DEVELOPMENT OF EIGHT-PARAMETER CONCEPTUAL RAIFALL-RUNOFF MODEL AND ITS APPLICATION AT A SEMI-ARID LOW YIELD CATCHMENT

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Available observations are often not sufficient as a basis for decision making in water management especially at arid and semi-arid catchments [catchments with streamflow/rainfall ratios of about 0.2 or less]. Deterministic conceptual rainfall-runoff models are frequently used as tools for a wide range of tasks to compensate the lack of measurements, e.g., to extend runoff series, compute design flood and to predict the effects of climatic change.

The problems of hydrology and water development planning in arid and semi-arid catchments are often very different from those of wet catchments. The majority of traditional conceptual rainfall-runoff models have been built for temperate or wet catchments, where all the required hydrological data are mostly available. Therefore, the need is stressing for building another conceptual rainfall-runoff models to deal with peculiarities characterizing the condition at arid and semi-arid ephemeral catchments, which at most suffer from drastic lack of hydrological information, and in time when these information are available it is highly variable in time and space.

The conceptual rainfall-runoff models or soil moisture accounting models have a structure of interconnected storage. Mroczkowski, et al. (1997) defined a model as a conceptual if at least one of its parameters has to be calibrated. . Examples of this type of models include the Stanford watershed model (Crawford and Linsely, 1966), MODHYDROLOG model (Chiew and Mc Mahon, 1994) ....etc.

In this study, a deterministic conceptual rainfall-runoff model has been developed; the model simulates streamflow hydrograph in an event basis. The major input requirements for this model are hourly rainfall, hourly potential evaporation and the average daily streamflow record. The model is calibrated and tested using the available data collected from only one semi-arid ephemeral catchment located at the central part of Jordan. The performance of the model was evaluated using the goodness of fit measures.

Shuffle Complex Evolution (SCE.UA) optimization method developed by Duan et al, (1992) is employed to optimize the parameters of the proposed model.

The simulation results obtained show that the proposed model has a good match between observed and simulated streamflow for both optimization and validation stages. Fig.1 illustrates the observed and optimized hydrographs for a selected four events at Wala catcment; the values of co-efficient of efficiency, R^2, for each storm are also given. Similarly, Fig.2 shows the observed and simulated hydrographs along with R^2 values for a selected single storm event of wadi Wala catchment. The good simulation results obtained

indicate that the model will be useful in design of hydraulic structures and for effective management of water resources at arid and semi-arid catchments.

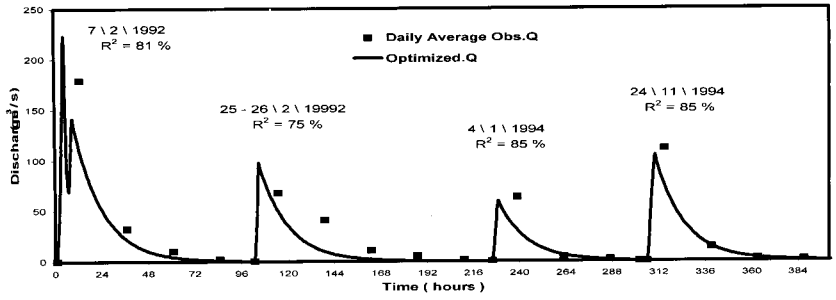

Fig. 1 Observed and optimized hydrographs for a selected four storms of wadi Wala catchment

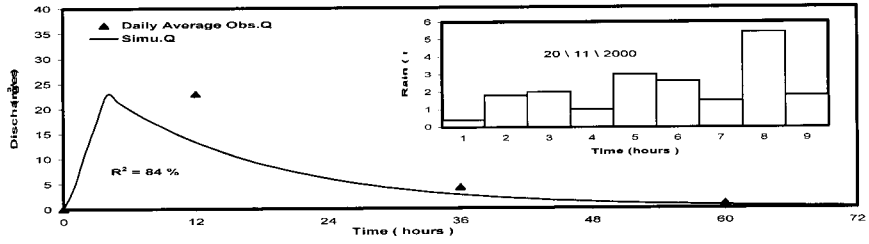

Fig. 2 Observed and simulated hydrographs for a selected storm event of wadi Wala catchment

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