



Field test of electromagnetic induction sensor GEM300 for soil moisture retrieval

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Soil moisture represents a key variable for several hydrological processes acting at hill-slope and small-catchment scale (104-107 m²). Through the classical indirect ground-based methods such as Time Domain Reflectometry (TDR) and capacitance sensors, the attention has been focusing on accuracy and precision at the small (point) scale, whereas their application over large areas has proven to be impractical and relatively expensive. In fact, considering the small sampling volume involved in the measurements, a high number of sampling sites might be required to achieve an acceptable spatial accuracy thus making the scaling-up of soil moisture measurements still problematic. Beside this, the operational difficulties that can easily arise on hard, dry or stony soils often inhibit the use of classical methods.

During the last decade, a considerable interest in the hydrological community has arisen on the opportunity to move from high-precision and high-accuracy point-scale measurements to a large number of measurements over a large area with a lower precision and accuracy.

In this context, geophysical methods, such as the electromagnetic induction (EMI), are potential candidate to support the study of soil moisture dynamics because of competitive costs, higher acquisition rate, easy of use, not invasive, etc. However, although the electrical resistivity is theoretically linked with soil moisture, the interpretation of electrical resistivity measurements is not straightforward, because of the influence of other soil factors.

In this study, we present the preliminary results related to the comparison between a set of volumetric soil moisture measurements carried out by both portable and buried TDR probes, and the bulk soil electrical conductivity measurements collected through the GEM-300, a multi-frequency EMI sensor. The measurements were carried out in an experimental small-basin named Fiumarella di Corleto, located in Basilicata region (southern Italy). Three test sites, located in specific soil-landscape units, have been investigated adopting different sampling schemes, starting in May 2012 and ending in October 2012. At one site, named "Transetto_1", soil moisture data were collected along a 60 m long transect in 11 evenly spaced sampling points. In the other two sites, named Monte Caperrino and Masseria Potenza, a regular square grid scheme, 80x80 m², was adopted with a 20 m sampling step in 25 points. Comparison of the two dataset allows identifying the best operational procedures for the use of GEM-300.