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ASSESSMENT OF RUNOFF GENERATION USING THE SIMPLE BIOSPHERE MODEL INCLUDING URBAN CANOPY FOR UPPER CHAO PHRAYA RIVER BASIN, THAILAND

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Outline of Presentation

- Motivation
- Objective
- Study area and data
- Methodology
- Result
- Summary

Motivation

- A Global Circulation Model (GCM) have uncertainties in climate predictions for three sources: internal variability, model uncertainty and scenario uncertainty
- Bias correction techniques could be a way to reduce uncertainty in GCMs output
- It is usually difficult for field measurement with complex terrain to directly measure the land and atmosphere interaction.
- The land surface model can be used alternative to provide the data.

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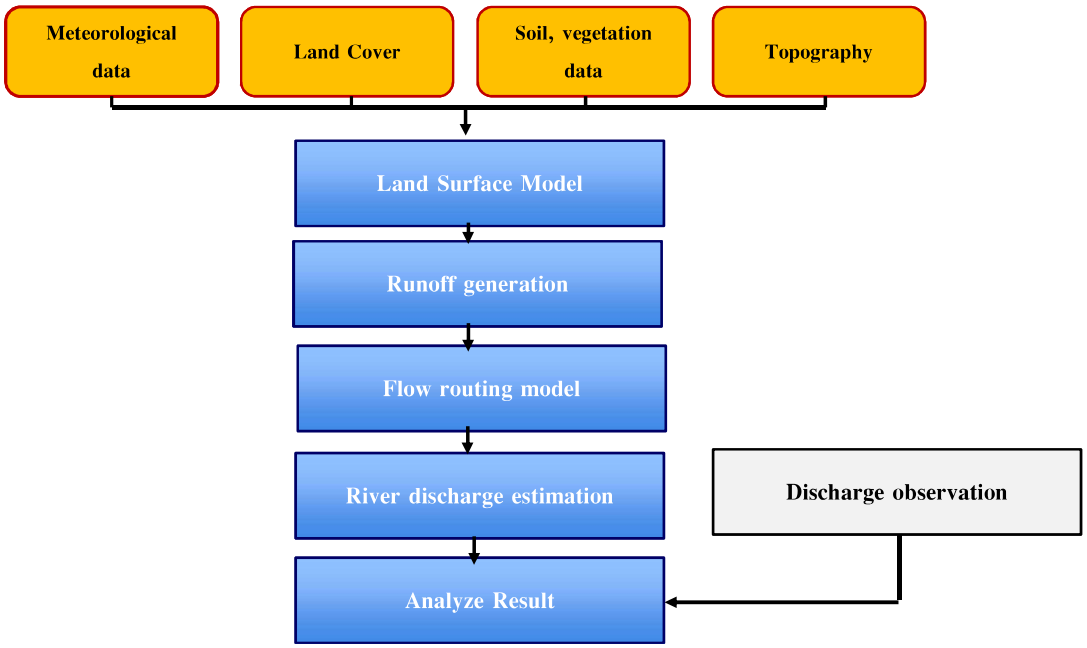
Objective

- The objective of this study is to evaluate the process of land surface model name SiBUC over the upper part of Chao Phraya River Basin

Methodology



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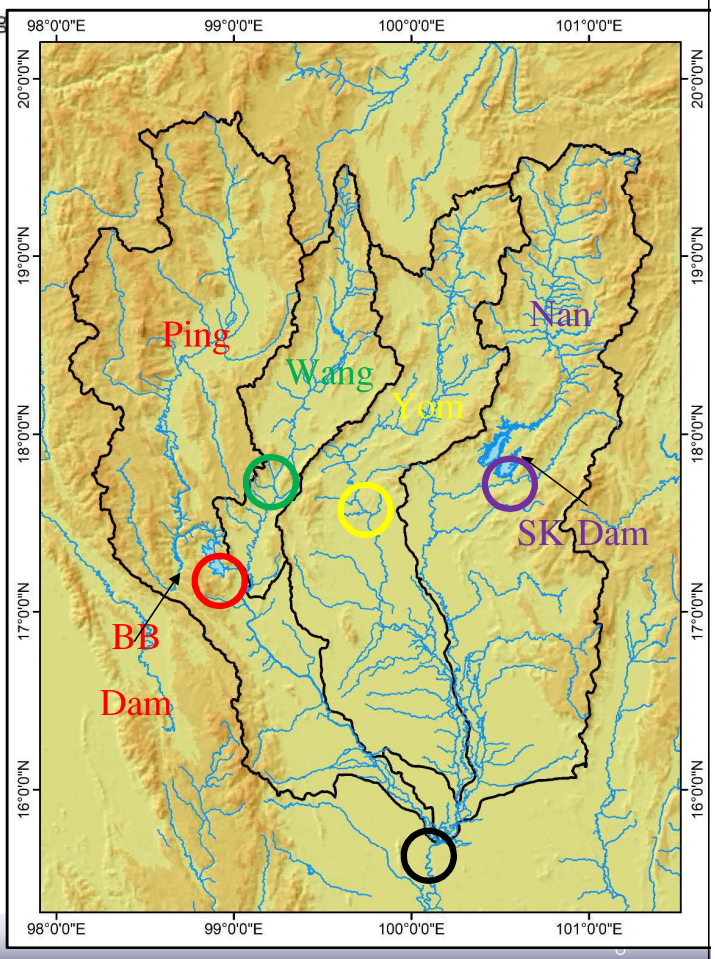
Study Area

