A fractional infiltration model for the simulation of the wetting front in non-saturated soils

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In this work the possibility of making use of fractional calculus in hydrology is considered. In the light of the application of non integer order derivatives to various systems in engineering, a fractional infiltration model has been analyzed. The present work is an attempt to ascertain whether fractional calculus is suitable as a tool for the simulation of the wetting front in partially saturated porous media. The model is based on the non linear Richards diffusion equation, therefore the substitution of the derivative with respect to time with a fractional derivative of order smaller than one is considered and the fractional Richards equation is solved by the use of a numerical algorithm (i.e.: Adams-Bashforth-Moulton method). The behavior of the saturation front as a function of time, space and fractional order and the influence of soil diffusivity on the volumetric moisture content are analyzed in order to create a complete description of many phenomena involved in superficial soil layers (as in any porous media) during extreme rain events. Finally some preliminary results based on connection between fractional order and hydrologic parameters are presented.