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# Visualisation of preferential water flows at shallow depth by electrical resistivity measurements with high spatial and temporal resolution

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The understanding of water transfers through soils usually needs models based on the Richards equation. These models fail at forecasting rapid water infiltration, the so-called water preferential flows. The latter have been already described in laboratory experiments or by simulation codes but their field demonstration still remains a challenge, due to their transient character. Nevertheless structural indicators like large cracks or large biological burrows are observed and may play a role in preferential infiltration. For several years, electrical resistivity has been used in field experiments to both describe small variations in soil bulk density or modifications of the soil water content. Actual multi-channel resistivimeters can record more than ten measurements within one second. The aim of this presentation is to discuss their ability at measuring quick transient modifications of the water content during a rainfall event. The experiment was conducted on a haplic luvisol. Manual irrigation (10 mm at a rainfall intensity of 40 mm.h-1) was realised along a 10 meter long band. 96 stainless steel electrodes, spaced 10 cm apart and fixed on a rigid PVC plate, were placed in line within the band and connected to a Syscal Pro multi-channel resistivimeter. A pole dipole configuration was used. Pseudo-sections measurements were performed each 5 minutes to describe transient water transfers into the soil. Apparent resistivity pseudo-sections were used as indicator of soil resistivity and water content indicator. Resistivity values did not change significantly at the bottom of the studied zone, i.e. about 1 m, even 24 h after irrigation. On the contrary, few minutes after the irrigation, apparent resistivity had decreased of about 10 % in few zones identified as

limits of compacted zones, whereas apparent resistivity remained stable in the other zones or increased in the compacted zones. One hour after the irrigation, the resistivity value at the limits of compacted zones had decreased, compared to the value just after irrigation, but was still higher than the initial value (before irrigation). The borders of compacted zones were then identified as zones of preferential flow for water, in accordance with modelling results published by several authors. The electrical imaging provided by multichannel resistivimeters appears very promising to increase our knowledge about transient flows at shallow depth. Indeed, with a strict control of the temperature evolution during the infiltration event, that may influences the resistivity values, such data with high temporal and spatial sampling, will contribute to a better constraint on the calculation of time-lapse inversion codes.