Soil moisture retrieval from ERS SAR backscattering under soil roughness uncertainty using a possibilistic approach

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Radar remote sensing of bare soil surfaces has shown to be very useful for retrieving soil moisture. However, the error on the retrieved value depends on the accuracy of the roughness parameters (RMS height and correlation length). Several studies have revealed that these parameters show a high variability within a field, and therefore, a lot of soil roughness profiles need to be measured to obtain accurate measurements of soil roughness. Yet, in an operational mode, soil roughness measurements are not available and therefore, for different tillages, possibility distributions of roughness values can be defined. Through inverting the Integral Equation Model, possibility distributions for soil moisture are determined. After transferring these possibilities into probabilities, mean soil moisture values and the uncertainty hereupon (given by the standard deviation) are obtained. It is found that the accuracy depends on the wetness state of the soil. Given the roughness uncertainty, field-averaged ERS radar observations at two sites in Belgium resulted in accurate soil moisture retrieval (less than 7 vol%).