



Improved model of discontinuous flow through porous media using ODEs with Preisach operator

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As far back as 1930, it was shown experimentally that there is a hysteretic effect in the relationship of the moisture content and the capillary pressure in soils that are not fully saturated. This effect can be quite strong in certain types of soils, and therefore it is desirable to incorporate hysteresis in the dynamical models describing flows of water through the soil. Here we investigate the effect of hysteresis on soil moisture content dynamics over a large period of time by numerical simulations with the FEST model. This model describes water balance in a fully vegetated slab of soil with transpiring plants by a first-order ordinary differential equation. The hysteresis is included by means of the Preisach operator, which is a mathematical tool ideally suited for rate-independent hysteretic processes. The flow of water in the model is discontinuous due to the rain. We use the rainfall and temperature measurements from the lower Feale watershed in Co. Kerry, Ireland to drive the model. In a previous study, only the infiltration and the drainage terms were considered. Here we use the temperature data to more accurately model transpiration, which improves correspondence between the model output and water content measurements.