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Comparison of soil water content distribution measured by TDR and ERT

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Soil water dynamics at the field scale is important to know in order to control optimal management of plant yield and solute fate. Time Domain Reflectometry (TDR) has been used for many years now to assess soil water content. Despite a very good temporal resolution, TDR suffer from their low spatial resolution and the fact that they cannot be inserted non-destructively in deep soil layers. On the other hand, Electrical Resistivity Tomography (ERT) can provide the 3D distribution of soil water content with a good spatial resolution but has a low temporal resolution due to the acquisition time. By combining these 2 techniques, it is possible to obtain the soil water content distribution with a good spatial and temporal distribution. This study was conducted to (i) assess the potential of ERT to follow root water uptake in the field; (ii) compare soil water content obtained by TDR and ERT measurements in a Maize field during the growing season; and (iii) estimate 3D water content dynamics with accurate spatial and temporal resolution.

In May 2010, an experimental plot was installed in a Maize field and ERT and TDR measurements were performed between June and October 2010. A grid of surface (124) and deep (140) electrodes was used to monitor 3D distribution of electrical conductivity by ERT during the complete growing season. In addition, 104 TDR probes were horizontally inserted in a six meters trench perpendicular to the maize rows at 7 depths (10, 25, 40, 60, 85, 105, 140 cm) under maize rows and inter-rows. ERT and TDR data were used to infer the water content dynamics based on petrophysical relationships. For five dates during the growing season, 2D figures of soil water content distribution were made for TDR and ERT measurements and the results were compared.

The first results show that ERT allows the visualization of the impact of uptake on water content in the field. TDR and ERT show comparable patterns. In particular, it is possible to see the row/inter-row maize pattern dynamics with both techniques. This is mainly visible during the dry periods where there is a decrease of soil water content under Maize rows especially due to root water uptake.