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Inundation potential maps using numerical simulations for the downtown Taipei city

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Inundation potential maps provide important information for flood mitigation and flood management. In urban areas, the work of constructing inundation maps become complicated because many facilities like storm sewer systems, drainage inlets, and pumping stations should be taken into account in a simulation model. Storm sewer systems are widely adopted for reducing surface runoff in urban areas. However, due to the limited capacities of inlets or conduits, the sewer systems are not always able to carry all the runoff. As a result, inundation takes place if the water overflows from sewer system at surcharged manhole. The excess water, including the rainfall excess and surcharged flow from sewer systems, becomes surface runoff flowing on the surface toward lowlands until it reaches another under-capacity drainage inlet. To describe the complicated rainfall-runoff phenomena in urban area, a dynamical model was developed by coupling a 2D non-inertia overland flow model for surface runoff simulation with the Storm Water Management Model for sewer flow calculation. The coupling model can simulate the bidirectional flow interactions between sewer and surface flows accurately. The model is verified by the Typhoon Xangsane event in 2000 and applied for simulating the Typhoon Nari event in 2001. The results show that the present model indeed improves simulation accuracy over the earlier model, and can be used to provide a more reliable flood mitigation design. It reveals that the dynamic urban inundation model is suitable for the flood simulation of an urban area under high intensity of rainfall. The Downtown Taipei is densely populated and highly developed as the political and financial center of Taiwan. It is surrounded by the Tamshui River on the west, the Hsintein Creek on the south, the Keelung River on the north and hills on the southeast and east. It is protected by the high-raised levees along

the rivers and dozens of pumping stations are built for flood control. However, on Sep. 16th and 17th in 2001, the Typhoon Nari swept through Taiwan with a historical-high rainfall record in northern Taiwan. It brought more than 780 mm of total rainfall with peak intensity 105 mm/h in the Downtown Taipei. It incurred the most serious flood damage of Taipei in decades. The improved model was applied to review the flooding processes during Typhoon Nari and the results. The present study demonstrates that the model with considering the interactive phenomena between sewer and overland flows gives more reasonable simulation results. Then the inundation potential maps were built by a series of inundation scenarios for various return period of rainfall by using the simulation model.