

Numerical results on the contribution of an earthworm hole to infiltration

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On 9 March 2016 the WormEx I experiment was launched at the experimental site of Cividate Camuno (274 m a.s.l., Oglio river basin, Central Italian Alps), aiming at contributing to understand how the soil–fauna digging activity affects soil–water flow. Particularly the experiment investigates the effects of earthworms holes on the soil–water constitutive laws, in the uppermost layers of a shallow anthropized soil.

In this framework a set of simulations of the water flow in presence of an earthworm hole was preliminarily performed. The FV–FD numerical code AdHydra was used to solve the Richards equation in an axis–symmetric 2D domain around a vertical earthworm hole. The hole was represented both as a void cylinder and as a virtual porous domain with typical constitutive laws of a Δ –soil. The hypothesis of Poiseuille flow and the Jourin–Borelli law applied to determine its conductivity and soil–water retention relationship. Different scenarios of hole depth and infiltration rate were explored.

As a result a meaningful change in the downflow condition was observed when burrows intersect a layered soil, both in saturated and partially unsaturated soils, in case a perched water table onsets at the interface between an upper and more conductive soil layer and a lower and less conductive one. These results may contribute to a better understanding of the streamflow generation processes and soil–water movement in shallow layered soils.