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AN URBAN FLOOD MODEL BASED ON TWO-LAYER WATER FLOW AND ITS APPLICATION

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Due to the rapid urbanization, impervious area increase greatly, which lead to the change of rainfall-runoff in urban area. Moreover, there are two discharge systems in urban area, i.e. overland flow and sewerage flow, and the water routing processes are complicated and much different with natural system. In this way, the studies on city flood simulation present more important in city flood control. However in most of existed urban hydrological models, a one-way connection between surface flow and underground flow is adopted, that means surface water can flow into the sewerage system, but the overflow from drain pipe could not be considered to route on the ground. For example in SWMM (Storm Water Management Model), a very famous urban flood model, when runoff exceeds the designed discharge capacity of drain pipe, the water will overflow from drain well, and be stored in a virtual pond, but can not flow on the ground, neither be discharged back into the sewerage system, even though the sewerage pipe is empty. However it is not true in the actual condition. To overcome this shortage, a two-layer hydrological model SSFM (Surface and Sewerage flow model) is developed in this paper. In this model, the water flow is divided into two layers, up layer is the surface flow, depicted by 2-D kinemics equations, and the down layer is river flow and sewerage flow, which is depicted by 1-D dynamic wave equations. The water exchange between the up layer and down layer is bidirectional and dynamic synchronously, that means the overflow from river or sewerage pipe can be routing on the ground, and also can be discharged into river or sewerage again under some condition. With this treatment, the simulation is close to the real flow. The

SSFM model was calibrated and validated in the Tonghui river basin, an urban area in Beijing, China, and the simulated results took on a good agreement with observed data. Then the model was applied in the Beijing Olympic park, a newly-built region in Beijing China, to forecast the city flood with rainfall frequencies of 2%, 5% and 10%. The temporal and spatial distribution of surface flow and drainage flow were obtained, and also the submerged range, period and ponding depth were analyzed in the paper. These simulated results can provide some support information for urban flood forecast and early-warning, which is helpful for urban flood management and control.