- Upper Chao Phraya River Basin
- Consist of 4 river basin and these river are supply discharge to Chao Phraya river in the central part of Thailand
- 2 Large size dam: Bhumibol, Sirikit dam are presented in the Basin with many more medium size dam, small
- P W Y N C
  Comparison position for each river basin



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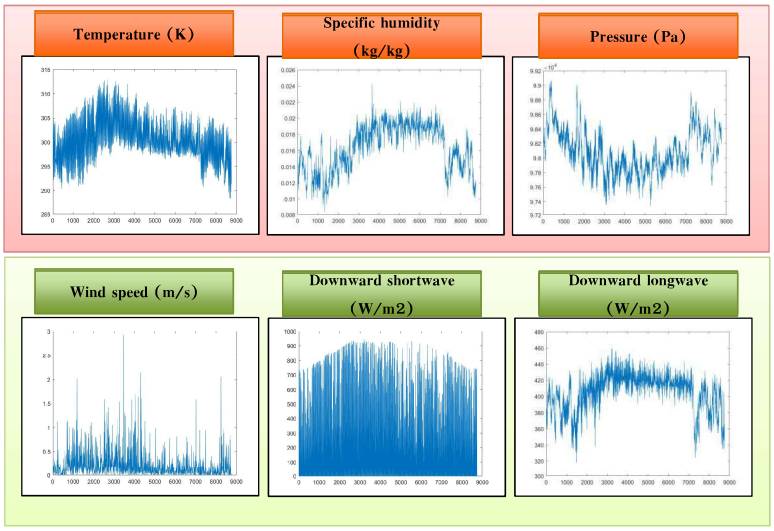
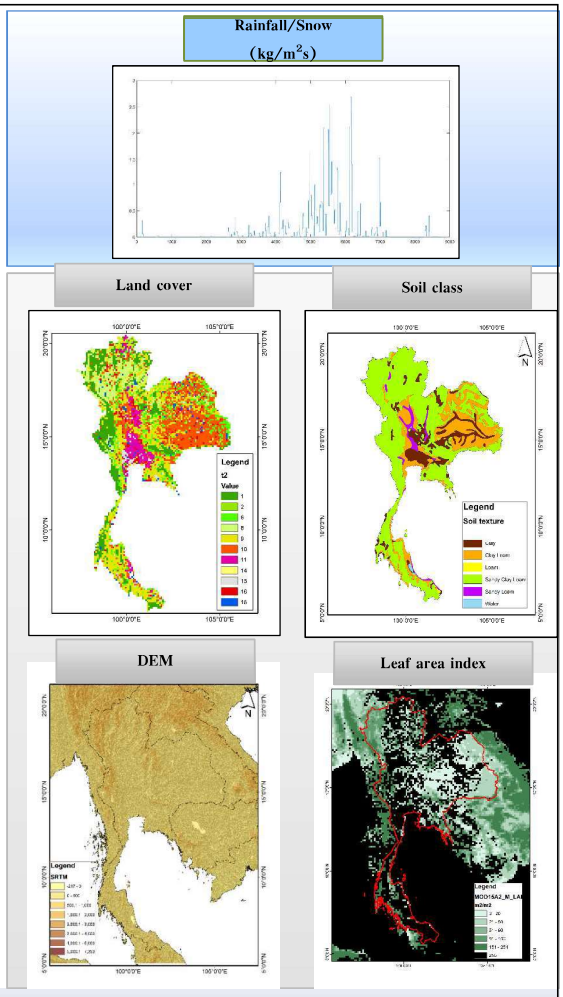
Data used

Obtain data from JRA-55, observation and survey by Thai government and Satellite image.





