Mapping Surface Soil Moisture Using L-band Radiometer Observations in the Second Australian Airborne Cal/val Experiment for SMOS (AACES-2)

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Abstract--Surface soil moisture is important in agronomic, hydrological, and meteorological processes at all spatial scales. The ability of inferring soil moisture by using passive microwave techniques has been intensively demonstrated. The second Australian Airborne Cal/val Experiment for SMOS (AACES-2) is a part of validation effort of the SMOS satellite performance in operational mode which took place on the central half of the 100km × 500km transect of the Murrumbidgee River catchment with a range of diverse soil moisture and land cover characteristics. The AACES-2 campaign was able to provide aircraft dual-polarized L-band radiometer observations at 1km resolution by the Polarimetric L-band Multibeam Radiometer (PLMR). Intensive near-surface soil moisture sampling and other ground measurements were supported as well Retrieval of soil moisture using physically based models is a classic example of underdetermined problem due to a lack of credible known soil roughness distributions at a regional scale. Characterization of this roughness is therefore crucial for an accurate derivation of soil moisture based on backscattering models. This study aims to derive surface soil moisture by using a two-step inversion approach with the advanced integrated equation model (AIEM). Dependent on the dual-polarized L-band brightness temperature observations and extensive vegetation and ground temperature measurements, firstly, radiative transfer model needed main roughness parameters (standard deviation of surface height σ and correlation length cl) were calibrated by training data sets. Then, soil moisture retrieval was conducted based on the calibrated roughness beyond the calibration area. Globally, soil moisture estimates were obtained with errors around 0.05 cm^3 cm^{-3} (RMSE) across different land covers. It is demonstrated that the proposed method is feasible to achieve reliable estimation of soil water content.