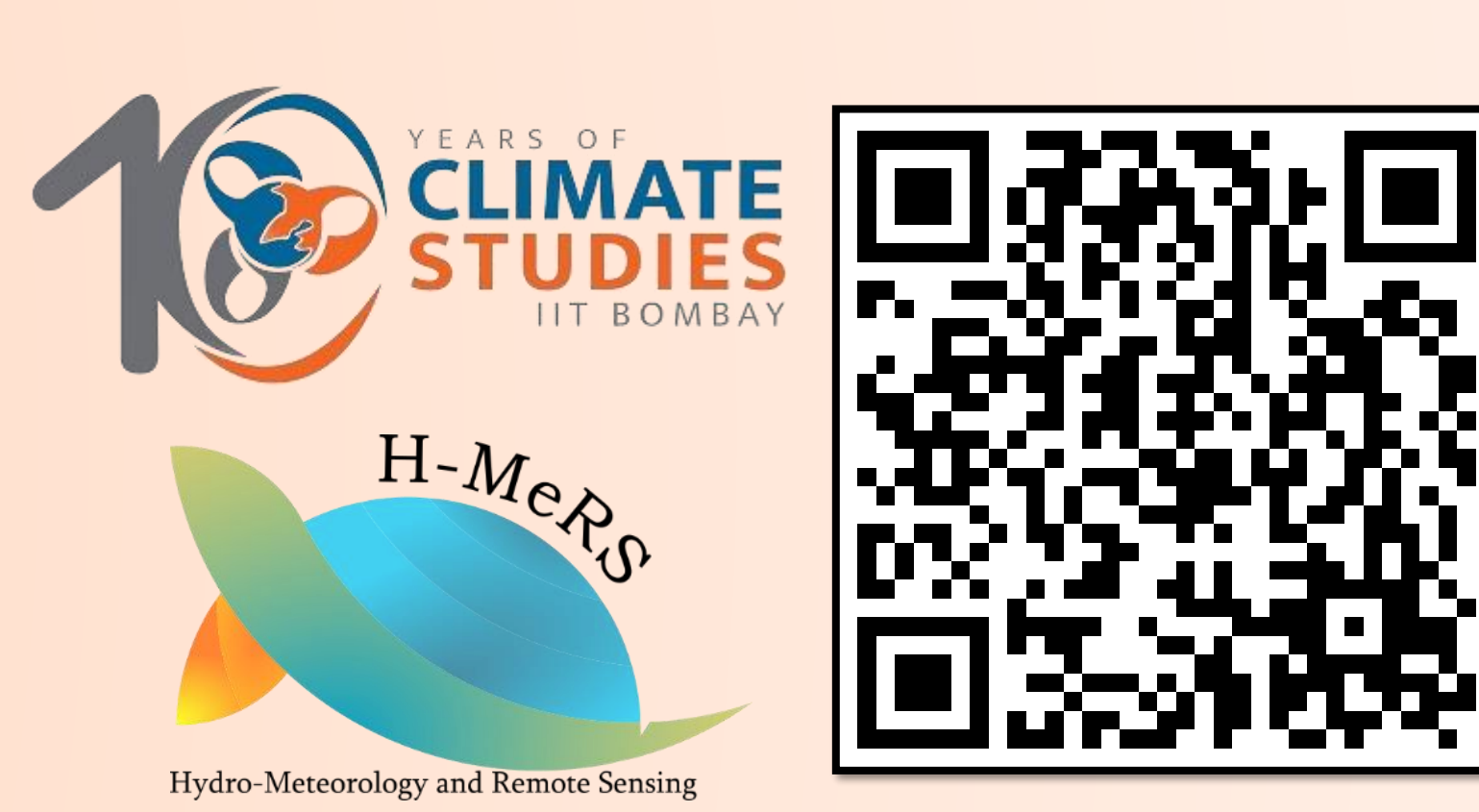




# Improving Flood Mapping Capabilities and Hydrological Model Calibration in India through the Surface Water and Ocean Topography (SWOT) Mission

