A MONTHLY WATER BALANCE MODEL FOR EVALUATION OF CLIMATE CHANGE IMPACTS ON THE STREAMFLOW OF GINGANGA AND KELANI GANGA BASINS, SRI LANKA

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Supervised by

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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 expect where the acknowledgment is made in text.

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Professor N.T.S. Wijesekera Date

This Thesis is gratefully dedicated to my family.

For their endless love, support and encouragement

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ABSTRACT

The availability and distribution of freshwater resources will be greatly affected by climate change and the vulnerability to water scarcity of affected populations currently experience could increase. Studies relating climate change and hydrology are becoming prevalent but few published studies focus on changes in Sri Lanka streamflow. There is ample evidence to suggest that the climate of South Asian region has already changed. Climate change or its increased variability is expected to alter the timing and magnitude of runoff. As a result it has important implications for existing water resources systems as well as for future water resources planning and management. A two-parameter monthly water balance model is adopted to simulate the runoff for the evaluation of climate change impacts on the streamflow of two major catchments in Kelani Ganga and Gin Ganga basins in Sri Lanka. The model was successfully calibrated and verified for Kelani Ganga & Gin Ganga basins showing that average values of 0.485 and 1110.50 mm for parameters c & SC respectively could simulate monthly streamflow with average MRAE 0.088 and average Nash-Sutcliffe efficiency 0.957. Application results show that the model efficiencies are high in both the calibration and verification periods. This study demonstrated the models capability and applicability to evaluate the climate change impacts on the streamflow and also to forecast for future scenarios. It is suggested that this two parameter model can be easily and efficiently incorporated in the climate impact studies to simulate monthly runoff and as well as in the water resources planning program.

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LIST OF ABBREVIATIONS

Abbreviation	Description
c	Parameter c
C	Runoff Coefficient
CC	Climate Change
DSD	Divisional Secretary Divisions
E	Nash–Sutcliffe coefficient
E (t)	Actual Evapotranspiration
EP (t)	Pan Evaporation
GCM	Global Circulation Model
IM1	Inter Monsoon 1
IPCC	Intergovernmental Panel on Climate Change
K	Pan Coefficient
MAR	Mean Annual Rainfall
MRAE	Mean Ratio of Absolute Error
MSE	Mean Square Error
NEM	North East Monsoon
P (t)	Rainfall
Q (t)	Runoff
RAEM	Ratio of Absolute Error to Mean
RE	Relative Error
RMSE	Root Mean Square Error
S (t)	Soil Moisture Content
SC	Field capacity of the catchment
SWM	South West Monsoon
TPMWBM	Two Parameter Monthly Water Balance Model
WMO	World Meteorological Organization