HS13-D4-AM2-318B-008 (HS13-A004)

Kimura's Versus Prasad's Storage Function Model for an Urban Watershed

Saritha Gopalan Padiyedath[1], Akira Kawamura[2], Hideo Amaguchi[3] and Gubash Azhikodan[4]

[1]Ph.D. Student, Dept. of Civil and Environmental Eng., Tokyo Metropolitan University (1-1 Minami Osawa, Hachioji, Tokyo 192-0397, Japan)
E-mail:charu666@gmail.com
[2]Professor, Dept. of Civil and Environmental Eng., Tokyo Metropolitan University (1-1 Minami Osawa, Hachioji, Tokyo 192-0397, Japan)
[3]Asst. Prof., Dept. of Civil and Environmental Eng., Tokyo Metropolitan University (1-1 Minami Osawa, Hachioji, Tokyo 192-0397, Japan)
[4]Asst. Prof., Dept. of Civil and Environmental Eng., Tokyo Metropolitan University (1-1 Minami Osawa, Hachioji, Tokyo 192-0397, Japan)

Urban flood constitutes a serious threat to the lives of human beings and the associated infrastructure. The storage function (SF) models are one of the conceptual model widely used for the flood prediction in different parts of the world due to its ability to express the non-linear relationship between rainfall and runoff. In this study, therefore, we aim to compare the conventional Kimura's and Prasad's SF models after modifying their framework in order to consider the total rainfall and discharge directly and thereby reducing the associated errors of separation. The 3-parameter SF models of Kimura and Prasad were transformed into 5-parameter models after the modification of the existing model framework by the addition of two parameters. Also, we analyzed the effect of lag time in the Kimura's SF model on hydrograph reproducibility and it revealed that the use of optimum lag time in Kimura's model can greatly improve the performance. Further, the two 5-parameter models were compared for an urban watershed in terms of hydrograph reproducibility, storage hysteresis loop, and Akaike information criterion (AIC) perspective. The Kanda river basin, a typical small to medium-sized urban watershed in Tokyo, was selected as the target basin and the two models were applied to five selected flood events. The reproducibility of hydrographs was assessed using different performance evaluation criteria of root mean squared error, Nash-Sutcliffe efficiency (NSE), and other error function of peak, volume, and time to peak. The Kimura's SF model with optimum lag time exhibited higher NSE values associated with lowest error evaluation criteria and lowest AIC values in the single-peak events which makes it the superior model for single-peak events. Concurrently, Prasad's model depicted better performance in terms of reproducibility and AIC aspect during the multi-peak events, which indicates that it is the parsimonious model for multi-peak events.