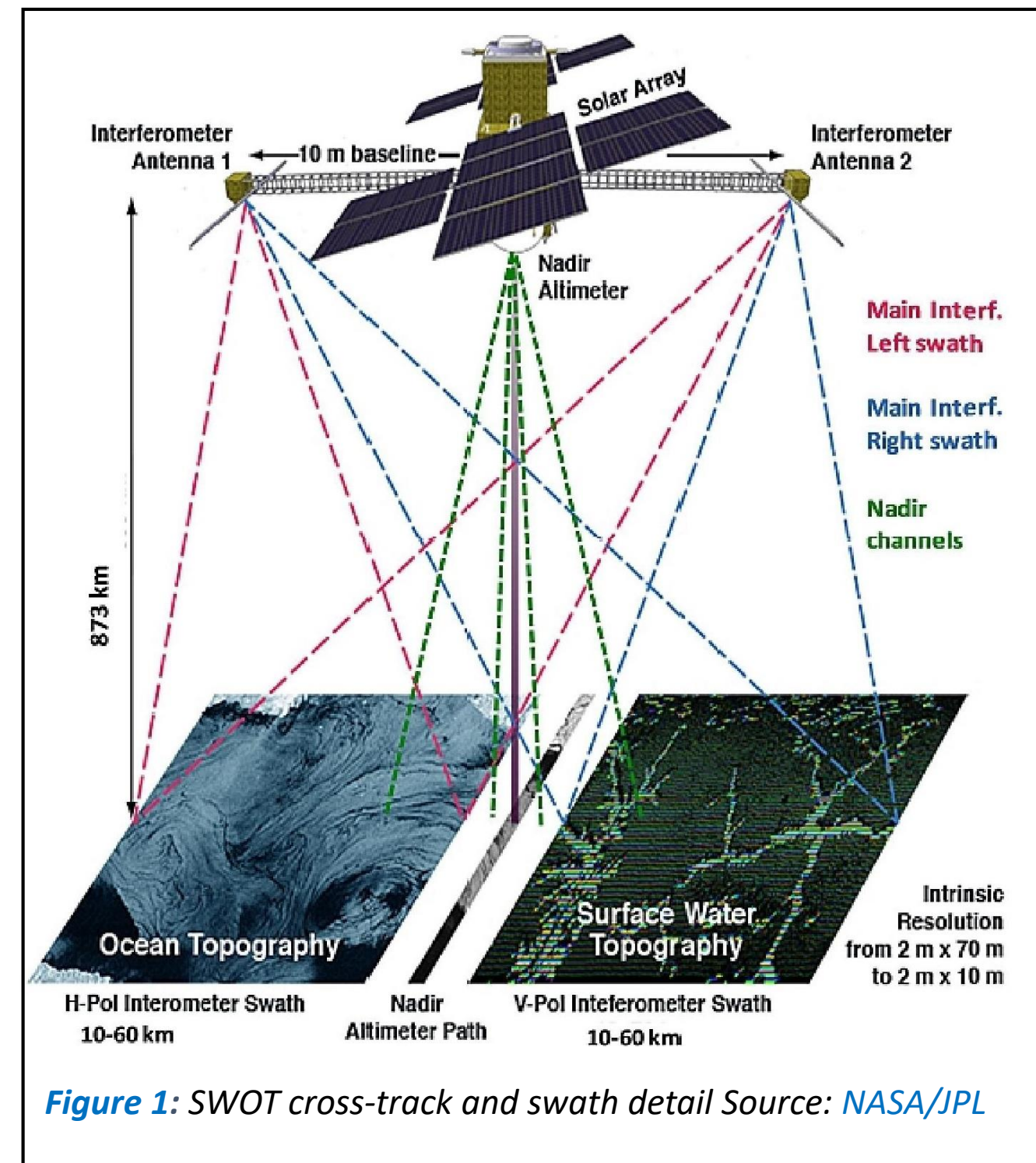
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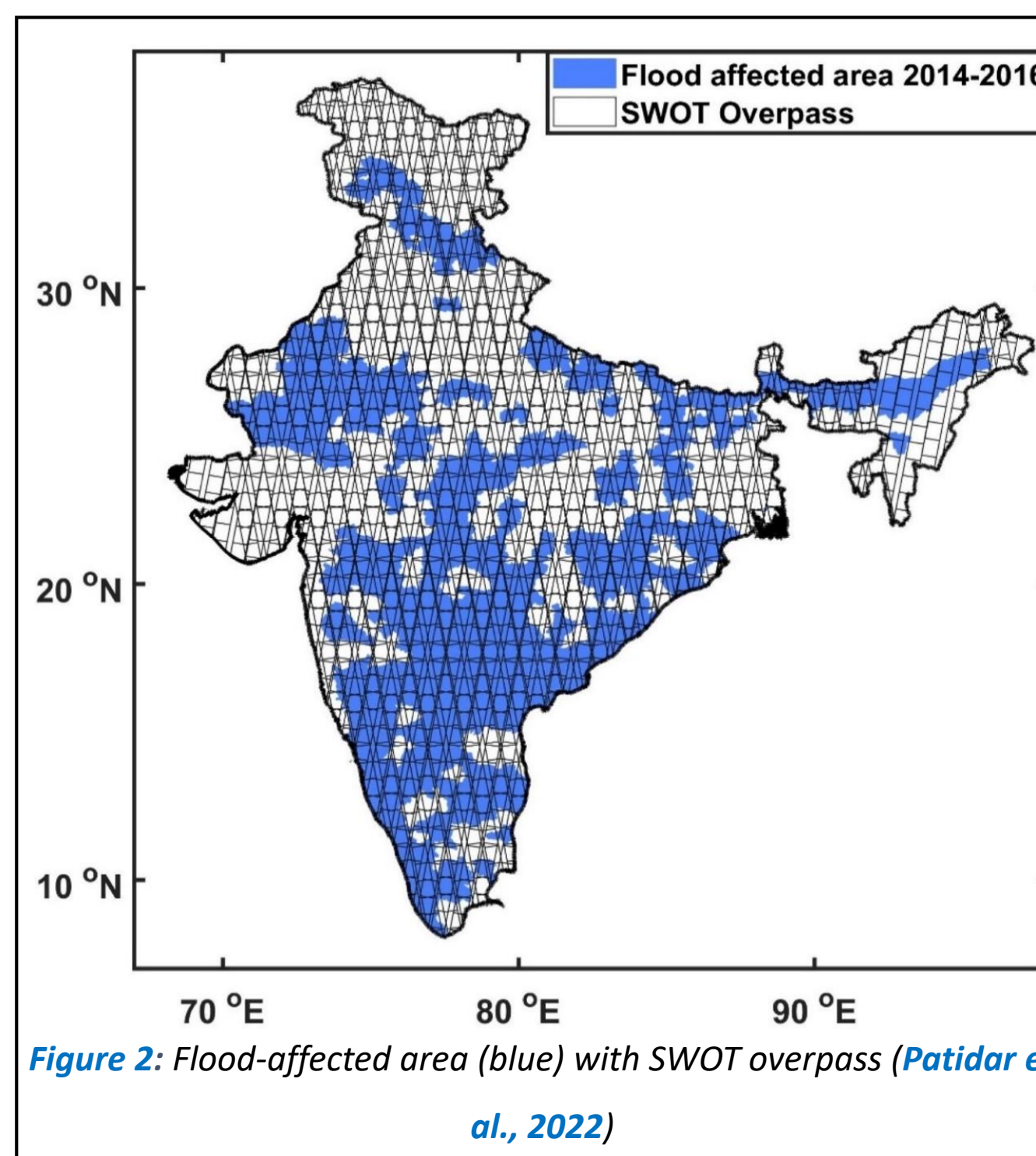
## Introduction

