EVALUATION OF THE EFFECT OF LOSS AND TRANSFORM METHODS ON THE PERFORMANCE OF HEC-HMS MODEL: A CASE STUDY IN KELANI RIVER BASIN, SRI LANKA

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ABSTRACT

Evaluation of the Effect of Loss and Transform Methods on the Performance of HEC-HMS Model: A Case Study in Kelani River Basin, Sri Lanka

Hydrological modelling plays a vital role in understanding the hydrological system of any watershed and providing reliable data to manage the water resources of the relevant watershed in a sustainable manner. Among the numerous types of hydrological models, HEC-HMS is very popular among hydrologic modellers due to its user-friendliness. Different methods are available in HEC-HMS to compute the hydrological process in a relevant watershed and the selection of appropriate methods among different available methods plays an important role in the performance of the model**.**

The objective of this study is to select the most suitable loss and transform methods for Kelani river basin, comparing different combinations of selected loss and transform methods available for event-based simulations. Seethawaka subbasin was selected as the study area. From the possible methods embedded in the HEC-HMS, two loss methods (SCS Curve Number method, Initial Constant method) and three transform methods (SCS Unit Hydrograph method, Clark Unit Hydrograph method, Snyder Unit Hydrograph method) were selected for this study. Six (06) different combinations using those loss and transform methods were tried out to evaluate the performance of the model. Percent Error in Peak (PEP) and Percent Error in Volume (PEV) objective functions were selected for this study to determine the performance of the model. Hourly rainfall and streamflow data for four (04) extreme flood events (May 2014, May 2016, May 2017, May 2018) which occurred in the recent past were used in this study as this is an event-based simulation. The 2018 flood event was used for the model calibration and other three events were used for the validation of the calibrated model.

Combination 01 (SCS-CN Loss Method and SCS-UH Transform Method) shows a better performance compared to other combinations w.r.t both PEP and PEV objective functions. N.S.E. and RMSE values were reported as 0.816 and 0.400 after calibrated w.r.t PEP objective function and as 0.830 and 0.400 after calibrated w.r.t. PEV objective function. Even considering the validation results, it was confirmed that Combination 01 shows the best results among all the 06 combinations.

It can be concluded that the SCS-CN loss method and SCS-UH transform method provides more reliable estimates w.r.t. both PEP and PEV objective functions in streamflow forecasting in Kelani river using HEC-HMS. Considering the ability of the model to predict the peak discharge and the time to peak, this developed model can be used to provide early flood warnings to the Deraniyagala area during extreme rainfall events as well.

Keywords: Event-based simulation, HEC-HMS, Hydrological modelling, Seethawaka river basin

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