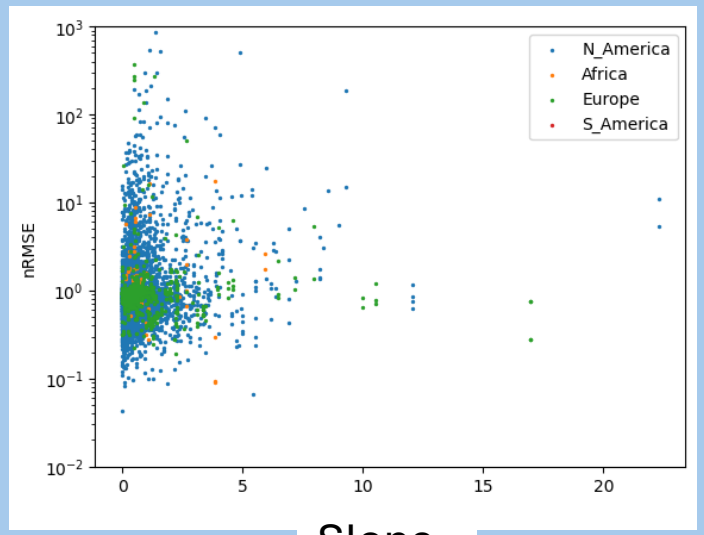


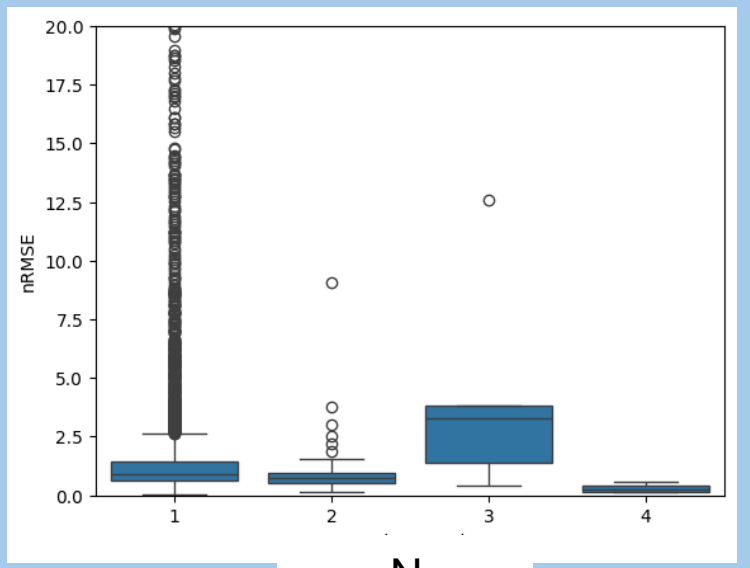




Courtesy of Hind Oubanas

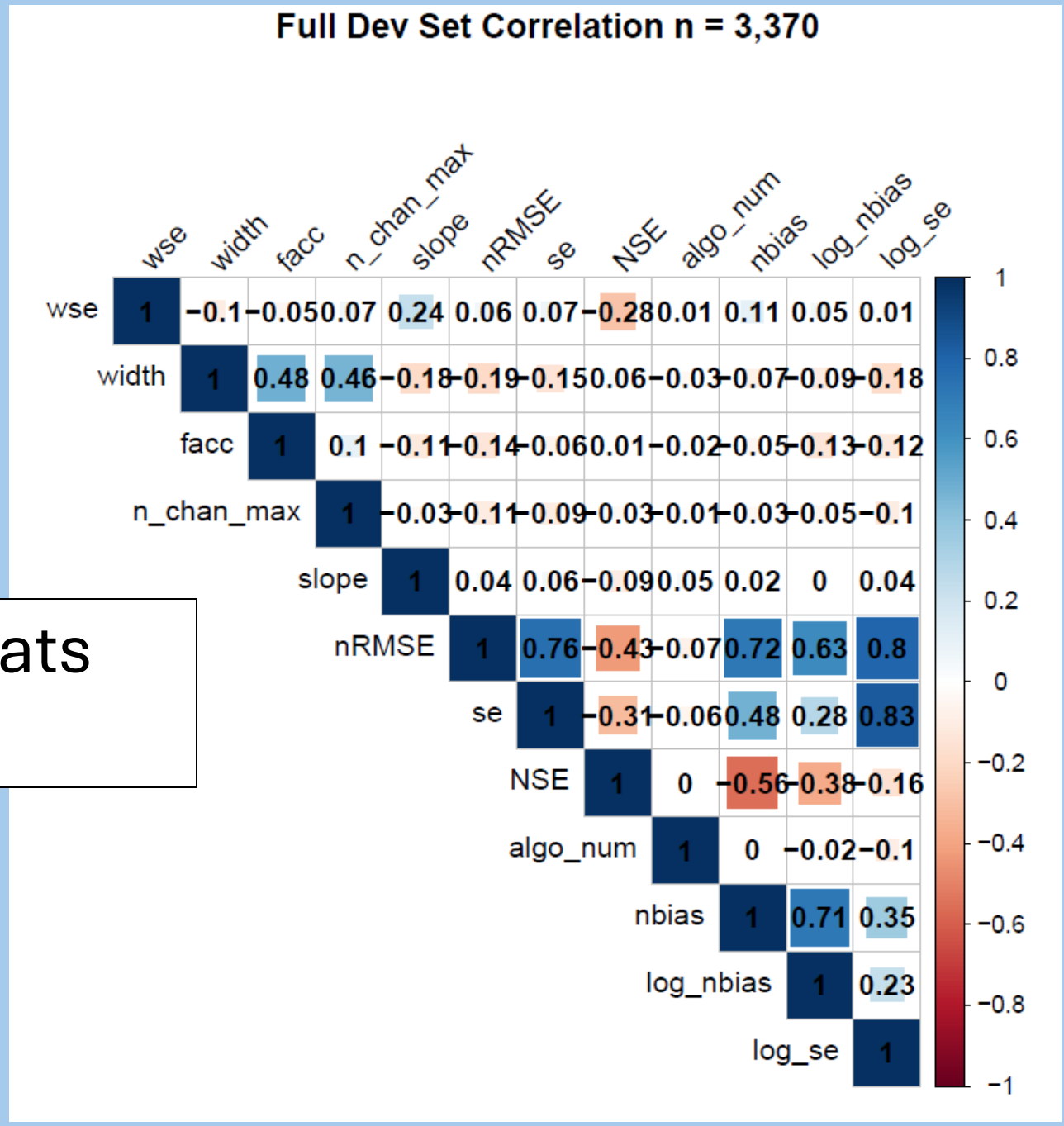