- The Surface Water Ocean Topography (SWOT) mission launched on 16<sup>th</sup> December 2022. SWOT will sense the earth's surface within the coverage using two wide swaths, 50km each across the satellite track, separated by 20km of nadir gap.
- The mission will have a nominal orbit repeat period of ~21 days.
- SWOT is expected to provide water surface elevation (WSE), water surface slope (WSS), and width for rivers wider than 100 m and water bodies as small as 0.062 Km<sup>2</sup>.
- The current study explores 1) the potential application of SWOT for flood mapping, 2) the uncertainties in SWOT-derived discharges and 3) hydrological model calibration over India.

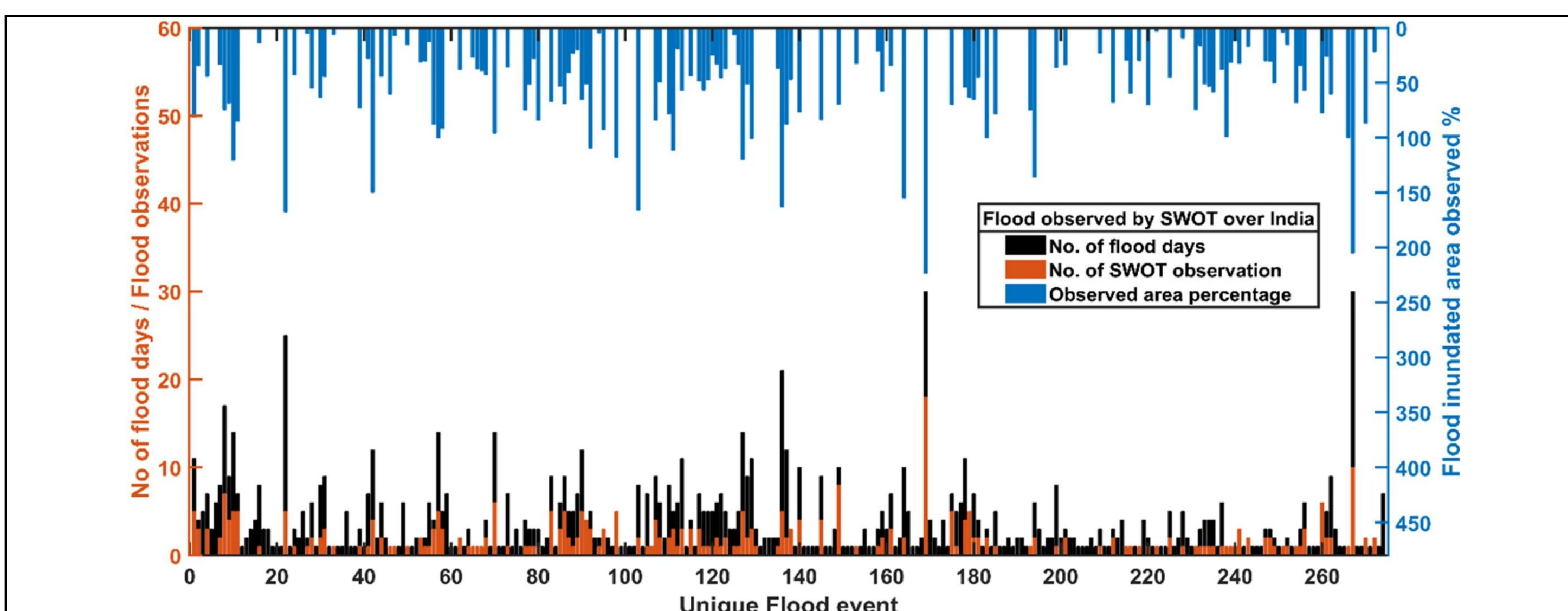


## 1) Flood Mapping over India using SWOT

- Through Patidar et al., (2022), we explore the potential of SWOT data for flood mapping over India for a hypothetical launch date of SWOT as 1<sup>st</sup> January 2014.
- Figure 2 displays the flood-affected areas during 2014-2016, with the corresponding SWOT overpass

