

**EVALUATION OF GRIDDED PRECIPITATION PRODUCTS
FOR STREAMFLOW MODELLING IN GIN WATERSHED,
SRI LANKA**

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Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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UNESCO Madanjeet Singh Centre for
South Asia Water Management (UMCSAWM)
Department of Civil Engineering

University of Moratuwa
Sri Lanka

February 2022

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ABSTRACT

Evaluation of Gridded Precipitation Products for Streamflow Modelling in Gin Watershed, Sri Lanka

An accurate representation of spatial precipitation is significant for hydrological studies. Spatial precipitation is also the basic input for distributed hydrological models and the accuracy of spatial precipitation affects the performance of hydrological models. In many parts of the world, ground-based observation networks are inadequate to capture spatial precipitation because gauge stations cannot be set up anywhere as financial and geographical factors play a vital role in the establishment. To overcome those challenges two existing gridded precipitation data (TRMM and APHRODITE) are used to simulate discharge in the Gin watershed of Sri Lanka. The coefficient of determination improves to 0.78 and 0.65 respectively for TRMM and APHRODITE data after bias correction. While comparing two gridded precipitation data to observed data, the TRMM data shows superior to APHRODITE with the same value of daily and a monthly average rainfall of 11.15 mm and 339.29 mm respectively. The standard deviation shows 21.16 for daily and 167.72 for a monthly scale with the difference of 31.00 % and -0.06 % to observed the data set.

The HEC-HMS model is used for generating streamflow from the two gridded and observed data against gauge data. From the other four-parameter (SCS Unit Hydrograph, Simple Canopy, SCS Method, Simple Surface, and Recession) soil moisture accounting parameter calculation was challenging as it has to be carefully determined. The three most sensitive parameters are soil percolation, tension zone storage, and impervious area while the groundwater storage two (GW2) is the least sensitive parameter. Model performance criteria such as RMSE, NSE, and PBIAS are carried out for calibration and validation. The observed data performed good in the simulation of streamflow compared to two gridded precipitation data with an NSE value of 0.70, RMSE Std Dev value of 0.50, and PBIAS of -8.40 % for calibration and NSE value of 0.66, RMSE Std Dev value of 0.66, and PBIAS of -2.34 % for validation. The result shows that the TRMM data is more suitable to be used for hydrological modelling for and water resources management in ungauged areas in Sri Lanka.

Keywords: APHRODITE, BIAS, CDF, HEC-HMS, SMA, TRMM

DEDICATION

I dedicate my dissertation work to my parents and plenty of friends. A special feeling of gratitude to my loving parents, Mr. Jaw Chung Doya and Mrs. Nim Jem Doya for their consistent support, inspiration, and encouragement. Even my gratitude goes to my sister, Pem Choden Doya for providing her endless assistance throughout my life.

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LIST OF ABBREVIATIONS

AMSRE	Advanced Microwave Scanning Radiometer
AMSU	Advanced Microwave Detector Unit
Avg	Average
Diff	Differences
FDC	Flow Duration Curve
GIS	Geographic Information System
GV	Ground verification
GW1	Groundwater layer 1
GW2	Groundwater layer 2
IO	Indian Ocean
JMA	Japan Meteorological Agency
MAE	Average-error magnitude
MHS	Microwave Humidity Detector
MRI	Meteorological Research Institute
NASA	National Aeronautics and area management
PBIAS	Percent bias
PMW	Passive microwave
PR	Combined precipitation radar
PRMS	Precipitation-Runoff Modelling System
PRMS	Precipitation-Runoff Modelling System
PVE	Streamflow volume errors,
RF	Rainfall
SbPP	Satellite-based precipitation products
SF	Streamflow
Sim	Simulated
SMA	Soil Moisture Accounting
SRE	Satellite-based rainfall estimate
SSMIS	Special microwave imaging sensors
SSMIS	Special microwave imaging sensors
USACE	United States Army Corps of Engineers
WB	Water balance
WMO	World Meteorological Organization