Evaluation of the performance of Hydrologic Engineering Centre - Hydrologic Modelling System (HEC-HMS) model in hydrological simulation of long term flow of Uruwal Oya, Sri Lanka

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Lack or non-availability of long term river flow data has been one of the major limiting factors in many tropical countries, which restricts the planning and designing of ecologically sustainable water management approaches. Employment of computer models in synthesizing daily flow data via hydrological simulation has been recognized as an ideal solution to address the above requirements. As the HEC-HMS model is one of the most reliable and widely used models that could be devised for hydrological simulations, the current study attempts to evaluate the performance of three different modelling approaches of HEC-HMS in the synthesis of long term daily flow data of the Uruwal Oya. Twenty year (1984 – 2014) daily rainfall data from Henarathgoda and Horagahalanda rain gauging stations and monthly evapotranspiration data for the Henarathgoda agro meteorological station together with daily flow data at the confluence point of Uruwal Oya and Aththanagalu Oya were used in the current study. GIS layers that were needed as input data for the flow simulation were developed by using Arc GIS 10.2. HEC-HMS (version 3.5) model was calibrated and validated for the periods of 1984 – 1994 and 1995 – 2014 respectively for the Uruwal Oya basin based on three selected methods *viz* Snyder unit hydrograph method, Deficit and Constant loss method and Initial and constant loss method in order to determine the most suitable simulation method. The flows simulated from each method were statistically evaluated against the actual flows by employing the coefficient of performance (CP_A'), the relative error (RE), scatter plot method (R^2) and the residual method. The Snyder unit hydrograph method that yielded 76.8%, 96.4%, 0.670, 1.65 and +0.25 values for residual points within mean ±1SD, mean ±2 SD, R^2, CP_A' and RE, respectively and the Deficit constant loss method that yielded 74.2%, 95.4%, 0.610, 1.70 and +0.28 values for residual points within mean ± 1SD, mean ± 2 SD, R^2, CP_A' and RE, respectively were recognized as the best performing transformation and loss methods, respectively in runoff simulation of the Uruwal Oya basin. Thus, the HEC-HMS model could be recommended as a reliable and effective approach for runoff simulation of similar wet zone river basins in Sri Lanka.

Keywords: HEC-HMS, hydrological modelling, river flow