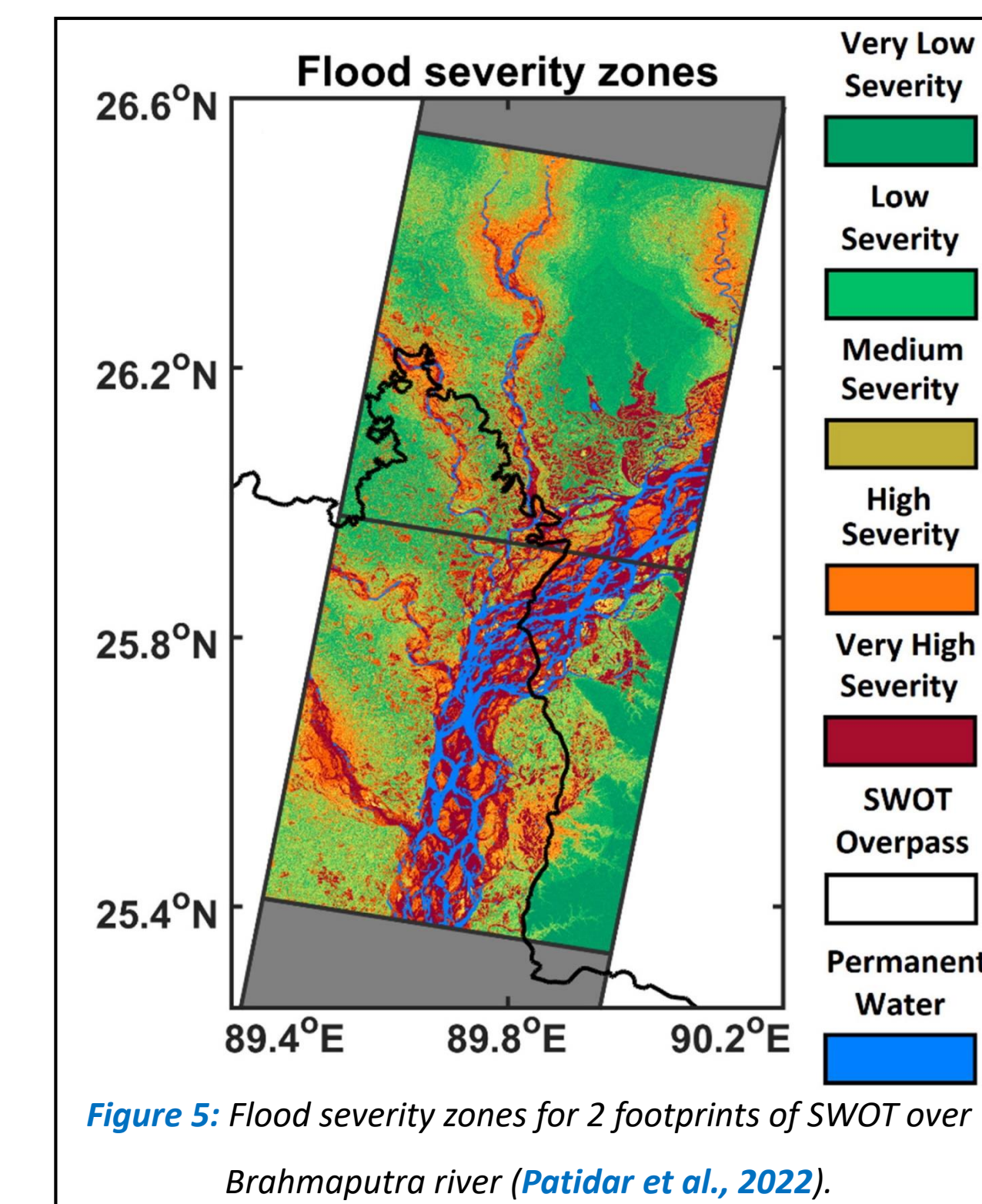
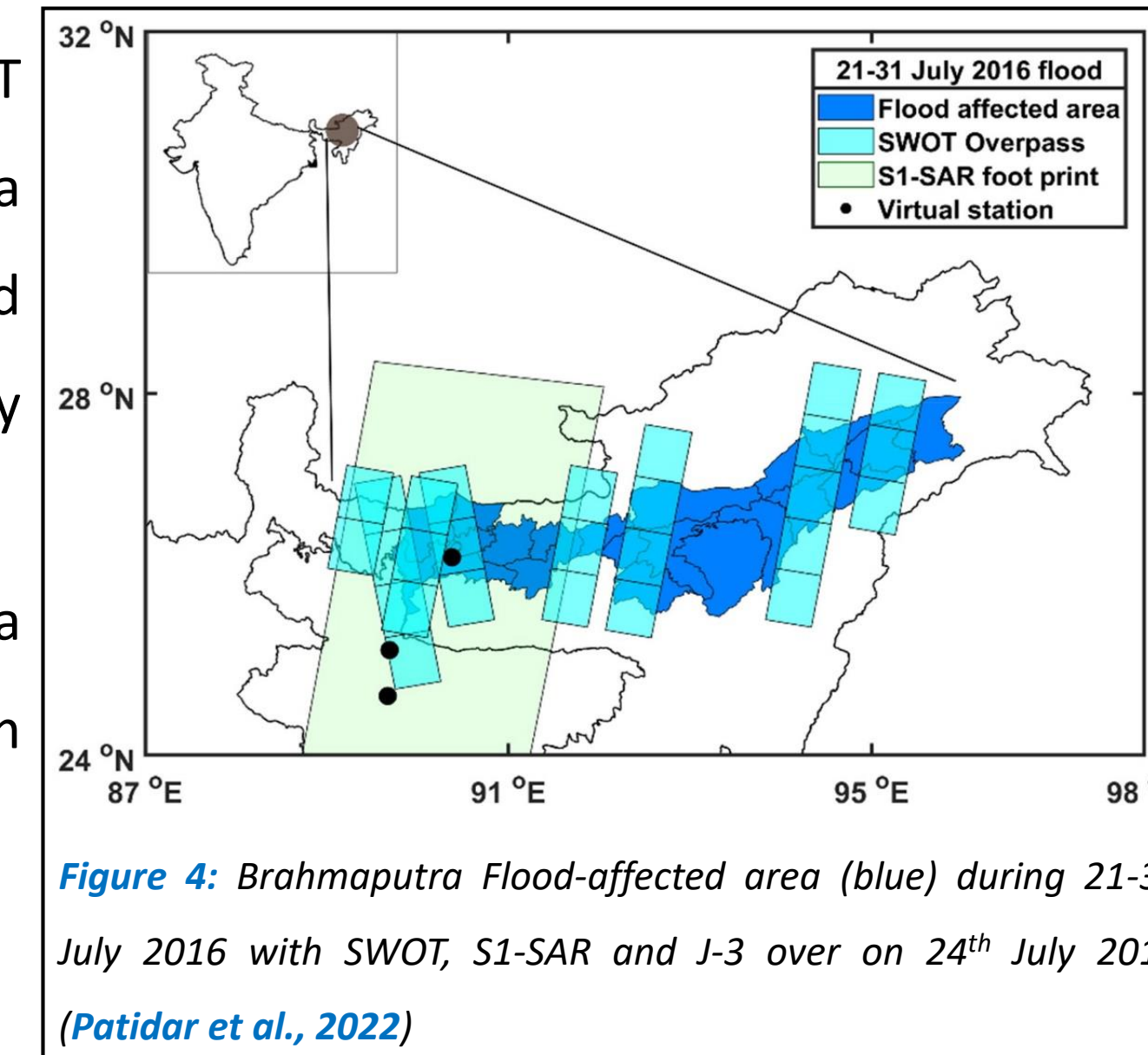


	No. Of Events	Observed by SWOT	Observed %
All Events	274	136	49.6 %
One days	109	23	21.1 %
Two days	165	113	61.8 %
Three days	127	102	64.5 %
Four days	96	82	85.4 %
> Four days	59	54	91.5 %



