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Derivation of soil moisture retrieval uncertainties associated to the simplification of the dynamic vegetation signal.

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Satellite-based microwave remote sensing has proven to provide reliable soil moisture observations on a global scale over the last decades. In microwave remote sensing of soil moisture the satellite signal holds information on both soil moisture and vegetation. Separating these components from each other is not straightforward. In the last years the importance of a robust and reliable vegetation parameterization within the soil moisture retrieval algorithms has become evident. In the TU-Wien soil moisture retrieval algorithm, developed by the Vienna University of Technology, the backscatter observations are corrected for vegetation effects by way of the slope and curvature. The slope and curvature are derivates of noisy backscatter measurements in relation to incidence angle and hence have a high level of noise. Therefore, they are averaged over several years resulting in a fixed seasonal vegetation correction, where no inter-annual variability is present in the characterisation of vegetation. This study assesses the strengths and weaknesses of the fixed seasonal vegetation correction in the TU-Wien soil moisture retrieval algorithm.

The Vegetation Optical Depth (VOD) retrieved from AMSR-E passive microwave observations with the VUA-NASA retrieval algorithm is analysed to identify regions with high inter-annual variability in vegetation. For these regions the effect of a fixed seasonal correction on the soil moisture retrieval is investigated. First, the TU-Wien soil moisture products before and after the application of the vegetation correction, the TU-Wien normalised backscatter and TU-Wien soil moisture respectively, are compared to modelled soil moisture from ECMWFs ERA-Interim. With this analysis regions where the vegetation correction decreases the quality of the TU-Wien soil moisture product with regard to modeled soil moisture can be identified. Secondly, the vegetation correction within the TU-Wien retrieval algorithm is replaced by the VOD to simulate an inter-annually dynamic vegetation correction. The VOD is like the slope and curvature an indicator of vegetation water content. This new soil moisture product based on VOD is then also compared to modeled soil moisture from ERA-Interim.

Results show that in areas of high inter-annual variability, like the Sahel, the TU-Wien vegetation correction is suboptimal and decreases the quality of the TU-Wien soil moisture product when compared to ERA-Interim. Spearman R with ERA-Interim soil moisture can decrease with as much as 0.4 after applying the vegetation correction. Using the VOD in these regions increases the quality of the TU-Wien soil moisture product. This study demonstrates that a fixed seasonal vegetation correction is not able to account for high inter-annual vegetation variability and leads to an inaccurate soil moisture signal, emphasizing the need for a dynamic vegetation correction.