Investigation of Root-Zone Soil Moisture Profile Sensitivity to Multiple Signal of Opportunity Sources

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Root-zone soil moisture (RZSM) is a key parameter for many applications across disciplines such as hydrology, meteorology, and climatology including modeling and simulation tools. Recent advancements in remote sensing in the area of passive radar and "Signals of Opportunity" (SoOp) have enabled new remote sensing technologies and techniques for ocean applications. This paper seeks to study the feasibility of obtaining RZSM profiles through the SoOp method by extending it over terrain. Several satellite communication infrastructures currently exist that offer various frequencies and incidence angles that can potentially enable the global monitoring of soil moisture at high spatio-temporal resolutions.

To enable this effort, Mississippi State University's recently-developed Signal of Opportunity Coherent Bistatic Scattering Model (SCoBi) will be employed to investigate the sensitivity of several, defined soil moisture profiles to changes in the bistatic radar configuration. SCoBi is an open-source modeling and simulation tool that enables fully polarimetric studies of land-based SoOp simulations. As the signal penetrates the soil profile, scattering takes place between stratified, uniform layers that is realized by propagation matrices and a matrix formulation of the boundary conditions at dielectric discontinuities as determined by Maxwell's equations.

This presentation will focus on the forward modeling of Purdue University's Summer 2018 tower-based, P-band SoOp measurements as well as the SoOpAirborne Demonstrator's (AD) Fall 2016 airborne P-band SoOp measurements in order to investigate signatures and trends that will potentially enable the development of inversion algorithms for soil moisture products using SoOp measurements. Recent studies have shown significant correlation between SCoBi and measurements taken at Purdue University's Agronomy Center for Research and Education (ACRE) during Summer 2017 SoOp field experiments. Various artificial soil moisture profiles will be generated that are based on *in situ* data measurements collected at ACRE and the Soil Climate Analysis Network (SCAN) stations at the Little Washita, OK, site for SoOp-AD's measurements. These profiles will be used to determine correlations with reflectivity measurements created from SCoBi simulations and reflectivities observed from the aforementioned airborne and land-based SoOp field measurements.