HEC-HMS MODEL PARAMETER TRANSFERABILITY FOR DAILY STREAMFLOW ESTIMATION IN GIN GANGA BASIN

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DECLARATION

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Professor N.T.S.Wijesekera — Date

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HEC-HMS Model Parameter Transferability for Daily Streamflow Estimation in Gin Ganga Basin

ABSTRACT

Rapid urbanization and population growth with economic advancement causes a conflict between limited freshwater supply and the demand. Accurate streamflow estimation in a watershed is a necessity for sustainable water resources management to overcome this conflict. Sustainable water management requires quantification of streamflow components for flood, drought and irrigation management. Hydrologic modeling is one of the most versatile options to estimate streamflow in watershed. Streamflow quantification by modeling had issues with ungauged watersheds due to lack of sufficient measured data to determine model parameters. The objective of this work is to apply HEC-HMS process-based model to simulate process-based river flow in an ungauged sub-watershed Thawalama at daily time scale, where the main watershed Baddegama is gauged, and check the possibility of parameter transferability from main to sub-watershed and vice versa. Here, spatiotemporal transferability approach was used to assess possibility of parameter transferability in order to estimate daily streamflow in an ungauged sub watershed. Temporal transferability approach also used to assess the comparison of selected transferability option for this work. Gin Ganga basin study area and HEC-HMS model were selected. Eight models developed for both Thawalama and Baddegama watersheds from 2007 to 2017 on a daily time scale. Calibration period was from 2007 to 2012 and validation period was from 2012 to 2017. Model efficiency was evaluated by the Root Mean Square Error (RMSE). Two models at Baddegama and Thawalama were calibrated and validated. For spatiotemporal approach, both model's calibrated parameters were transferred from Baddegama to Thawalama and vice versa for 10 years of period. For temporal approach calibrated parameters of both models were transferred to same watersheds for 10 years of period. Then the model performance evaluated with flow hydrograph, flow duration curve for low, high and intermediate flows to asses calibrated parameter transferability of HEC-HMS from Baddegama to Thawalama sub-watershed and vice versa. Thawalama and Baddegama models were calibrated with RMSE of 4.8 mm/day, 3.0 mm/day and validated with RMSE of 5.0 mm/day, 3.5 mm/day respectively. The spatiotemporal parameter transferability approach to Baddegama main watershed from Thawalama sub-watershed showed RMSE of 6.0 mm/day and vice versa showed RMSE of 5.8 mm/day. The temporal parameter transferability approach to Baddegama main watershed from Thawalama sub-watershed showed RMSE of 3.3 mm/day and vice versa showed RMSE of 4.9 mm/day. Results concluded that spatiotemporal transfer approach showed better achievement in model parameter transferability from main to sub-watershed. Temporal transfer approach showed better achievement in model transferability from sub to main watershed. Spatiotemporal transferability approach showed better model performance rating than temporal approach with RSR value of 0.5 for Thawalama sub-watershed to Baddegama main watershed and RSR value of 0.6 for vice versa. The HEC-HMS model can be successfully applied to assess the transferability approach within the Gin Ganga basin for sustainable water resource management. Furthermore, need to asses individual parameter influence on transferability approach with compared to watershed physical characteristics.

Key Words
Process-based hydrologic model, HEC-HMS, Sustainable Water Resources Management, Spatial Transferability

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LIST OF ABBREVIATION

Abbreviation	Description
FDC	Flow Duration Curve
MRAE	Mean Ratio of Absolute Error
MAR	Mean Annual Rainfall
NEM	North East Monsoon
NWSDB	National Water Supply and Drainage Board
RAEM	Ratio of Absolute Error to Mean Relative Error
RF	Rainfall
RMSE	Root Mean Square Error
SF	Streamflow
SMA	Soil Moisture Accounting
SWRM	Sustainable Water Resources Management