Geophysical Research Abstracts
Vol. 16, EGU2014-13898, 2014
EGU General Assembly 2014

Evaluation of alternative climate data sources for rainfall-runoff modeling in data scarce tropical watershed

Tadesse Alemayehu (1), Ann van Griensven (1,2), and Willy Bauwens (1)

(1) Department of Hydrology and Hydraulics Engineering, Vrije Universiteit Brussel, Brussel, Belgium (tabitew@vub.ac.be),
(2) UNESCO-IHE Institute for Water Education, Department of Water Science and Engineering, Delft, the Netherlands

Often times rainfall-runoff modeling efforts are challenged by scarcity of hydro-climatological data, if not by data quality. Apparently, accurate and representative climate data are crucial for realistic simulation of hydrological processes in a watershed using hydrological model. Hydro-climatological monitoring networks in the Upper Mara basin are very sparse and the data availability for modeling studies is very limited. Hence, one of the overarching objectives of this study is to investigate the capability of two rainfall data sources - Water and Global Change (WATCH) as well as Climate Forecast System Reanalysis (CFSR) - for streamflow simulation using the Soil and Water Assessment Tool (SWAT). In addition, the SWAT simulated flows using point rain gauge data (the classical SWAT centroid approach) are compared with flows simulated using areal rainfall derived from WATCH, CFSR as well as locally measured data. Other than rainfall, potential evapotranspiration (PET) is one of the variables required as an input to the SWAT model; nevertheless, there is no measured weather variable to compute PET in the study area. Thus, the potential of CFSR data to compute PET is also assessed. Climate data from Global circulation Models (GCM) are often vulnerable to systematic errors and thus, a statistical bias correction was applied to rainfall data from these two datasets. The bias correction improved the seasonality of rainfall and its distribution. The physically based SWAT model is set up for 1988-1992 time windows to simulate streamflow. As noted from the SWAT simulations, the SWAT simulated flow based on the raw and bias corrected CFSR and WATCH data do not mimic well the observed daily hydrograph pattern. However, when the SWAT model forced by the measured rainfall data, the simulated flows showed a good agreement with the observed flow. The goodness-of-fit based on Nash-Sutcliffe efficiency (NSE) criteria ranges from 0.19 to 0.42 for the global datasets while for the locally measured rainfall inputs the NSE is about 0.65. Despite the low performance of the rainfall data derived from CFSR, the PET computed using the weather variables such as temperature, relative humidity, wind speed and solar radiation from CFSR improved slightly when used as an input to the SWAT model instead of the SWAT weather generator. In conclusion, in watersheds like the Upper Mara, where rainfall varies highly in space, rainfall data from gauge stations is a better alternative than global reanalysis data especially if they are distributed across the watershed even if sparsely. Besides, the finer resolution globally available CFSR data (i.e. 38 km) can be considered as a potential surrogate for weather variables required to compute PET.

Key words: reanalysis climate data, model performance, SWAT, Upper Mara