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Vienna, Austria & Online | 23–27 May 2022

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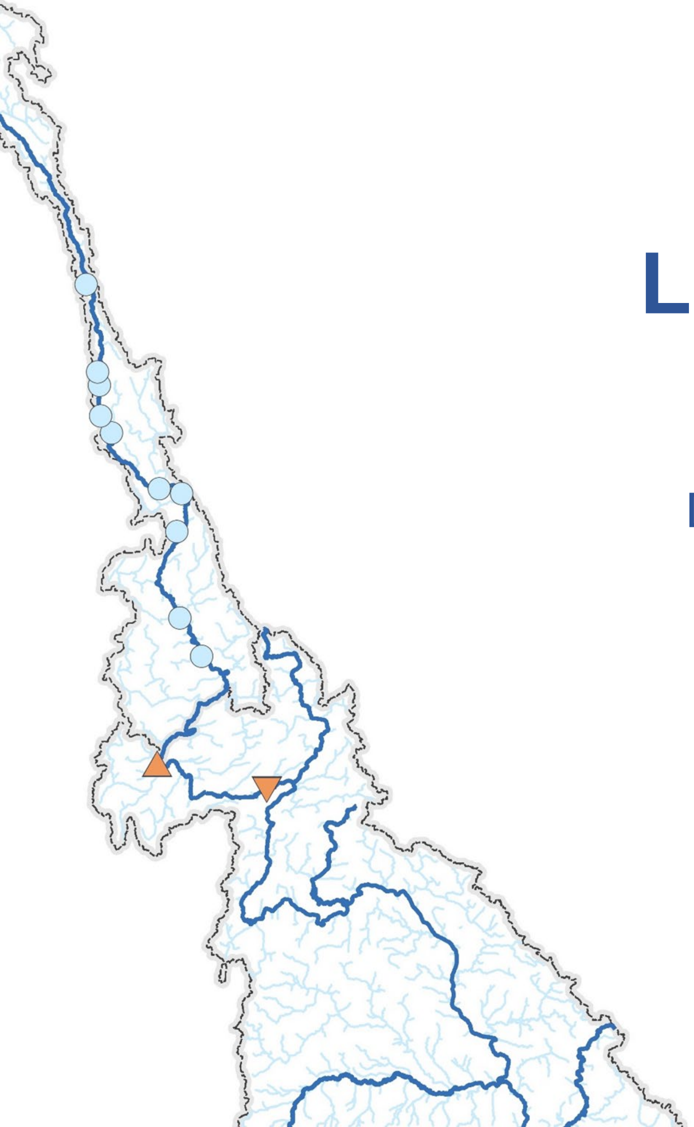

Improving the Reliability of Large-scale Hydrological Model with Satellite Observations

Dung Trung Vu[1], Thanh Duc Dang[2], and Stefano Galelli[1]

[EGU22-4817]

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(1)

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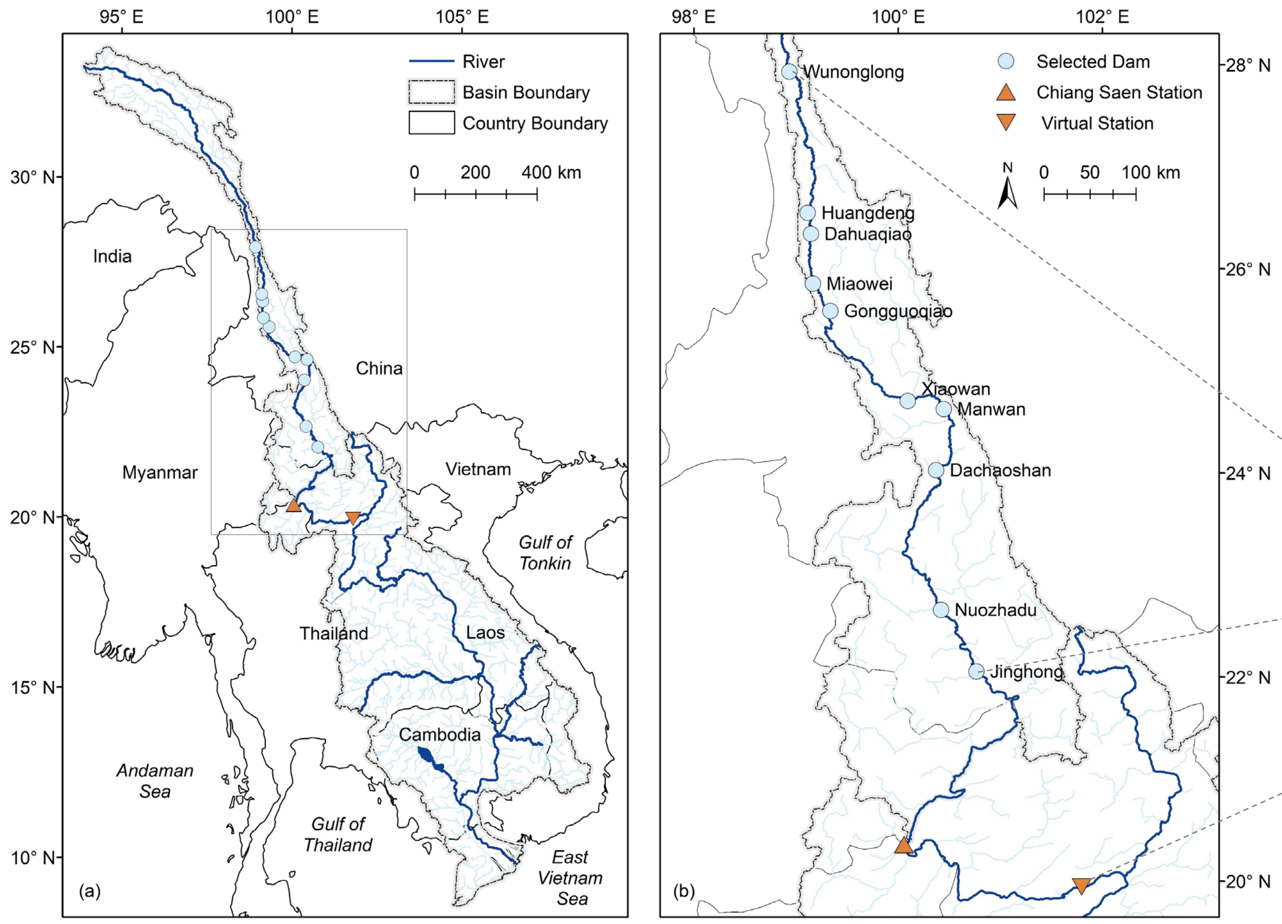
(2)

