

SWOT

Science Team Meeting

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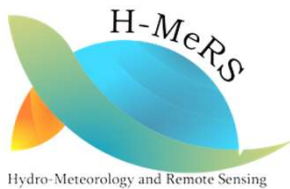
ARCACHON • France

14-17 OCT. 2025

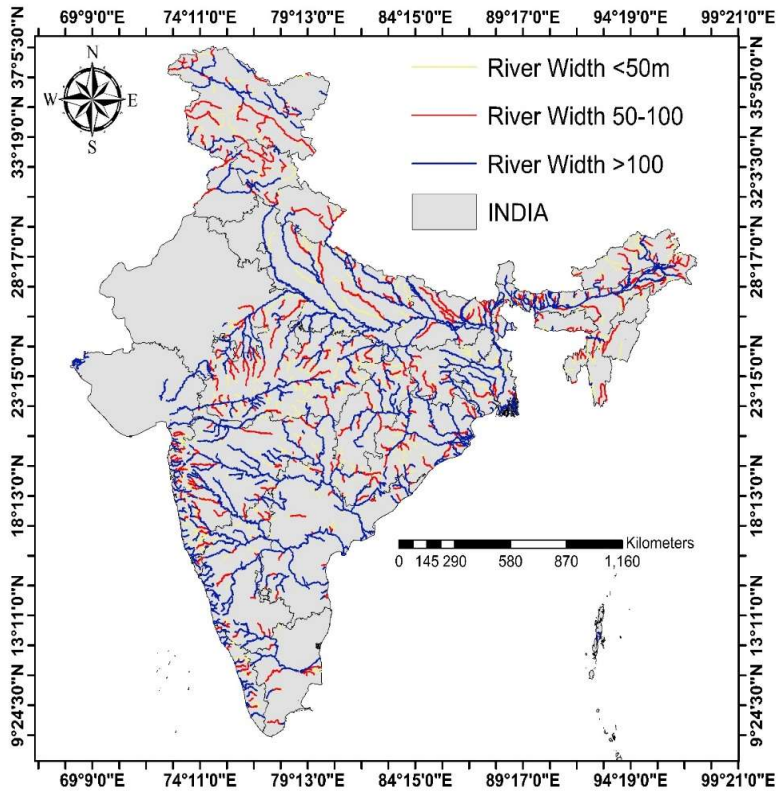
Evaluating the Potential of the SWOT Mission for Hydrological Applications in India



Girish Patidar, J. Indu, Subhankar Karmakar
Indian Institute of Technology Bombay

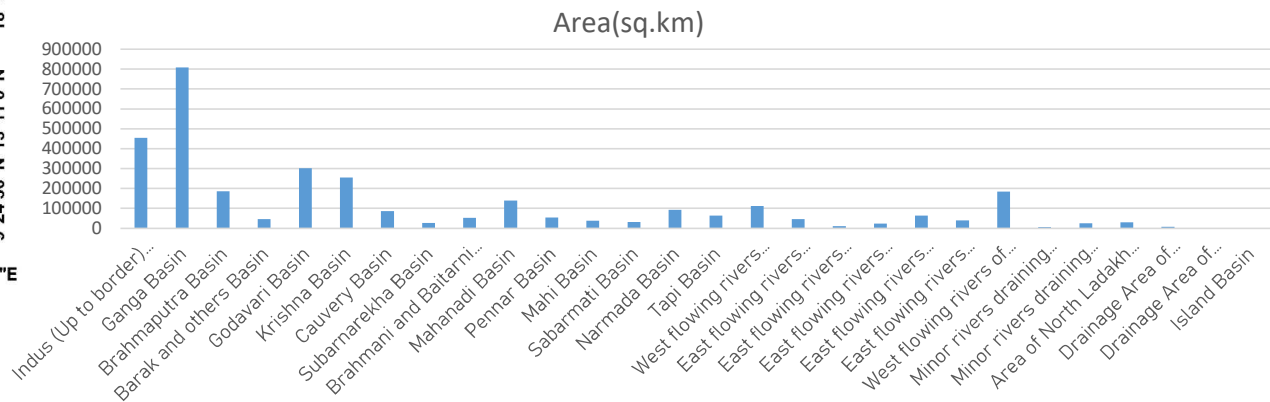


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Map of SWOT-observable rivers at 50 m and 100 m width thresholds
(Source: Pavelsky et al., 2014a)

With a land area of 3.2 million km², India is home to many river systems and perennial streams.
Rivers: Himalayan, Deccan, Coastal and Inland Drainage



(Source: <https://indiawris.gov.in>)

WHAT TO EXPECT?



