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Derivation of flood-inducing rainfall and runoff for highly urbanized area based on high-resolution radar-gauge composite rainfall data and flooded area GIS Data

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This study estimated the Flood-Inducing-Rainfall (FIR) and the Flood-Inducing-Runoff (FIRO) to be used as the basis of the flood warning for the highly urbanized area of Seoul, Korea. For this, we derived the depth-duration relationship of rainfall and runoff for the 261 flood events during 2010 and 2011 based on the 10-minute 1km-1km radar-gauge composite rainfall field and flooded area GIS data. We found that FIR and FIRO vary at the range of 37mm/hr-63mm/hr and the range of 10mm/hr-42mm/hr, respectively. The large variability residing in the FIR and FIRO was well explained by the flooded area proportion in the watershed (FP) and the rainfall coefficient of variation (CV): As the FP increases, FIR and FIRO increased too, suggesting that the greater rainfall leads to greater flooded area; as the rainfall CV increases, FIR and FIRO decreased suggesting that the temporally concentrated rainfall requires less total rainfall to cause flooding. The 21 flood events that occurred for the period of 2012 through 2015 at the study area was used for the validation of the derived FIR and FIRO. When the 5 percent of the flooded area can be tolerated, the ratio of hit and miss of the warning system based on the rainfall was 44.2 percent and 9.5 percent, respectively. The ratio of hit and miss of the warning system based on the runoff was 67 percent and 4.7 percent, respectively. Lastly, we show the importance of considering the radar-gauge composite rainfall data as well as rainfall and temporal variability in flood warning by comparing our results to the ones based on the gauge-only or radar-only rainfall data and to the one that does not consider the temporal variability.

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