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Impact of diurnal variation in vegetation water content on radar backscatter of maize during water stress

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Microwave emission and backscatter of vegetated surfaces are influenced by vegetation water content (VWC), which varies in response to availability of soil moisture in the root zone. Understanding the influence of diurnal VWC dynamics on radar backscatter will improve soil moisture retrievals using microwave remote sensing, and will provide insight into the potential use for radar to directly monitor vegetation water status.

The goal of this research is to investigate the effect of diurnal variation in VWC of an agricultural canopy on backscatter for different radar configurations. Water stress was induced in a corn (Zea mays) canopy near Citra, Florida, between September 1 and October 20, 2013. Diurnal destructive samples from the canopy were collected to determine leaf, stalk and total VWC. Water stress was quantified by calculating the evaporation deficit and measuring the soil water tension.

The water-cloud model was used to model the influence of VWC and soil moisture variations on backscatter for a range of frequencies, polarizations and incidence angles. Furthermore, radar backscatter time series was simulated to show the effect of water stress on the diurnal variation in backscatter due to VWC.

Results of this study show the very significant effects that VWC dynamics have on radar backscatter. We also highlight the potential for vegetation and soil water status monitoring using microwave remote sensing.