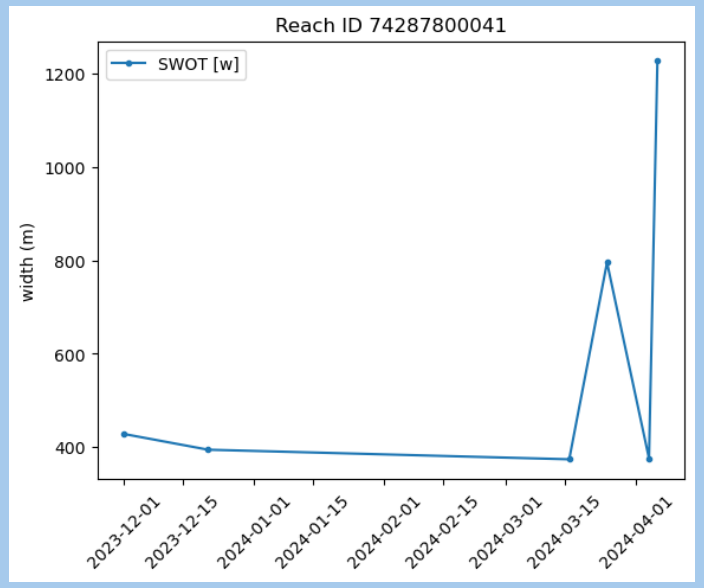


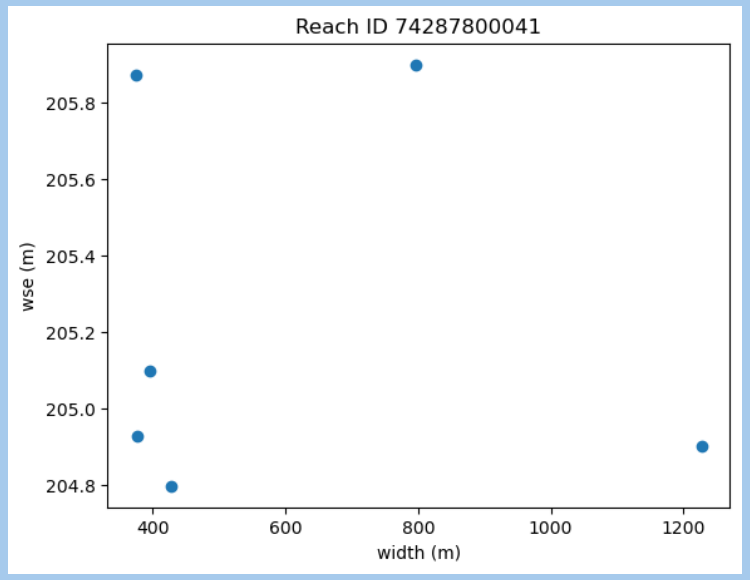
River characteristics (from SWORD) do not explain the error

