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The use of hydro-geophysical monitoring for the identification of root-water-uptake patterns: ERT and MALM experiments in a vineyard

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The time and space patterns of root water uptake (RWU) is inherently difficult to assess, as the relevant processes take place underground, and have large variations in space and time, involving water infiltration, redistribution and suction by the roots. In previous studies, we investigated the use of 3D ERT and Mise-a-la-mase (MALM) surveys carried out during time-lapse monitoring of water infiltration under natural conditions and applied irrigations, on a variety of plant species.

It has been long ascertained that ERT can provide accurate imaging of spatial-temporal changes in electrical resistivity at the decimeter scale, which can be converted into high resolution estimates of soil moisture content dynamics. This can be used to infer the effects of local RWU as a sink term in Richards' equation models.

In this study we aim to present how the use of MALM, in addition to ERT, can provide independent and complementary information directly related to the location of active roots, thus paving the way for a more complete approach to hydro-geophysical identification of RWU patterns. The use of MALM requires, in addition to field measurements, also the application of DC electrical modelling and inversion in order to identify the active roots as sources of electrical current in the ground. In this contribution we will present in particular a case study applied to a vineyard in Bordeaux, France, where repeated measurements were conducted under different conditions.