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**Abstract**

Rainfed agriculture provides several benefits such as food and water resource production. However, it is becoming increasingly exposed to climate and anthropogenic changes. Which can increase the threats on crop and water resource production. To investigate the future anthropogenic and climate change impacts on crops production and water resources' preservation it is essential to ensure that models can appropriately simulate complex agro-hydrological processes in rainfed watershed. The objective of this study was to perform a multi-criteria evaluation of the SWAT model to understand and simulate agro-hydrological processes of the rainfed semi-arid watershed in Tunisia. In this study, 20 years (1995-2015) of hydro-meteorological and vegetation data from the Mediterranean Observatory for Rural Environment and Water (OMERE) have been used. Monitoring includes daily hydrometric data, soil moisture on multiple profiles, actual evapotranspiration, and aboveground biomass. The study focuses on the Lebna watershed (210 $km^2$) northeast of Tunisia marked by the predominance of rainfed wheat, legumes and fodder crops. The SWAT model is implemented by adopting a three-step calibration procedure. A first step was devoted to sensitivity analysis using the SWAT_CUP tool for model parameters. The calibration of the discharge at the level of the watershed, followed by a simultaneous calibration of the discharge and the evapotranspiration in order to test the effect on the model performances. The third step is to specify the management operations in the model and to assess the impacts on the results. The simulation was performed for the years 1995 to 2015, of which the first four years were considered for warming up the model. The analysis of the results of the model is carried out based on the discretization of the watershed according to a parcel division into more than 600 distinct units. According to the results, the model performance was improved by the multiparameter and multivariable calibration in terms of NSE. The ongoing analysis will concentrate on implementing reservoirs to have a better understanding of the possible impacts on the simulation.

**Keywords**

Flow, calibration,SWATcup