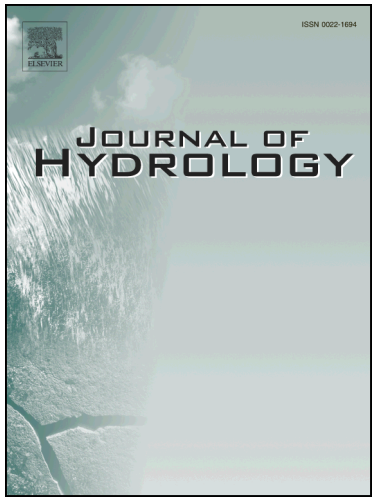

Research papers

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A Simple Analytical Infiltration Model for Short-duration Rainfall

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Abstract

Many infiltration models have been proposed to simulate infiltration process. Different initial soil conditions and non-uniform initial water content can lead to infiltration simulation errors, especially for short-duration rainfall (SHR). Few infiltration models are specifically derived to eliminate the errors caused by the complex initial soil conditions. We present a simple analytical infiltration model for SHR infiltration simulation, i.e., Short-duration Infiltration Process model (SHIP model). The infiltration simulated by 5 models (i.e., SHIP (high) model, SHIP (middle) model, SHIP (low) model, Philip model and Parlange model) were compared based on numerical experiments and soil column experiments. In numerical experiments, SHIP (middle) and Parlange models had robust solutions for SHR infiltration simulation of 12 typical soils under different initial soil conditions. The absolute values of percent bias were less than 12% and the values of Nash and Sutcliffe efficiency were greater than 0.83. Additionally, in soil column experiments, infiltration rate fluctuated in a range because of non-uniform initial water content. SHIP (high) and SHIP (low) models can simulate an infiltration range, which successfully covered the fluctuation range of the observed infiltration rate. According to the robustness of solutions and the coverage of fluctuation range of infiltration rate, SHIP model can be integrated into hydrologic models to simulate SHR infiltration process and benefit the flood forecast.