

INTRODUCTION

- SWOT is of key importance over Indian rivers as it provides continuous high-resolution monitoring over the most complex and dynamic river systems that are often poorly gauged.
- Bitwise quality flags assess the quality of pixel cloud data used to generate SWOT's reach and node products and highlight the underlying source of error.
- This study evaluates the role of bitwise flags in improving the reliability of SWOT-derived hydrological estimates.

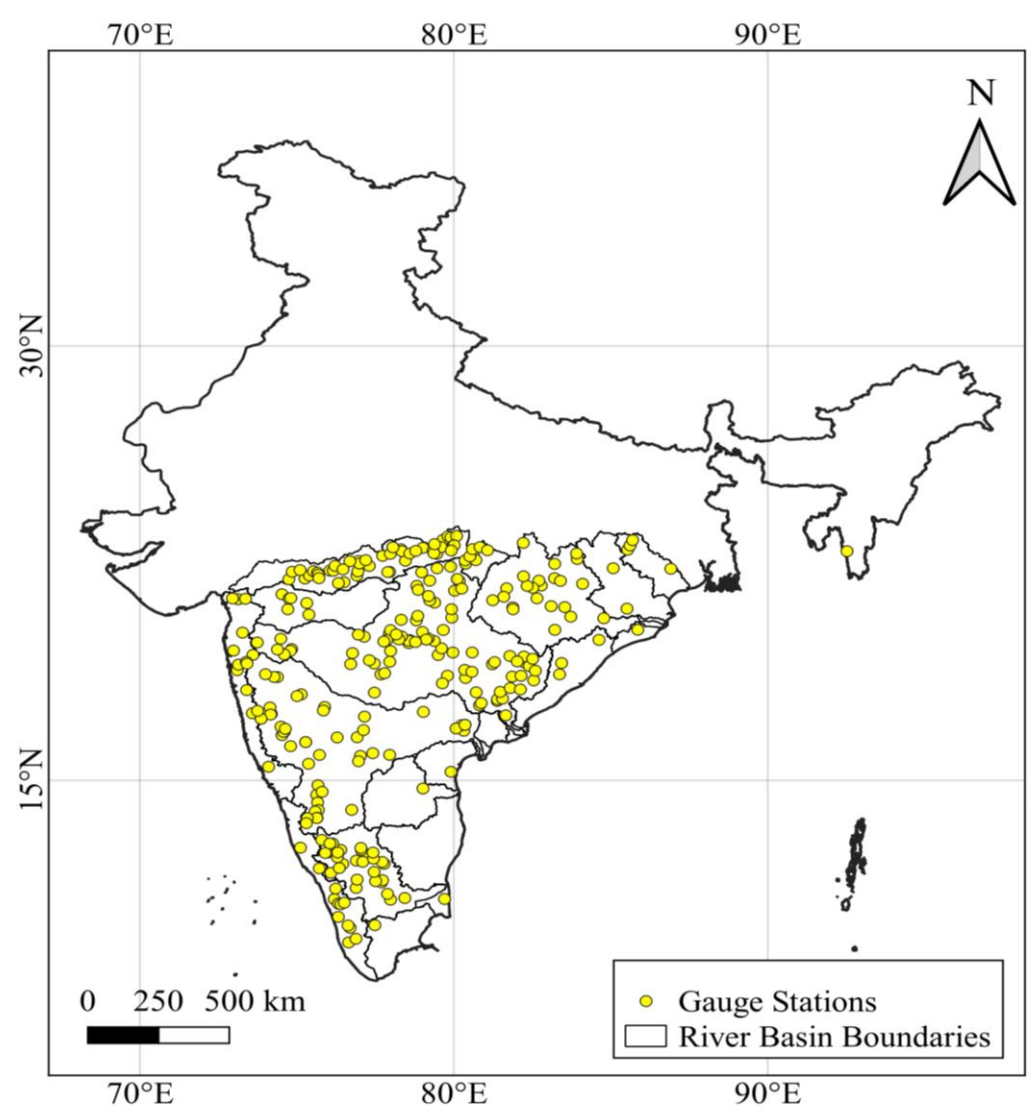


Figure 1: River basins and locations of the gauge stations over India

OBJECTIVES

- To assess the effects of bitwise quality flags on SWOT node and reach product accuracy and identify the best flag or flag combinations that optimize data availability and accuracy.
- To compare the accuracy of the node and reach products at common locations.
- To examine the influence of river morphology on the accuracy of SWOT-derived water surface elevation (WSE) measurements.

