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Real-Time Prediction of Urban Flooding by Combining Hydraulic and Probabilistic Methods

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Recently, flood damage caused by localized heavy rainfall is increasing due to urbanization and climate change. As result of flood damage, recovery cost and time are increasing and it is expected to grow even worse in the future. In order to solve these problems, it is necessary to predict the flooding area in consideration of the sufficient lead time. Furthermore, basic research about presenting the manhole location which has not sufficient capacity should be preceded.
The existing physical-based model gives accurate and elaborate results, however, it is time-consuming process. It also needs various data such as rainfall, topographic characteristics, 1D urban runoff simulation result, and hydrologic parameters. In addition, since it takes a considerable amount of time to perform the simulation, it has been difficult to secure the sufficient lead time through real-time prediction. This study presents a solution for this problem by combining hydraulic and probabilistic methods. The accumulated overflow for each manhole was predicted in study area based on nonlinear modeling analysis.
Nonlinear modeling analysis technique was performed which helps to quantify the extent to which numerical input-output data can be expressed as a reliable smooth model. To perform these prediction, nonlinear auto-regressive neural network was constructed that learns the urban runoff for various rainfall conditions at each manhole. The methodologies presented in this study are applied to Gangnam basin in Seoul, Korea. The simulated results agree with the observed in terms of flood volume with sufficient lead time.
Through above process, the time for preparing input data is saved and sufficient lead time for flood disaster is secured by using the system that learning the relation between various rainfall and urban flood consequence. In conclusion, the result of this study will save time by implementing effective real-time flood volume prediction considering manhole surcharges in urban area.