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Soil moisture plays a key role in hydrological cycle. It is consequently a key variable for weather forecasting, climate studies, water resources and crop management, and forecasting extreme events. L-band (21cm, 1.4 GHz) microwave radiometry is among the best ways to estimate soil moisture by remote sensing. Other means (higher frequency radiometry, optical domain, active remote sensing) suff er strong deficiencies, due to a larger vulnerability to cloud cover and/or various perturbing factors (such as roughness or vegetation cover), as well as poor sensitivity (Kerr 2007). As a consequence of recent technical development, two new satellite missions, the Soil Moisture and Ocean Salinity (SMOS) and the Soil Moisture Active Passive (SMAP), will be providing for the fi rst time global mapping of surface soil moisture based on radiometric measurements at L-band.
The radiative transfer models that simulate soil emission could be roughly divided between the coherent models and non-coherent model approaches. In coherent models approaches, the soil is seen as a layered medium and each layer is characterized by its dielectric constant and temperature. The contribution of each layer to the total soil microwave emission is determined by computing the propagation of a coherent electromagnetic wave, through the layered medium. In the non-coherent models, the soil is usually seen as a single layer with an effective soil moisture and effective temperature. The soil moisture and temperature pro file is used to calculate the soil effective temperature, whereas the soil emissivity is calculated from the moisture content at the surface layer. For operational applications involving microwave radiometry, soil moisture is generally estimated by inverting a simple non-coherent model of soil microwave emission. (Raju et al. 1995) compared both approaches of soil modeling and they found that both accurately model soil emission providing the non-coherent approach uses an appropriate soil moisture depth. They found that for L-band radiometers pertinent soil moisture depth was close to 2.5 cm which is in agreement with theory (Ulaby et al. 1986).
In the framework of the SMOS mission preparation, several sites have been instrumented to calibrate and validate SMOS data when it becomes available. Field and airborne campaigns have been carried out to test, validate and understand better the radiative transfer models at L-band. Some of them have shown that, in order to accurately model soil emission, it was necessary to adjust a roughness parameter as a function of soil moisture. In this way, a linear dependency of soil roughness with soil moisture was found by Escorihuela et al. over a bare soil on the SMOSREX site (Escorihuela et al. 2007b). Similarly, over vegetated areas, it was found that the calibration of the soil emission was essential to retrieve accurate estimates of soil moisture. The soil roughness parameters from field and airborne L band microwave data over vegetated areas were found to be sensitive to soil moisture during the SMOSREX, the COSMOS and NAFE campaigns (Saleh et al. 2006; Saleh et al. 2009; Panciera et al. 2009).
In these sites, surface soil moisture was monitored with sensors that provide an integrated measurement over the 0 - 5 cm surface layer. Although the L-band soil moisture sampling depth is expected to be somewhat shallower than 5 cm, these type of sensors are widely used to validate remote sensing data at L-band (Calvet et al. 2007; Merlin et al. 2008). This choice is dictated by the geometry of existing moisture sensors, which are difficult to install and maintain near the surface.

The aim of this study is to analyze the influence of the soil moisture sampling depth in the parameterization of soil emission in microwave radiometry at L-band. The analysis is based on brightness temperature, soil moisture and temperature measurements acquired over a bare soil during the SMOSREX experiment. A more detailed pro le of surface soil moisture was obtained with a soil heat and water flows mechanistic model. It was found that (1) the soil moisture sampling depth depends on soil moisture conditions, (2) the e ffective soil moisture sampling depth is shallower than provided by widely used field moisture sensors, and (3) the soil moisture sampling depth has an impact on the calibration of soil roughness model parameters. These conclusions are crucial for the calibration and validation of remote sensing data at L-band.