**1. Can we get
NRT Discharge estimates
over India?**

Validation



**2. First hand validation of
SWOT Datasets?**

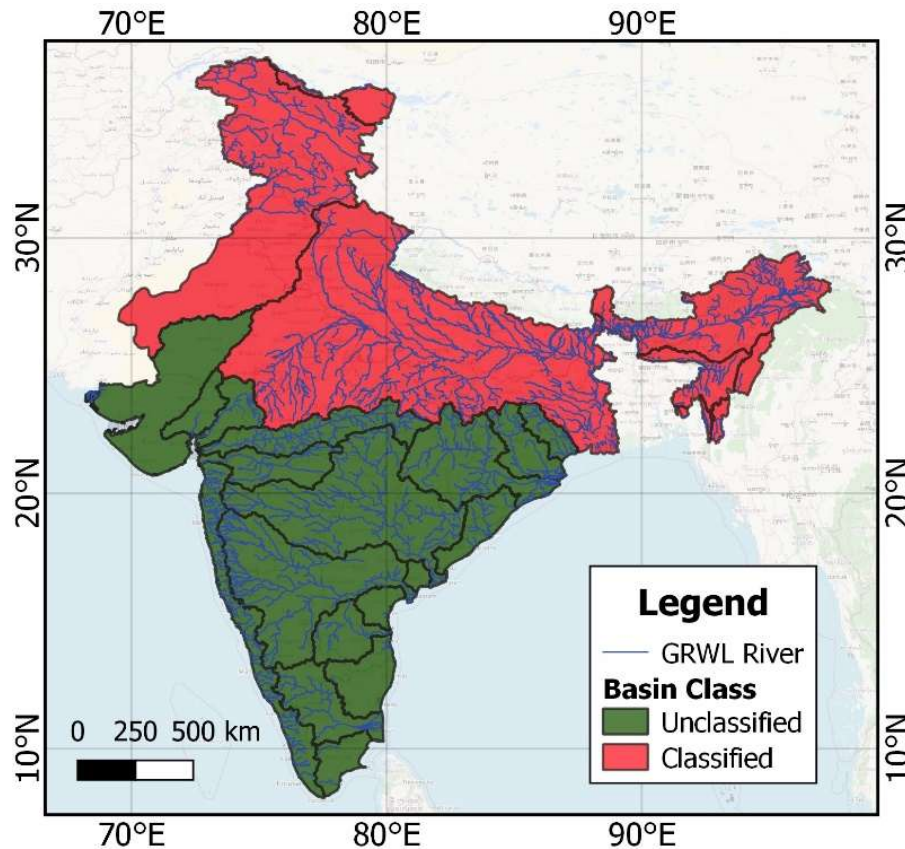
River Discharge



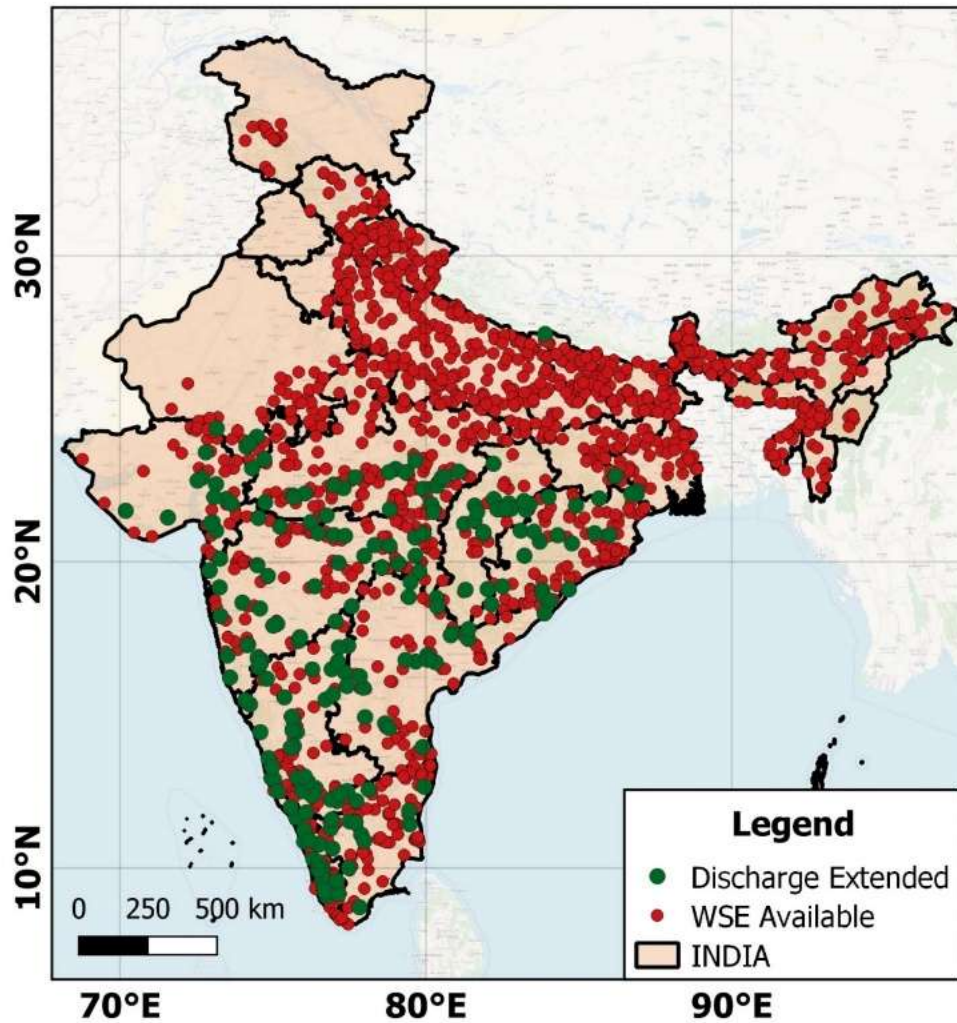
**3. Is there an alternative to
SWOT river width?**



CAN WE OBTAIN NEAR REAL TIME (NRT) WSE AND DISCHARGE OVER INDIA?



- ✓ CWC manages 1,500+ stations
(CWC under Ministry of Jal Shakti)
- ✓ Near-real-time data is unavailable !
- ✓ CWC provides graphical representations of sub-daily WSE data (hourly during monsoon seasons) for the entire river network (classified and unclassified) monitoring stations over CWC's flood monitoring and flood dissemination portal (<https://ffs.india-water.gov.in/>).
- ✓ Variations of WSE across 7 day moving windows



- ✓ Web Scraping to extract NRT telemetry-based WSE measurement of more than 1500 stations Generated RCs for more than 200 stations using historical WSE-discharge measurement.
- ✓ Extended NRT discharge of more than 200 stations over India.
- ✓ Developed a web portal (www.Indiariverflow.com) for sub-daily data dissemination.
 - ✓ 30+ Million WSE (2020-2024)
 - ✓ 4+ Million Discharge (2020-2024)

<http://indiariverflow.com/>

Real-Time Discharge India



This Dashboard Provides Real-Time Discharge and WSE. For more details, visit : [GUARDIAN: Patidar et al., 2024](#)

For visualizing and downloading data from the portal follow the steps :

- 1) Select the station from the drop down menu (you can get the name of the station from the gauging location map by hovering over it)
- 2) After selecting station it will get highlighted on the map
- 3) WSE plot will appear and if station is having valid RC then it will plot discharge data
- 4) For downloading the data click on the download button located below gauging location figure

For any queries contact : [Girish Patidar](#) , [Prof. J. Indu](#)

Select station from drop-down:

Select...

Gauging location over India



4

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Extending Sub-Daily River Discharge data over India (GUARDIAN)

[Girish Patidar, J. Indu](#) & [Subhankar Karmakar](#)