Problem Statement



Mekong River Basin (a) and its upper portion (b)

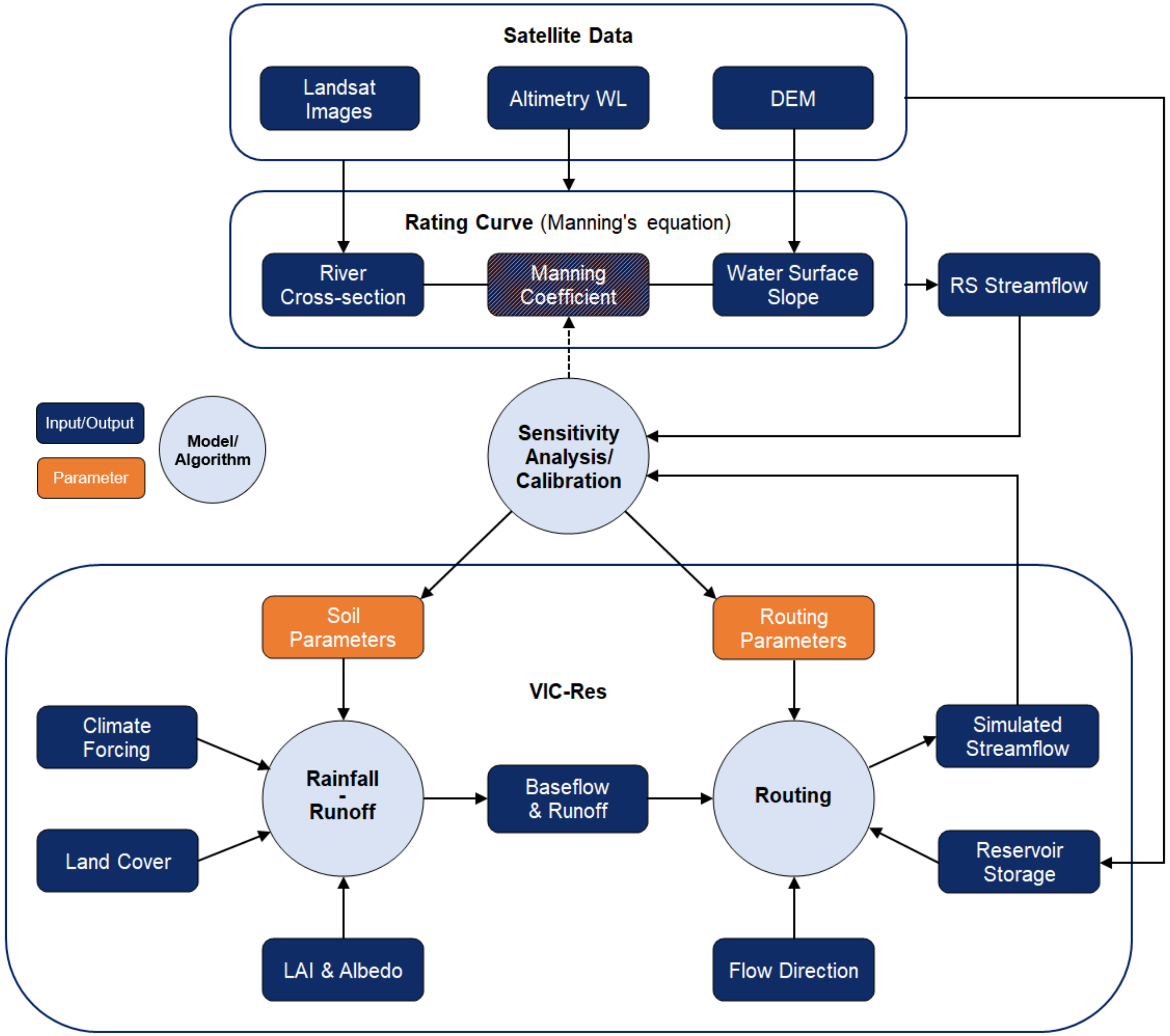
- Popularity of **large-scale hydrological models**
- A challenging task: **lack of data**
  Data are often not measured or shared between the riparian countries of transboundary rivers

➢ **Reservoir storage**

➢ **River discharge**

Satellite observations

Methodology

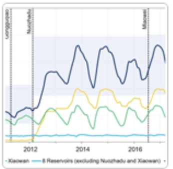


Methodology | Hydrological Model with Reservoir Operations

Hydrol. Earth Syst. Sci., 26, 2345–2364, 2022
https://doi.org/10.5194/hess-26-2345-2022

05 May 2022

Satellite observations reveal 13 years of reservoir filling strategies, operating rules, and hydrological alterations in the Upper Mekong River basin



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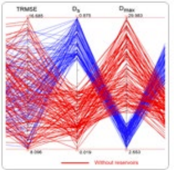
3 Department of Civil and Environmental Engineering, University of Washington, Seattle, WA, USA

Hydrol. Earth Syst. Sci., 24, 397–416, 2020
https://doi.org/10.5194/hess-24-397-2020

24 Jan 2020

On the representation of water reservoir storage and operations in large-scale hydrological models: implications on model parameterization and climate change impact assessments



