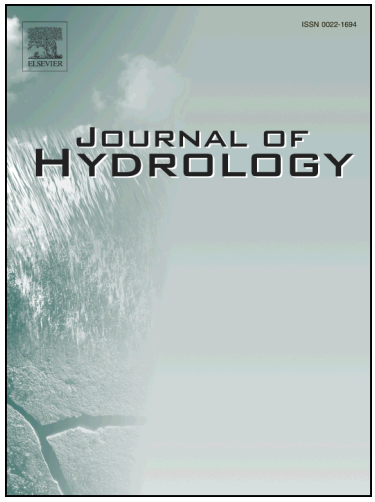

Research papers

Infiltration on sloping terrain and its role on runoff generation and slope stability

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Infiltration on sloping terrain and its role on runoff generation and slope stability

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Abstract

A modified Green-and-Ampt model is formulated to quantify infiltration on sloping terrain underlain by homogeneous soil wetted by surficial water application. This paper's theory for quantifying infiltration relies on the mathematical statement of the coupled partial differential equations (pdes) governing infiltration and runoff. These pdes are solved by employing an explicit finite-difference numerical method that yields the infiltration, the infiltration rate, the depth to the wetting front, the rate of runoff, and the depth of runoff everywhere on the slope during external wetting. Data inputs consist of a water application rate or the rainfall hyetograph of a storm of arbitrary duration, soil hydraulic characteristics and antecedent moisture, and the slope's hydraulic and geometric characteristics. The presented theory predicts the effect an advancing wetting front has on slope stability with respect to translational sliding. This paper's theory also develops the 1D pde governing suspended sediment transport and slope degradation caused by runoff influenced by infiltration. Three examples illustrate the application of the developed theory to calculate infiltration and runoff on a slope and their role on the stability of cohesive and cohesionless soils forming sloping terrain.

Keywords: infiltration, kinematic wave, runoff, factor of safety, landslides, rainfall.