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Ground-based L-band active and passive observations of growing corn and soybean during SMAPVEX16-MicroWEX

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The NASA Soil Moisture Active/Passive (SMAP) and the ESA Soil Moisture and Ocean Salinity (SMOS) missions include microwave radiometers at L-band that provides global observations of SM at 36 and 25km, respectively, with a repeat coverage of every 2-3 days. Agricultural regions, with their highly dynamic vegetation and spatial heterogeneity are particularly challenging for soil moisture retrieval algorithms. The Microwave Water and Energy Balance Experiment was conducted as part of the SMAP Validation Experiment (SMAPVEX16-MicroWEX) during the summer of 2016 in a predominantly agricultural region in Iowa, USA. During SMAPVEX16-MicroWEX, ground-based observations of active and passive signatures were obtained every 15-30 minutes during a growing season of corn and soybean from May 23 through September 2, 2016. The field site was within the South Fork Watershed at the Sweeney Farms, near the city of Buckeye. The University of Florida L-band Automated Radar System (UF-LARS) observed the backscatter from corn. The brightness temperatures (TB) at the corn site were observed by the University of Michigan L-Band Radiometer (UMLMR), while those at the soybean site were observed by the University of Florida L-band Microwave Radiometer (UFLMR). Concurrent and co-located observations of soil, vegetation, and micro-meteorological conditions were also conducted at both the sites.

The passive signatures from both the corn and the soybean sites were found to be similar during the early season, as both the fields were nearly bare terrains. As expected, the TB diverge during the mid-season, when the vegetation water content (VWC) of the corn is about 2 kg/m2. Interestingly, the TB of the two crops are similar again toward the end of the season, when VWC of the soybean crop reaches about 2 kg/m2. Preliminary modeling results show that physically-based emission models significantly underestimate vegetation opacity for a mature soybean canopy. These findings provide insights into retrieval algorithms for soil moisture in agricultural terrains.