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Development of Coastal Inundation–Inland and River Flow Interface Module Based on 2D Hydrodynamic Model

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Abstract : Due to the climate change, the coastal urban area repeatedly suffers from the loss of property and life by flooding. There are three main causes of inland submergence. First, when heavy rain with high intensity occurs, the water quantity in inland cannot be drained into rivers by increase in impervious surface of the land development and defect of the pump, storm sewer. Second, river inundation occurs then water surface level surpasses the top of levee. Finally, Coastal inundation occurs due to rising sea water. However, previous studies ignored the complex mechanism of flooding, and showed discrepancy and inadequacy due to linear summation of each analysis result. In this study, inland flooding and river inundation were analyzed together by HDM-2D model. Petrov-Galerkin stabilizing method and flux-blocking algorithm were applied to simulate the inland flooding. In addition, sink/source terms with exponentially growth rate attribute were added to the shallow water equations to include the inland flooding analysis module. The applications of developed model gave satisfactory results, and provided accurate prediction in comprehensive flooding analysis. The applications of developed model gave satisfactory results, and provided accurate prediction in comprehensive flooding analysis. To consider the coastal surge, another module was developed by adding seawater to the existing Inland Flooding-River Inundation binding module for comprehensive flooding analysis. Based on the combined modules, the Coastal Inundation – Inland & River Flow Interface was simulated by inputting the flow rate and depth data in artificial flume. Accordingly, it was able to analyze the flood patterns of coastal cities over time. This study is expected to help identify the complex causes of flooding in coastal areas where complex flooding occurs, and assist in analyzing damage to coastal cities. Acknowledgements—This research was supported by a grant 'Development of the Evaluation Technology for Complex Causes of Inundation Vulnerability and the Response Plans in Coastal Urban Areas for Adaptation to Climate Change' [MPSS-NH-2015-77] from the Natural Hazard Mitigation Research Group, Ministry of Public Safety and Security of Korea.

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