Effectiveness of Flood Diversion Canals and Retention Ponds as Adaptation Strategies in the Upper Chao Phraya River Basin

*Saritha Padiyedath Gopalan[1], Naota Hanasaki[1]

1. National Institute for Environmental Studies

The flood assessment in the upper Chao Phraya River basin (CPRB) is vital due to frequent flood occurrence in the past decades that has caused tremendous economic as well as agricultural losses. The upper CPRB is characterized by four major tributaries of Ping, Wang, Yom, and Nan. Among the tributaries, flooding is regular in the lower Yom Basin due to its gentle slope, lack of major flow regulation structures, and the low channel carrying capacity at various locations. The government has implemented flood mitigation measures such as Yom-Nan flood diversion canal system to divert water from Yom to Nan River and retention ponds since 2014. Hence, the objective of this study is to analyze the effect of this diversion canal system and retention ponds as adaptation strategies on reducing the daily discharge below the channel carrying capacity for the historic (1980-1999) as well as future (2080-2099) scenarios under representative concentration pathway (RCP) 4.5 and 8.5 emission scenarios using the H08 global hydrological model with the generalized scheme (GS; universal parameters) as well as the regionalized scheme (RS; regional parameters). The effect was mainly analyzed at three stations of Sukhothai, Bang Rakam, and Sam Ngam in Yom basin, where the channel carrying capacities are 550, 207, and 614 m^3/s, respectively.

The results of the historic simulation (Figure 1) show that the incorporated adaptation strategies can reduce the discharge below the channel carrying capacity at Sukhothai and Sam Ngam, while there was no significant reduction in the discharge at the Bang Rakam due to the low channel capacity. Although a similar pattern was observed in the future scenarios with adaptation strategies, the number of flooding days were still quite high in all the considered stations. Therefore, from this result, it can be envisaged that the canal system along with retention ponds alone cannot manage future floods in the basin. Regarding the effectiveness of the diversion schemes, the highest reduction in flooding days was exhibited by the RS simulation at both Sukhothai and Sam Nagam stations due to the regionalized parameters. On the contrary, the GS simulation has been found to be superior at Bang Rakam. This is because a part of the water diverted from the upstream of Yom River is returning to its lower reaches (at Bang Rakam station) through the canal system in RS simulation, whereas this return flow is absent in GS simulation due to universal parameters. The GS would be comparable with the RS by better parameterizations and can be implemented in hydrological models.

Keywords: Climate change, Thailand, H08 model

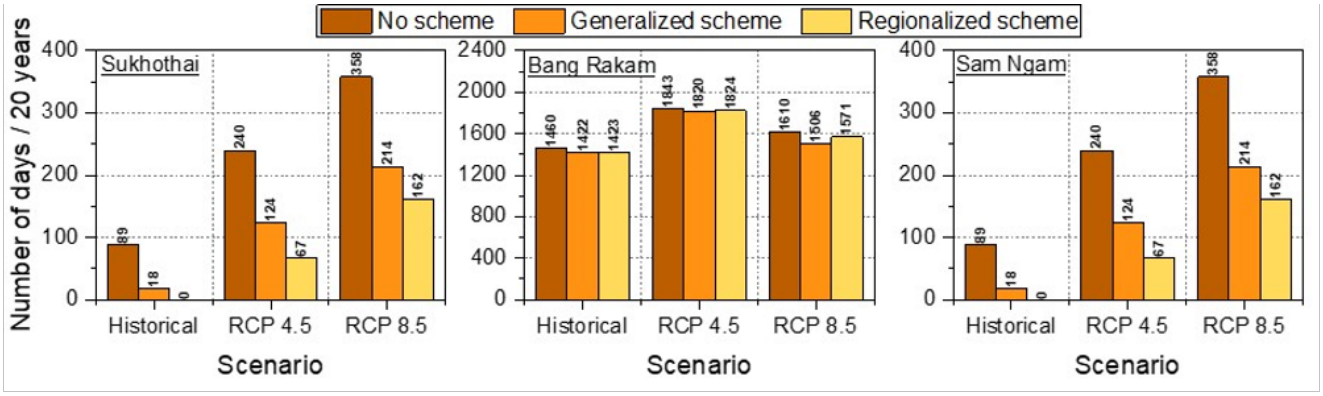

Figure 1. The number of days the daily discharge exceeded the channel carrying capacity at Sukhothai, Bang Rakam, and Sam Ngam stations in the historic as well as the future scenarios.