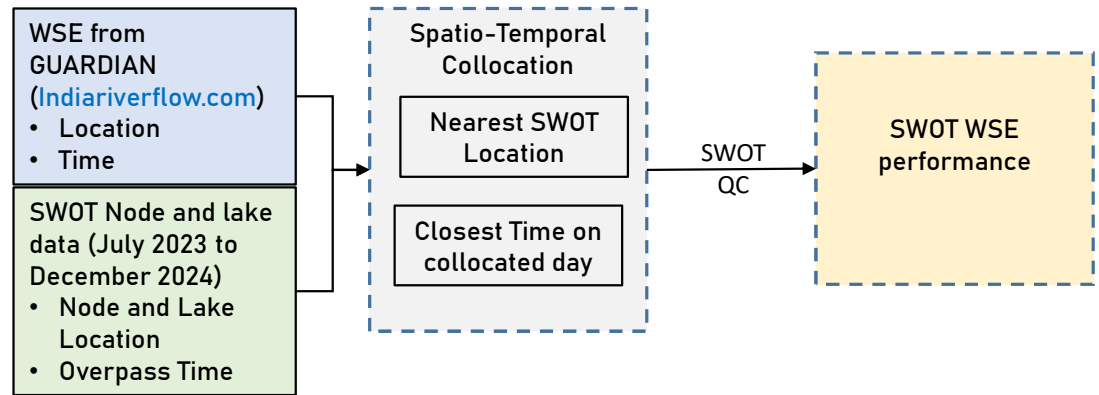
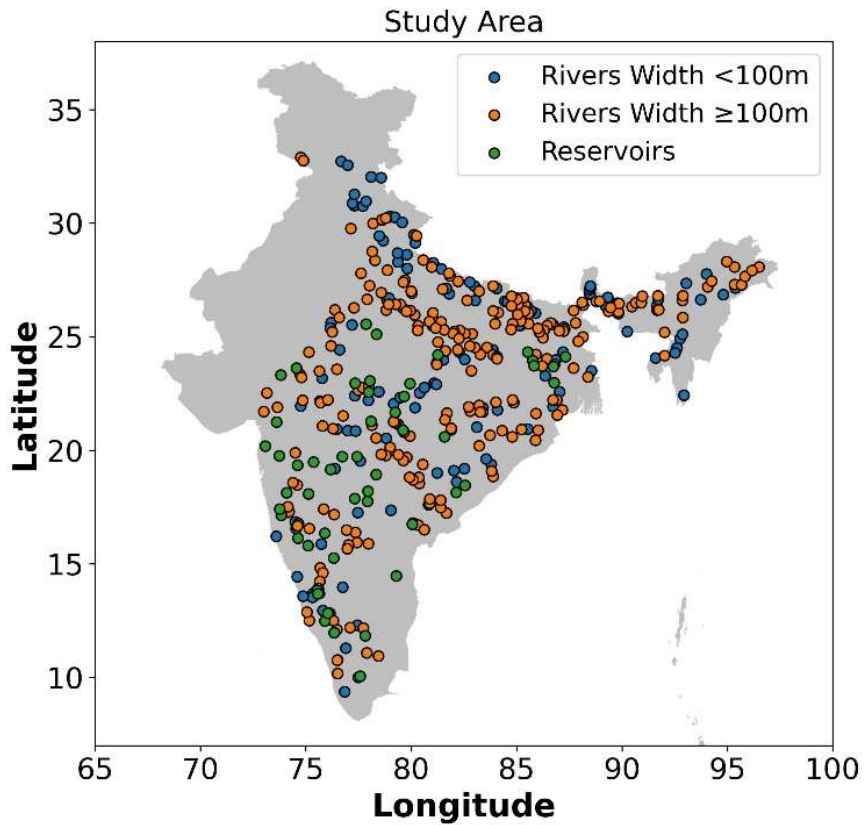
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