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Backscattering modelling over heterogeneous roughness soil surface

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In the last decades, different analytical or semi-empirical models have been developed to study the backscattering behaviour of homogenous soil surfaces (SPM, IEM, Oh, Dubois, Shi, ...). The use of these backscatter models to analyse medium to low spatial resolution microwave data is still very complicated, particularly because of the difficulty in defining a unique roughness parameter, capable of adequately representing heterogeneous terrain. Therefore, the roughness parameter is often used as just a parameter to fit the model to real radar data.

In this paper, an approach is proposed for roughness analysis and the modelling of backscattering, under conditions of surface heterogeneity. This study is based on the development of a semi-empirical backscattering model, defined with a single roughness parameter $Zs=s^2/l$ (s being the root mean square surface height and l the correlation length).

The proposed backscattering model has been validated with IEM (Integral Equation Model) simulations, for high radar incidence angles, and within its domain of roughness validity. A range of experimental measurements was used to validate the model expressions for homogenous and heterogeneous sites. The real measurements correspond to ASAR/ENVISAT data over Villamblain site in France. The effective low spatial resolution roughness, inferred from signals backscattered over a surface with heterogeneous roughness, is defined for different roughness types. The retrieved roughness based on the proposed inversion model shows a very good agreement with real data.