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The influence of soil properties in estimating soil moisture from satellite C-band Synthetic Aperture Radar

John Beale (1), Toby Waine (1), Ron Corstanje (1), Boris Snapir (1), and Jonathan Evans (2)
(1) Cranfield University, (2) Centre for Ecology and Hydrology, Wallingford

Regularly updated soil moisture maps are needed that combine wide scale for regional and national studies, whilst capturing the field-scale variability that is needed by many applications in agriculture, hydrology and meteorology. C-band SAR satellites, such as Sentinel-1, offer the high spatial and temporal resolution required, but the estimation of soil moisture from SAR requires correction for many contributing factors including vegetation, soil roughness, soil texture and temperature. This paper reviews and predicts the significance of soil texture and organic matter content to the errors that may be present in any estimation that is made using default assumptions. We show that each factor may contribute to a 10% error if an incorrect assumption is made. Soil moisture retrieval over agricultural fields in northern latitudes requires any algorithm to account for rapid and large changes in SAR backscatter due to crop growth and harvesting, tillage operations and freezing of the soil surface. This has particular significance for the extending the use of change detection approaches into arable farming areas. We discuss the prospect for developing a model to guide the setting of soil roughness parameters based on land use, soil texture and tillage, and for automatic correction for frozen soil. Successful implementation will improve the accuracy and validity of estimating soil moisture from C-band SAR satellite data, at the field scale.