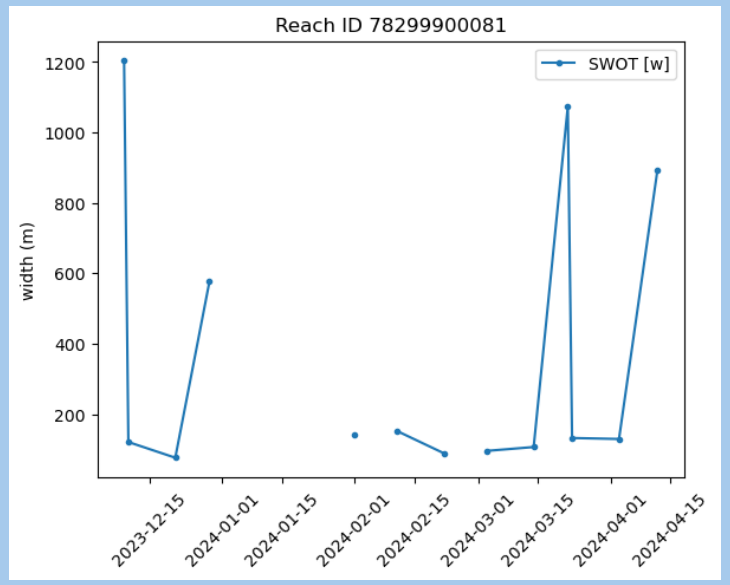
Correlation across multiple stats and SWORD parameters