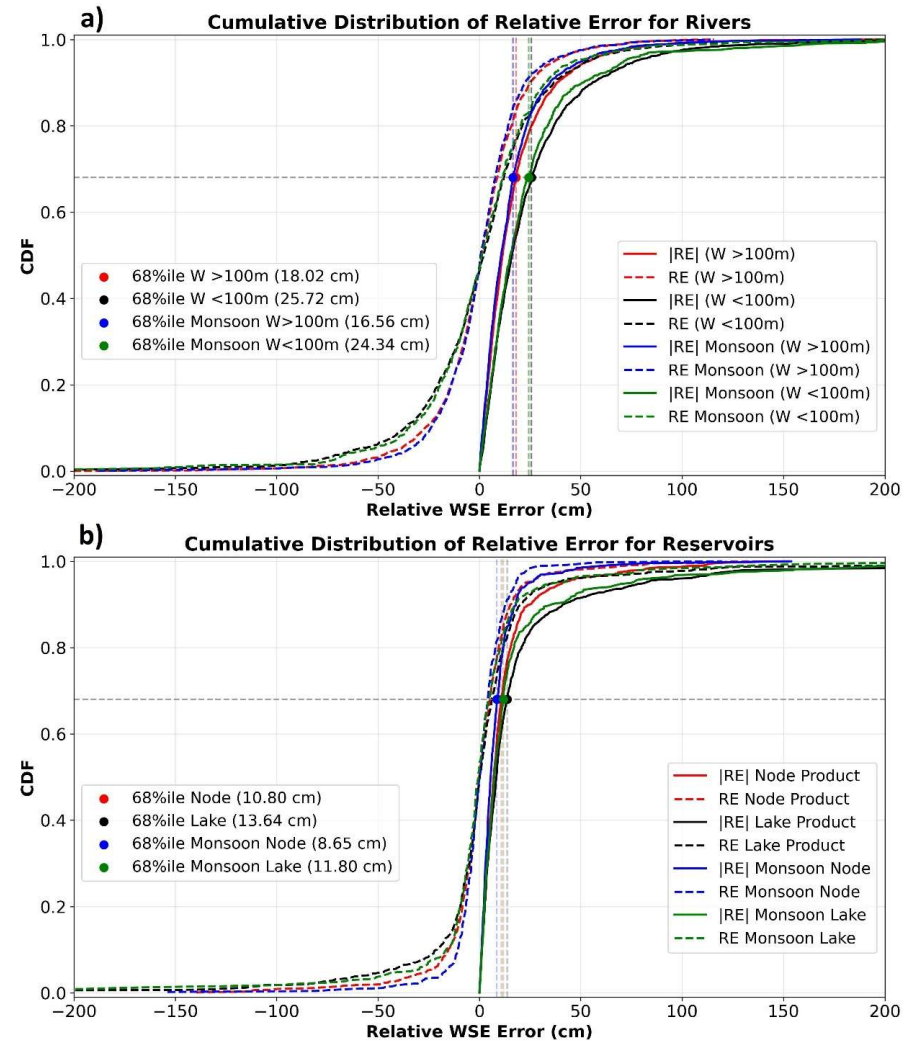
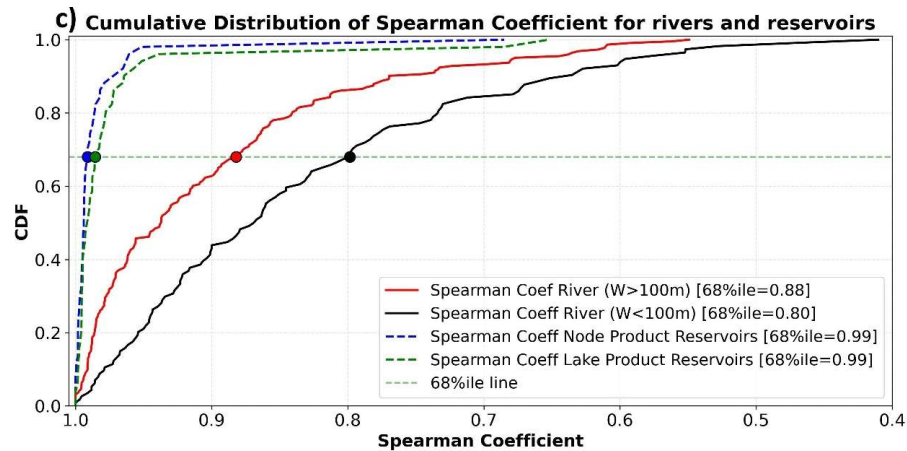
First-hand validation and performance assessment of the SWOT-derived WSE data



