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Global map of soil roughness using L-band SMOS data

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Since 2010, soil moisture (SM) has been mapped over the Earth by the Soil Moisture and Ocean Salinity (SMOS) satellite. This mission is the first one to monitor SM over land using passive L-band radiometry technique. At this frequency the signal depends on SM and vegetation but is significantly affected by surface soil roughness. Quantifying the surface soil roughness on ground surface emissivity is a key issue to improve the quality of passive microwave large-scale SM products.
The core of the SMOS algorithm permitting to provide SM operational data is the inversion of the L-band Microwave Emission of Biosphere (L-MEB) model that is the result of an extensive review of the current knowledge of the microwave emission. In this model, surface soil roughness is modeled with empirical parameters (Qr , Hr , Nrp , with p = H or V polarizations). These parameters have been estimated by numerous studies but only at local scale using in situ measurements or airborne campaigns. However, these local estimations are not representative at large scale and they are not consistent with the actual surface roughness conditions, especially in agricultural areas and can lead to important errors in the SM retrievals.
In this study, a method has been developed to obtain the first global map of the roughness parameter, by combining the vegetation and soil roughness into one parameter, referred to as TR. SM and TR were retrieved globally using the SMOS L3 brigthness temperature and the forward emission model L-MEB for 2011. The effect of vegetation and roughness can be separated in TR using the LAI MODIS data to account for the vegetation. This map could lead to improve soil moisture retrievals for present and future microwave remote sensing missions such as SMOS and the Soil Moisture Active Passive (SMAP).