## 1.1) Flood Severity from SWOT

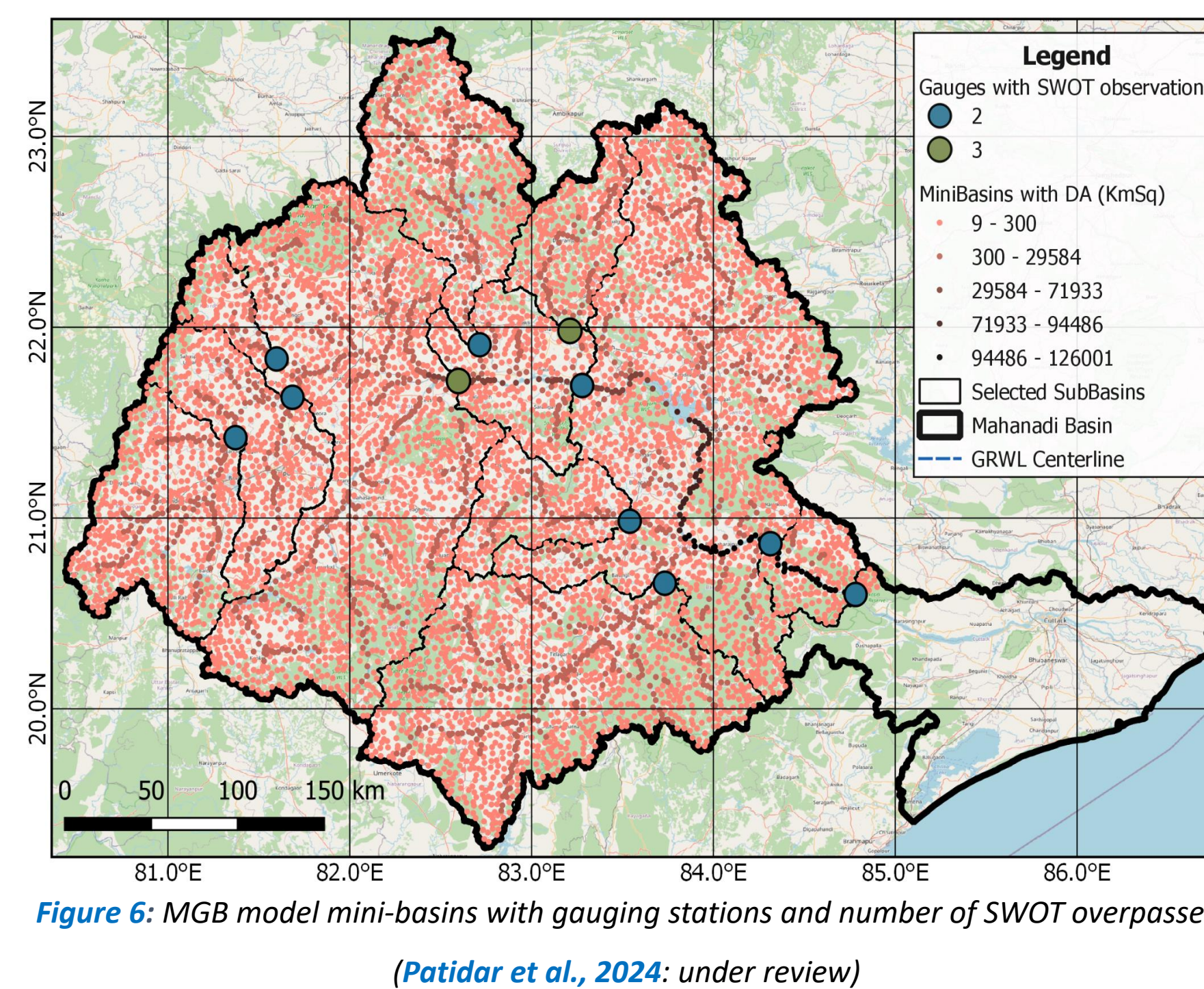
- Through Patidar et al., (2022), we examine SWOT observations of a 11 day flood event in Brahmaputra river, on the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and 6<sup>th</sup> day of the flood event (which falls on 22<sup>nd</sup>, 23<sup>rd</sup>, 24<sup>th</sup>, and 26<sup>th</sup> July 2016; Figure 4)
- A flood severity map for the flood-affected area corresponding to two SWOT footprints over a stream of the Brahmaputra River is generated (Figure 5).



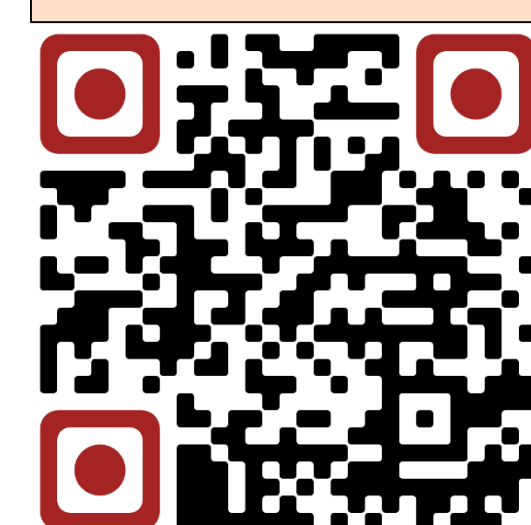
- The severity map provides a unique insight into the flood-affected area that was missing in traditional flood-affected area mapping using optical and SAR datasets.
- The study area is part of the transboundary zone of India and Bangladesh, and the severity map provides a high-resolution insight into the flood severity zonation in the transboundary conflict zone with minimum computational resources.