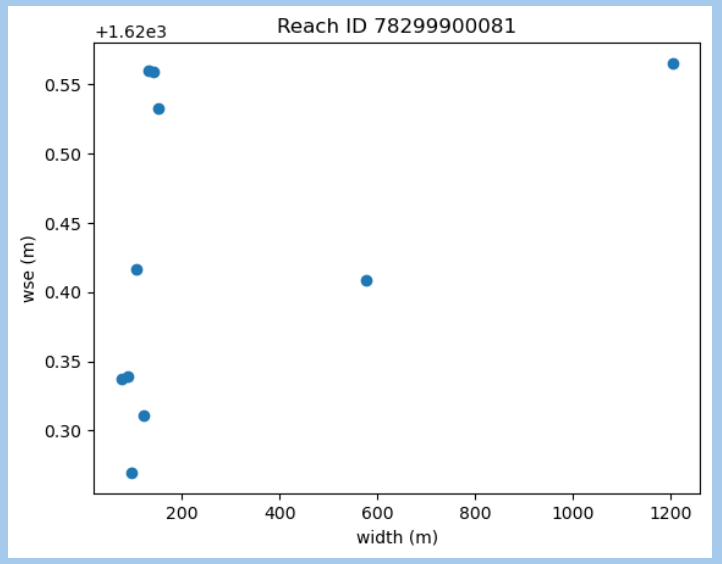


Width Time Series with unrealistic width variation



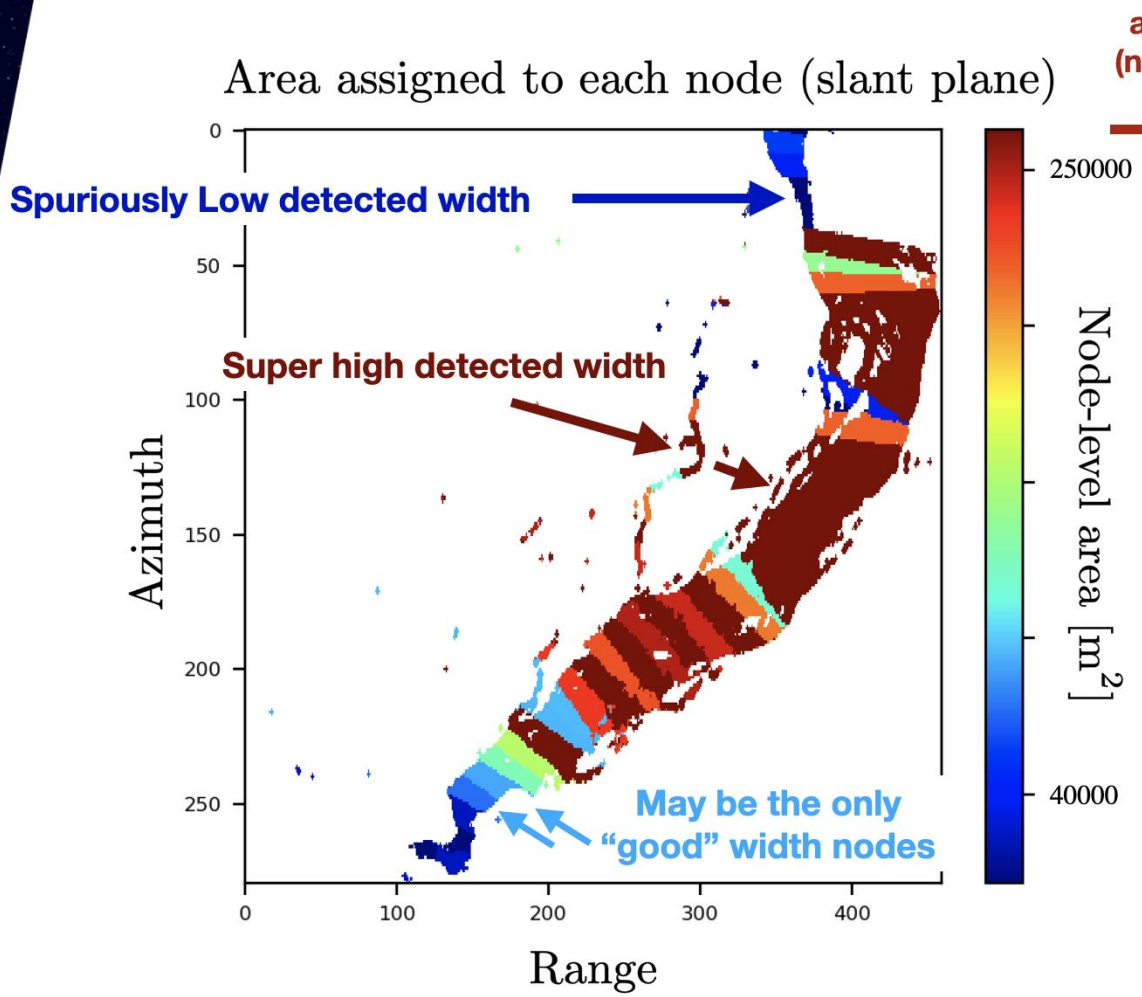




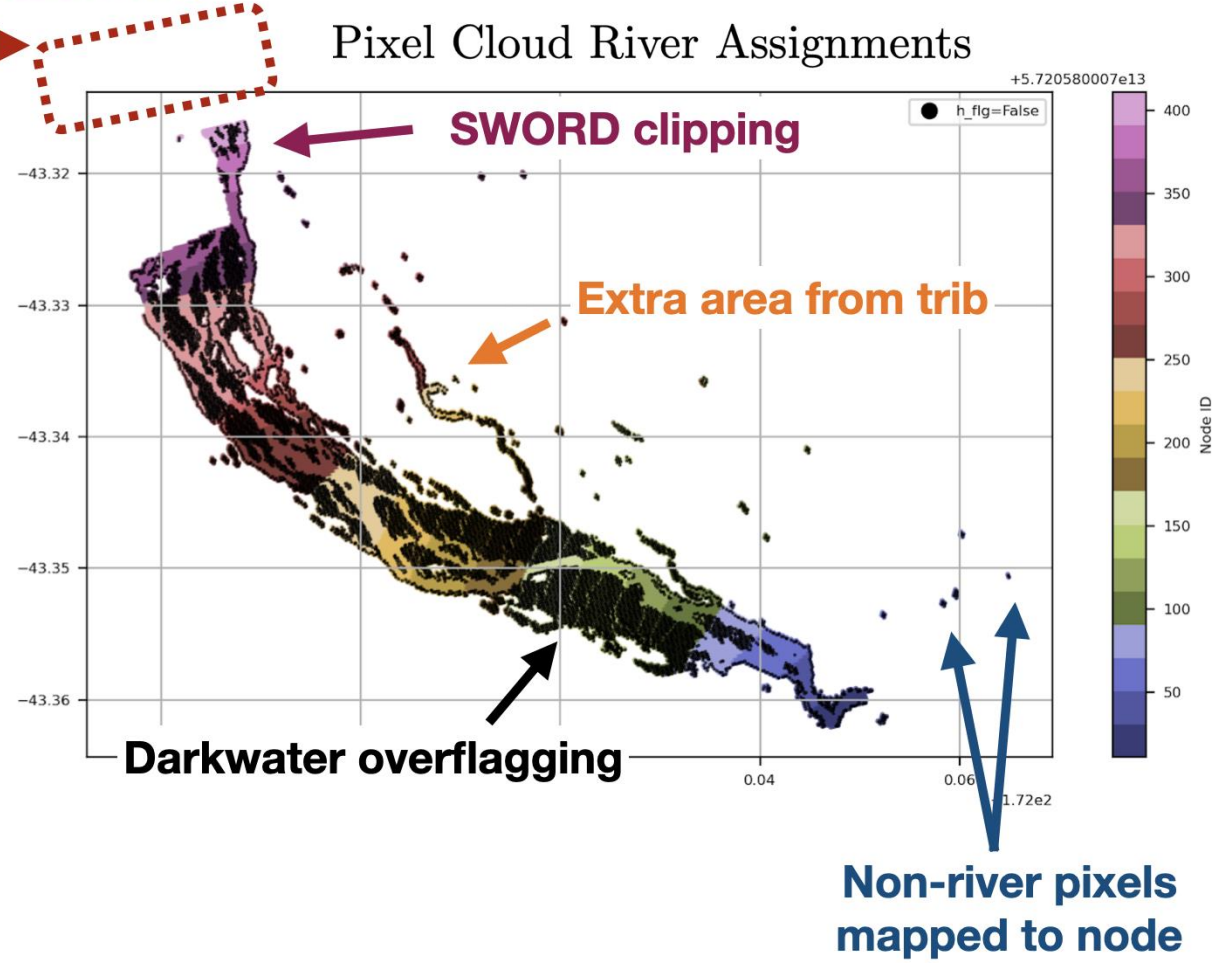


High Width Variability: an “all-in-one” Waimak case study

High (O[10]) node-to-node variability in area (& width) estimates due to various issues



area=0 edge node
(not visualized here)

