EGU2020-4466
https://doi.org/10.5194/egusphere-egu2020-4466
EGU General Assembly 2020

Impact assessment of reservoir operation for potential adaptation in the upper Chao Phraya River basin

Saritha Padiyedath Gopalan and Naota Hanasaki
Centre for Climate Change Adaptation, National Institute for Environmental Studies, Tsukuba, Japan (pgsaritha@nies.go.jp)

The increased flood occurrence in the lower reaches of Chao Phraya River Basin, a major river system of Thailand, has caused tremendous economic as well as agricultural losses in the past. Reservoir operation is one of the most influential factors that can alleviate flood damage by controlling the natural flow. Hence, this study examines the effect of reservoir operation on the flood peak reduction for the baseline (1990-1999) as well as future (2090-2099) scenarios under representative concentration pathway (RCP) 6 emission scenario using the H08 global hydrological model with reservoir operation module. The main objectives of the study are; (i) analyze the effect of two largest existing reservoirs of Bhumibol and Sirikit at Nakhon Sawan (catchment area: 109973 km^2), where major tributaries of the Chao Phraya River join together, and (ii) analyze the effect of a hypothetical dam, located in the upper reaches of Yom River (one of the tributaries of Chao Phraya River), at Sukhothai (catchment area: 12769 km^2) and Nakhon Sawan for the baseline and future scenarios. For this purpose, the H08 model was calibrated at Nakhon Sawan and validated at 26 gauging stations within the catchment with an average daily and monthly Nash-Sutcliffe efficiency values of 50 and 66% respectively. The results of baseline scenario simulation revealed that the two major reservoirs cause an enormous reduction in the daily peak discharge by 21-52% at Nakhon Sawan, whereas the impact of the hypothetical dam was negligible (3-14%) due to its reduced storage capacity compared with the major reservoirs. On the other hand, the proposed hypothetical dam exhibited significant potential for the flood peak reduction by 15-53% at Sukhothai. Therefore, it can be envisaged that the hypothetical dam could reduce flood damage at the lower reaches of Yom River where flooding is regular due to gentle slope. Further, the simulated change in daily peak discharge without the reservoir effect for the future scenario was -0.55 to 5.78 and -0.72 to 7.68 times higher at Nakhon Sawan and Sukhothai respectively compared with the baseline scenario. The impact of two existing as well the hypothetical reservoirs on flood peak reduction was similar compared with the baseline scenario at Nakhon Sawan as well as at Sukhothai. This further indicates that the changes in discharge due to climate change are larger than those achieved by the reservoir operations for the future scenario even though the simulated discharge highly depends on which general circulation model was used as input.