$$Relative\ Error_{WSE} = WSE_i^{swot} - WSE_i^{gauge} - (WSE_{mean}^{swot} - WSE_{mean}^{gauge})$$

- Total 419 stations
- 233 rivers wider than 100 m
- 134 rivers narrower than 100 m
- 52 reservoirs

- ✓ Total observations for rivers: 31,632: 15,765 (49.8%) are for narrower rivers and 15,867 (50.2%) are for wider rivers.
- ✓ After the quality flag of SWOT node observations: 12,908 (40.81%) are retained.
- ✓ Wider rivers exhibit a low relative error of 18.02 cm and a high Spearman correlation ($\rho_s > 0.88$).
- ✓ Narrower rivers exhibit increased uncertainty, with a relative error of 25.72 cm.



Geophysical Research Letters*

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RESEARCH LETTER

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Special Collection:

Science from the Surface Water and Ocean Topography Satellite Mission

Performance Assessment of Surface Water and Ocean Topography (SWOT) Mission for WSE Measurement Across India

Girish Patidar¹ , J. Indu^{1,2} , and Subhankar Karmakar^{1,3} 

¹Centre for Climate Studies, Indian Institute of Technology Bombay, Mumbai, India, ²Department of Civil Engineering, Indian Institute of Technology Bombay, Mumbai, India, ³Environmental Science and Engineering Department, Indian Institute of Technology Bombay, Mumbai, India

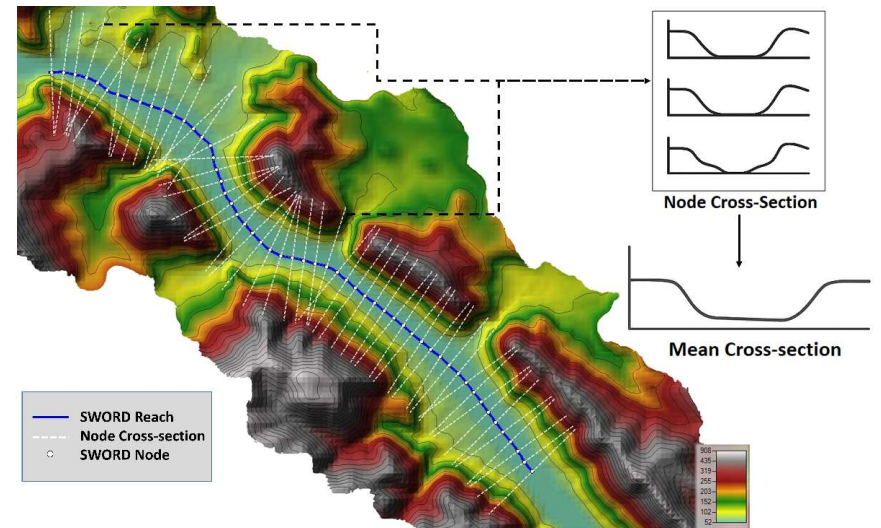
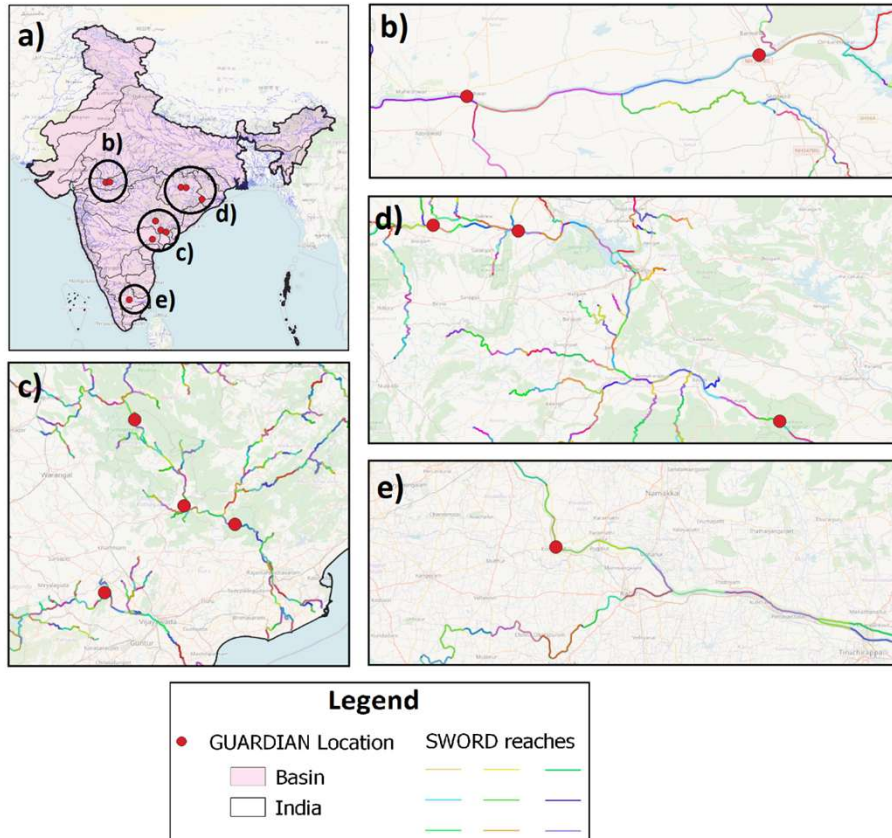


- SWOT performs well over Indian rivers!
- Performance improves during the monsoon, where RE decreases to 16.56 cm for wider rivers and 24.34 cm for narrower rivers, emphasizing SWOT's enhanced accuracy under high-flow conditions.
- Over reservoirs, SWOT achieves high accuracy, with an RE of 10.80 cm for node product and 13.64 cm for lake product.
- SWOT shows high performance during the monsoon with RE of 8.65 cm and 11.80 cm for node and lake products, respectively, possibly due to reduced dark water effects.