Thanh Duc Dang, A. F. M. Kamal Chowdhury, and Stefano Galelli
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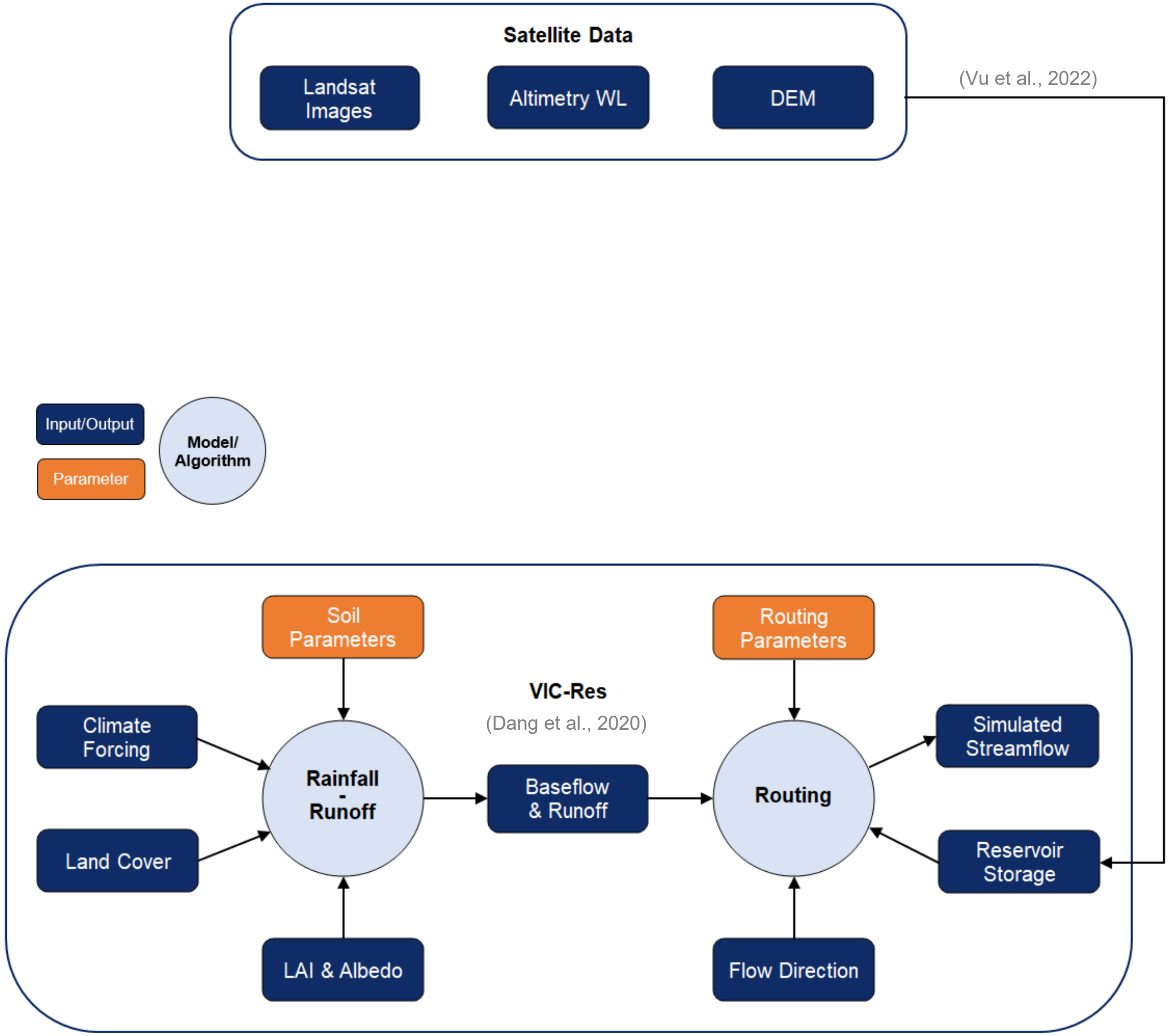
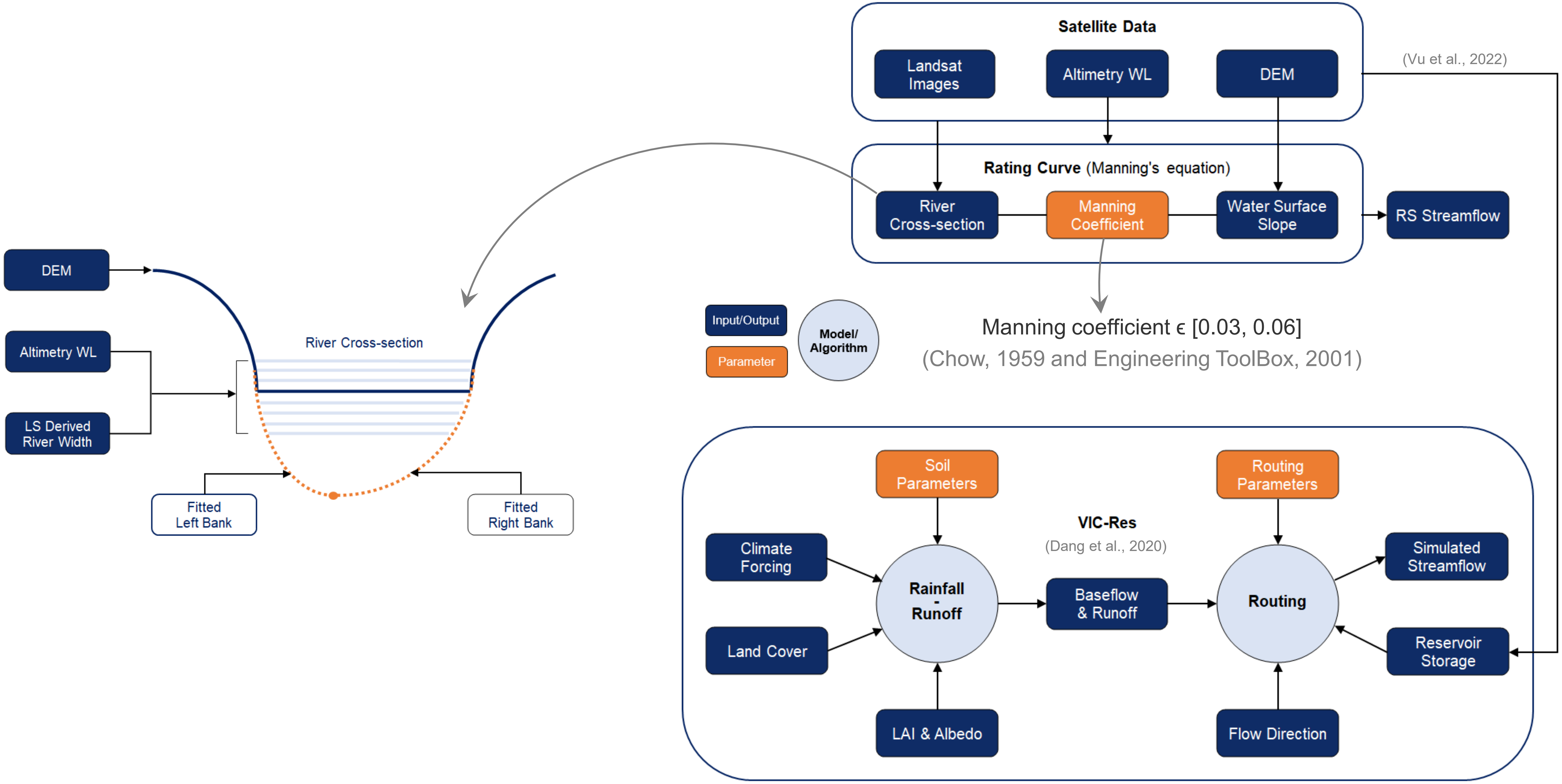
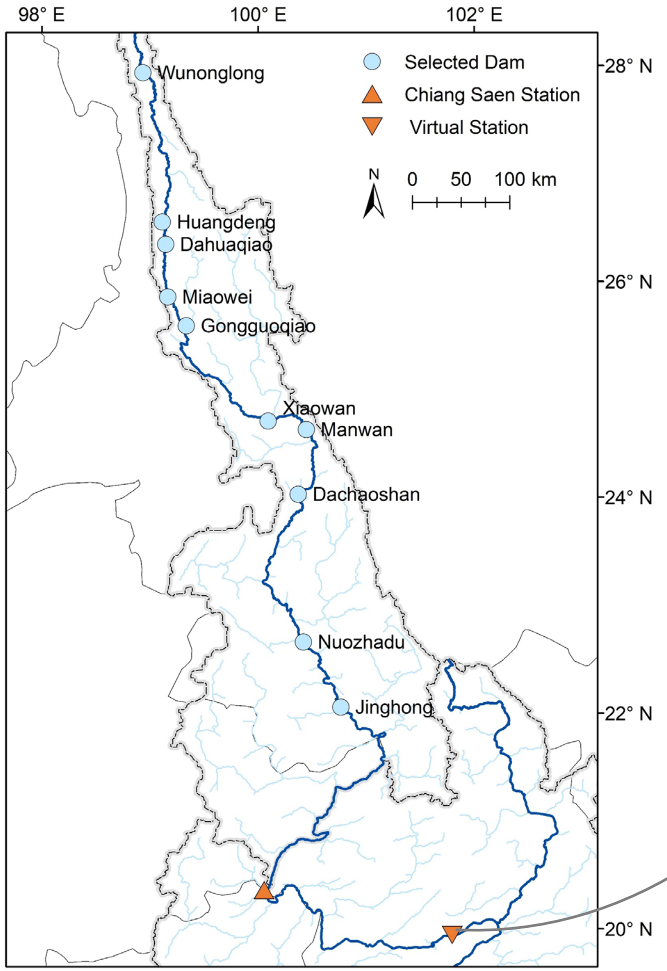


