Derivation of rainfall threshold for urban flood warning based on the dual drainage model simulation

Duc Anh Dao*, Dongkyun Kim**, Dang Hai Ha Tran***

Abstract

This study proposed an equation for Rainfall Threshold for Flood Warning (RTFW) for urban areas based on computer simulations. First, a coupled 1D-2D dual-drainage model was developed for nine watersheds in Seoul, Korea. Next, the model simulation was repeated for a total of 540 combinations of the synthetic rainfall events and watershed imperviousness (9 watersheds x 4 NRCS Curve Number (CN) values x 15 rainfall events). Then, the results of the 101 simulations with the critical flooded depth (0.25m-0.35m) were used to develop the equation that relates the value of RTFW to the rainfall event temporal variability (represented as coefficient of variation) and the watershed Curve Number. The results suggest that 1) the rainfall with greater temporal variability causes critical floods with less amount of total rainfall; and that 2) the greater imperviousness requires less rainfall to have critical floods. For validation, the proposed equation was applied for the flood warning system with two storm events occurred in 2010 and 2011 over 239 watersheds in Seoul. The results of the application showed high performance of the warning system in issuing the flood warning, with the hit, false and missed alarm rates at 68%, 32% and 7.4% respectively for the 2010 event and 49%, 51% and 10.7% for the event in 2011.

Keywords : Rainfall threshold, Urban flood, Coupled 1D/2D flood model

Acknowledgment

This work was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT). (No. NRF-2021R1A2C2003471)

* Member · PhD candidate, Dept. of Civil Engineering, Hongik University

** Associate Professor, Dept. of Civil and Environmental Engineering, Hongik University · E-mail : kim.dongkyun@hongik.ac.kr

*** Member · Master, Dept. of Civil Engineering, Hongik University