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Assessment of a design to monitor the influence of crop residue management on the dynamics of soil water content with ERT

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Choices related to crop residue management affect the soil structure. As a consequence, they may determine the spatio-temporal dynamics of water content and eventually the crop yields. In order to better understand the influence of these strategies on hydraulic processes occurring at the plot scale, we opted for the use electrical resistivity tomography (ERT). This approach presents the advantage to limit soil disturbance but is still faced to important challenges when applied in an agricultural field context. Especially changing soil-electrode contact has to be considered, as it can lead to bad quality data, especially for setups with small electrodes and small inter-electrode distance. The objective of this study was to test the efficiency of a high-resolution 3-D field measurement design to properly assess the dynamics of soil water content.

ERT measurements were conducted in a Cutanic Siltic Luvisol in Gembloux, Belgium, on two plots of 2m2 ploughed in Oct 2014 at a depth of 25 cm and sown with maize in April 2015. The plants were removed on one of the plots in order to obtain a bare soil reference. A grid of 98 surface stainless steel electrodes was layed-out on each plot and four sticks supporting each eight stainless steel electrodes were vertically inserted into the soil up to 1.20 m to get more detailed information in depth. The experiments were performed between Jul and Oct 2015, in order to get measurements both in dry and wet periods. For surface and borehole monitoring, a dipole-dipole array configuration including in-line and cross-line measurements was adopted. Normal and reciprocal measurements were performed systematically to assess the data quality: only the datasets with a mean reciprocal error lower than 3% were considered for the data inversion.

This contribution will show the first inverted results showing the complexity of experimental design and data analysis for high-resolution, timelapse ERT in field conditions. Based on these results, we will draw conclusions about a minimal data set to be obtained in our upcoming field experiments.