

**ANALYSIS OF THE EFFECT OF LOSS AND  
BASEFLOW METHODS AND CATCHMENT SCALE ON  
PERFORMANCE OF HEC-HMS MODEL FOR  
KELANI RIVER BASIN, SRI LANKA**

Ahmad Mohy Ud Din

(158570 F)

Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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Ahmad Mohy Ud Din

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Thesis submitted in partial fulfilment of the requirements for the degree of  
Master of Science in Water Resources Engineering and Management

Supervised by  
Dr. R. L. H. L. Rajapakse

UNESCO Madanjeet Singh Centre for  
South Asia Water Management (UMCSAWM)

Department of Civil Engineering

University of Moratuwa  
Sri Lanka

June 2018

## **DECLARATION**

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Dr. R. L. H. L. Rajapakse

Date

# **Analysis of the Effect of Loss and Baseflow Methods and Catchment Scale on Performance of HEC-HMS Model for Kelani River Basin, Sri Lanka**

## **ABSTRACT**

Hydrological models have become an indispensable tool for efficient water resource management which requires proper estimation of runoff in basins and recognition of appropriate catchment scale. The HEC-HMS (Hydrologic Engineering Center's Hydraulic Modeling System) is a reliable and freely available model. Different loss and baseflow estimation methods available in HEC-HMS have their own pros and cons. Lumping of model parameters over a large area reduces the model performance. In order to find the best loss and baseflow methods for simulating rainfall runoff and to check the possibility of further improvement in model performance by moving toward distributed modeling, Glencorse watershed in Kelani river basin of Sri Lanka was selected as the project area.

Daily rainfall data from 2006/2007 to 2008/2009 and 2010/2011 to 2013/2014 for four rainfall stations in Glencorse watershed with daily stream flow data of Glencorse gauging station for the same duration were used for this study. Two different combinations of baseflow and loss methods for simulation of runoff were considered while Clark unit hydrograph method was used as transform model. In the First Option, the Deficit and Constant Method and Recession Method were used as loss and baseflow methods, respectively, while for the Second Option, the Soil Moisture Accounting (SMA) and Linear reservoir methods were used for continuous simulation. Glencorse watershed was divided into 3, 6, 9 and 16 sub divisions to assess the improvement in model performance by shifting toward distributed modelling. Manual calibration approach was used for with Mean Ratio of Absolute Error (MRAE) as the main objective function while another two statistical goodness of fit measures, Nash–Sutcliffe model efficiency coefficient (NASH) and percent error in volume were also checked as an additional observation.

Soil Moisture Accounting as loss model and linear reservoir model as baseflow model simulated runoff more efficiently as compared to the other combination. Evaluation showed value of MRAE and NASH for Option 1 were 0.38 and 0.67 for calibration and 0.40 and 0.42 for verification, respectively. Option 2 evaluation showed MRAE and NASH as 0.31 and 0.70 for calibration and 0.34 and 0.57 during verification, respectively. Soil Moisture Accounting and Linear Reservoir method used for distributed model showed improvement in model performance up to 6 sub-divisions after which the model performance started declining. Selection of appropriate method among different methods available in HEC-HMS should be in accordance with overall objective of study as it plays an important role in accurate estimation of runoff. Moving toward distributed modelling improves model performance but high resolution data and machine power is required..

**Keywords:** hydrological modelling, water resource management, HEC-HMS software, loss and base flow methods

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