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# Soil surface roughness characterization for microwave remote sensing applications

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With this poster we present a simple and efficient method to measure soil surface roughness in an agricultural environment. Micro scale soil surface roughness is a crucial parameter in many environmental applications. In recent studies it is strongly recognized that soil surface roughness significantly influences the backscatter of agricultural surface, especially on bare fields. Indeed, while different roughness indices depend on their measurement length, no satisfying roughness parametrization and measurement technique has been found yet, introducing large uncertainty in the interpretation of the radar backscattering.

In this study, we introduce a photogrammetric system which consists of a customized consumer grade Canon EOS 5d camera and a reference frame providing ground control points. With the system one can generate digital surface models (DSM) with a minimum size of 1 x 2.5 $m^2$, extendable to any desired size, with a ground x,y- resolution of 2 mm. Using this approach, we generated a set of DSM with sizes ranging from 2.5 $m^2$ to 22 $m^2$, acquired over different roughness conditions representing ploughed, harrowed as well as crusted fields on different test sites. For roughness characterization we calculated in microwave remote sensing common roughness indices such as the RMS- height s and the autocorrelation length l. In an extensive statistical investigation we show the behavior of the roughness indices for different acquisition sizes of the proposed method.

Results indicate, compared to results from profiles generated out of the dataset, that using a three dimensional measuring device, the calculated roughness indices are more robust in their estimation. In addition, a strong directional dependency of the proposed roughness indices was observed which could be related to the orientation of the seedbed rows to the acqusition direction. In a geostatistical analysis, we decomposed the acquired roughness indices into different scales, yielding a roughness quantity for each roughness scale.

With this approach, an efficient and sufficiently accurate method for roughness characterization during microwave remote sensing field campaigns is provided.