Simulation of Rainfall-Runoff in the Diyala River Basin in Iraq using Hydrological Model by HMS with remote sensing, Geo-HMS and ArcGIS

Faris Sahib Alrammahi[1a] and Ahmed Naseh Ahmed Hamdan [2b]

1PhP student in Civil Engineering Dep., University of Basrah, Iraq.
1Engineering Dep., Imam Kadhum College, Iraq.
2Civil Engineering Dep., University of Basrah, Iraq
[a] Corresponding author: farisali@alkadhum-col.edu.iq;
[b]ahmed.hamdan@uobasrah.edu.iq

Abstract. In Iraq, the Diyala River (DR) occasionally experiences both droughts and floods. The DR is supplying the amount of water to Tigris River at the south of Baghdad. Estimation of runoff from precipitation is very important because of its impact on decision-making in water resources management. The conceptual and distributed hydrological model was adopted and by HEC-HMS, Geo-HMS, and GIS software, remote digital elevation models were processed. The sensitivity, calibration, and validation were made through the period 2017-2021. The estimated CN values were from 60 to 100 with distributed related ratios between 0.6% to 52.8%. The differences between the observed and estimated inlet discharge of Hemrin Dam were for (+0.1 to -0.2) % with some more at peak discharge point. The HEC-HMS, using data from NASA and FAO, was acceptable model. The results with an accuracy of 95%, which is indicated by the value of R2 and PBIAS indicators.

1- Introduction

Estimation of surface runoff from precipitation is very important because of its impact on decision-making in water resources management. There are many methods to estimate that amount, whether they depend on field data, mathematical and statistical equations, or both. All of these methods are known as models of Rainfall-Runoff [1]. There is a complex relationship between Rainfall-Runoff and good understanding leads to good estimation [2]. All attempts to model Rainfall-Runoff are based on simplifying the hydrologic processes and watershed characteristics into mathematical operations that are easy to deal with [3]. The runoff model can be defined as expressed in general in Eq. (1)[3]:

$$Q = [H] P \quad (1)$$

Where Q is the output of the model (Runoff); P is the input (rainfall); and H represents adopted functions in a model representing the relationships and characteristics of a studied catchments.

Perhaps the beginning of the process of this modeling back to the nineteenth century. In 9132, Sherman proposed the hydrograph unit technique, and perhaps it is the first attempt to adopt hydrograph prediction instead of the maximum flow with related time technique [4]. The year 1950 is considered the year of the major transformation witnessed by the modeling process, because researchers in hydrology became aware of more accurately how to understand and describe complex dynamical