## 2) Uncertainty in SWOT Discharge

- Research Question:** If SWOT WSE is reported to have an error of <25cm, what is the uncertainty in ensuing discharges over Mahanadi river basin, India?
- SWOT-type discharge ( $Q_{SWOT}$ ) shows NSE ranges from 0.75 to 0.97, with corresponding NRMSE ranges from 1.30 % to 5.26 %.
- Furthermore, MGB hydrological model is calibrated using SWOT-type and gauge discharge data.



### Contact Details

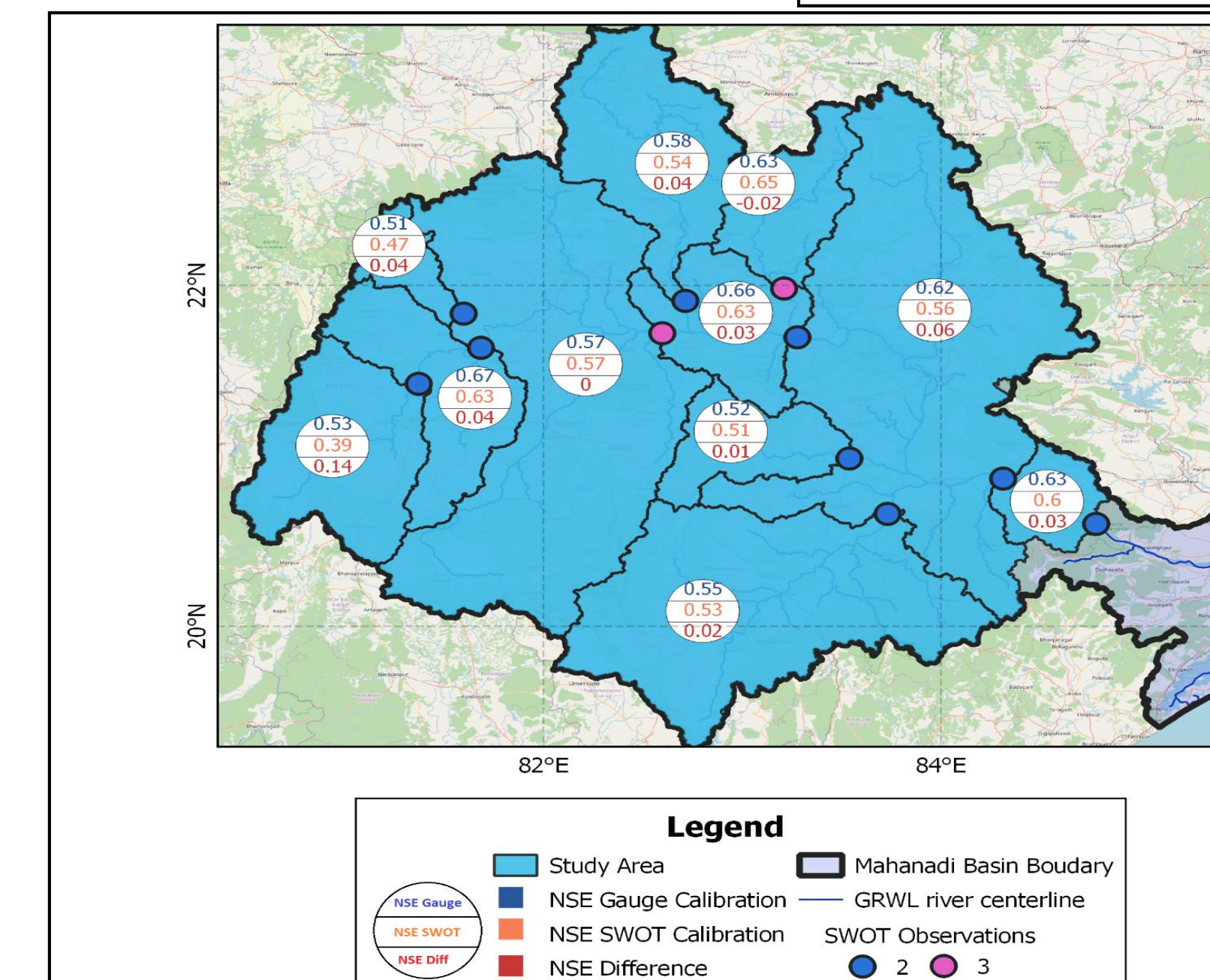
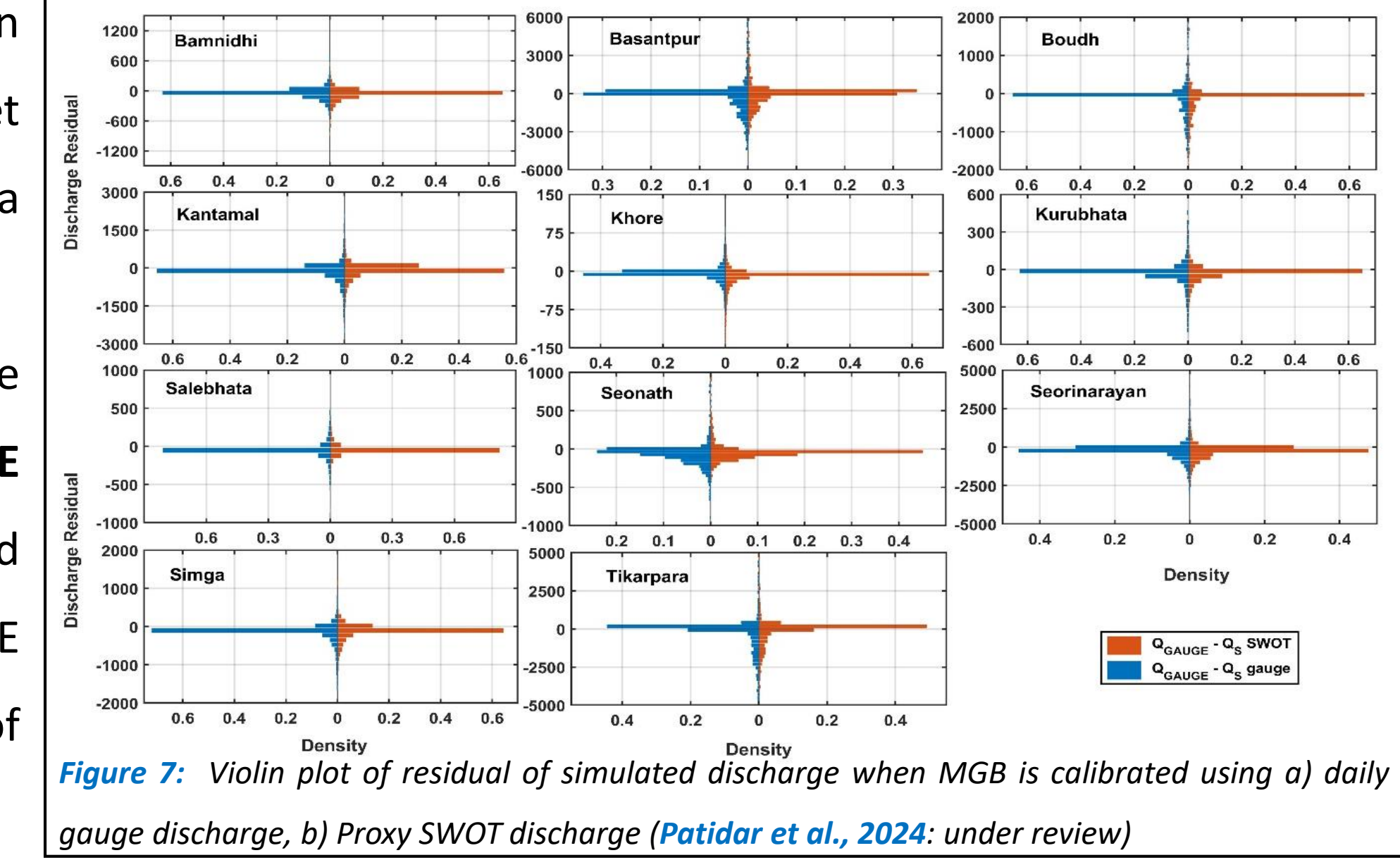


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## 3) Hydrological Model Calibration using SWOT

- Research Question:** Can SWOT-type discharge dataset be used to calibrate a hydrological model?
- MGB calibrated using gauge discharge: NSE and NRMSE range from 0.51 to 0.67 and 2.24% to 7.61%, with the NSE value of 0.63 at the outlet of the Mahanadi basin.



- MGB calibrated using  $Q_{SWOT}$ : NSE and NRMSE range from 0.46 to 0.63 and 2.36% to 8.03%, with the NSE value of 0.60 at the outlet of the Mahanadi basin.
- Minimum and maximum change in NSE being 0 and 0.14, respectively.
- Interestingly, one station even exhibits enhanced NSE when the MGB model is calibrated using SWOT based discharge data (Nickles et al., (2020)).

## Conclusion

- SWOT data can be used to generate flood severity zone mapping in the frequent flood-prone and data-scarce regions in India.
- SWOT mission is showing great potential for hydrological model calibration over Indian basins.
- SWOT discharge even shows enhanced performance over some sub-basins for hydrological model calibration compared to gauge discharge

### References

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### Acknowledgement

