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Development of GIS-Based Urban Flood Inundation Analysis System

KUN-YEUN HAN[1], CHANG-HEE LEE[2], JI-SUNG KIM[2]

[1] *Kyungpook National University, Korea*

[2] *Urban Flood Disaster Management Research Center, Korea*

The recent rainfall pattern in Korea can be summarized as the total number of rain day has decreased, but the total amount of rainfall has increased, and the total number of heavy rain day(80mm/day) has increased. Therefore, the natural damage associated with flood disaster has been dramatically increased. Especially inundation in the urban area causes serious damage to people and assets because of the concentration of infrastructure and population growth. The purpose of this research is to develop an integrated urban flood inundation analysis system(U-FIAS) which can simulate inundation phenomena in urban area, and to establish a system which can be operated in a GIS(Geographic Information System) environment. An urban inundation model coupling an one-dimensional stormwater model, SWMM(Storm Water Management Model), and a two-dimensional inundation model was developed to simulate inundation caused by the surcharge of storm sewers in urban areas. SWMM was employed to resolve the storm sewer flow and to provide the overflow hydrographs caused by the failure of a drainage system due to the shortage of drainage capacity and adjacent river stage rise. The two-dimensional overland-flow model was used to calculate the detail inundation zones and depths due to the surcharge on overland surface with complex building arrangement and topography. The combined model is suitable for analysis of inundation on urban areas due to overflow of storm sewer and flooding caused by the failure of pumping station. The limitation of this model which can not simulate the interaction between drainage systems and surcharged flow was resolved by developing dual-drainage inundation analysis model which was based upon hydraulic flow routing procedures for surface flow and pipe flow. The dual-drainage inundation analysis model can simulate the effect of complex storm drainage system. The developed model was applied to four drainage areas, such as Dorim, Goonja, Jangan, and Banpo catchments. The computed inundated depth and area have good agreement with the observed data during the flood events. The developed U-FIAS model can help the decision support system of flood control authority for redesigning and constructing flood prevention structures and making the potential inundation zone, and establishing flood-mitigation measures.