

Application of flood-intensity-duration curve, rainfall-intensity-duration curve and time of concentration to analyze the pattern of storms and their corresponding floods for the natural flood events

Nam Won Kim (1), Mun-Ju Shin (2), and Jeong Eun Lee (3)

(1) Korea Institute of Civil Engineering and Building Technology, Gyeonggi-Do, Republic of Korea (nwkim@kict.re.kr), (2) Korea Institute of Civil Engineering and Building Technology, Gyeonggi-Do, Republic of Korea (mjshin@kict.re.kr), (3) Korea Institute of Civil Engineering and Building Technology, Gyeonggi-Do, Republic of Korea (jeus22@kict.re.kr)

The analysis of storm effects on floods is essential step for designing hydraulic structure and flood plain. There are previous studies for analyzing the relationship between the storm patterns and peak flow, flood volume and durations for various sizes of the catchments, but they are not enough to analyze the natural storm effects on flood responses quantitatively. This study suggests a novel method of quantitative analysis using unique factors extracted from the time series of storms and floods to investigate the relationship between natural storms and their corresponding flood responses. We used a distributed rainfall-runoff model of Grid based Rainfall-runoff Model (GRM) to generate the simulated flow and areal rainfall for 50 catchments in Republic of Korea size from 5.6 km² to 1584.2 km², which are including overlapped dependent catchments and non-overlapped independent catchments. The parameters of the GRM model were calibrated to get the good model performances of Nash-Sutcliffe efficiency. Then Flood-Intensity-Duration Curve (FIDC) and Rainfall-Intensity-Duration Curve (RIDC) were generated by Flood-Duration-Frequency and Intensity-Duration-Frequency methods respectively using the time series of hydrographs and hyetographs. Time of concentration developed for the Korea catchments was used as a consistent measure to extract the unique factors from the FIDC and RIDC over the different size of catchments. These unique factors for the storms and floods were analyzed against the different size of catchments to investigate the natural storm effects on floods. This method can be easily used to get the intuition of the natural storm effects with various patterns on flood responses.

Acknowledgement

This research was supported by a grant (11-TI-C06) from Advanced Water Management Research Program funded by Ministry of Land, Infrastructure and Transport of Korean government.