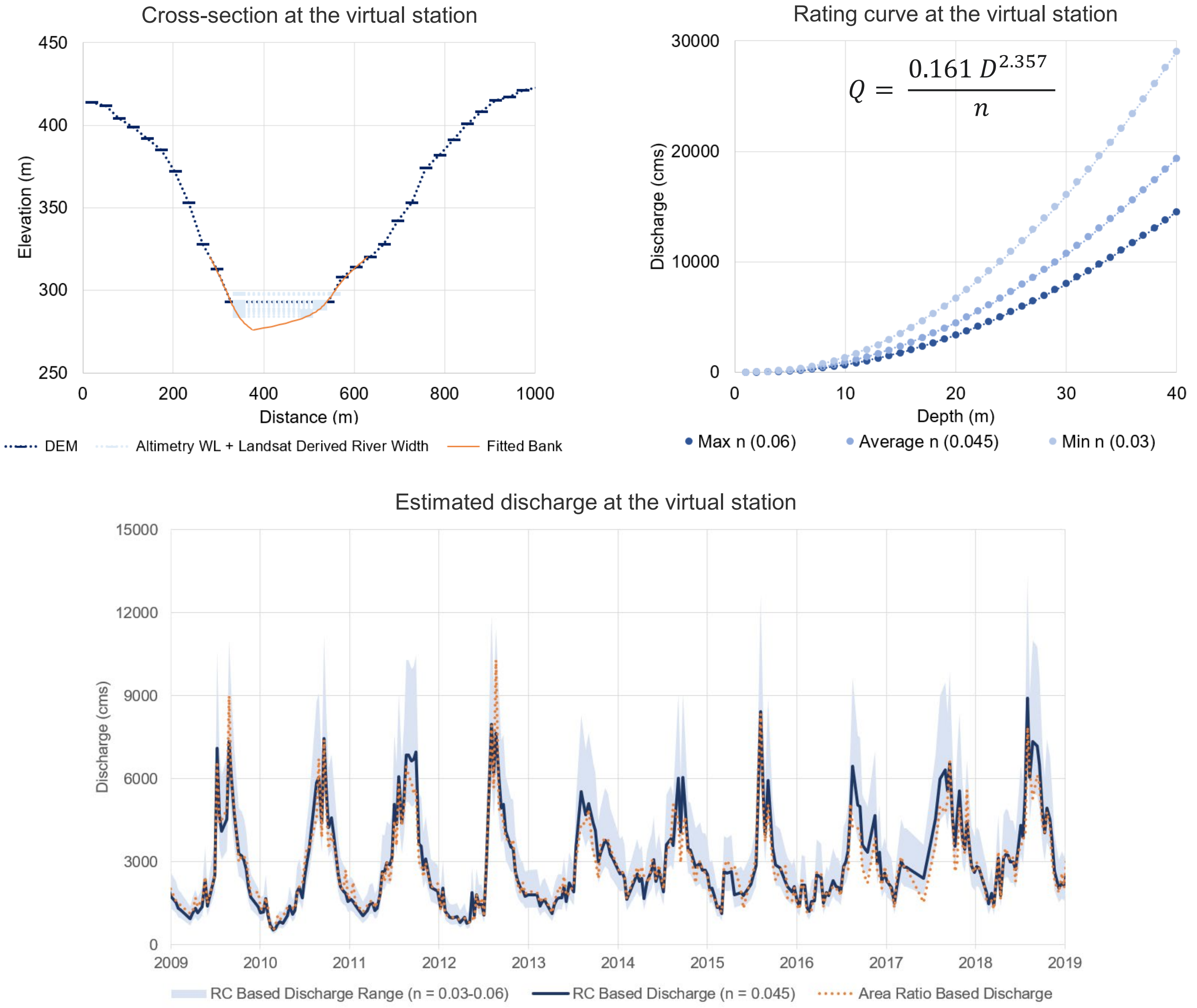
Methodology | Remote-sensed Discharge



Results

Remote-sensed Discharge





Methodology | Sensitivity Analysis

- 10 input factors: 7 soil parameters
  2 routing parameters
  Manning coefficient

