



# Performance evaluation of CFSR, MERRA-2 and TRMM3B42 data sets in hydrological modelling of data scarce tropical catchments: a case of Manafwa, Uganda

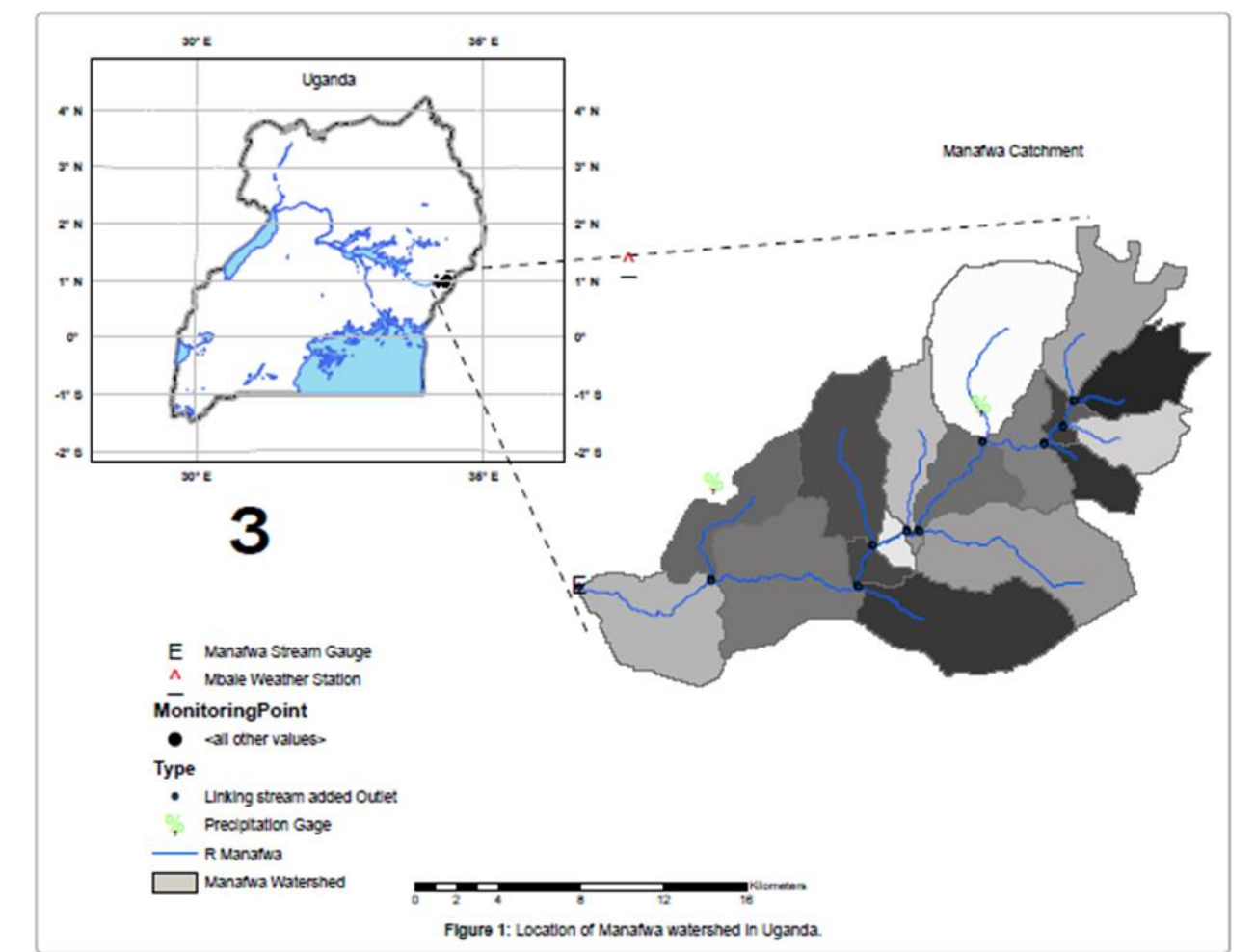
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## Background/Introduction

Data scarcity has been a huge problem in modelling various catchments especially in the tropical region. Satellite data and different statistical methods are being used to improve the quality of conventional meteorological data. However, the potential of using this data needs to be further investigated.

