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Electrical resistivity and TDR methods for soil moisture estimation in central Italy test-sites

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Soil moisture, despite its small percentage, plays an important role in the global hydrological cycle influencing the Earth energy balance and the distribution of precipitations. Moreover, the soil moisture controls the plants transpiration; the structure, the function and the diversity of the dryland ecosystems; it regulates the microbial activity that influences important biogeochemical processes (i.e. nitrification and CO2 production) and it can be responsible of many geo-hydrological processes (floods, erosion, shallow landslides) involving Earth surface. There, soil moisture represents a very important quantity that can be investigated by integrating several methodologies operating at different scales. Recently, new technologies have permitted a remarkable advancing of both punctual and basin or continental scale measurements. However, nowadays a gap still exists in the possibility to obtain routinely measurements at intermediate catchment scale (small basins).
Time Domain Reflectometry (TDR) is one of the most used soil moisture measurement technique for hydrological applications that, although its high accuracy, has the drawback of limited investigated volume. In the last years, an important contribution for obtaining a wider spatial resolution is given by emerging geophysical methods such as the ones based on electromagnetic waves. In particular, during in-field acquisition operations, the electrical resistivity method has demonstrated to be applicable for this purpose.
Results related to the simultaneous applications of both electrical resistivity and TDR methods in some test sites located in the Umbria region (central Italy) are discussed here. The measurements are related to a period of almost one year and allowed to monitor soil moisture variation trend over time and space. In particular, it has been found a good correlation between geophysical and TDR measurements showing that the integration of these two types of survey approaches into hydrological studies could noticeably increase our understanding of physical processes, especially at the intermediate scale.