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Estimating effective roughness parameters of the L-MEB model for soil moisture retrieval from SMAPVEX12 data

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Despite the continuing efforts to improve existing soil moisture retrieval algorithms, the ability to estimate soil moisture from passive microwave observations is still hampered by problems in accurately modelling the observed microwave signal. Due to the significant influence of both soil roughness and vegetation on the measured brightness temperatures, the parameterisation of these variables is of primary importance for the retrieval of the soil moisture state. Given the complex interference of surface roughness, the effect is usually accounted for using a semi-empirical model such as the one from Wang and Choudhury (1981). Together with a vegetation module, this roughness formulation is implemented in the L-band Microwave Emission from the Biosphere (L-MEB) model (Wigneron et al., 2007), which is also adopted in the operational SMOS Level 2 Soil Moisture retrieval algorithm. However, one of the main issues remains the estimation of the key roughness parameter of the Wang and Choudhury model. Several techniques exists to estimate this principal roughness parameter. Most of them try to estimate an effective roughness parameter, which is not directly linked to the physical roughness of the soil, but which can be considered optimal for the inversion of the radiative transfer model. A number of recent studies concluded that the roughness parameters could be linearly related to the observed surface soil moisture, which could be explained by a dielectric roughness, induced by the heterogeneous distribution of moisture in the soil reservoir. However, this concept has not yet been validated at large scales and/or under vegetated surfaces.

This study investigated the behaviour of effective roughness parameters derived from passive remote sensing data using the L-MEB model and developed a simple model for estimating these parameters at large scale. To this end, data from the SMAP Validation Experiment 2012 (SMAPVEX12) conducted in Canada were used. Results indicate that the effective roughness parameters of the L-MEB model can be empirically related to the observed brightness temperatures and the Leaf Area Index (LAI) of the vegetation, which indicates that the roughness parameters are partly compensating for the simple vegetation component in the radiative transfer model. A simple empirical model was fitted to the data to describe the dependence between the roughness parameters and the observed brightness temperatures and LAI. Based on a leaf-one-out cross-validation of the roughness model, it is shown that the root mean square error on the soil moisture estimates can be reduced from 0.13 m^3/m^3, using a constant roughness parameter, to approximately 0.054 m^3/m^3, using the dynamic model introduced in this study.

References

J. R. Wang and B. J. Choudhury, "Remote sensing of soil moisture content over a bare field at 1.4 GHz frequency," Journal of Geophysical Research - Oceans and Atmospheres, vol. 86, no. NC6, pp. 5277–5282, 1981.

J. P. Wigneron, Y. H. Kerr, P. Waldteufel, K. Saleh, M. J. Escorihuela, P. Richaume, P. Ferrazzoli, P. de Rosnay, R. Gurney, J. C. Calvet, J. P. Grant, M. Guglielmetti, B. Hornbuckle, C. Maetzler, T. Pellarin, and M. Schwank, "L band Microwave Emission of the Biosphere (L-MEB) Model: Description and calibration against experimental data sets over crop fields," Remote Sensing of Environment, vol.107, no. 4, pp. 639–655, 2007.