# Flood Evaluation Using Multiple Precipitation Datasets in Stung Sen River Basin, Cambodia

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## 1. Introduction

Shifts in precipitation and temperature lead to changes in runoff and water availability. Changing rainfall patterns will lead to increase flooding, drought, and storms, which will increase damage from extreme events, affecting roads, water supply, and other infrastructure[1)]. In past decades, water resources in the Tonle Sap Lake have been altered by human activities like rapid population growth, urbanization, deforestation, agricultural expansion and hydropower demand[2)]. Such activities contribute to climate change. Flooding is one of the major disasters in Cambodia that frequently occurs over the years, especially in the study area. Historical floods showed that Stung Sen River Basin is usually at risk of severely damages whenever the big floods occur, particularly 2000 and 2011 flood events. To be aware of the flood damages from flood depth and extension, various precipitation datasets are selected to conduct in this study.

## 2. Methodology

### Study area

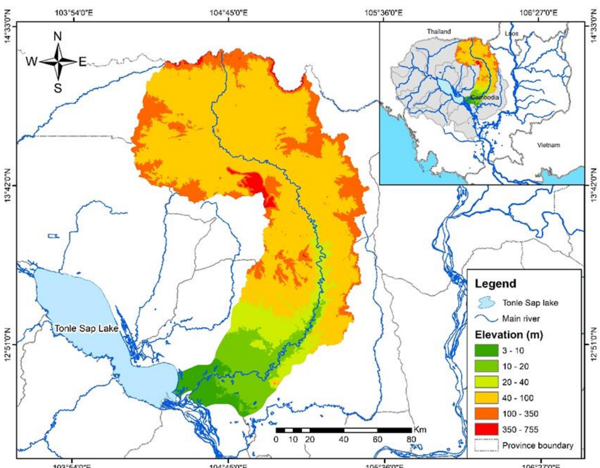


**Fig. 1.** Stung Sen River Basin location

Being the biggest tributary among the 11 tributaries in Tonle Sap Lake, Stung Sen River Basin is located in the central of Cambodia up to Thailand's border where the key contributor of Tonle Sap Lake is. The total catchment area is approximately 16,000 km$^2$ with the length of 500 km and 60% of mountainous area. The climate is dominated by tropical monsoon that covers annual average rainfall of 1,500 mm.

### Rainfall-Runoff-Inundation (RRI) model

RRI model is a hydrologic distributed model that is developed to simulate rainfall runoff and flood inundation at once[3)]. This distributed model is based on diffusive wave (both 2D and 1D diffusive waves) between the river channel and the slope grid cells has been chosen to apply in many studies to performing flood evaluation. Considering subsurface and vertical infiltration flow, the model will calculate the flow condition based on land use type.

### Precipitation datasets

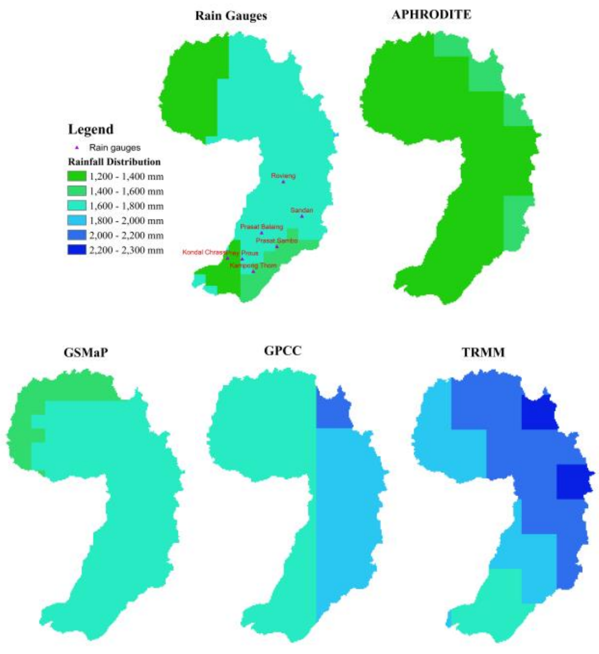


**Fig. 2.** Rainfall distribution of various datasets

Rainfall data is the major component for simulating in RRI model. The observation rainfall data in the selected study area, which are predominantly acquired in the downstream of basin and no rain gauges available in the upstream, are not enough to interpret the flood characteristics. Collectively, there are only 7 rain gauges in the downstream of the Stung Sen River Basin resulting in high variation of rainfall distribution. Hence, multiple gridded precipitation datasets including APHRODITE, GSMaP, GPCC, and TRMM from different resolutions are used to examine the model performance for river flow and flood inundation and to compare which precipitation is best for this study.