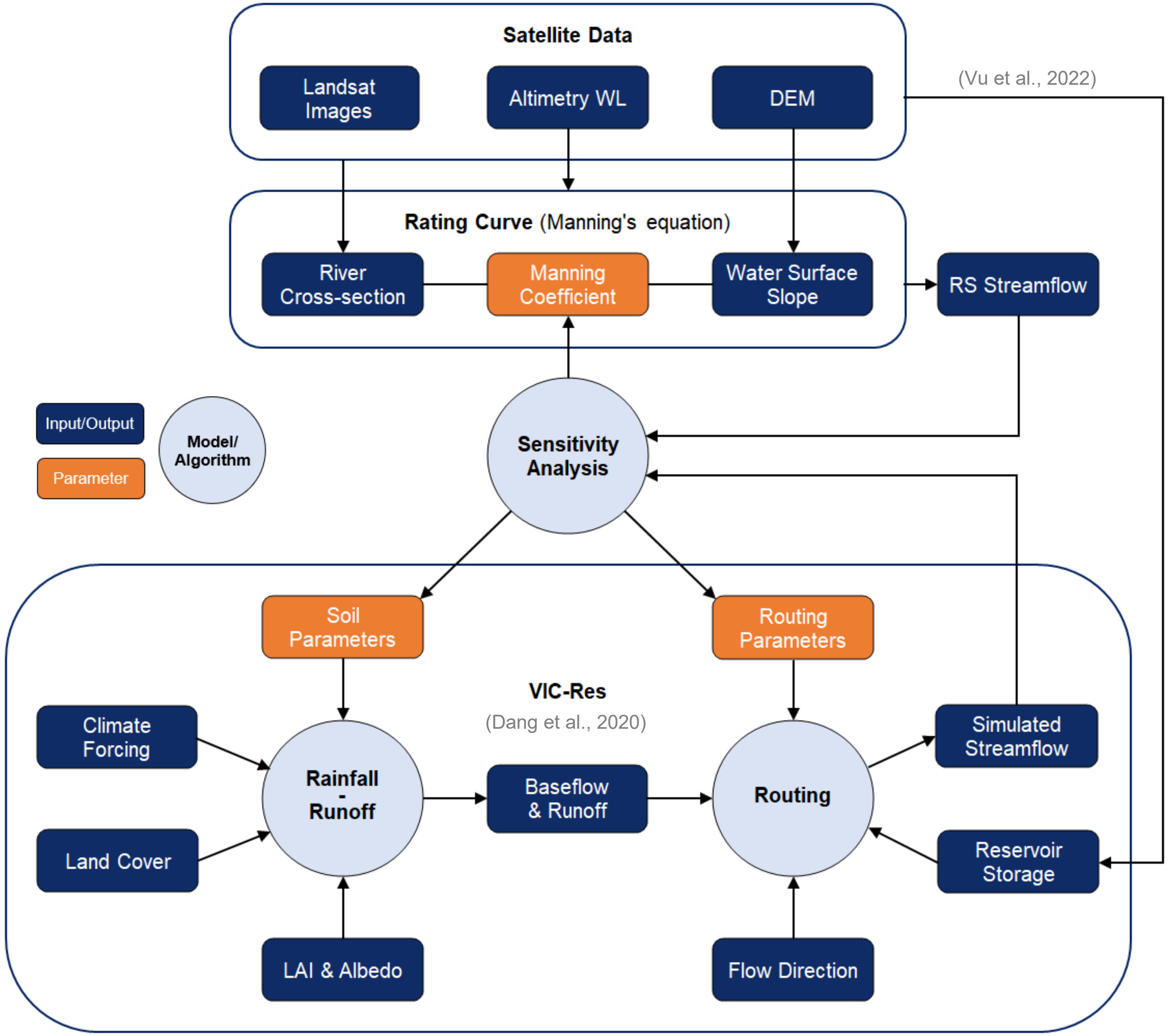
- 4 scalar model outputs: statistical indicators

Indicator	Captured aspect of model accuracy
NSE	High flow
TMRSE	Low flow
MSDE	Shape of hydrograph
ROCE	Water balance

(Dawson et al., 2010, and Dang et al. 2020)

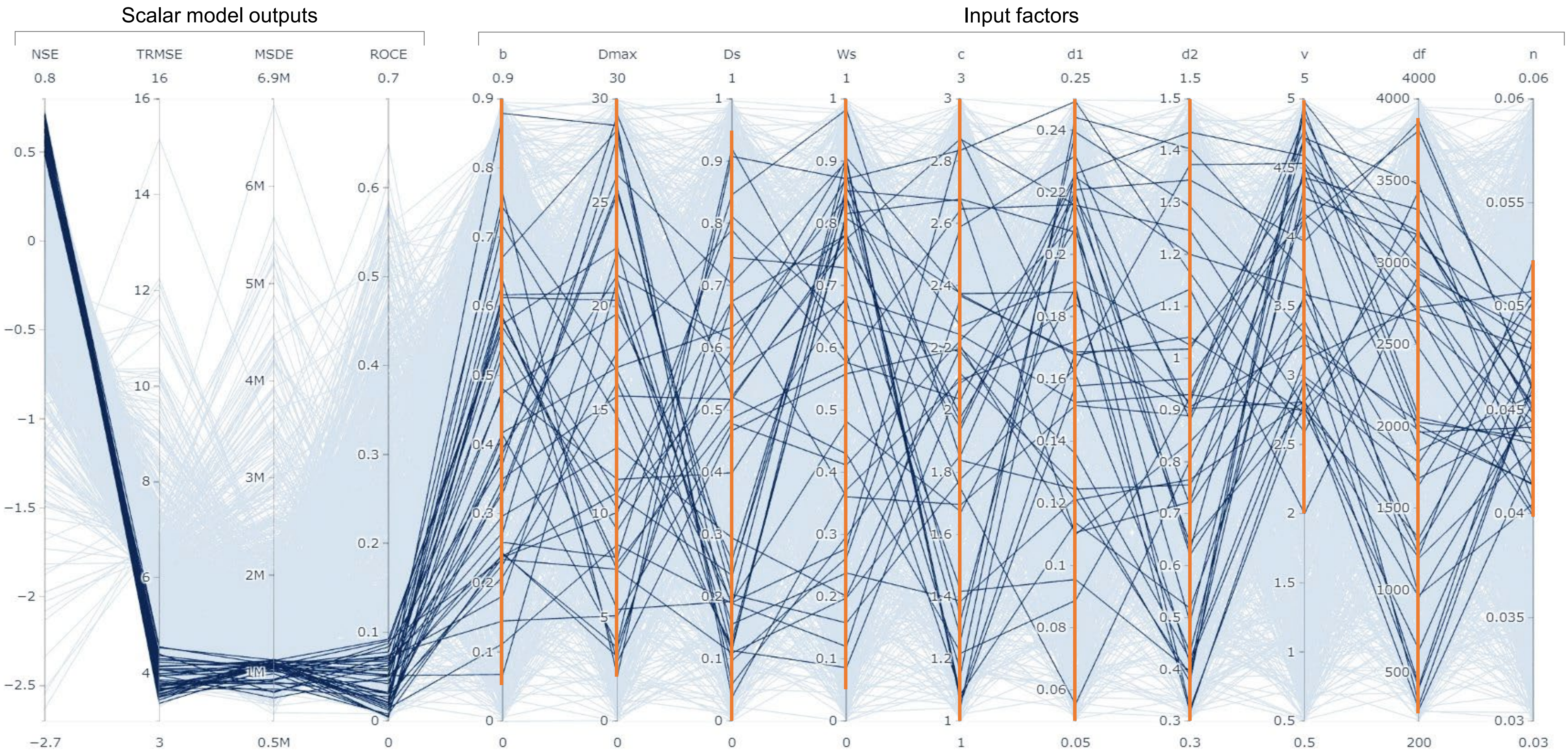
- Input sampling: Latin hypercube sampling with multidimensional uniformity

