

AN ASSESSMENT OF RESERVOIR OPERATION POTENTIAL FOR FLOW REGULATION IN THE CHAO PHRAYA RIVER BASIN

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The flow regulation of the Chao Phraya River is very crucial due to the frequent flood and drought occurrences. Therefore, it is essential to maintain a lower limit (to stabilize the flow) and an upper limit (for the flood control) of outflow, which can be achieved by building structures such as reservoirs. There are several large and small-sized reservoirs in the basin and many of them are multi-purpose that could be used to regulate the flow in the Chao Phraya River. Hence, this study examines the efficacy of the eight existing reservoirs for regulating the flow in the basin by quantifying the low as well as high flows for the baseline (1990-1999) as well as future (2090-2099) scenarios. The hydrological analysis was performed using the H08 global hydrological model with the reservoir operation module. The effect of the individual reservoir was analyzed at a point downstream to it, and the cumulative impact of all reservoirs was assessed at Nakhon Sawan and Bangkok, two major cities within the Chao Phraya River basin. It was clear from the baseline scenario simulation that the individual reservoir operation considerably reduced high flows with an exceedance probability of 10% (Q_{10}) and improved the low flows with an exceedance probability of 95% (Q_{95}). The Q_{10} was reduced to 1485 m³/s from 1992 m³/s, and the Q_{95} was increased to 233 m³/s from 13 m³/s at Nakhon Sawan after the cumulative reservoir operation. A similar pattern was observed for Bangkok City with a reduced Q_{10} value of 1837 m³/s from 2366 m³/s and an enhanced Q_{95} value of 265 m³/s from 17 m³/s. This further reveals that the reservoir operation can regulate the river flow by storing water in the wet season and releasing it in the dry season, and hence it benefits both flood and drought mitigation. Further, the simulated results for the future scenario exhibited an immense increase in the high flows compared with baseline scenario which can be attributed to (i) the climate change that increases precipitation/streamflow in the wet season, and (ii) the increased projection of precipitation by some general circulation models. The reservoir operation was able to reduce the downstream high flows to some extent, whereas as they well maintained the low flows. The results demonstrate that the Chao Phraya River basin is more likely susceptible to floods than the droughts in the near future which can be alleviated by combining structural as well as non-structural measures.

Keywords: CLIMATE CHANGE, RESERVOIR OPERATION , ADAPTATION