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# Comparison of two retrieval methods with combined passive and active microwave remote sensing observations for soil moisture

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ABSTRACT

The brightness temperature (BT) and backscattering coefficient (BSC) measured simultaneously by passive and active microwave sensors have great potential for the estimation of land surface soil moisture (SM). Several methods with combined passive and active microwave remote sensing observations for SM have been reported. Usually, the use of these methods, requires an accurate roughness condition, especially when dealing over the bare surface or surface with low vegetation. In this paper, two different retrieval methods for estimating SM using synthetic microwave remote sensing data were compared. The difference between the two methods is the way to estimate the roughness parameter. The three-parameter retrieval approach (THRA) takes the roughness parameter as a variable to be retrieved, and derives land surface parameters (e.g., SM, surface temperature (ST) and roughness) simultaneously from BT and BSC using nonlinear algorithms. The two-parameter retrieval approach (TWRA) retrieves roughness from BSC firstly, then takes the roughness as an input parameter to retrieve SM and ST from BT. The two retrieval methods were applied on AMSR-E (Advance Microwave Scanning Radiometer for EOS) and QuikSCAT/Seawinds (The Seawinds scatterometer on NASA's (National Aeronautics and Space Administration) Quick Scatterometer) observations which have been carried out for the SMEX03 (Soil Moisture Experiment 2003) region in ON, the north of Oklanoma. The comparison results shows TWRA has achieved a higher accuracy than THRA in dealing with the active and passive microwave observations at different overpass times.



## 1. Introduction

SM dominates the partitioning of net radiation energy into sensible and latent heat fluxes, and rainfall into runoff and root-zone storage at the land–air interface. Hence, it plays a crucial role in current hydrologic, climatic, agricultural, and biogeochemical models, and becomes a parameter of great interest in remote sensing. Over bare surfaces or low vegetation surfaces, SM, together with ST and roughness, are linked to radiometric signatures through their influence on microwave emissivity of the land surface. Because each remote sensing sensor is distinctly sensitive to different land surface parameters, in order to obtain a higher accuracy SM using remote sensing technology, retrieving multiple land surface parameters with combined passive/active microwave remote sensing observations has become a research focus [1,2].

Previous research has shown that passive (radiometer) and active (radar) microwave remote sensors can be utilized to monitor SM over land surface [3,4]. These two sensors have a certain amount of physical information in common. However, radar is likely to be more sensitive to surface features (e.g., roughness and vegetation structure) and radiometer is likely to

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