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Estimating Probable Maximum Precipitation and Probable Maximum Flood by Considering the Combined Effect of Typhoon and Monsoon Weather System under Climate Change

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ABSTRACT

During the typhoon season (especially on June to August), the combined effect of typhoon and southwesterly monsoon flow transports plentiful moisture to Southern Taiwan causing the heavy rainfall and leading the severe flood, which may have the serious consequence of these disasters. Therefore, this study aims to take the combined effect of typhoon and southwesterly monsoon flow (SF) account for estimating estimate probable maximum precipitation (PMPST) and probable maximum flood (PMFST). Moreover, the impact on the PMPST and PMFST under climate change also address in this study. The study area is Tsengwen Reservoir catchment.

The independent system (IS) approach that investigated by the equation of moisture convergence and the observed data is proposed to estimate PMPST in this study, which the PMPST equals the summation of maximum typhoon precipitation and maximum SF precipitation (SFP). The storm transposition method and storm separation method are selected to estimate the maximum precipitation of typhoons and the liner regression analysis is used on establishing SFP equation which is adopted to estimate maximum SFP. Based on the PMPST, the PMFST is derived by using the dimensionless synthetic unit hydrograph which is recommended by the reservoir safety assessment reports in Taiwan. For the climate change, the baseline period is from 1980 to 1999 and the future period is form 2020 to 2039, 7 GCMs under A1B emission scenario are selected which conform with the requirement of Taiwan government in this study.

The results show that the PMPST estimates for 60-hr duration by IS approach are approximately 15% larger than the traditional PMP estimates and the PMFST approximately close the traditional PMF estimates. Under the climate change, the PMPST and PMFST have a mean change percentage 9% and 8% from the baseline period to the future period, respectively. This work is a pioneer of PMP estimation considering the combined effect of typhoon and SF. Further studies on this issue are essential and encouraged.