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Threshold rainfall for flash flooding from full hydrodynamic modeling

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A full hydrodynamic model is developed for modeling flash flooding generated by temporally and spatially variable rainfall. The model is based on the complete shallow water hydrodynamic equations, incorporating boundary resistance and infiltration loss. The governing equations are numerically solved with a second-order Total-Variation-Diminishing version of the Weighted-Average-Flux method, along with the HLL approximate Riemann Solver. A series of numerical modeling tests demonstrate the ability of the full hydrodynamic model to appropriately reproduce runoff hydrographs downstream and the flow structure, such as roll waves prone to occur over steep surfaces, which however cannot be properly resolved by traditional distributed hydrological models involving kinematic and diffusion wave approximations. On the basis of the full hydrodynamic modeling, a new technique is proposed to determine threshold rainfall for flash flooding. This study facilitates a promising tool for effective flash flood prediction.