METHODOLOGY

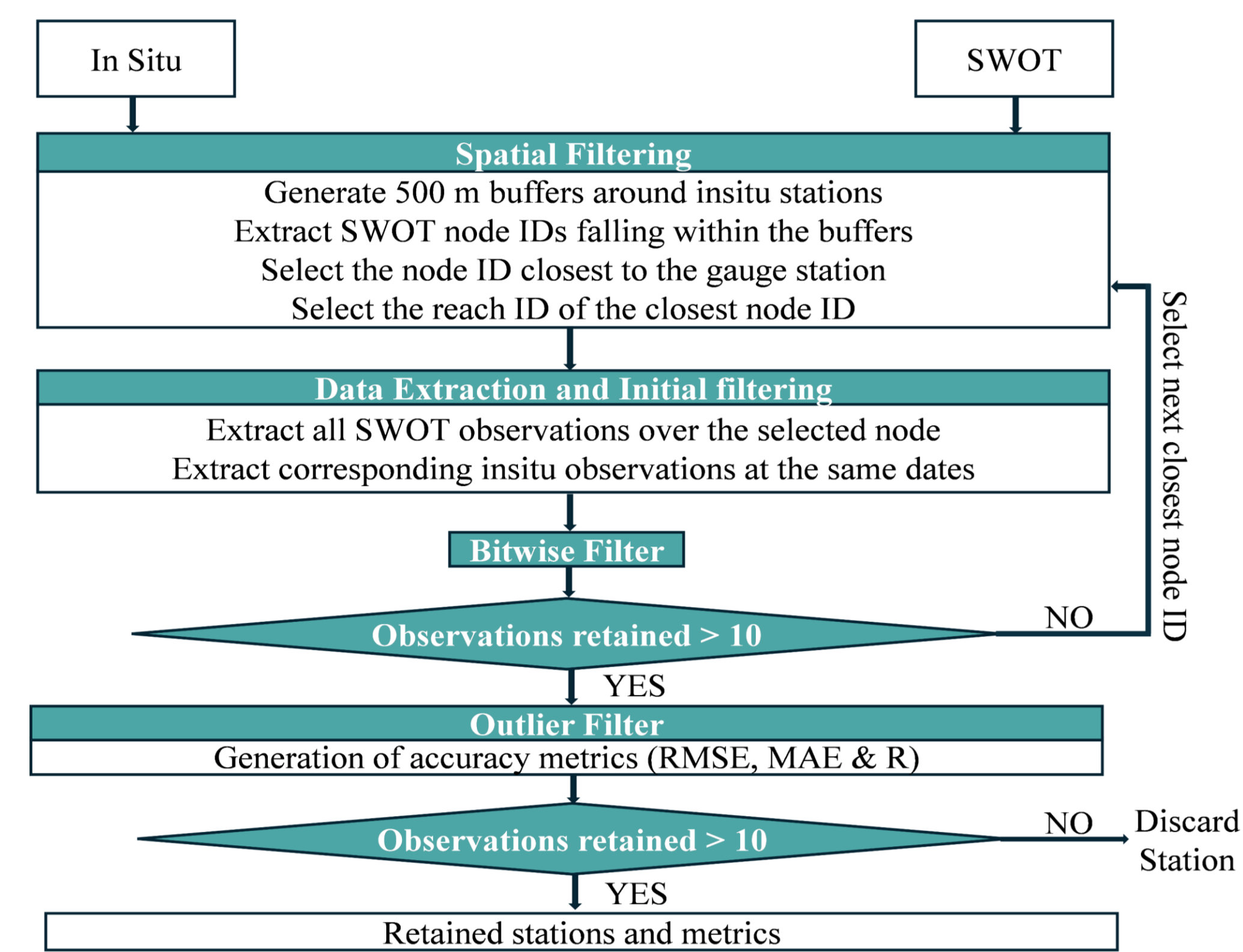


Figure 2: Flowchart illustrating the methodology

RESULTS

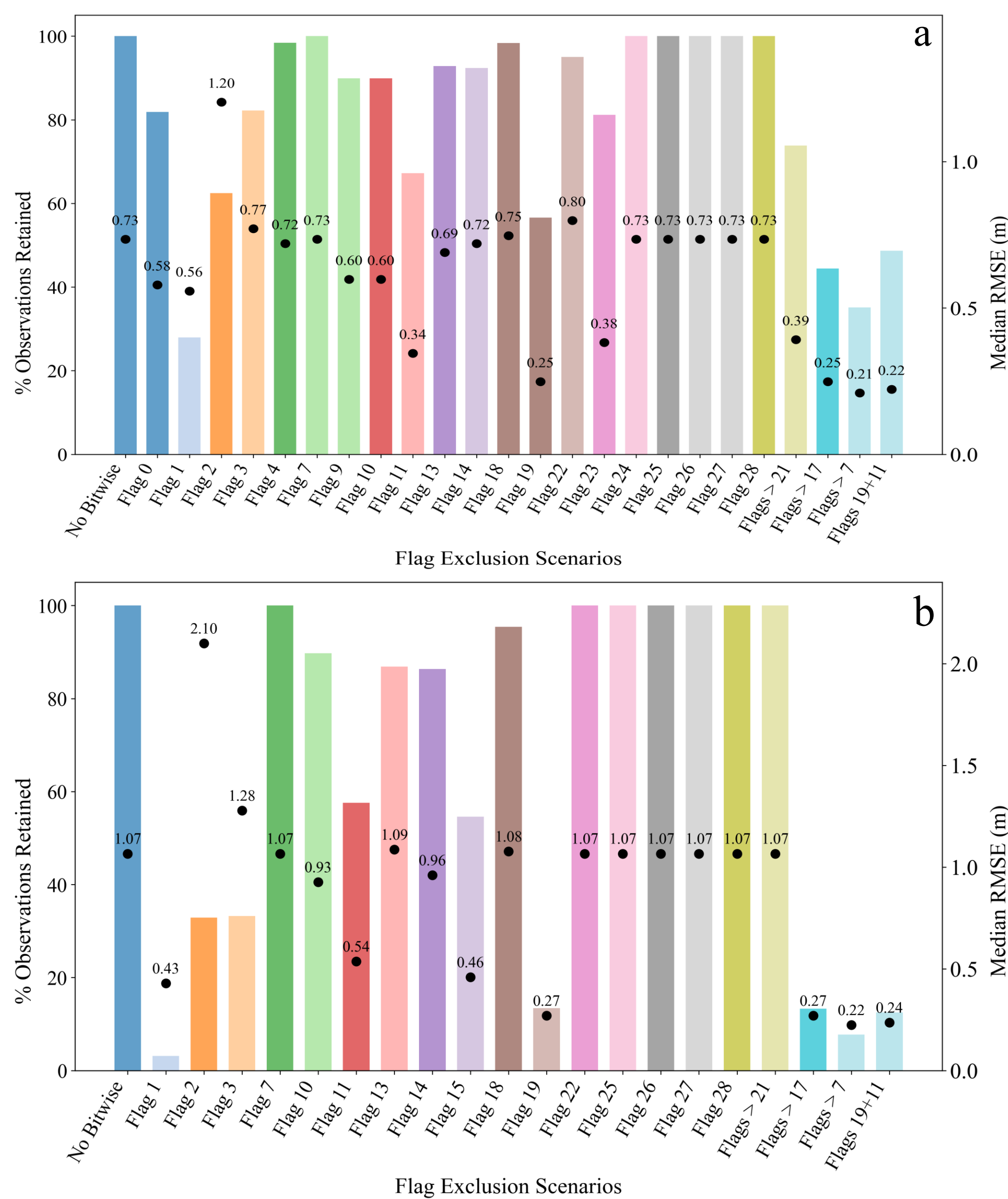


Figure 3: Effect of different combinations of bitwise filter on the % observations retained and the median RMSE value of the SWOT vector a) node and b) reach product

Table 1: A summary of the accuracy metrics of the node and reach products.

Statistics		Node	Reach
RMSE	Median	0.248	0.270
	Mean	0.615	0.454
MAE	Median	0.201	0.207
	Mean	0.501	0.370
R	Median	0.903	0.918
	Mean	0.774	0.818

Table 2: Summary statistics for the node and reach products.