- Sample size: 1000



Results | Sensitivity Analysis

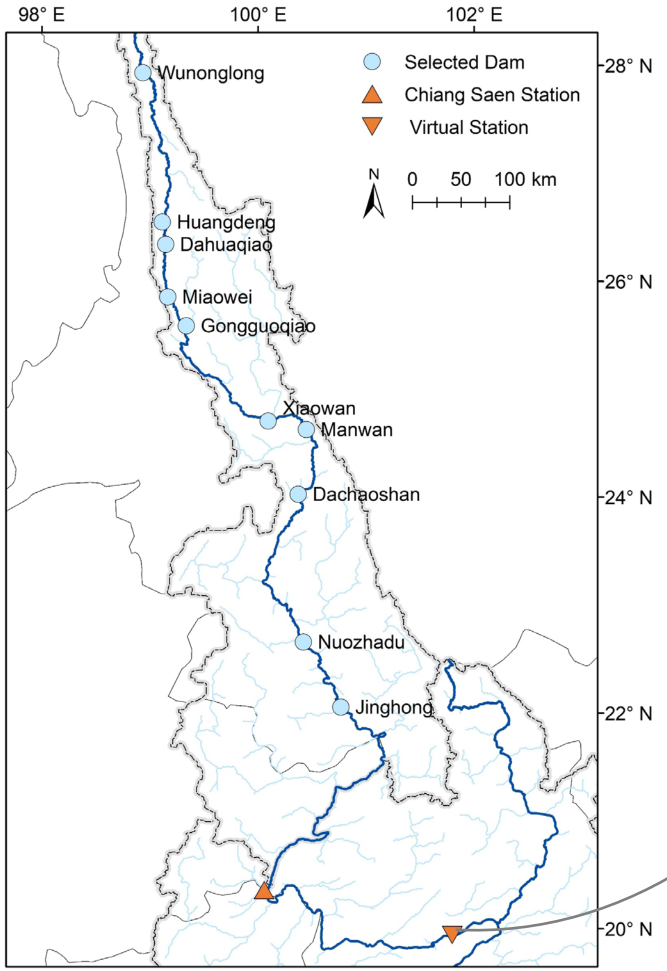
Parallel coordinate plot and narrowed range of input factors (orange lines)



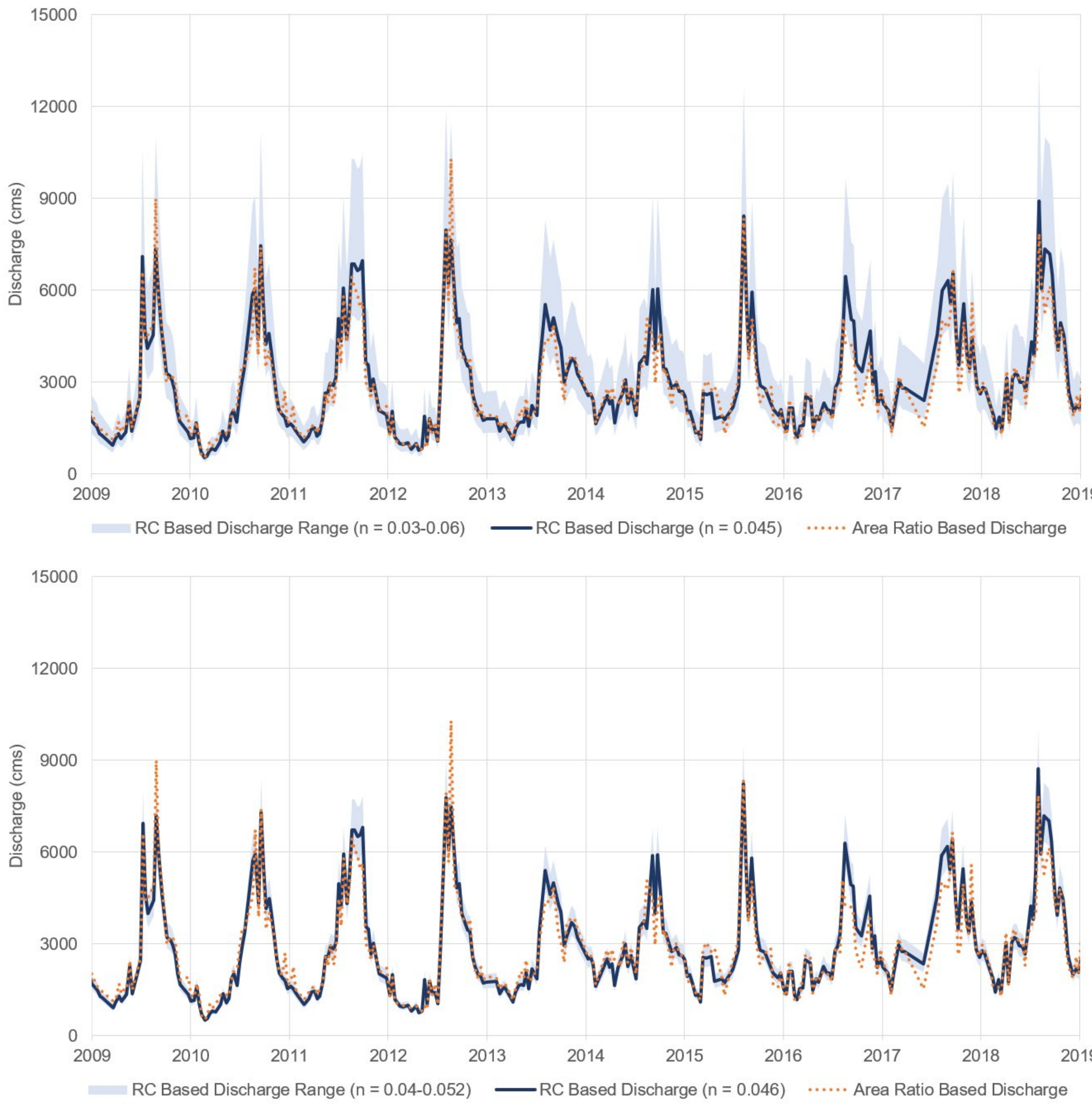
25% samples with highest NSE ∩ 25% samples with lowest TRMSE ∩ 25% samples with lowest MSDE ∩ 25% samples with lowest ROCE = 40 best samples (dark blue lines)

