Satellite-based Hydrological Model (SHM): Quantification of Uncertainty in Streamflow Simulation

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Satellite-based Hydrological Model (SHM): Quantification of Uncertainty in Streamflow Simulation

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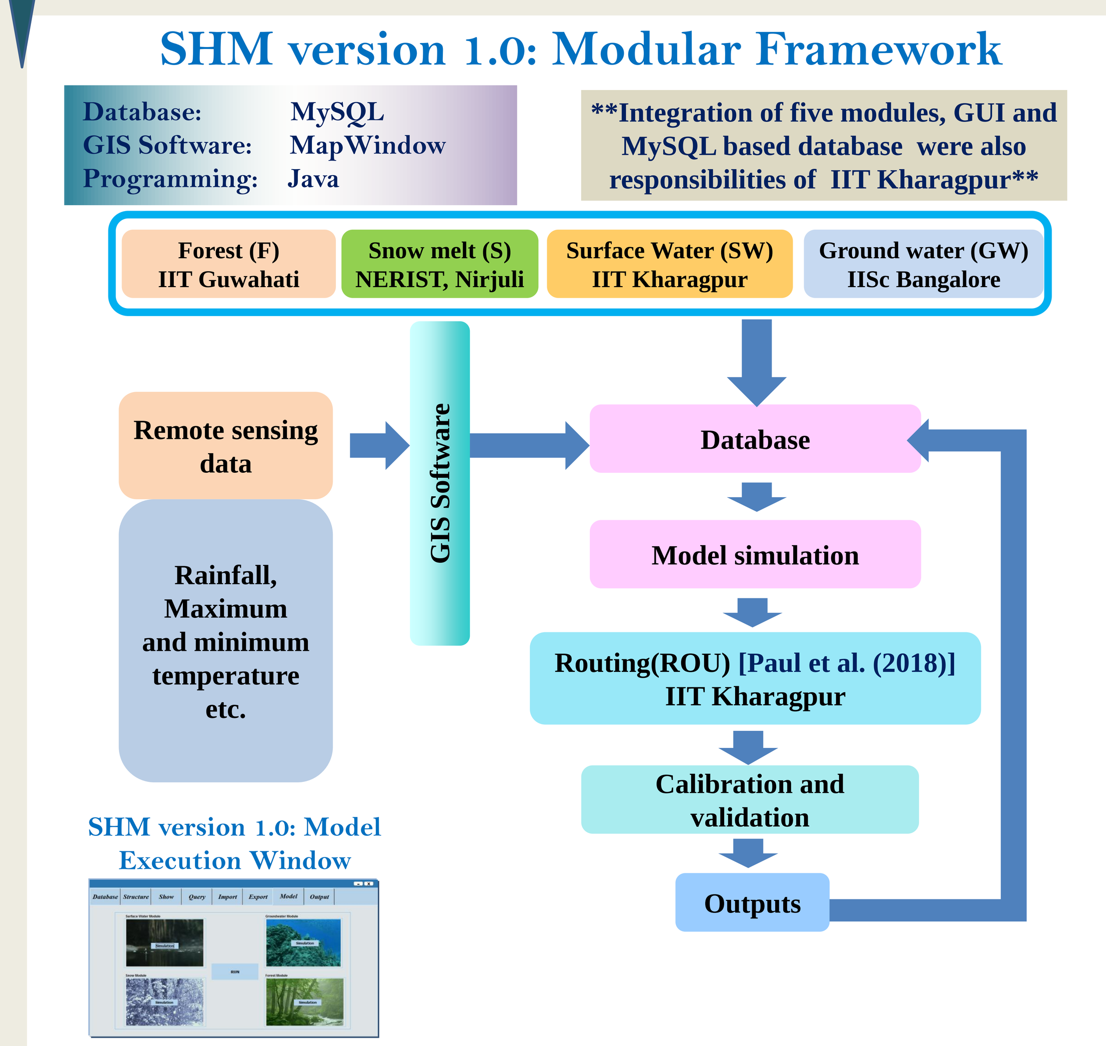
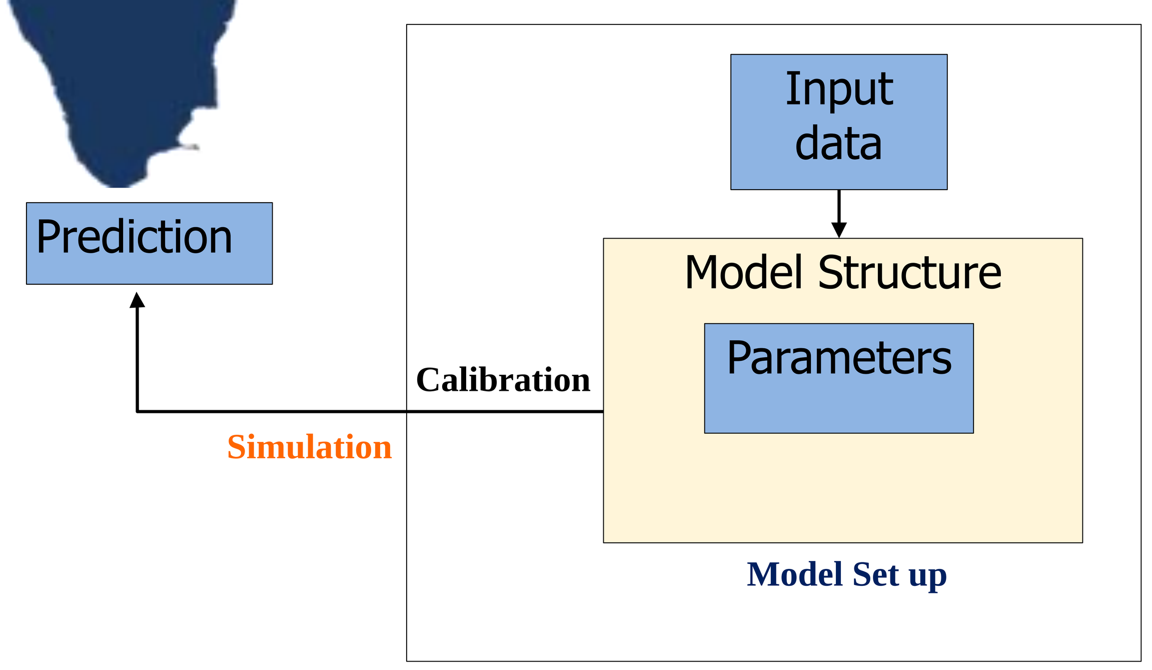
Background



