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Modeling L band radiometric sensitivity to soil moisture under forests and comparisons with EUROSTARRS signatures

A. Della Vecchia (1), P. Ferrazzoli (1), L. Guerriero (1), K. Saleh (2), J.-P. Wigneron (3)

(1) DISP, Tor Vergata University (ferrazzoli@disp.uniroma2.it/ Fax +39 06 7259 7420), (2) University of Valencia, (3) INRA Bioclimatologie

Several scientific and technological efforts, aimed at monitoring soil moisture by microwave spaceborne radiometers, are being done worldwide. Important projects, such as SMOS and HYDROS, based on the development of L-band radiometers, are under development. For a global scale observation system, the presence of forests must be considered. Forests cover a large fraction of land, so that several pixels will be subject, totally or partially, to such a kind of cover. In spite of this, a limited number of theoretical and experimental studies have addressed the topic of emission by forest covered surfaces. The objective of this work is to investigate the problem by using a theoretical emission model, based on the radiative transfer theory. The advantage of a theoretical approach lies in the possibility to investigate the effects of several structural and environmental parameters, including soil moisture, other soil properties, presence of litter and/or understory, amount of woody and leafy biomass, geometrical structure of forests. Also the effects of polarization and angle may be considered. Such an investigation cannot be done by using only the limited amount of presently available experimental data.

In the last years, this electromagnetic model was validated using several passive and active microwave signatures collected over agricultural and arboreous vegetation, at different frequencies. Recently, the model was run using detailed description of Les Landes forest as input. Model outputs have been compared with L band radiometric signatures collected over the same forest, in the framework of EUROSTARRS campaign. This paper shows the results of this comparison, which indicate a gen-

eral agreement between simulated and measured emissivities. Moreover, the model has been used to investigate the sensitivity to soil moisture under several assumptions of forest biomass, forest structure, and understory vegetation. Simulations have been done at both polarizations and several angles. Results of this investigation are presented in this paper. As expected, the sensitivity to soil moisture is poor for very dense vegetation covers, but soil emission may be still appreciable for some common forest structures.