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An Intercomparison of Vegetation Products from Satellite-based Observations used for Soil Moisture Retrievals

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Vegetation and its water content affect active and passive microwave soil moisture retrievals and need to be taken into account in such retrieval methodologies. This study compares the vegetation parameterisation that is used in the TU-Wien soil moisture retrieval algorithm to other vegetation products, such as the Vegetation Optical Depth (VOD), Net Primary Production (NPP) and Leaf Area Index (LAI). When only considering the retrieval algorithm for active microwaves, which was developed by the TU-Wien, the effect of vegetation on the backscattering coefficient is described by the so-called slope [1]. The slope is the first derivative of the backscattering coefficient in relation to the incidence angle. Soil surface backscatter normally decreases quite rapidly with the incidence angle over bare or sparsely vegetated soils, whereas the contribution of dense vegetation is fairly uniform over a large range of incidence angles. Consequently, the slope becomes less steep with increasing vegetation. Because the slope is a derivate of noisy backscatter measurements, it is characterised by an even higher level of noise. Therefore, it is averaged over several years assuming that the state of the vegetation doesn't change inter-annually.

The slope is compared to three dynamic vegetation products over Australia, the VOD, NPP and LAI. The VOD was retrieved from AMSR-E passive microwave data using the VUA-NASA retrieval algorithm and provides information on vegetation with a global coverage of approximately every two days [2]. LAI is defined as half the developed area of photosynthetically active elements of the vegetation per unit horizontal ground area. In this study LAI is used from the Geoland2 products derived from SPOT Vegetation*. The NPP is the net rate at which plants build up carbon through photosynthesis and is a model-based estimate from the BiosEquil model [3, 4].

Results show that VOD and slope correspond reasonably well over vegetated areas, whereas in arid areas, where the microwave signals mostly stem from the soil surface and deeper soil layers, they are negatively correlated. A second comparison of monthly values of both vegetation parameters to modelled NPP data shows that particularly over dry areas the VOD corresponds better to the NPP, with r=0.79 for VOD-NPP and r=-0.09 for slope-NPP.

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