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Geophysical mapping of soil static characteristics and monitoring of soil dynamic states: an example on agricultural land.

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In this contribution we the results of nearly three years of non invasive monitoring of the soil conditions in an experimental farm in a region of semi-arid climate in Southern Sardinia. The main of the study is to understand the effects of soil types and soil-vegetation interactions on soil water balance. The adopted technique is a combination of time-lapse electromagnetic induction (EMI) monitoring over wide areas and localized irrigation tests monitored by electrical resistivity tomography (ERT) and TDR soil moisture measurements, with the general aim of achieving quantitative field-scale estimates of moisture content of the first meter of topsoil. Mapping of natural gamma-ray emission, texture analysis and laboratory calibration of an electrical constitutive relationship on soil samples complete the dataset. Unlike remote sensing techniques, non invasive geophysics penetrates the soil subsurface and can effectively image moisture content in the soil active layer. We observed that the growth of vegetation, with the associated below ground allocation of biomass, has a significant impact on the soil moisture dynamics. In particular vegetation extracts a large amount of water from the soil in the hot season, but it also reduces evaporation by shadowing the soil surface. In addition, vegetation enhances the soil wetting process as the root system facilitates water infiltration, thus creating a positive feedback system.