National Centers for Environmental Prediction (NCEP)/National Center for Atmospheric Research (NCAR) (Tarana & Slobodan, 2010), Climate Forecasting System Reanalysis (CFSR) (Daniel, et al., 2014), European Center for Medium-Range Weather Forecasts (ECMWF) ERA-Interim (Peng, et al., 2020), Tropical Rainfall Measuring Mission (TRMM) (Liu, et al., 2012) and Modern-Era Retrospective Analysis for Research and Applications (MERRA) (Gelaro, et al., 2017) are some of the widely used datasets.



Location of Manafwa Watershed in Uganda

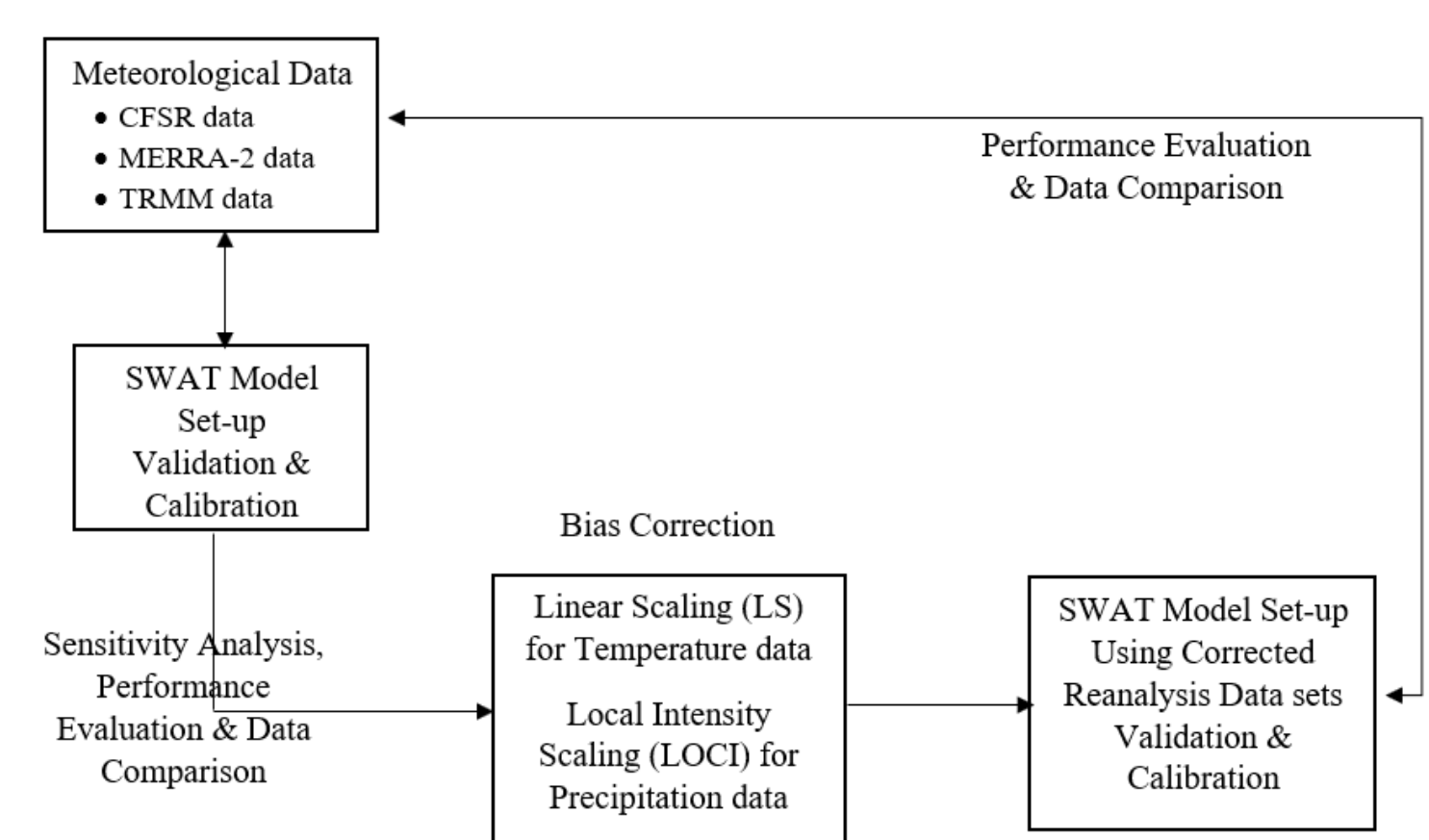
## Objectives

- Application of the observed data and reanalysis data sets for continuous runoff modelling and compare performance using statistical metrics like NSE, R2 etc
- Obtaining Bias corrections on gauged data from the Manafwa Catchment and applying this corrected data to see how best it can simulate river discharge.

