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Performance analysis of different microwave radiative transfer models for time-series soil moisture estimation

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Soil moisture plays an important role in land surface processes such as water and energy fluxes.To derive soil moisture in high spatial and temporal resolution SAR remote sensing technologies has proven to be very suitable. Over the last decades different retrieval approaches, from empirical (Water Cloud Model, Attema and Ulaby 1978) over semi-empirical (Oh's-model 1992, Oh et al. 1992; SSRT, DeRoo et al. 2001) to more physical based (IEM, Fung 1994) radiative transfer (RT) models, have been proposed for the retreival of soil moisture over various landscape types. In the past all these RT-models have been widely used on different test-sites and studies. Nevertheless, a clear validation site and tool for the comparison of different models among themselves and in different model combinations for the different backscatter contribution of soil and vegetation is missing. The Copernicus Sentinel missions and especially the Sentinel 1A and 1B satellites offer new opportunities in terms of spatial and temporal resolution to analyze and validate the outputs of the different radiative transfer models.

This study presents a comparative analysis of different microwave RT-models and there eligibility to predict Sentinel-1 backscatter values. The tested RT-models consist of vegetation and soil scattering components. Therefore, soil models with different complexity for estimating the soil scattering contribution (Oh et al., Dubois et al., Integral Equation Method) are coupled with vegetation models which are calculating the vegetation scattering contribution (Water Cloud Model, Single Scattering Radiative Transfer) of the total radar backscatter. In addition to the analysis of the performance of the different RT-models, a comparison of a time varying and non-time varying parametrization of empirical and semi-emipirical vegetation model parameters values is shown. The used RT-models are driven by an extensive field data base of in-situ data on field basis which has been acquired at the Munich-North-Isar (MNI) test-site located in the south of Germany in 2017 and 2018.