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Numerical study of the effect of spatial distribution of artificial rainfall on unsaturated flow in a finite soil slope

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Shallow landslides cause significant financial and human losses annually. Most previous studies have focused on large-scale mountainous slopes, investigating landslides in small-scale urban slopes requires analyzing two-phase flow under rainfall. Therefore, the aim of this study is investigating the effect of local artificial rainfall distribution due to irrigation on unsaturated flow in small-scale soil slopes in different rainfall scenarios. To achieve this goal, a numerical model of a soil slope was created using the multiphase COMSOL software, and artificial rainfall with different spatial distributions was applied in four scenarios. Specifically, rainfall was simulated at the top of the slope, the middle of the slope, the bottom of the slope and the entire boundary. The results showed that the least variation in pore water pressure at the toe of the slope occurs when rainfall is distributed at the upper boundary, and the most critical condition occurs when rainfall is applied to the entire model boundary. These results highlight the role of rainfall spatial distribution in slope stability, especially in agricultural lands and recreational parks where artificial irrigation is common.

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