Possibilistic soil roughness identification for uncertainty reduction on SAR retrieved soil moisture

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Soil roughness plays an essential role in the reflection of the incoming radar signal at the soil surface and is therefore highly important in the retrieval of soil moisture information from the backscattered radar signal. However, soil roughness, generally described by means of the root mean square (rms) height and the correlation length, remains difficult to measure correctly and is furthermore found to be highly variable. In order to overcome these difficulties, possibility distributions may be used to describe the available knowledge on the roughness state of an agricultural field. These distributions can then further be used to retrieve soil moisture information. Nevertheless, using possibility distributions without taking into account any interactivity between the roughness parameters, results in rather wide distributions of retrieved soil moisture content. First, possibility distributions for both roughness parameters are independently estimated on the basis of a synthetically generated roughness data set. Next, the interactivity between rms height and correlation length is taken into account through the identification of a joint possibility distribution by means of a possibilistic clustering algorithm. When applied to actual Synthetic Aperture Radar (SAR) data, results show that a narrower, i.e. more specific, possibility distribution of soil moisture content is obtained when the possibilistic retrieval procedure is performed based on the joint possibility distributions.