TRANSFERABILITY OF MODEL PARAMETERS FOR MONTHLY STREAMFLOW ESTIMATION IN UNGAUGED WATERSHEDS IN KALU RIVER BASIN

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Degree of Master of Science

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in text.

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Engiliyage Nalika Lakmali Date

The above candidate has carried out research for the Masters thesis under my supervision.

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Professor N.T.S.Wijesekera Date

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Transferability of Model Parameters for Monthly Streamflow Estimation in Ungauged Watersheds in Kalu River Basin

Abstract

Prediction and forecasting of ungauged streamflow have become a challenge to watershed modelers especially when practical water resources planning and management are a major concern. Over the years, researches have experienced and executed various methodologies and approaches to find a way to estimate streamflows at ungauged locations where they found that transformation of model parameters can be used effectively in this regard, which still requires further research. The present study targeted to find the adequacy of parameter transferability options to estimate streamflow at ungagged outlets. Two parameter monthly water balance model which was developed by Xiong and Guo (1999), is used for the modeling of two gauged watersheds at Ellagawa and Rathnapura which are located in Kalu river basin, Sri Lanka. Three model parameter transfer schemes have been tested under the study. They are namely, temporal, spatial, and spatio-temporal. The transferability of model parameters within Kalu River basin showed that the temporal transfer scheme has the highest capability of predicting overall flows with the average MRAE values of 0.34 while it is 0.42 and 0.35 in spatial and spatiotemporal transfer schemes respectively. Spatial and spatiotemporal transfer schemes perform at the same accuracy level for predicting high flows with an average MRAE value of 0.27 while it is 0.30 in temporal transfer scheme. The temporal transfer scheme has the highest capability to predict intermediate flows with an average MRAE value of 0.32 while it is 0.41 and 0.36 in spatial and spatiotemporal schemes respectively. Spatio-temporal transfer scheme performs best for low flows with an average MRAE value of 0.35 while it is 0.43 and 0.52 in temporal and spatial transfer schemes respectively. Further, compared to high and intermediate flows, low flow estimation has the highest MRAE values in all three considered transfer schemes.Results of seasonal flow analysis indicated that spatiotemporal scheme has the highest capability to predict Yala season streamflows with a 13% of average error for Ellagawa watershed and spatial transfer scheme has the highest capability to predict Maha seasonal flow with an average error of 13.29%. Model parameter C is 2.09 for Rathnapura watershed and it is 2.38 for Ellagawa which is having a 13% difference in each other.SC is 1420 for Rathnapura and 1461 for Ellagawa having a 3% difference from each other, indicating that model parameters do not vary across the catchments in Kalu River Basin and they are stable in a spatial domain. Transferability option 3, which used 19 years total data has the high capability to predict streamflows with a high accuracy level by giving MRAE values 0.35, 0.27, 0.36 and 0.35 for overall, high, intermediate and low flows respectively compared to transferability option 2 which used 12 years of common data period giving MRAE values 0.42, 0.27, 0.41 and 0.52 for overall, high, intermediate and low flows respectively indicates longer the data period, the higher the accuracy of streamflow predictions irrespective of the transfer scheme used. Since high and intermediate flow predictions are in higher accuracy level with lower MRAE values compared to that of for the low flows, streamflows predicted by transferred model parameters are sufficient and adequate to design and planning of water resources infrastructure and their management in ungauged watersheds within Kalu river basin.

Key Words: Ungauged watersheds, Parameter, Transferability, Model, Sri Lanka

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