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Maria-José Escorihuela, Yann H. Kerr, Andre Chanzy, Jean-Pierre Wigneron

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Effective soil moisture sampling depth of L-band radiometry

M.J. Escorihuela (1), Y.H. Kerr (2), A. Chanzy (3), and J.P. Wigneron (4)

(1) IsardSAT, Barcelona, Spain (mj.escorihuela@isardsat.cat), (2) CESBIO, Toulouse, France, (3) INRA Avignon, France, (4) INRA Bordeaux, France

In the near future two new satellite missions, the Soil Moisture and Ocean Salinity (SMOS) and the Soil Moisture Active Passive (SMAP) will be providing for the first time global mapping of surface soil moisture based on radiometric measurements at L-band. For operational applications involving microwave radiometry, soil moisture is generally estimated by inverting a simple model of soil microwave emission.

Several field and airborne campaigns have been carried out in order to test, validate and better understand radiative transfer models at L-band. Some of them have shown that in order to accurately model bare soil emission, it was necessary to adjust one parameter as a function of soil moisture. In this way, an exponential and linear dependency of roughness with soil moisture was found by *Wigneron et al. 2001* and *Escorihuela et al. 2007* respectively. While *Schneeberger et al. 2004* fitted a coherent emission model with a transition zone whose thickness depended also in soil moisture. A sensitivity of soil roughness to soil moisture was also found for airborne L-band microwave data during the COSMOS campaign *Saleh et al. 2008*. This kind of parameterizations pose the problem that are site dependent and thus their application at the satellite scale is not straight forward. Furthermore, they seem to indicate that the actual effective soil moisture sampling depth is somewhat different that the one provided by the field sensors.

The aim of this study is thus to analyze the influence of the soil moisture sampling depth in the parameterizations of soil emission in microwave radiometry at L-band. Brightness temperature, soil moisture and temperature profiles were measured over a bare soil. A more detailed profile of surface soil moisture was obtained with a soil heat and water flows mechanistic model. It was found that (1) the effective soil moisture sampling depth is shallower than provided by widely used field moisture sensors, (2) the effective soil moisture sampling depth depended on soil moisture. This conclusions are crucial for the calibration and validation of remote sensing data at L-band. A parameterization for soil moisture sampling depth at L-band is proposed.