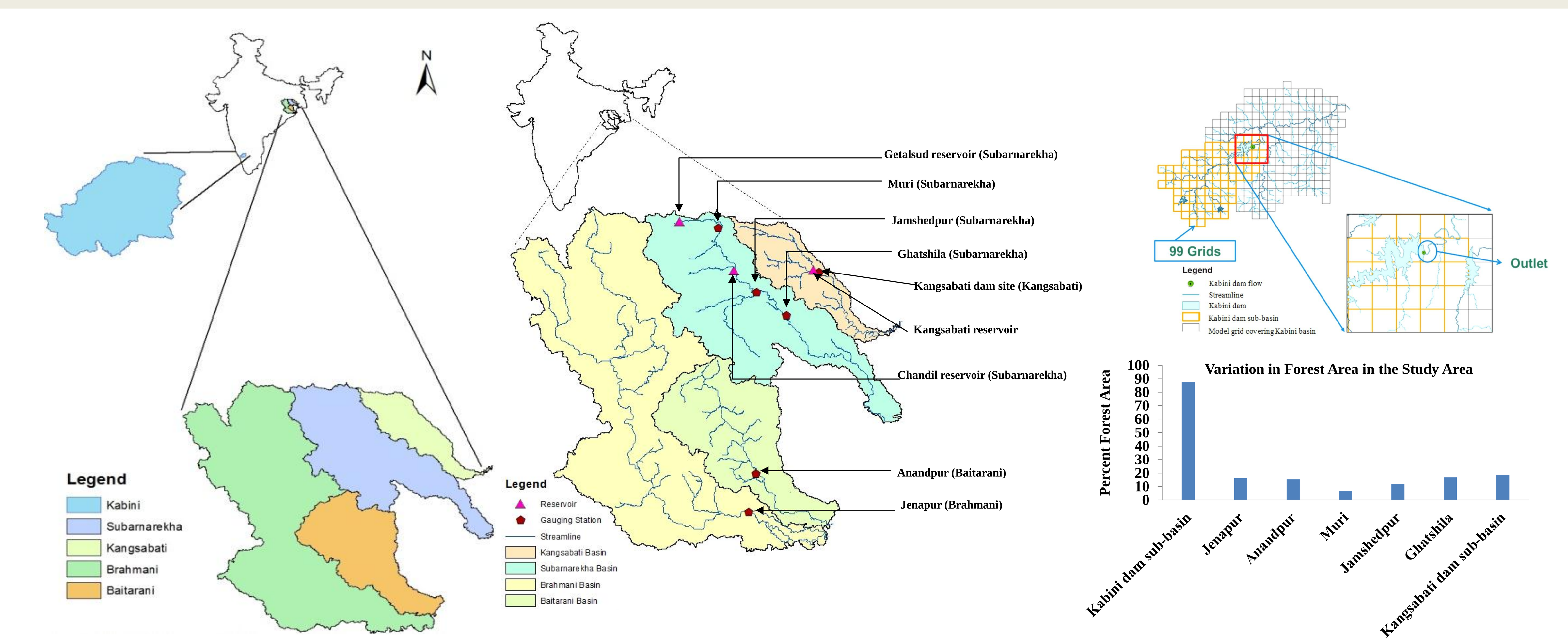


- Uncertainty analysis of the prediction covers all the sources of uncertainty.
- Quantile Regression [Kumar et al. (2015)] has been selected for the purpose.
- Few terms related to quantile regression
  - Absolute (Observed – Simulated)=Residual
  - Normalized Quantile Simulation (NQS)
  - Normalized Quantile Residual (NQR)

Objective

To analyze prediction uncertainty of the newly developed model

Study Area



Methodology: Calibration and Validation

SHM has been manually calibrated and validated for daily streamflow simulations in seven sub-basins for the periods:

	Anandpur (Baitarani)	Jenapur (Brahmani)	Kabini dam sub-basin (Kabini)	Kangsabati dam sub-basin (Kangsabati)	Muri (Subarnarekha)	Jamsehdpur (Subarnarekha)	Ghatshila (Subarnarekha)
Calibration	1977-1989	1995-1999	2002-2006	1987-1995	1992-1998	1987-1995	1987-1995
Validation	1991-2003	2000-2004	2007-2010	1996-2003	1999-2003	1997-2005	1998-2004

Methodology: Uncertainty Analysis

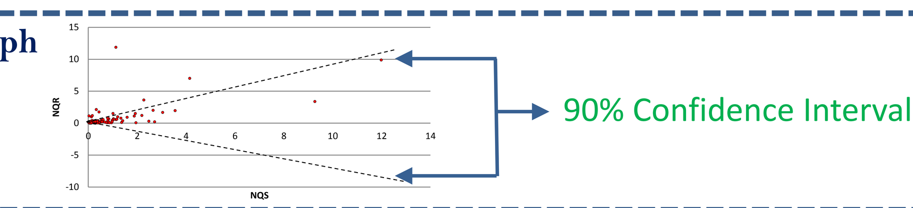
Step-1: Calculation of NQR and NQS

Date	Observed	Simulated	Residual	NQS	NQR
1987-01-05	4.05	23.95	19.90	0.27	0.21
1987-01-06	6.78	14.59	7.81	0.32	0.27
1987-01-07	6.78	15.14	8.36	0.32	0.27
1987-01-08	6.44	21.74	15.30	0.29	0.23
1987-01-09	0.00	25.29	25.29	0.27	0.18
1987-01-10	0.00	10.58	10.58	0.34	0.25