Results

Sensitivity Analysis

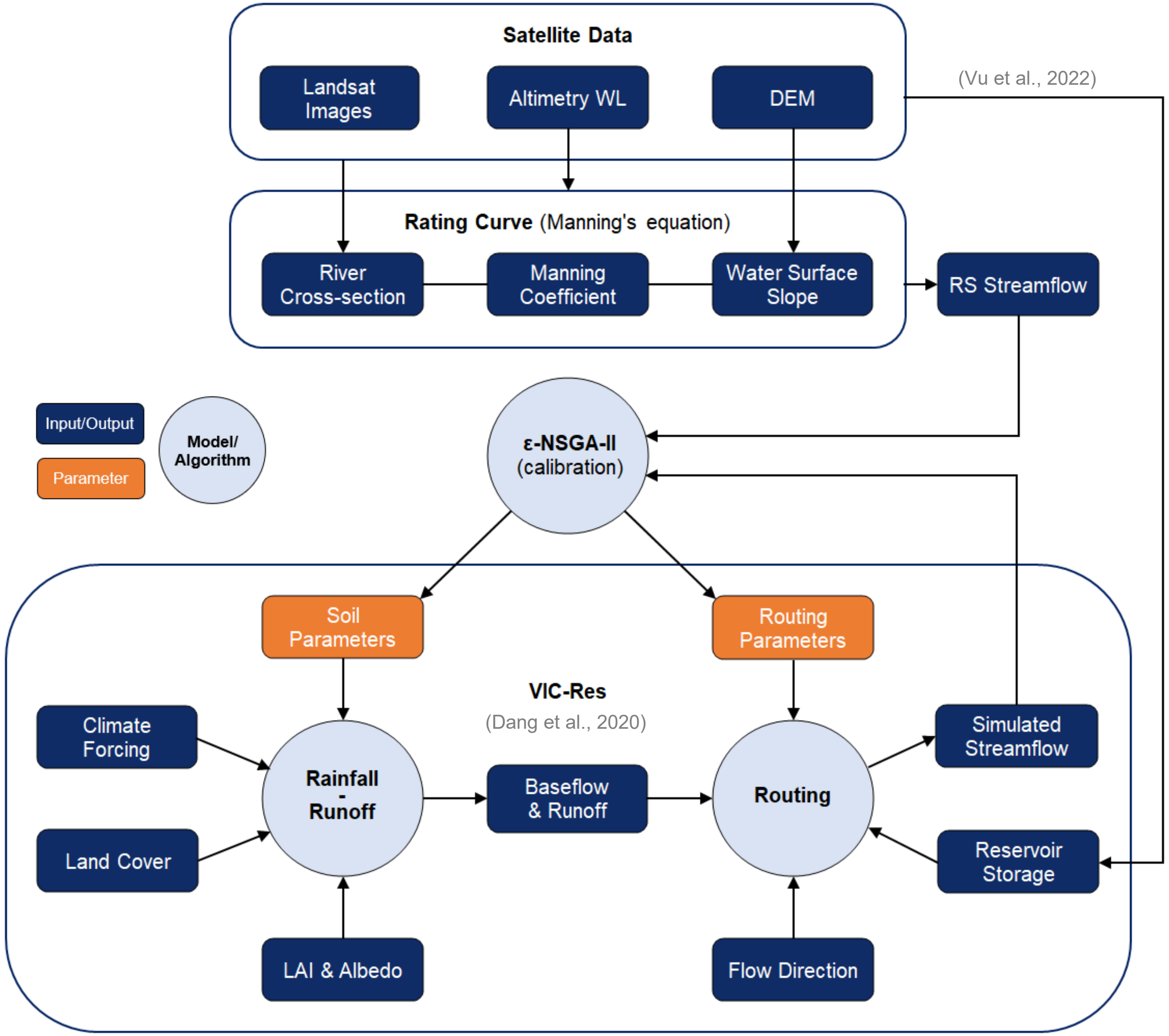


Discharge estimated with initial (top) and narrowed (bottom) ranges of Manning coefficient value



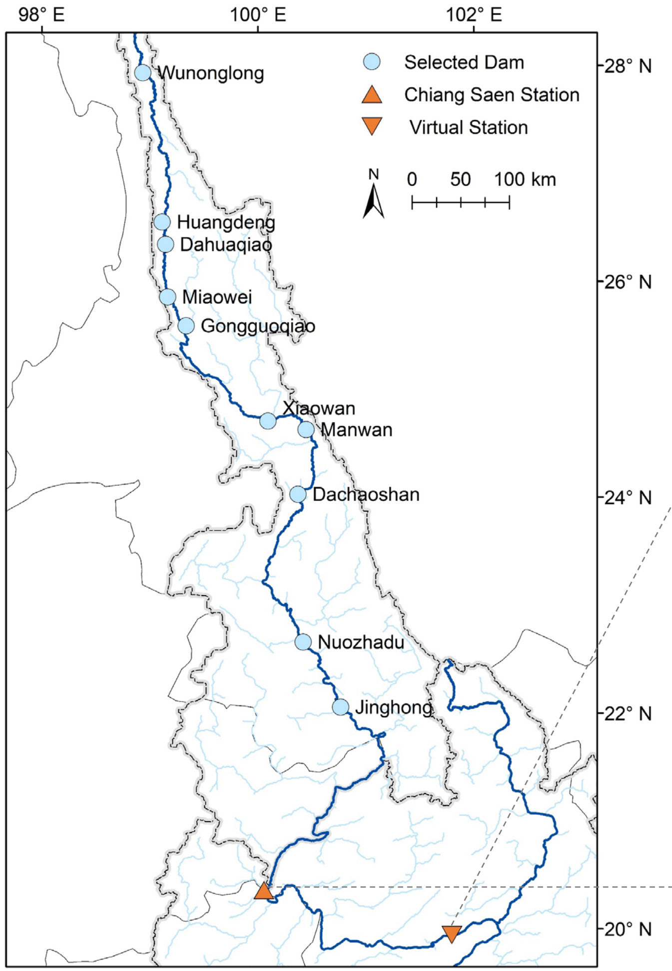
Methodology | Model Calibration

- Number of function evaluations = 100
- Population size = 10
- Number of cores = 10
- Objective functions:
  - max. NSE
  - min. TRMSE
  - min. MSDE
  - min. ROCE

