LAG TIME RELATIONS TO CATCHMENT SHAPE DESCRIPTORS AND HYDROLOGICAL RESPONSE

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As hydrologists we would consider why and how the channel networks have been created as well as how that particular networks respond to rainfall events. Unfortunately, the exact solutions of such problems have not been obtained until now. Recently Moussa(2003) has tried to define catchment shape descriptors to characterize the hydrological response of the basin and then to analyze the relationship between these descriptors and the scale of observation. In order to study the relationship between morphometric properties of basins and basin hydrological response, he has proposed a new catchment-shape index, i.e., the equivalent ellipse which has the same center of gravity, the same principal inertia axes, the same area and the same ratio of minimal inertia moment to maximal inertia moment as the catchment.

The main object of the present paper is to determine the representative velocity of GIUH, since, as seen generally, the velocities result in different values according to each storm event as a result of time-varying system. From the views of Rosso(1984) and Chutha, and Dooge(1990) that the shapes of GIUH and Nash model are very close, both of them are assumed to be equal in this paper so as to determine the representative GIUH velocity. The main reason to do so is to attempt to search for the feasibility of practical use of them both in determining the representative GIUH velocity. Also, the lag times for the fittest velocity of GIUH are related to catchment shape descriptors to see whether they will give the better results or not by using the regression method.

As applications, 3 catchments located in Korea(south) are tested to discuss the validity of this study. The catchment plan-forms of 17 subbasins based on the location of stage gauging station are extracted from DEM with 20 m grid resolution. The shape of the equivalent ellipse is presented to approach a circle along the river downwards. The definition of catchment shape descriptors $a+b$ and $a+b+\varepsilon OM$ implies the very close relation to the lag time. In this study regression analysis between two descriptors and the lag times of 3 catchments is performed assuming power relationship. Whichever case of $a+b$ or $a+b+\varepsilon OM$ is chosen, when judged from correlation coefficients. Therefore, considering the simplicity in view of applicability, the former is recommended for actual affairs in here. In addition, when the lag times are correlated with the other characteristics of catchment, that is, the mainstream length and the stream length from the outlet to a point opposite the basin centroid which have been used for synthetic unit hydrograph, respectively, these descriptors are tested as the better correlation to the lag time than others mentioned above.

By comparing the calculated outflows with the observed ones not used in analyzing the present model for obtaining the fittest lag time or GIUH velocity, the proposed GIUH is shown to be applicable, reasonable approach for obtaining the response function of a catchment. The results obtained in this study may be expanded to the estimation of hydrological response of ungaged catchment.

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