RMSE (m)	Node	Reach
Median	0.203	0.271
Mean	0.384	0.466
Min	0.063	0.076
Max	3.297	2.961

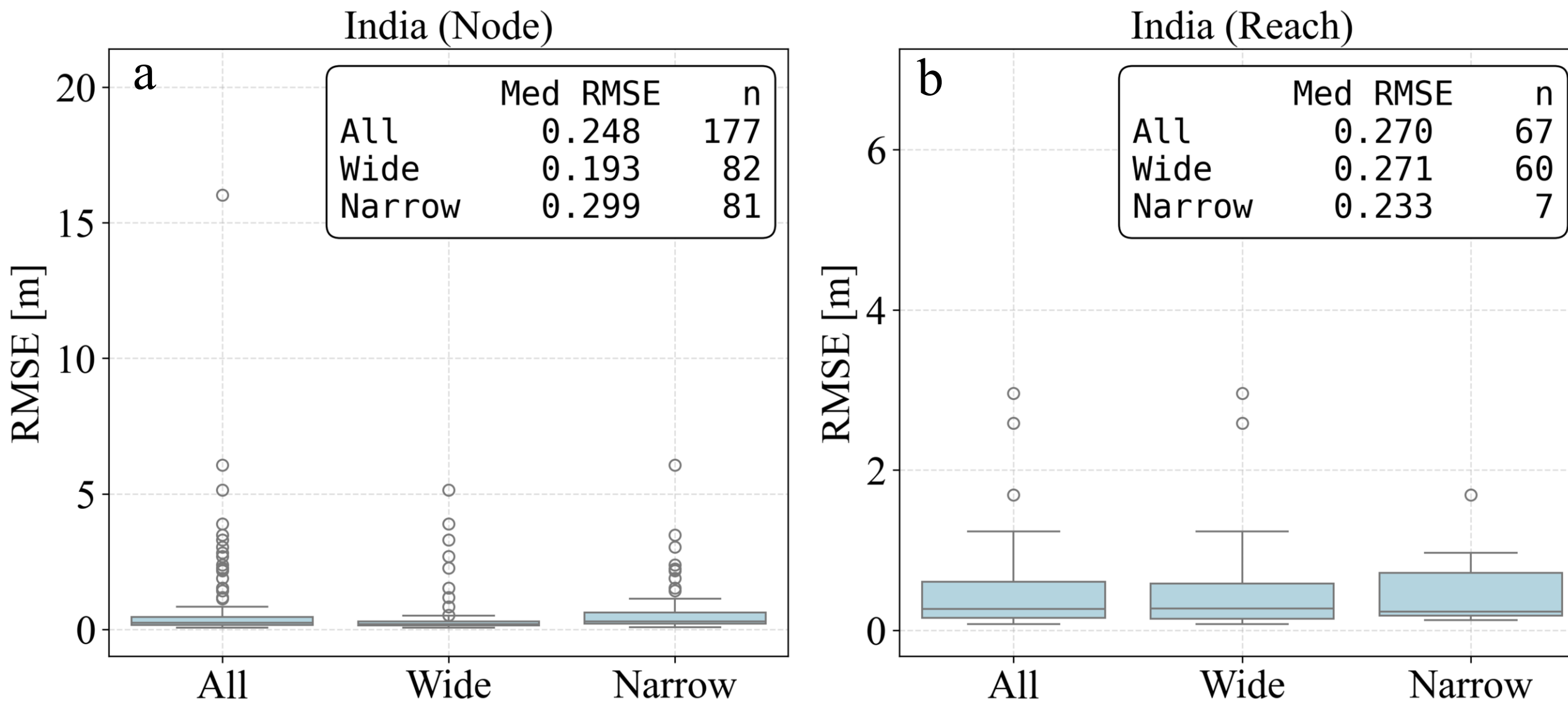


Figure 4: Variations in the accuracies of the a) node and b) reach datasets over the narrow and wide rivers across India

