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# Is soil homogeneous and uniform at a very small scale ?

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Soil is a complex system and is naturally heterogeneous. Due to these heterogeneities, soil properties change in time and space. Therefore, many samples are needed to obtain the “average” hydrodynamic properties. Moreover, the methods used for calculating these properties are expensive and time consuming. It is accepted that soil is homogeneous at a small scale (m2) and that its properties are uniform at that scale, allowing the use of the Darcy’s law and the Richard’s equation. To test this assumption, an infiltration-runoff experiment was conducted at the 1m2 scale under simulated rainfall. Soil is classified as a Calcosol with a clay loam texture and a high structural stability. The slope was equal to 5% and two rainfall intensities were used, 15 mm h-1 applied on a dry soil, and 32 mm h-1 applied on a wet soil 48h after the first experiment. 24 micro-tensiometers were installed at two depths (8 and 13 cm) for the monitoring of soil matric potentials every 10 s. Runoff was measured manually. Evolution of soil matric potentials are very heterogeneous whatever the depth of insertion : the rate of front wetting (calculated from time reaction of tensiometers) ranges from 126 mm h-1 to 376 mm h-1 at 8 cm depth, and from 165 mm h-1 to 365 mm h-1 at 13cm depth. After the experiments, 12 cores samples were taken from the A horizon for the determination of the hydrodynamic properties using the Wind’s evaporation method and the constant head permeameter. The hydraulic conductivity at saturation Ks ranges from 5 to 220 mm h-1 and the hydrodynamic properties in the unsaturated range are also highly variable. A 2D infiltration model based on the Richard’s equation was then developed to quantify the influence of the variability of soil properties on the infiltration rate and pattern.