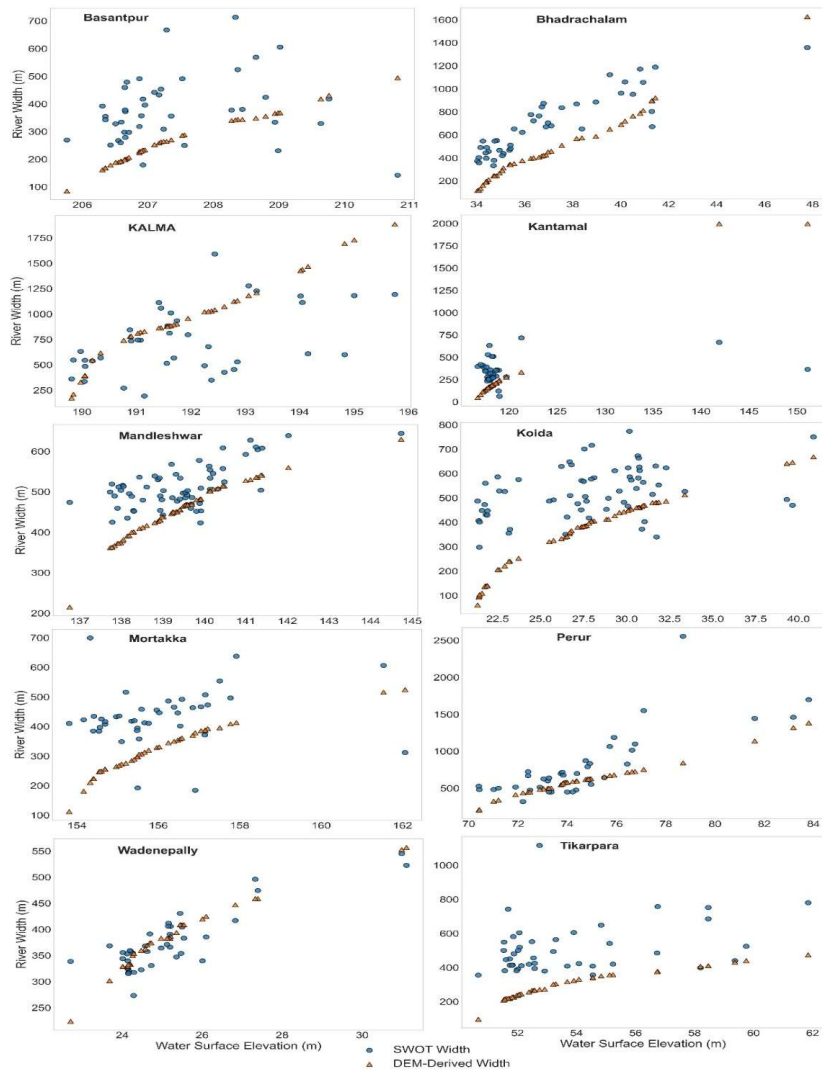
River Discharge



**CAN THERE BE AN ALTERNATIVE TO SWOT
RIVER WIDTH FOR DISCHARGE ESTIMATION?**



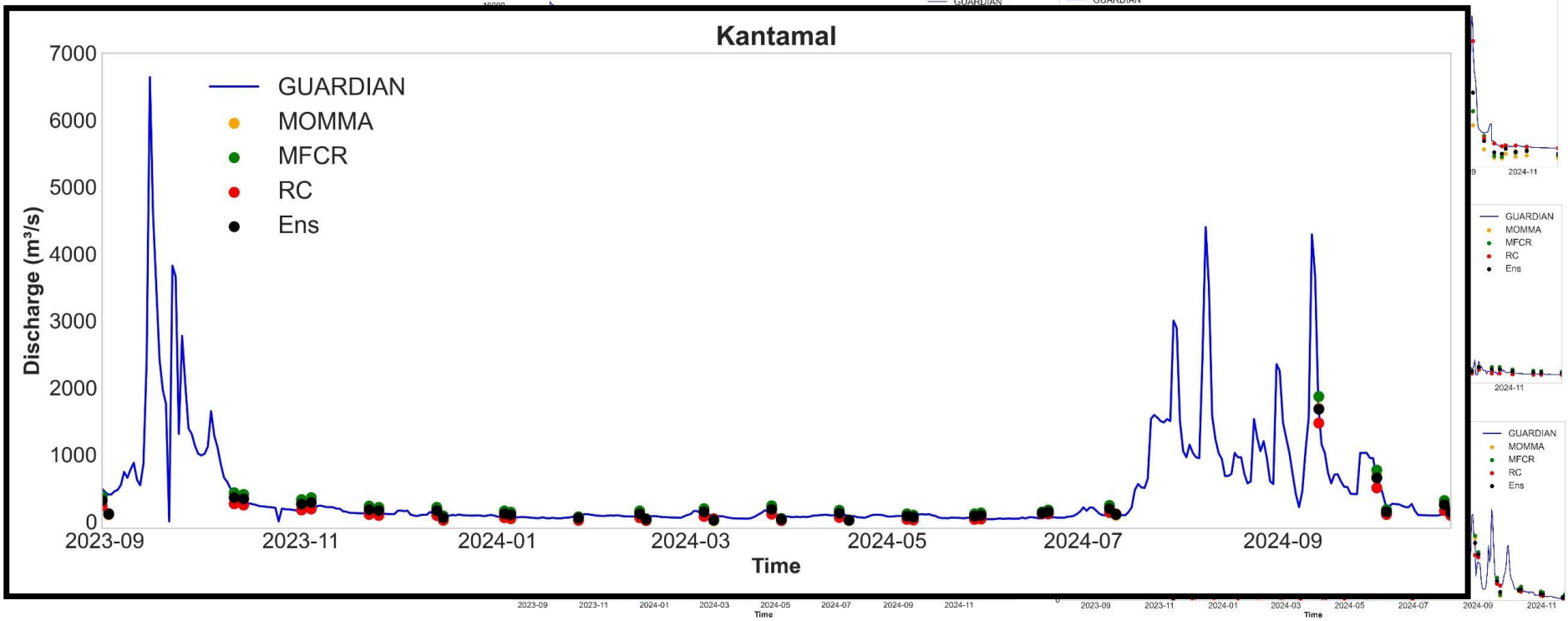
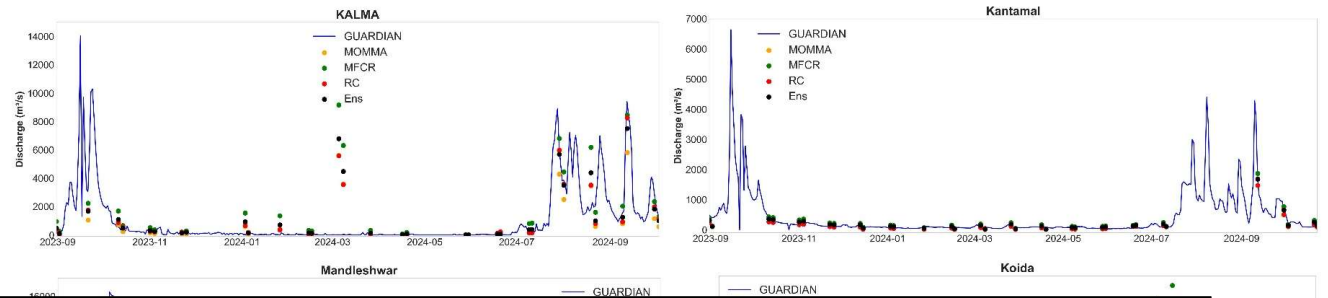
Can the SWOT WSE, Slope estimates + MERIT DEM based width estimates and GUARDIAN datasets help Optimizing FLP?



Scatter plot of WSE from SWOT with the width from SWOT and DEM-derived for all ten stations

DEM-derived width seems to show better hydraulic consistency, which shows a more stable and monotonic relationship, an essential characteristic for reliable discharge estimation

(Manuscript under preparation)



(Manuscript under preparation)

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CONCLUSION



YES!

Validation



YES!

River Discharge



MAYBE?

THANK YOU!

MERCI!

- The SWOT EA Team Faisal H, Margaret S
- Stephane Calmant (LEGOS), Hind Oubanas, Paris Adrien
- Central Water Commission, Odisha, India
- CEFIPRA project
- Collaborators from IIT Bombay Prof. Subhankar Karmakar, Prof. R. Balaji
- Excellent group of students!

