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EVALUATION OF THE CALIBRATED INTEGRAL EQUATION MODEL OVER AGRICULTURAL FIELDS FOR SURFACE PARAMETER RETRIEVAL USING POLARIMETRIC SAR

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ABSTRACT:

Monitoring soil moisture in agricultural fields in early season is important for improving crop growth and productivity. RADARSAT-2 polarimmetric SAR data has potential of estimating surface parameters using different models. The Integral Equation Model (IEM) is a physical backscattering model for bare soil, which takes into account the incidence angle, the surface roughness values such as root mean square of height (HRMS) and correlation length (L), and the auto-correlation function (ACF), and has been widely employed in retrieving soil moisture and surface parameters for a wide range of roughness conditions. However, the field measurement of L is always problematic, instead of IEM, the calibrated IEM model is adopted in this paper, which uses the calibrated L to replace the original L with an empirical relationship between HRMS and L. In addition, for the purpose of reducing soil erosion and providing the nutrition economically, crop residues are left in some fields from the previous year. It is also necessary to evaluate the calibrated IEM model in fields with crop residues. To evaluate the errors of estimated soil moisture and HRMS from RADARSAT-2 data, ground truth data are collected simultaneously with RADARSAT-2 satellite overpass. Soil moisture is measured in the fields by the Theta probes, while the HRMS and L are measured by a one-meter long needle profiler. The root mean square error (RMSE) of HRMS and soil moisture is used in quantitative validation, The results demonstrate that in the fields with crop residues, a severe underestimation of soil moisture with the calibrated IEM is observed with the RMSE of 46.08%, while in the bare fields the soil moisture fits the ground truth better with the RMSE 6.21%. The estimation of HRMS performs better for fields with crop residues (RMSE 0.04 cm) than that in bare fields (RMSE 0.25 cm).

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