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The influence of Vegetation Water Content (VWC) dynamics on microwave observations of a corn canopy during SMAPVEX16-IA

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Vegetation cover confounds soil moisture retrieval from both active and passive microwave remote sensing observations. Vegetation attenuates the signal from the soil as well as contributing to emission and scattering. The goal of this study was to characterize the vertical distribution of moisture within an agricultural canopy, to examine how this varies during the growing season and to determine the influence these changes have on emission and backscatter from the surface. To this end, an extensive campaign of destructive sampling was conducted in a rain-fed corn field at Buckeye, Iowa within the SMAPVEX16-IA study domain. The experiment duration extended from the beginning of IOP1 to the end of IOP2, i.e. from May 18 to August 16 2016.

Destructive vegetation sampling was performed on most days upon which SMAP had both an ascending and a descending pass. On these days, destructive samples were collected at 6pm and 6pm unless the weather conditions were prohibitive. In addition to measuring the bulk vegetation water content for comparison to the SMAP retrieved VWC, the samples were split into leaves and stems. To study the vertical profiles, leaf moisture content was measured as a function of collar height and the stem was cut into 10cm sections. The influence of plant development on the bulk and profile VWC was clearly discernible in the observations. Diurnal variations in bulk VWC were relatively small due to moisture availability in the root zone.

SMAP brightness temperatures, and tower-based observations from the University of Florida radiometer and radar systems were analyzed to investigate the impact of VWC variations on emission and backscatter. Dynamic variations in SMAP retrieved soil moisture were notably larger than those observed in-situ, particularly during the early growing season. This may be attributed to the difference between observed VWC and that used in the SMAP retrieval during the early growing season. Backscatter (and RVI) increased, as expected, in response to accumulating biomass, though retaining some sensitivity to soil moisture variations. Polarization-dependent diurnal differences of up to 2dB were observed in the backscatter from the fully grown corn canopy.