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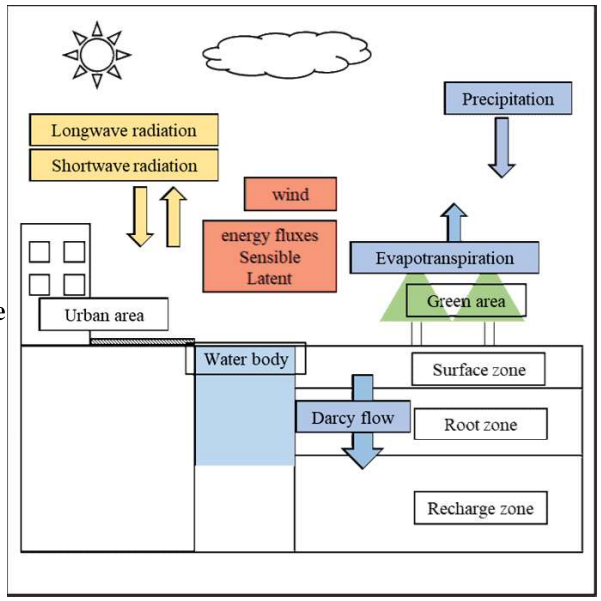
Runoff generation

- Land surface model namely "Simple Biosphere including Urban Canopy (SiBUC)"
- The SiBUC are using mosaic parameterization approach to include each land-use patch of the grid element to the atmosphere.
- The models are incorporated with three sub-models (green area, urban are and water body) to describe each grid cell.
- The average surface fluxes for each grid are from averaging the surface fluxes based on each land-use weighted by its sectional area.
- using Richards' equation for soil moisture store in three sub-soil layer and Darcy's law to expressed vertical exchanges between soil layers.



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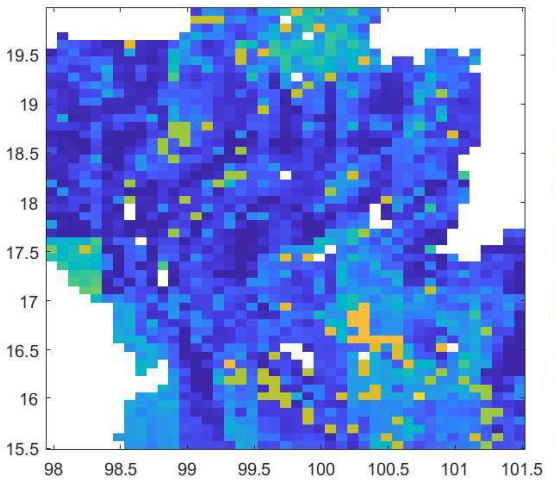
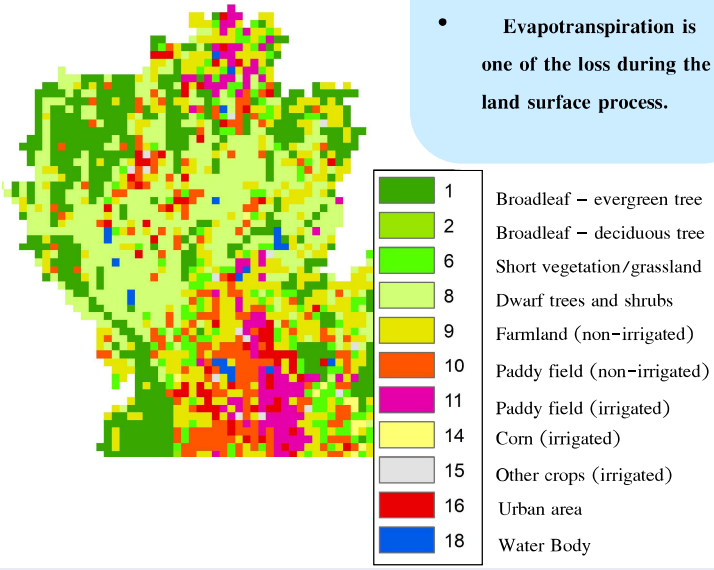
Runoff ratio(runoff/precipitation)

- Runoff ratio are show how much precipitation are become runoff.
- Evapotranspiration is one of the loss during the land surface process.

