Surface Runoff Modeling of Ephemeral Streams Considering Homogenization Theory in Arid Regions, Wadi Assiut in Egypt

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1. Introduction

Understanding of hydrological processes of wadi system in the arid regions is so important due to the importance of the water resources which represent the main dominant resource in such areas. The scarcity of data and the lack of high quality observations are crucial obstacles that confront the researchers to develop the powerful hydrological models. Moreover, the ephemeral streams are characterized by the discontinuous occurrence of flow in both time and space in the ephemeral streams.

2. Objectives

The objective of this research is to study the Wadi system management and flood threat control in Wadi Assiut watershed, Egypt. In addition to study the interaction between ground water and surface water due to the importance of the groundwater in the arid and semi-arid regions where the ephemeral streams have very crucial effect on the subsurface water caused by the transmission losses through the wadi bed as recharge to groundwater.

3. Methodology and conceptual model

We propose to apply a homogenization method of up-scaling technique of the hydrological parameters related to a distributed runoff model from microscopic aspects up to macroscopic ones in the arid and semi arid areas. A surface flow direction prescribed through a flow routing map is significant to replace the discontinuous flow in the lumped model cell to the homogenized equivalent flow for the simplicity of calculations in the complicated wadi system based on the conservation of water balance.

Also, our approach (Fig.1) is physically-based numerical model based on sporadic precipitation and under conditions of data deficiency where we developed the watershed modeling based on GIS technique, surface runoff and stream routing modeling based on using the Kinematic wave approximation, the initial and transmission losses modeling estimated based on SCS (SCS, 1985) method (an empirical model for rainfall abstractions suggested by the U.S Soil conservation Service) and Walter's equation (Walters, 1990) respectively, and groundwater modeling based on the linear storage model.
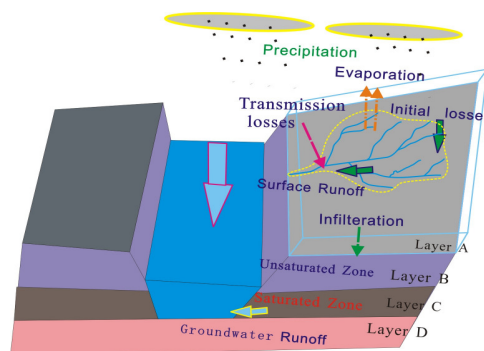

Fig. 1 Conceptual model of Wadi System

4. Conclusion

The merit of this work is for estimation the distributed runoff regionally not only in the Nile River basin, Egypt, including the wadi system, but also in the other arid and semi-arid regions.

References

1. SCS, 1985: National Engineering Handbook, section 4: hydrology, US Department of Agriculture, Soil Conservation Service, Engineering Division, Washington, DC.

2. Walters, M.O., 1990: Transmission losses in arid regions. J. of Hydraulic Engineering, ASCE 116,129-138