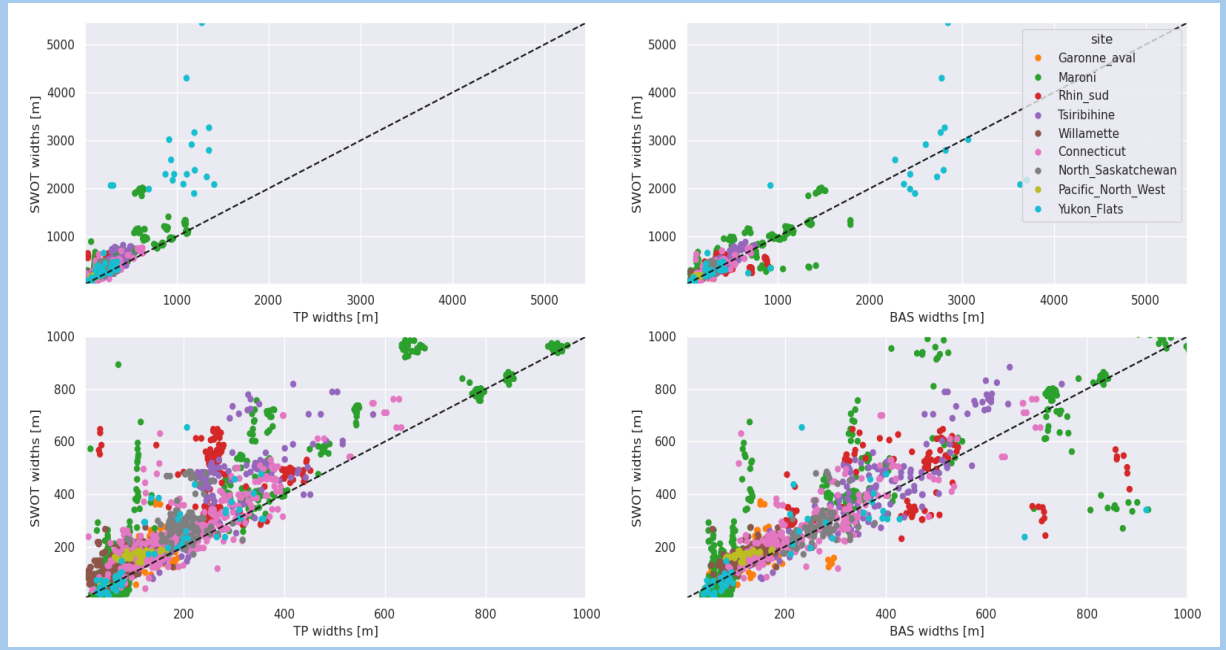


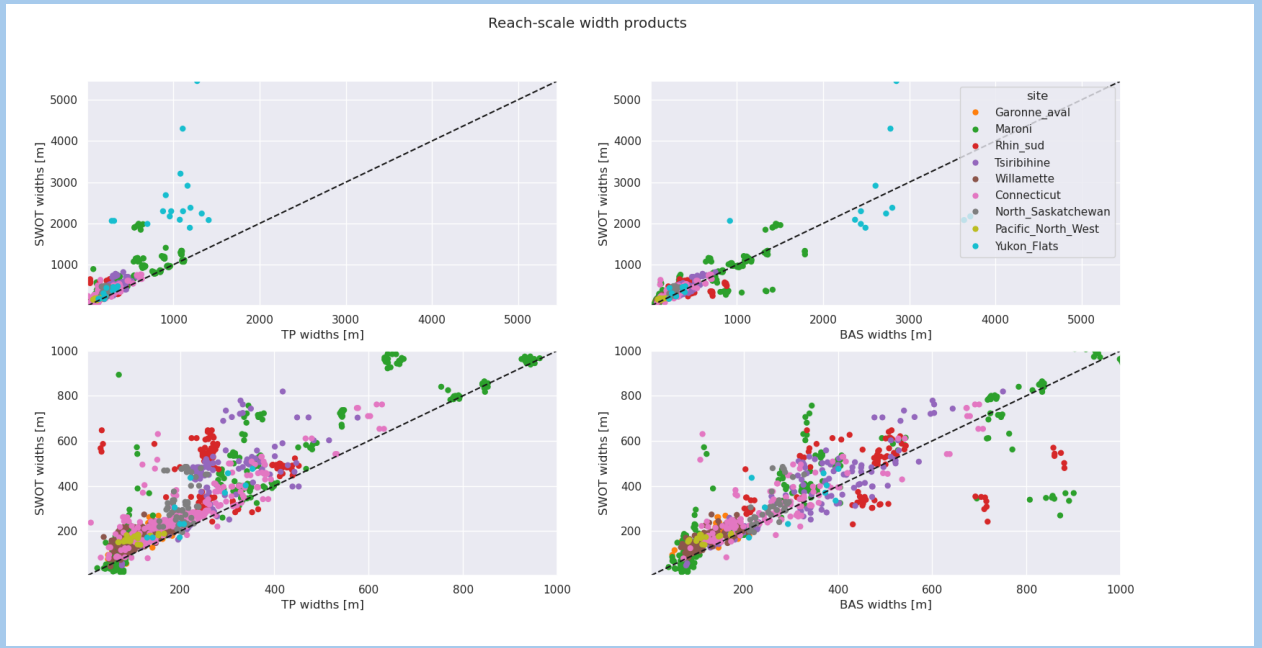
Courtesy of Cassie Stuurman

Courtesy of Charlotte Emery
– CS GROUP - France

From reference water mask (sentinel 1&2 Pleiades and Radarsat images), 2 river width algorithms are used :

- TP : RiverObs adapted to classic water mask