### VALUE ADDITION

- This study evaluates the performance of two reanalysis data sets i.e CFSR and MERRA-2 and TRMM satellite product in hydrological modelling of the Manafwa Catchment, Uganda.
- This study will be useful in validating the use of these datasets in runoff modelling for data scarce catchments especially in the tropical region.
- The proposed methodology will contribute to the bias correction of these datasets and hence, the hydrologic simulation modelling at the river basin scale with increased accuracy.

## Methodology



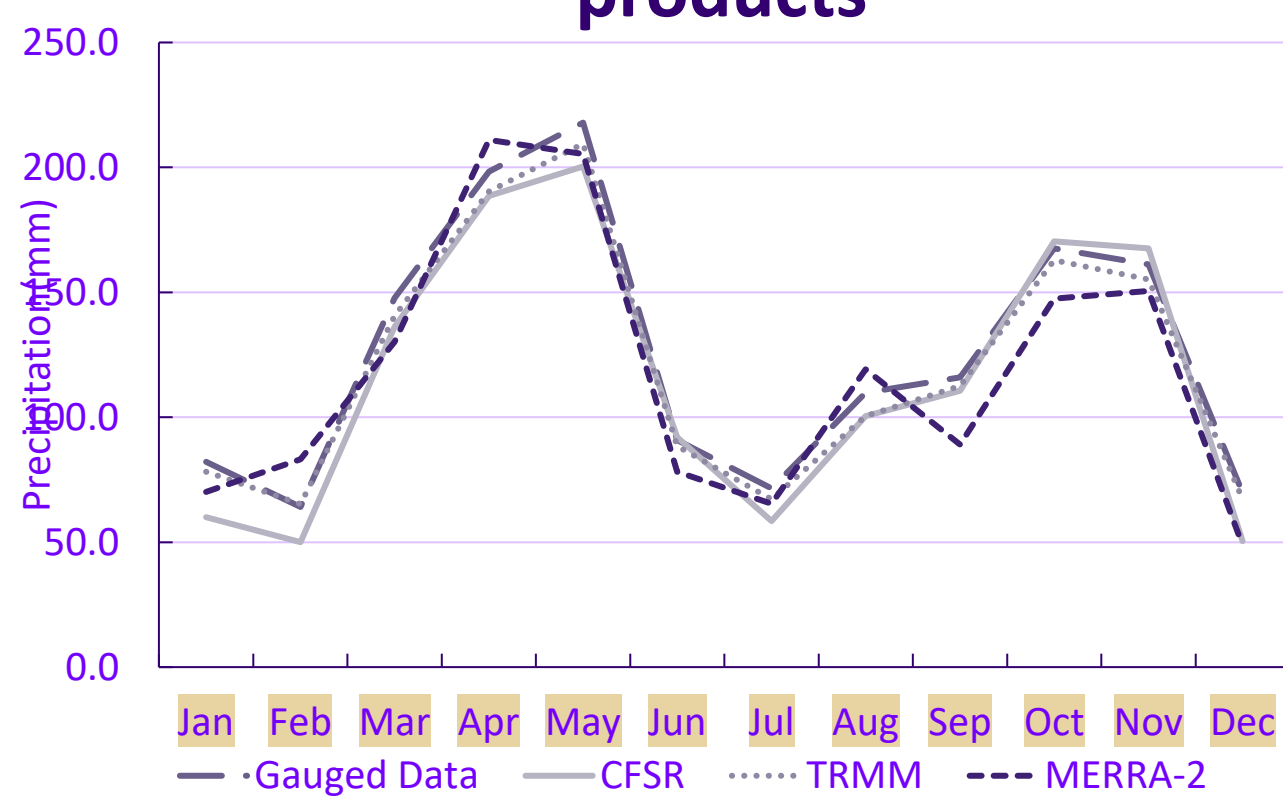
## Results

Model performance indicators indicated that, at monthly time steps, all the three datasets produced values of Nash Sutcliff Efficiency ( $NSE \geq 0.5$ ), Coefficient of Determination ( $R^2 \geq 0.5$ ) and  $PBIAS \pm 25\%$ . In addition, it is worth noting that MERRA-2 underperformed compared to TRMM and CFSR. The performance indicators improved with bias correction.

