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Assessment of soil surface roughness characteristics at field-scale for soil erosion studies using microwave remote sensing data

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Soil surface roughness (SSR) is a crucial parameter in the assessment and modelling of soil erosion in agricultural landscapes. Still, in recent modelling efforts, roughness is usually treated as a static parameter, leading to strong simplification and data uncertainty in the description of these physical processes and the derivation of hydrological quantities. However, this simplification is not only due to the lack of theoretical process knowledge, but rather refers to the lack of appropriate roughness input data, as it is very complex to measure roughness under natural conditions.
To overcome the current limitations, the performance of microwave remote sensing acquisitions is investigated to derive SSR dynamics for a whole vegetation period over several agricultural fields. As the backscattered signal of an incident microwave shows an inherent dependency from the geometric properties, e.g. the roughness conditions, of an illuminated scene, microwave remote sensing imagery shows a good potential to derive SSR for soil erosion studies sufficiently. The proposed approach utilizes airborne PolSAR data, acquired at C- and L-Band (e.g. 5.6 GHz and 1.3 GHz) for the derivation of four potential roughness estimators. In addition an extensive ground truth database of photogrammetrically measured roughness samples is used to validate the results. To characterize the in-field measurements the RMS-height s – which is the standard deviation of the heights to a reference height - was chosen. Using the best fit approach, a highly accurate assessment of SSR at field-scale could be achieved by deriving s using a linear model from the real part of the circular coherence (Re[RRLL]).

In this presentation, we show the database of the proposed approach acquired in the framework of the AgriSAR 2006 campaign funded by the European Space Agency, ESA, as well as methods and results of the proposed approach. In addition we will discuss the results in context of soil erosion research and in the framework of a future utilization of this approach by using operational SAR satellites such as Radarsat2, Alos-2, TanDEM-L and NovaSAR-S.