- BAS : Traditional method to compute width from water mask
- =>
  SWOT currently overestimates ri ver widths





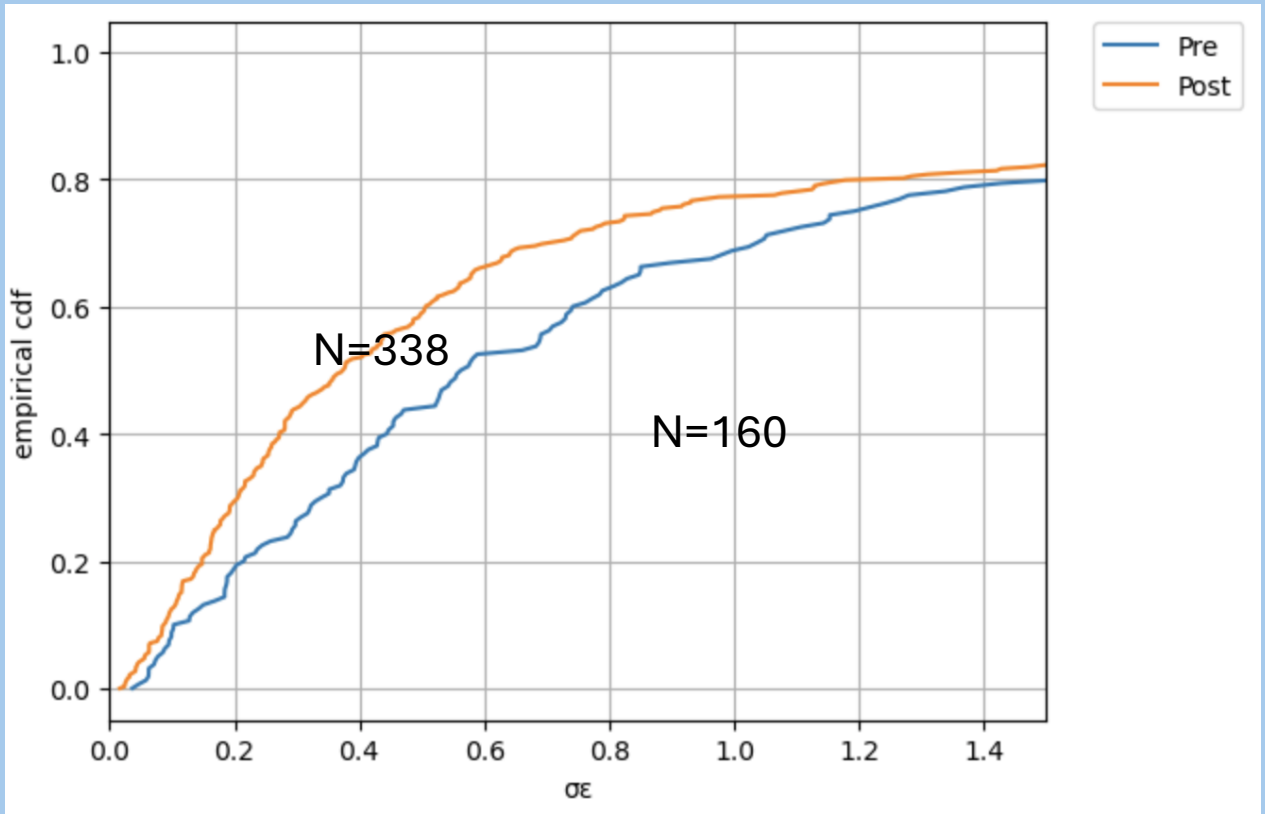
New run experiment using set width

The Hypotheses:

For Momma,
nominal dynamic widths should improve discharge estimates.