20 years daily average



Land cover



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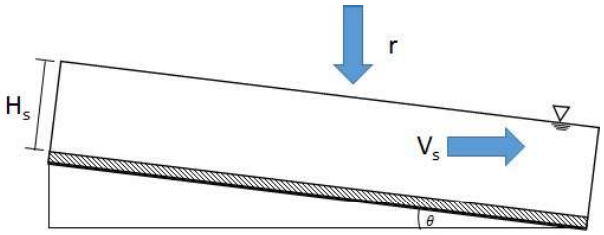
Discharge simulation

- 1K- FRM develop in Hydrology and Water Resources Research Laboratory, at Kyoto University. to simulate the river discharge
- The models are based on one- dimensional kinematic wave.
- Only Overland flow is considerate

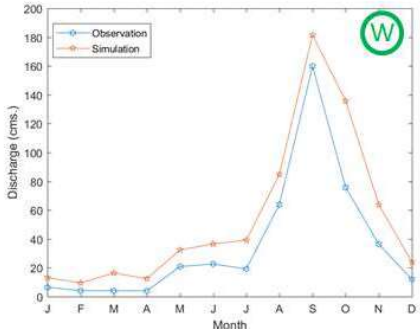


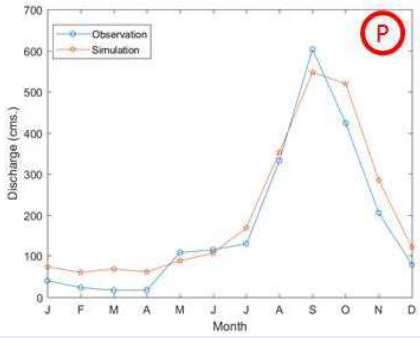
$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} = q_L \qquad (1)$$

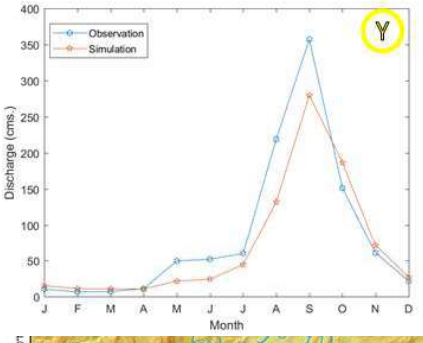
$$Q = \alpha A^m,\ \alpha = \frac{\sqrt{\sin\theta}}{n},\ m = \frac{5}{3} \qquad (2)$$

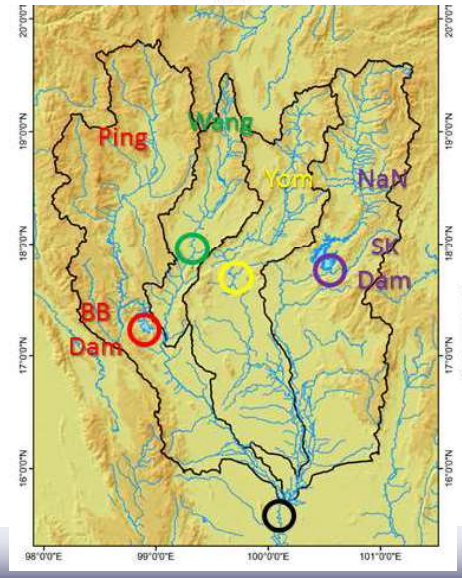
- The continuity equation is defined in (1). Where; t is time; x is space coordinate; A is flow cross-section area; Q is flow rate; qL is lateral flow per unit length from the side of the main flow or can determine as rainfall intensity or runoff generation give vertically to the slope. Equation (2) are derived simplify momentum equation with Manning equation to rout the water. Where n is manning coefficient; θ is channel gradient.