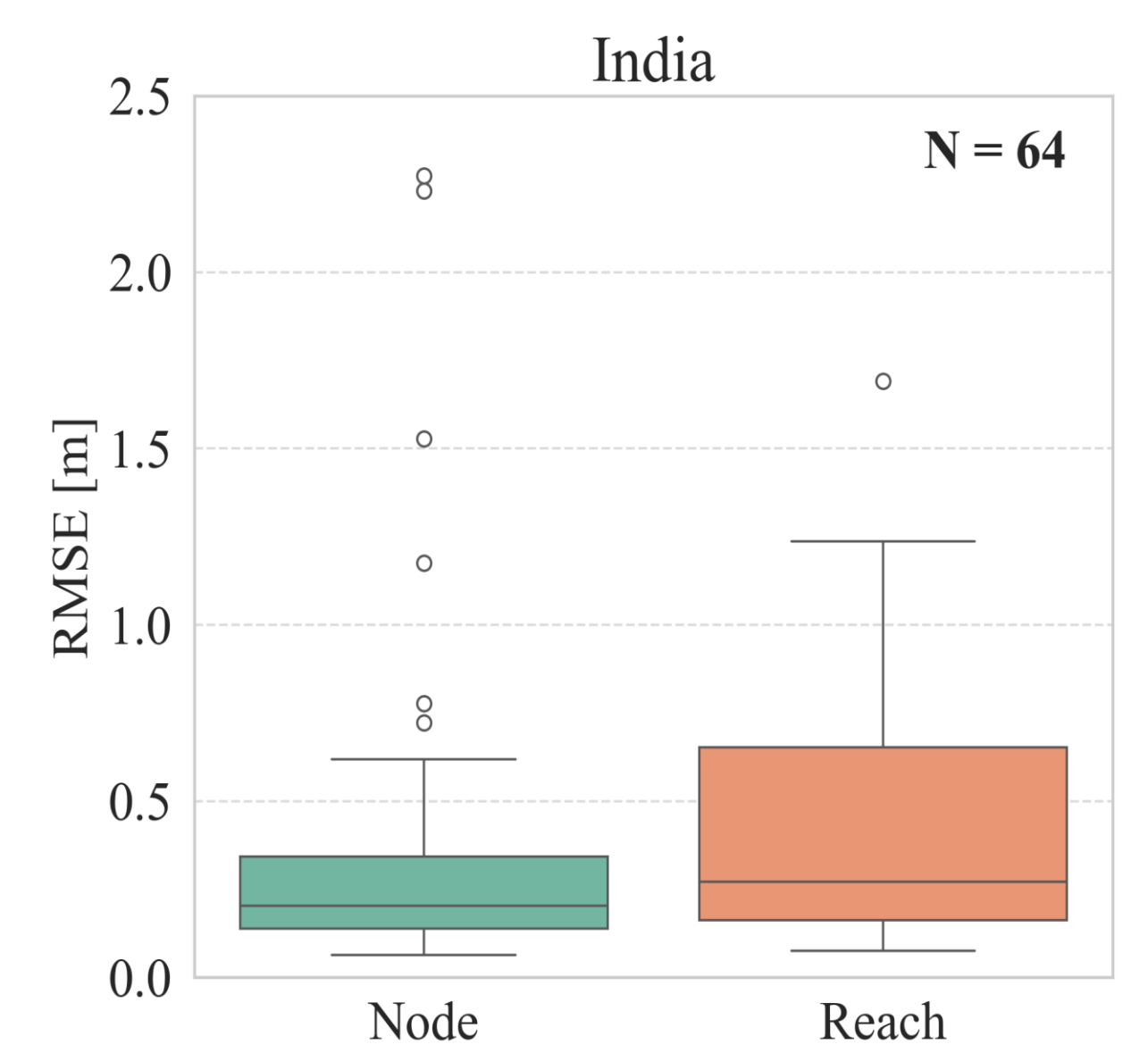


Figure 5: A direct comparison between the node and reach product accuracy at common locations.