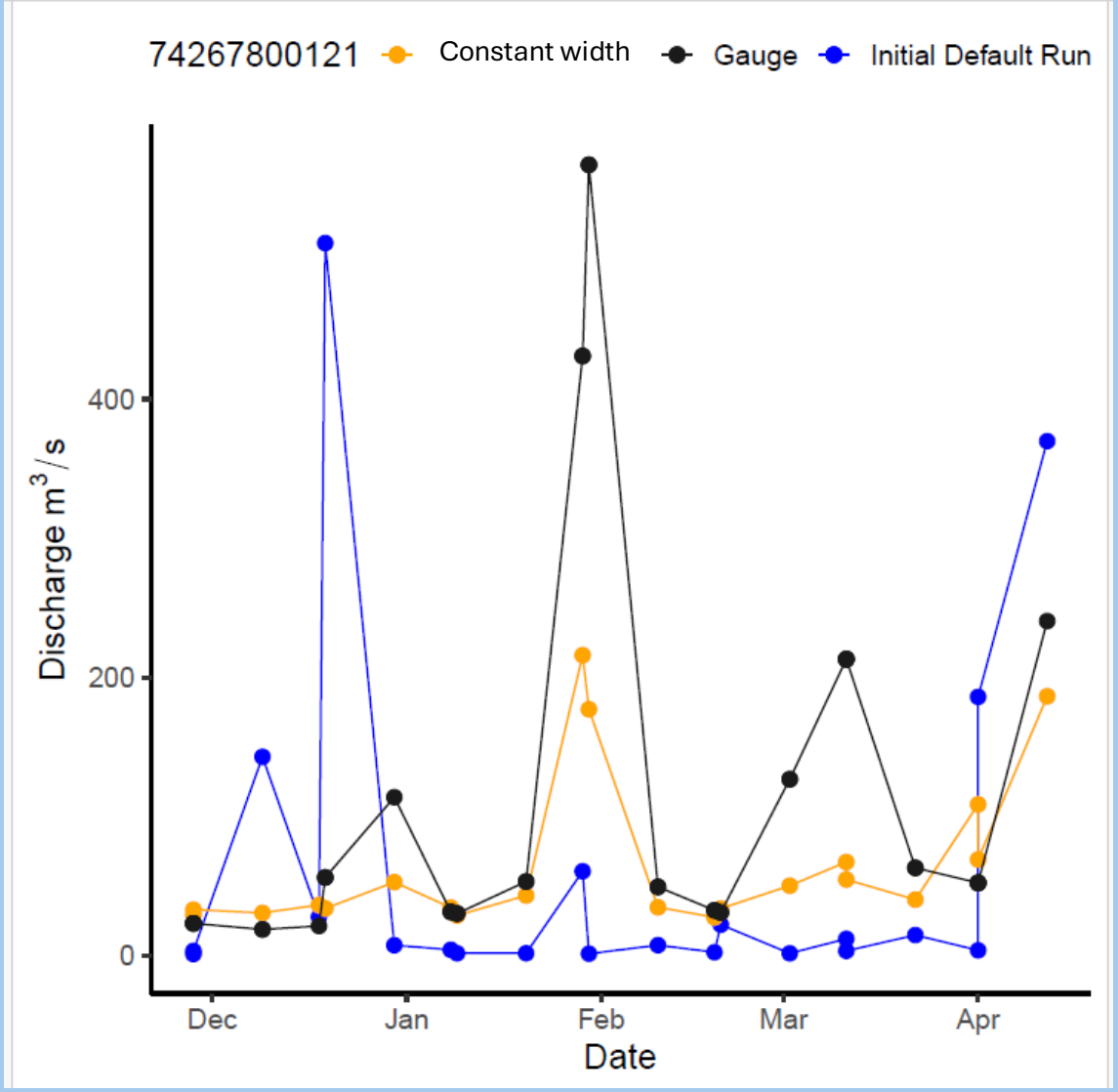
Therefore, if static width improves Q accuracy, the widths are a major source of error.

Momma got better!



- **Momma ran on many more reaches (More than doubled)**
- **Errors in dynamics were reduced**
- **Momma devs agree these results can be interpreted this way**

