REGIONALIZATION OF A CONTINUOUS RUNOFF MODEL PARAMETERS BASED ON BASIN PHYSICAL CHARACTERISTICS

IL WON JUNG [1] and DEG HYO BAE [2]

[1] Ph.D Candidate Student, Department of Civil & Environmental Engineering, Sejong University, 98 Kunja-Dong, Kwangjin-Gu, Seoul, 143-747, Korea
(Tel: +82-2-3408-3337, Fax: +82-2-3408-3332, e-mail: bobilwon@hanmail.net)
[2] Associate Professor, Department of Civil & Environmental Engineering, Sejong University, 98 Kunja-Dong, Kwangjin-Gu, Seoul, 143-747, Korea
(Tel: +82-2-3408-3814, Fax: +82-2-3408-3332, e-mail:dhbae@sejong.ac.kr)

The long-term runoff analysis is an important task for various water resources applications such as watershed planning and management, hydraulic structure design, and flood control and management, etc. The best way for the analysis is to use the observed streamflow data, however, those data are frequently not available for some areas. In this case, it is inevitably necessary to use a rainfall-runoff model is model calibration and verification by using existing observed streamflow data and then is the regionalization of model parameters for ungauged watersheds.

In this study, we propose a regionalization method for long-term rainfall-runoff analysis on ungauged catchments by using the geographical features of the watershed and attempt to verify the usefulness of the proposed method. The regionalization method presented in this study is the use of multiple regression equation that describes the relationship between the basin geographical data and observed stream flows. This method is based on the configuration of basin characteristics and river discharges at the drainage basin outlet. In other words, the river flows at a certain location of the basin are affected by the basin characteristics such as basin area (AR), basin slope (SL), mean basin elevation (EL), maximum soil available water holding capacity (SM) and area ratio of forest in a watershed (LU), etc. Therefore, once the relationship between observed river flows and basin characteristics is found on the calibration basins, the model parameters on ungauged basins are regionalized from the river flow and basin characteristics relationship. For the selection of the relationship between observed flows and basin characteristics, stepwise multiple regression analysis is used in this study. The procedure for the regionalization of model parameters on ungauged watershed is shown in Figure 1.

Multiple regression analysis for deriving the relationship between river flows and basin characteristics is performed in this study. By analyzing the relationship between basin characteristics and mean discharge over the selected study areas, SM is selected as the best fitting coefficient of determination (0.91). The rest of the variables are performed on the order of AR(0.75), SL(0.72), EL(0.69) and LU(0.57), respectively. Finally, the variables SM, SL and LU are selected for the best multiple regression equation.

For evaluation of the regionalization method proposed in this study, two dam sites (Soyang and Chungju dam) are selected for verification sites under the assumption that these two watersheds are ungauged areas. Consequently, the hydrographs show that observed and simulated flow are well agreed in shapes and magnitudes for both cases. Also, the range of correlation coefficient (R), root mean square error (RMSE) and model efficiency (ME) is between 0.82 and 0.89, 3.42 and 3.67 mm/day, 0.66 and 0.77,

respectively. The volume error (VE) is 7.68% and -0.81%. The statistical and graphical results for the verification period show that the simulated flows are well agreed with observed ones.

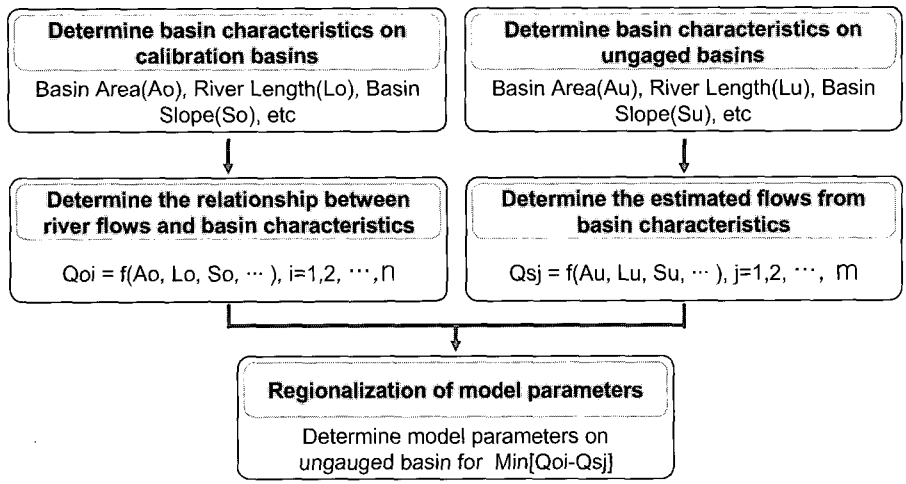

Fig. 1 Regionalization procedure of the model parameters.