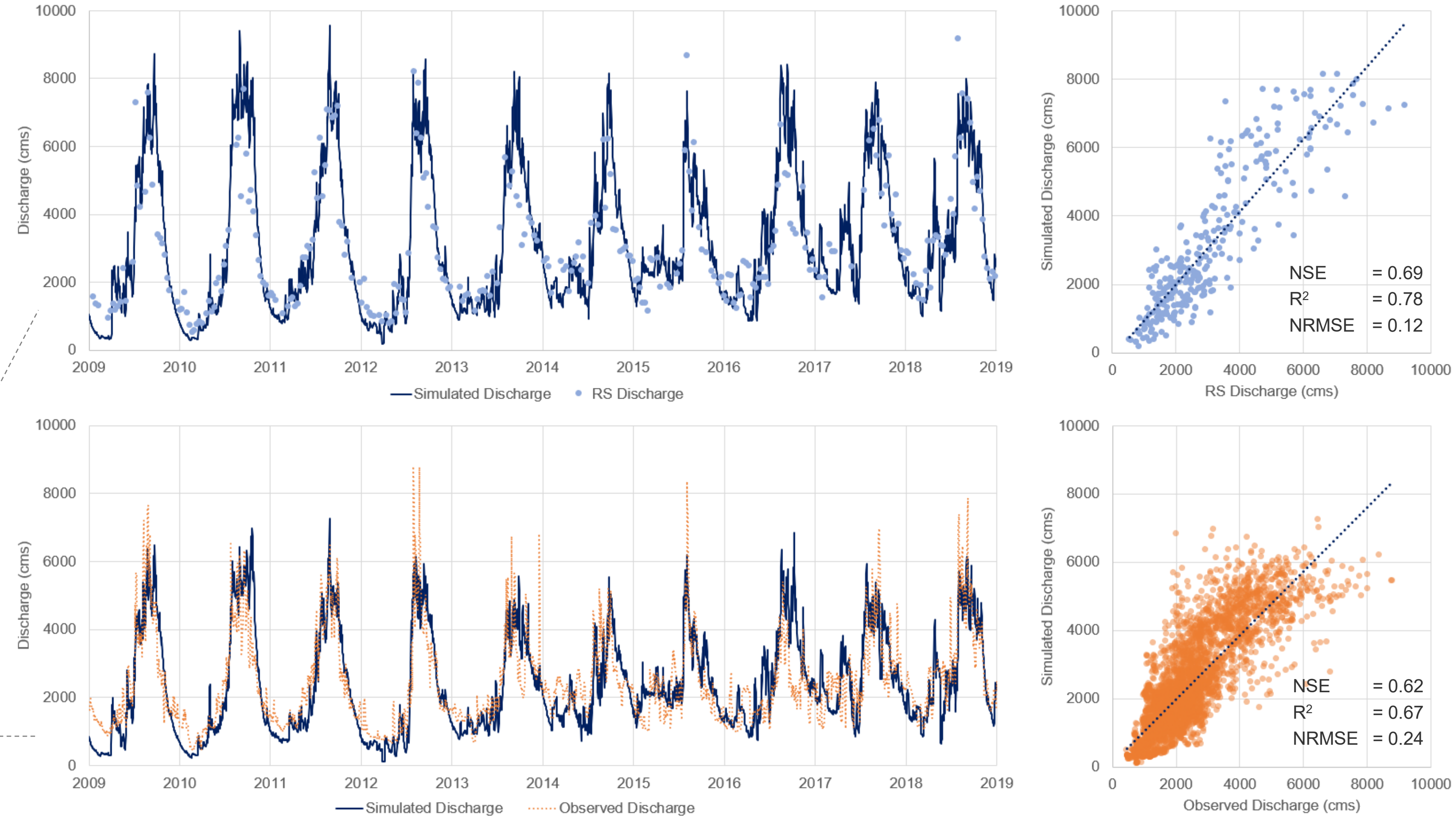


Results

Model Calibration and Validation



Performance of model calibration at virtual station (top) and validation at Chiang Saen station (bottom)



Indicators at CS are calculated from daily interval data

Indicators at VS are calculated with the days when RS data is available

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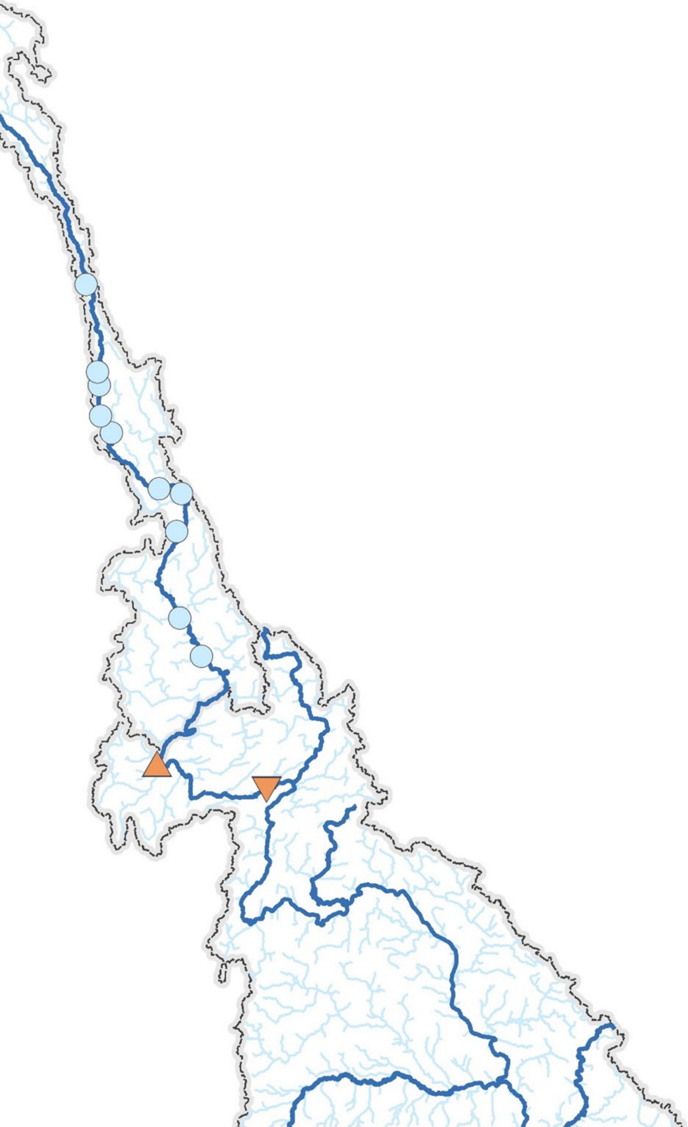

Thank you!

Resilient Water Systems Group

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