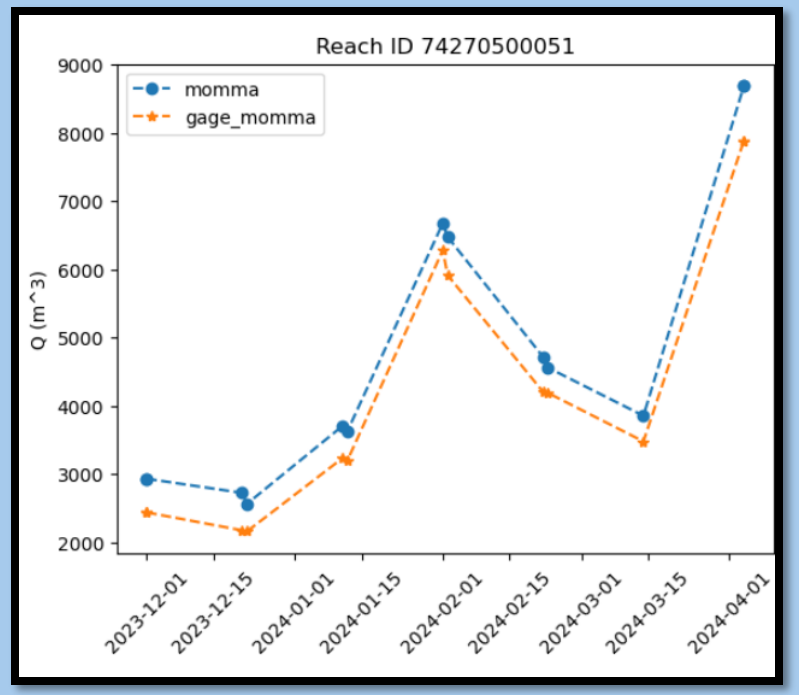
How do we interpret the result

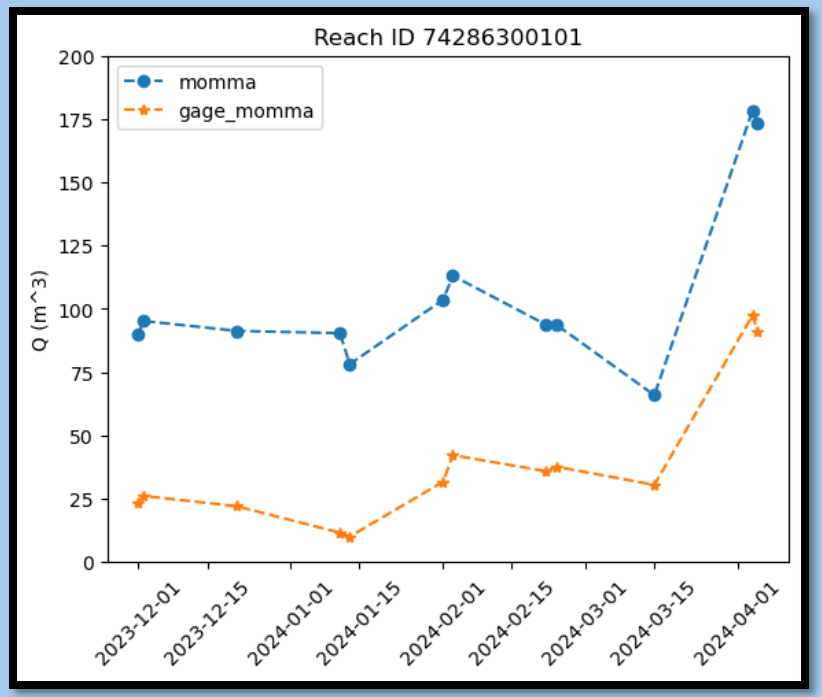


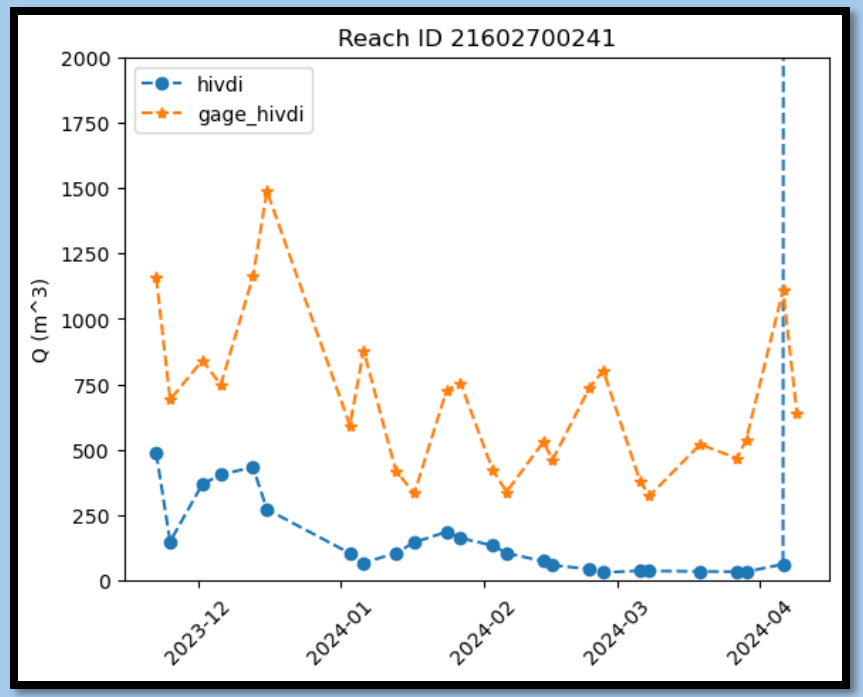
- Here we see the removal unrealistic width changes
- Muted but well-matched dynamics are present as expected
- Width is not a silver bullet, but this experiment show us that we must address width before we can move on to other issues

Courtesy of Merritt Harlin

How much data did Cassie's recommended filter throw out?







4.8%

87%

95%

There is a tradeoff between data quality and data quantity!

Summary

- We successfully ran on our largest reach set yet
- Despite overall validation results being below expectations, there are still many examples of successfully estimating discharge
- Confluence is working when inputs are good
- We have a few lines of evidence that point to width data quality driving poor discharge results and this is a solvable problem
- As the dataset grows confluence will have improved capacity to manage noise in the data


Thanks so much to everyone who contributed !