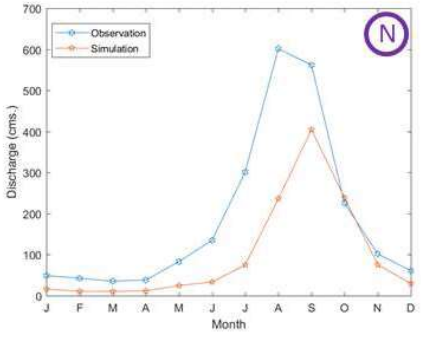
Monthly

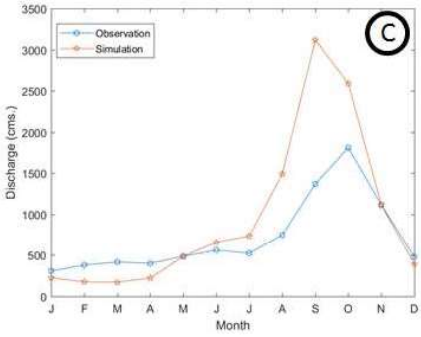






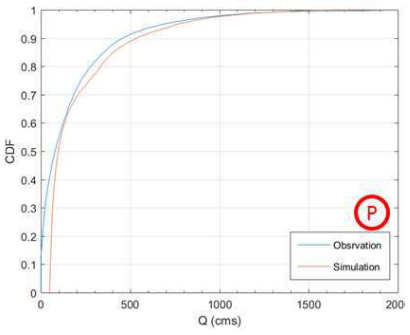


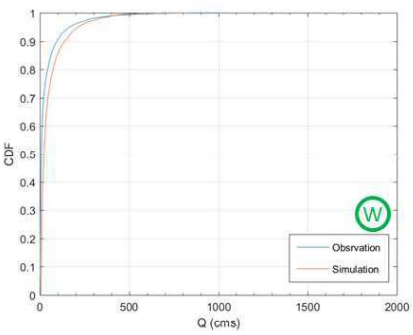


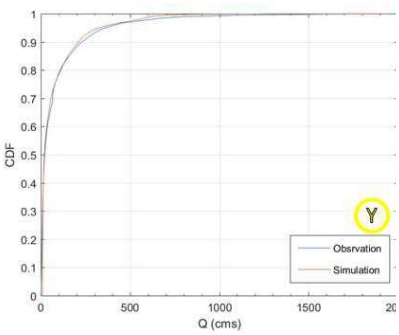


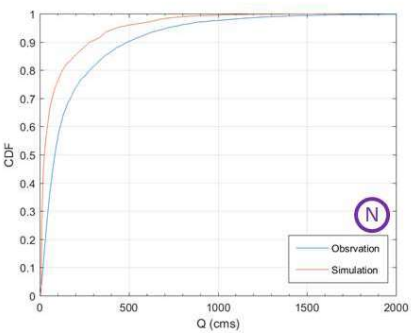
Daily

Cumulative distribution function (CDF) descripted the probability that discharge events are less or equal to a specified value based on the daily discharge