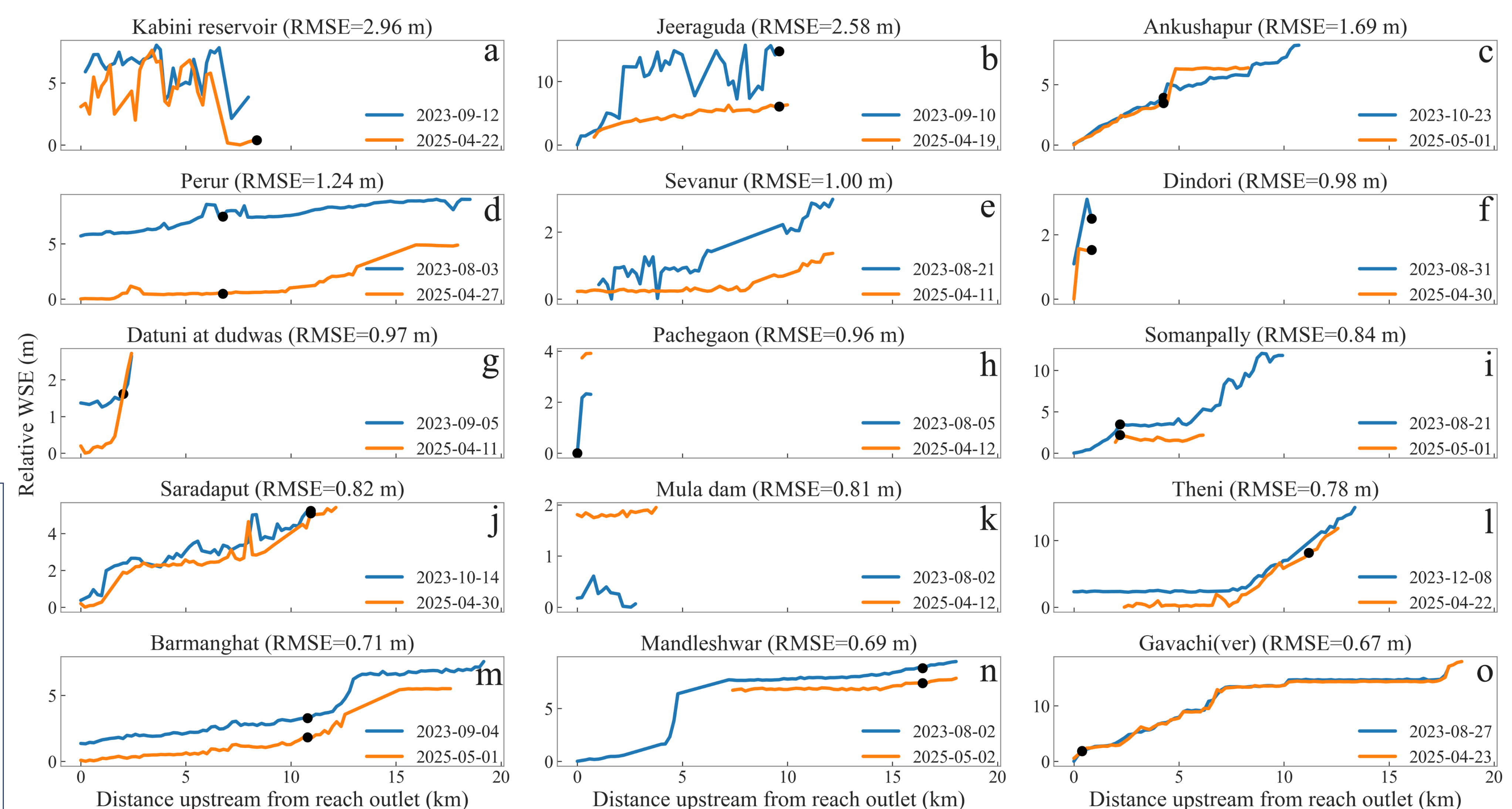


Figure 6: Water surface elevation profiles along the reaches with the highest median RMSE values in India. The black marker represents the node closest to the position of the gauge station.

SUMMARY AND CONCLUSIONS

- Exclusion of observations with Flag 19 (geolocation_qual_degraded) achieves an optimum balance between data retention and accuracy.
- The node product shows less data loss under bitwise filtering and is retained over most of the SWOT-observed river channels.
- Over India, the node product performs better compared to the reach product over 64 stations that are analyzed.
- Accuracy of the node product improves over the wider channels.
- The RMSE of the reach product is more than twice the mission requirements.
- The higher RMSE values over the reaches in India can be attributed to irregularities in the reach lengths, rapid WSE variations along the reach, and gauge stations located towards upstream or downstream ends of the reach.
- This analysis highlights the need to subdivide the long reaches into smaller segments, considering riverbed elevation changes, so that the reach-averaged WSE value better represents the elevations along the entire reach.

FUTURE WORK

- To analyze the factors contributing to significantly lower performance of SWOT-derived WSEs over India.
- To integrate observations from other satellite altimetry missions to refine SWOT calibration in India.

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