Mathematical Modeling of Rainwater Harvesting Systems for Upper Khanaqin in Diyala Governorate

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ABSTRACT

The rainwater harvesting system is an important component of arid and semi-arid countries due to its' essential role in reducing the growing gap between the need for water and its' scarcity and availability issues during dry seasons. The purpose of this study is to estimate the amount of surface runoff volume that can be harvested during flood seasons for use at other times. The location being evaluated (the upper part of Khanaqin city) was modelled using the mathematical model of Soil and Water Assessment Tool (SWAT). The catchment area of 701.836 km^2 was surveyed using remote sensing techniques and satellite images which include Digital Elevation Model (DEM) maps, land cover maps and soil maps of Food and Agriculture Organization (FAO). The results showed that the average volume of surface runoff for 21-year period from 1990 to 2010 is equal to (73,242,268.13 m^3). Furthermore, the predicted value of the average volume of surface runoff for 18 years during a period extended from 2018 to 2035 is equal to (76,352,348.53 m^3). The selection of the period from 1990 to 2010 for which the model simulation was conducted is due to the fact that the daily climatic data that has been used in the SWAT model simulation only available and extended within this period. It has been proposed as the site for the location of the dam for designing a system of irrigation relying on remote-sensing techniques and understanding the elevations and slopes of the topographic maps using the Geographic Information System (GIS) programme. As the proposed area had not been assessed, the neighbouring catchments' data was used in the SWAT-CUP programme to calibrate the mathematical model.

The calibration flow data used was dated from 2006 to 2010, and the validation test data was from 2010 to 2013, after treating it with the regionalization method (ratio method). The results show that the Nash-Sutcliffe Coefficient (NS) and the Coefficient of determination (R^2) for calibration and validation equal -0.05, 0.08 and 0, 0.04 respectively.