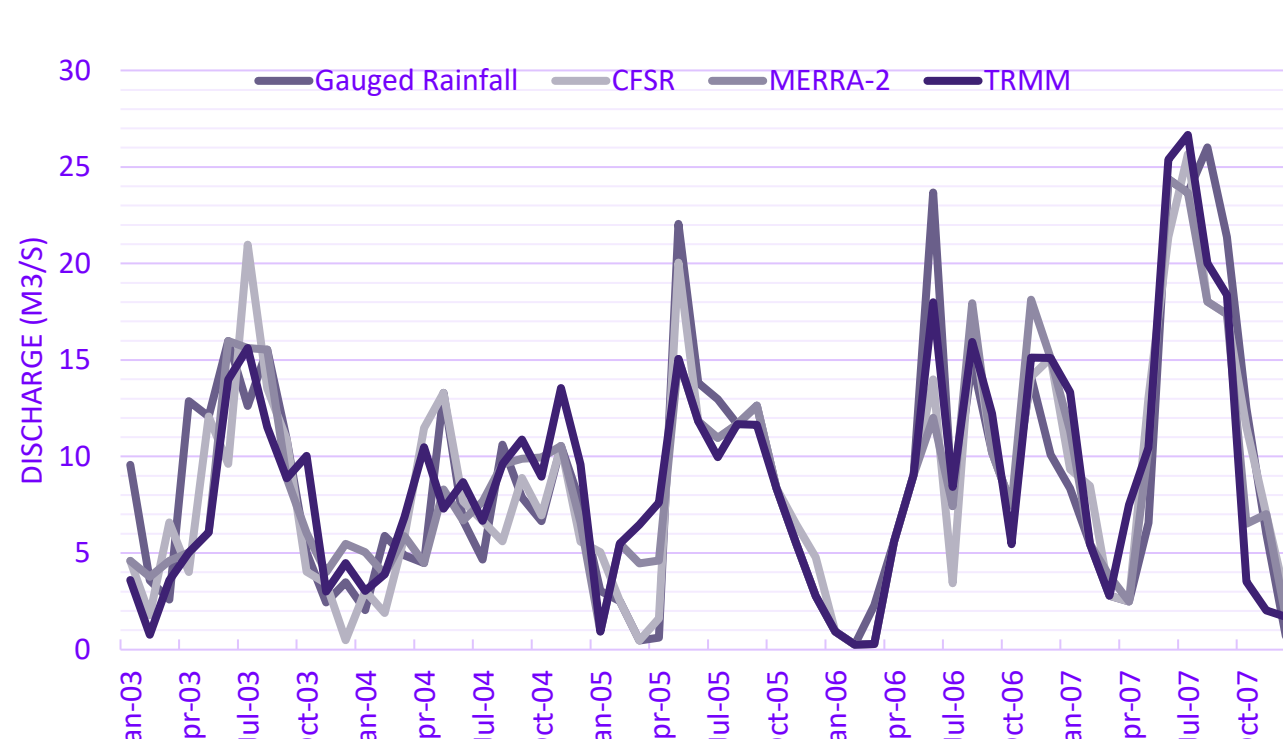
## Acknowledgement

Building Capacity in Water Engineering for Addressing SDG's in East Africa (CAWESDEA) Project – Internship Programme  
Strengthening Engineering Ecosystem in Sub – Saharan Africa (IDRC Funded Programme - 2018-2021)

### Average monthly rainfall of rain gauges and reanalysis rainfall products



### Simulated flow by gauged rainfall, TRMM, CFSR and MERRA-2 Before Bias correction



### Bias Correction Methods

For precipitation, the Local Intensity Scaling (LOCI) method was used whereas for temperature, the Linear Scaling (LS) method was used. Both are conducted on a monthly basis for each calendar month during the period 2000-2012.

### Simulated flow by gauged rainfall, TRMM, CFSR and MERRA-2 After Bias correction

