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Retrieving surface soil moisture by a multi-angle and multi-sensor approach using active radar imagery for field-scale studies in a semi-arid environment

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Soil moisture distribution plays an important role in the understanding of land-atmosphere interaction, hydrological modelling as well as for agricultural management. Semi-empirical algorithms are found capable to estimate surface soil moisture on bare fields in various catchment scale studies, while only few good results have been obtained at the field-scale. Theoretical models, e.g. the advanced integral equation model (AIEM) require accurate parameterization e.g. surface roughness information, which is labour-intensive for field measurement and problematic in estimating correlation length. In this context, our study compares different semi-empirical algorithms applied to our test site in Sardinia, Italy and finds unstable performance between these algorithms. Despite semi-empirical algorithms are capable to retrieve surface soil moisture to a reasonable accuracy, an inherent limitation exists as a site-dependent calibration is crucial. Therefore, a multi-angle approach, which is largely based on the IEM, is implemented by using a larger database of multi-sensor radar imagery supported by consecutive in-situ measurements. Results show that even though the approach can be utilized without ancillary data, it provides less accurate surface soil moisture monitoring than calibrated semi-empirical algorithms. Potentials for algorithm development are emphasized. The work is part of the multi-disciplinary FP7 project CLIMB (Climate induced changes on the hydrology of Mediterranean Basins).