Optimal Methods on Hydrologic Flow Routing Operations

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Abstract

Flood is among those unsteady flows which is dynamic in different places and times. It is of great importance in engineering project to predict flood behaviors. Modeling of this phenomenon with the use of mathematical way can help designers in understanding the effect of flood flow alongside of the river and its surrounding areas. Flood routing is among those models in which flood behavior prediction was done toward the river stream. Indeed, the flow routing is the basic way of hydraulic structures. Flood routing in general are divided into two types of hydrologic and hydraulic methods. The present research made use of three methods of Convex, Modified Att-kin and Muskingum and also two different series of data from Kor and Sivand rivers. In this regard, beside describing the three principles mentioned above, their results were examined and investigated and then the accuracy of flood routing errors were estimated trough the analogy of each method with the observed discharge. In estimating each method results and error analysis, values such as observed and routed peak discharge and the exact amount of error in every single step with the concurrent effect were used. Ultimately, the results indicated that the Muskingum method with the estimated parameters based on the least-squared method and correlation coefficient had the best correspondence with the observed discharge. In addition, this method can confidently be used with the least error analysis in flood routing in rivers.

Keywords:Hydrologic Routing,Muskingum,Convex,Modified Att-Kin,Optimal Coefficients.

1. INTRODUCTION

The flood routing which is based on the hydrological techniques has gained widespread usage due to its ease and acceptable response.Hydrological methods that are considered in this study are included Convex, Modified ATT-KIN and Linear Muskingum.The reason behind choosing these methods is the sufficient accuracy they have in comparison to other methods of hydrological models. Hydrological methods are permanent due to their one-dimensional continuity equation, their relation between the inflow and outflow discharge and their internal reach storage. This equation is as follow [1, 2]:

$$\frac{\Delta S}{\Delta t} = I - O \quad (1)$$

In this equation, I, O and S, are the inflow discharge, outflow discharge and storage volume respectively and Δt shows the time step. The point that discriminate different methods of hydrological models is how to use storage equation in each single method of hydrological models. Storage methods in hydrological methods disregard to their linearity or nonlinearity are based on two general following forms.In short, Table. 1 indicates how to use storage equation in any of hydrological models.

$$S = K[XI + (1 - X)O]^m \quad (2)$$

$$S = K[XI^m + (1 - X)O^m] \quad (3)$$