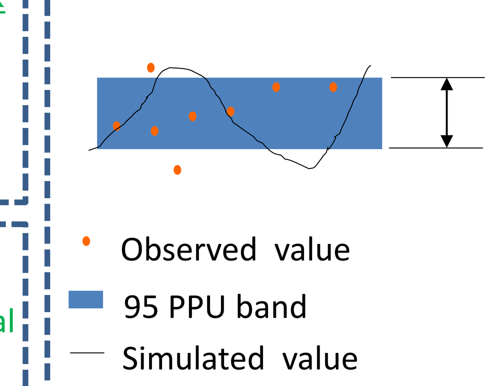
$NQR = \frac{R-\mu_R}{\sigma_R}$

$NQS = \frac{S-\mu_S}{\sigma_S}$

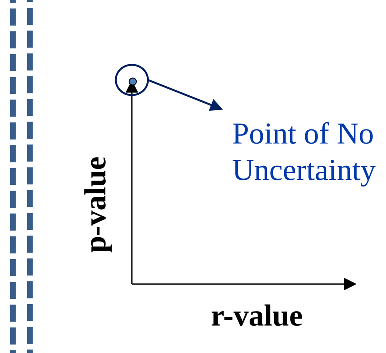
Step-2:Plotting of NQR vs NQS graph



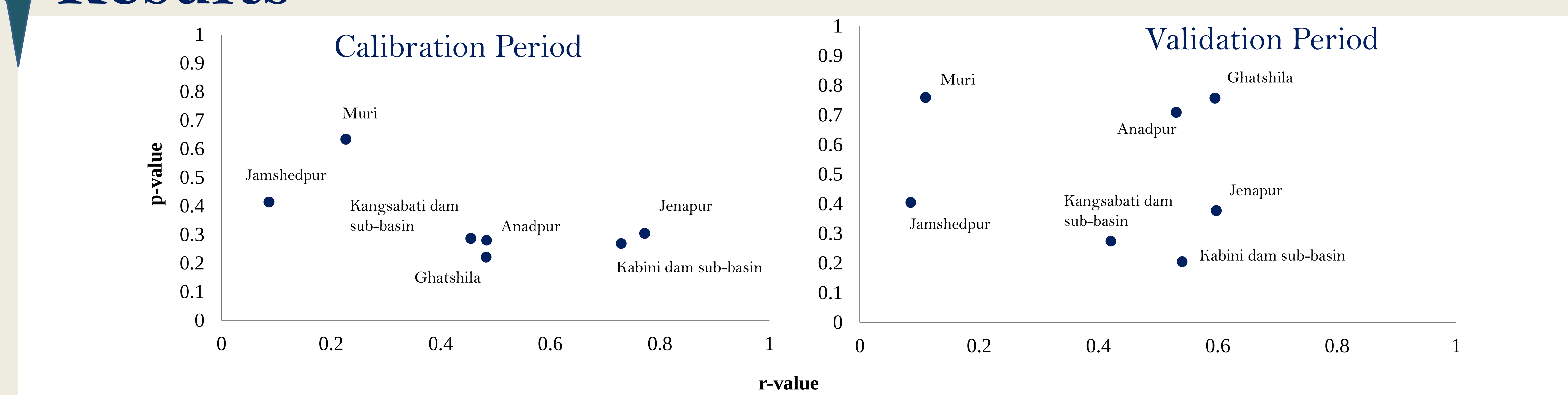
Step-3: Generation of 95PPU band

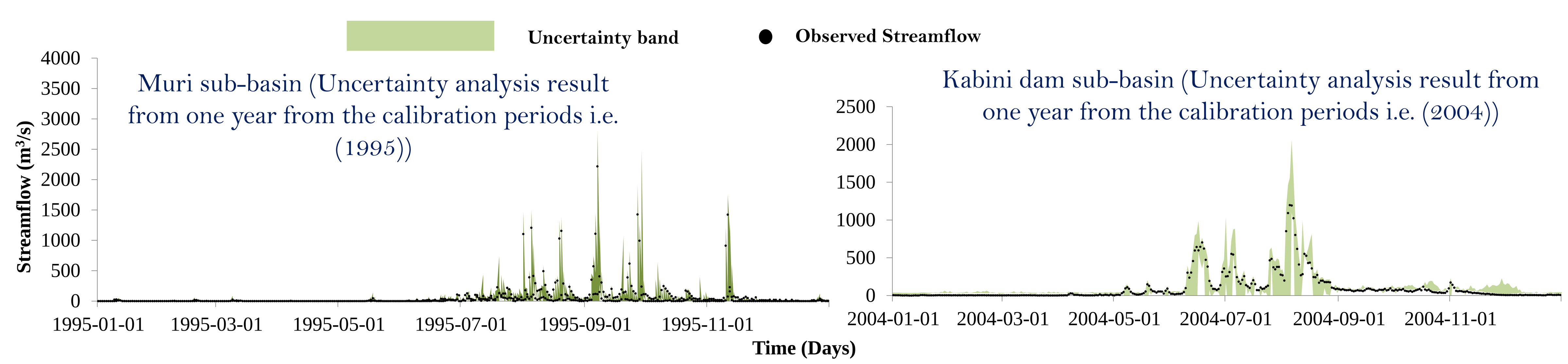


Step-4: Generation of p-value vs r-value plot



Results





Conclusions

- Uncertainty is maximum in Kabini dam sub-basin (forest land cover =87.88%) and minimum in Muri sub-basin (forest land cover =6.90%).
- Results show that 'F' module needs improvement for reducing uncertainty.
- The study highlights the importance of the uncertainty analysis in identifying the drawbacks of a hydrological model.

References

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