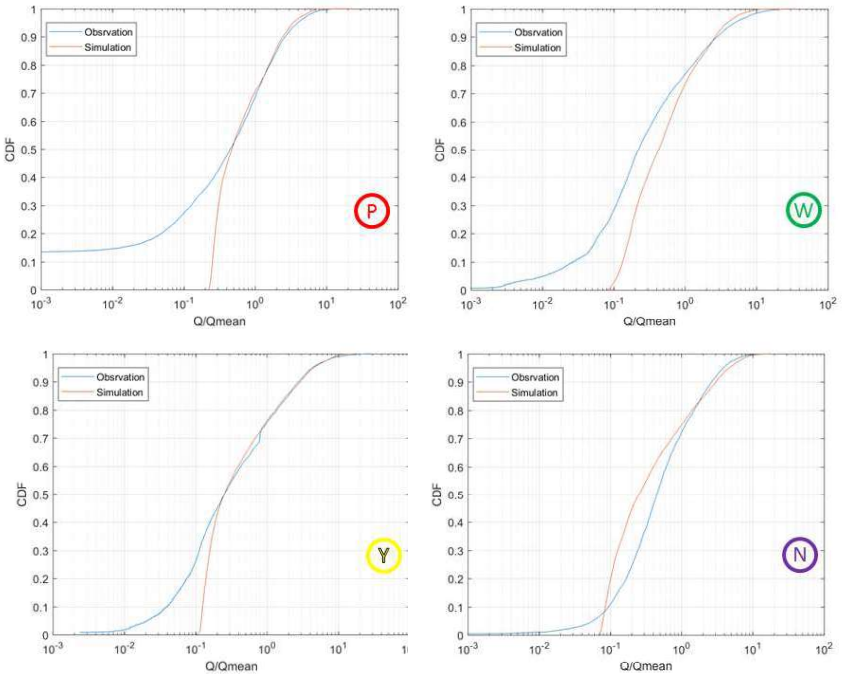






Daily

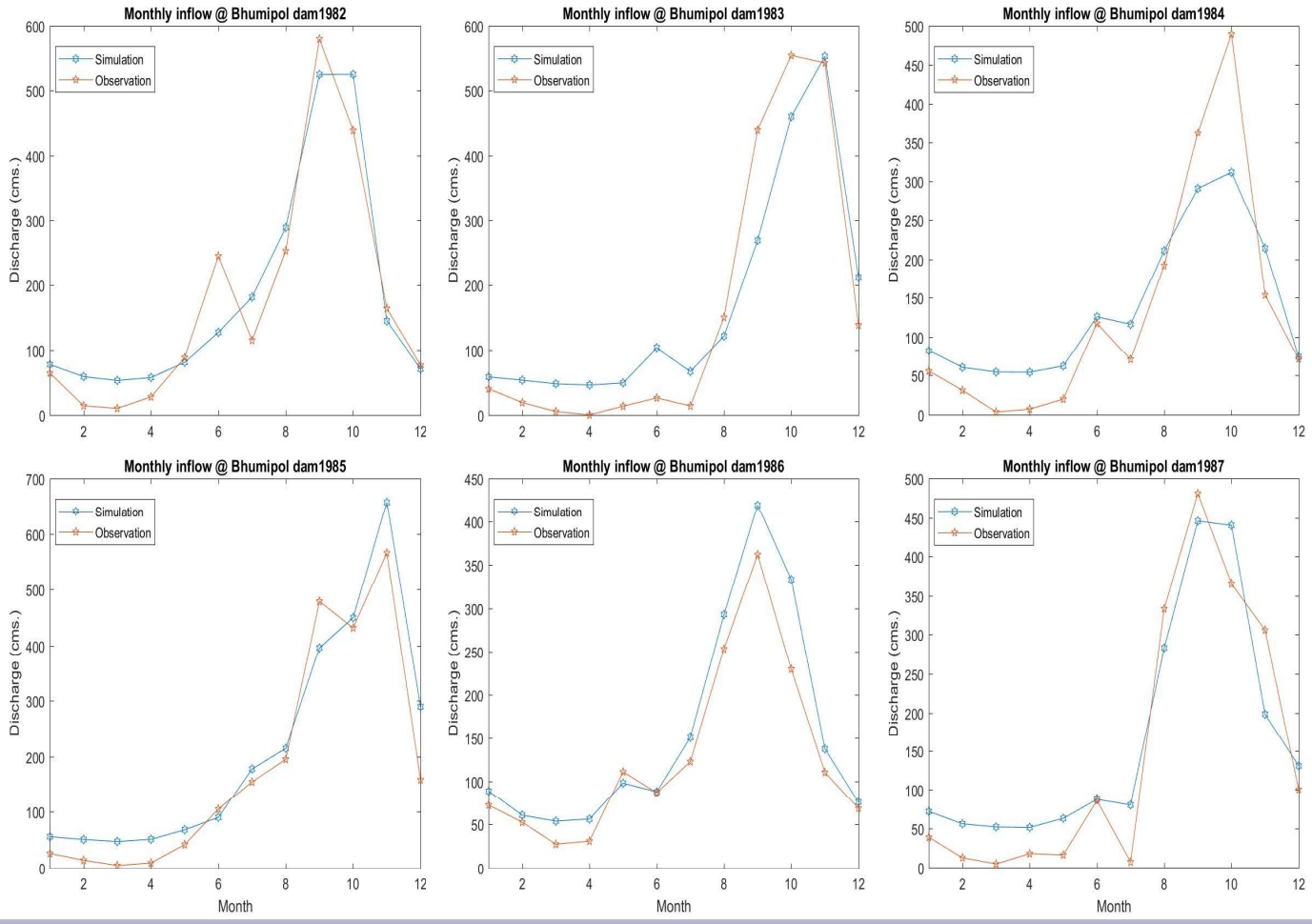
The value of normalizing daily discharge can describe the high discharge are more than 1 (Q/Qmean > 1) and for low discharge are less than 1 (Q/Qmean < 1).