## 3. Results and Discussions

Comparing with observed discharge, TRMM and GPCC display a good correlation, especially peak flow in rainy season; while APHRODITE, GSMaP, and rain gauge show underestimation. Among the gridded precipitation datasets, TRMM shows a better performance for predicting discharge and flood inundation with NSE = 0.74 and $R^2$ = 0.76.

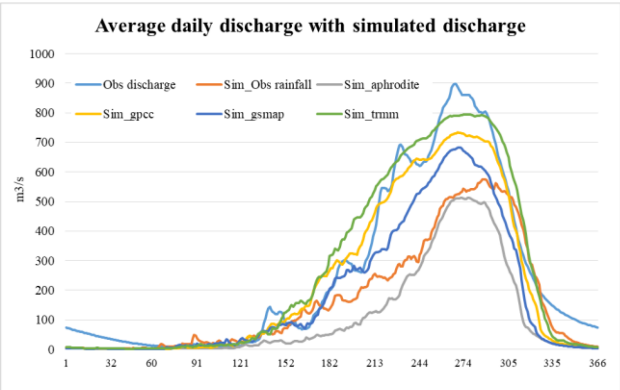


**Fig. 3.** Comparison of average daily discharge with simulated flow from various rainfall datasets

The different flood inundation maps are also indicated based on each precipitation data. The results revealed that the inundation depth from rain gauges and TRMM displayed a severe flood at the city center more than 5 m. On the other hand, GSMaP and GPCC showed the same peak flood depth within 4 to 5 m. APHRODITE viewed the peak flood from 3 to 4 m due to the low precipitation distribution.

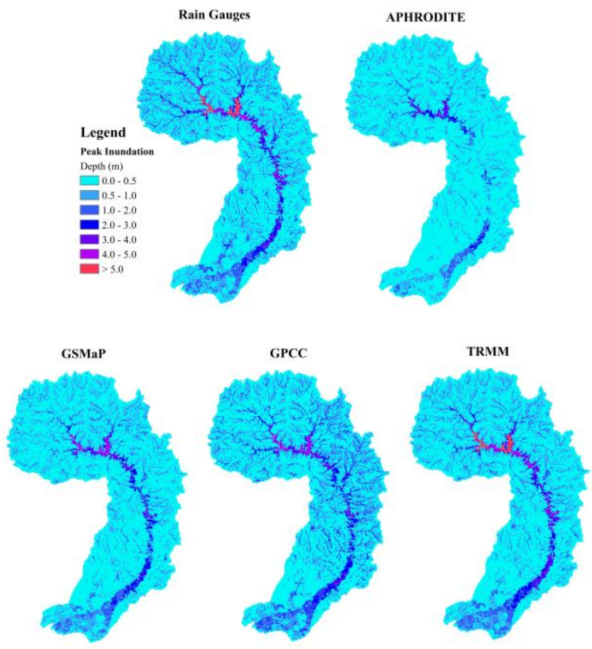


**Fig.4.** Flood inundation for each precipitation datasets

## 4. Conclusion and Future works

This study evaluated the performance of four gridded precipitation datasets with the observation data for river discharge and flood simulation of RRI model in the Stung Sen River Basin. The results suggested that TRMM is the most compatible for this study out of other four rainfall datasets. Therefore, the information from numerous rainfall data helps to discover the differences and the best for this small study area. The future research will focus on the flood extension comparison with observation and the climate change scenarios.

## References

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3) Sayama, T., Ozawa, G., Kawakami, T., Nabesaka, S., & Fukami, K. (2012). Rainfall–runoff–inundation analysis of the 2010 Pakistan flood in the Kabul River basin. *Hydrological Sciences Journal*, *57*(2), 298-312.