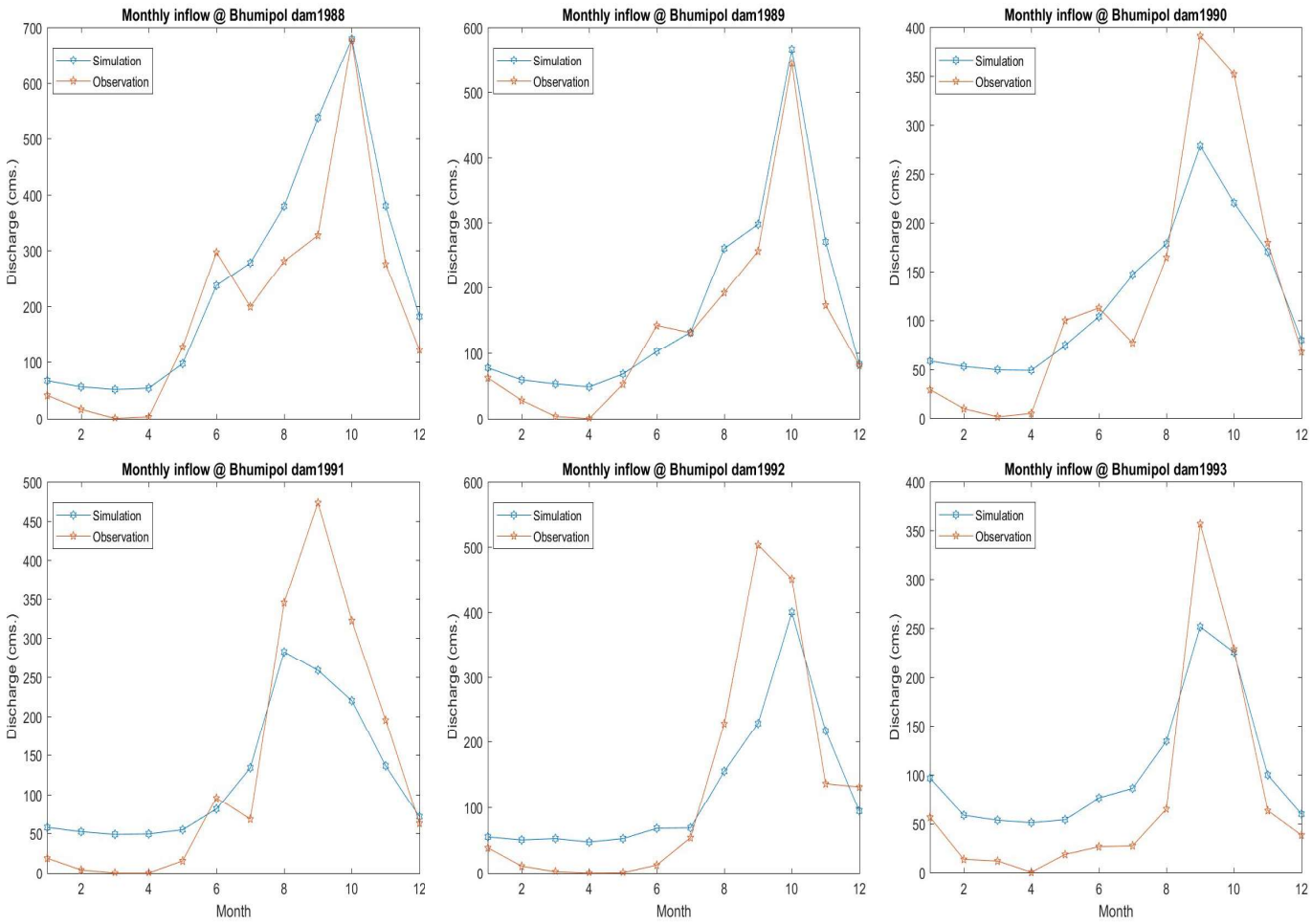


Summary

- The monthly result shows good performance with can follow the flow pattern for each sub-basin. Still, show the missed estimate.
- The daily scale shows well capture for the normal flow range. While show clearly overestimate on high discharge and underestimate on low discharge
- If more quality input data are available, the model can be a useful tool.
- Future works: improve the SiBUC runoff generation and compare with the GCM runoff product.

Thank you for your kind attention




Monthly inflow @ Bhumipol dam1988
Monthly inflow @ Bhumipol dam1989
Monthly inflow @ Bhumipol dam1990
Monthly inflow @ Bhumipol dam1991
Monthly inflow @ Bhumipol dam1992
Monthly inflow @ Bhumipol dam1993
Simulation
Observation
Discharge (cms.)
Month