Polarimetric decomposition of dual-frequency SAR data for soil moisture retrieval over agricultural fields

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ABSTRACT

Estimation of soil moisture from Synthetic Aperture Radar (SAR) data at fine spatial resolution is crucial for planning agricultural activities. Over the agricultural fields which are seasonally covered by different crops, the polarimetric decomposition is often used to separate different scattering mechanisms (e.g. surface, dihedral and volume scattering), and then retrieve the soil moisture from the relative components (surface and dihedral). However, the scattering mechanisms vary with the microwave frequency used in SAR system, making it challenging to establish an universal soil moisture retrieval model. Nevertheless, the frequency diversity in the SAR observation also provides an opportunity to improve the soil moisture retrieval.

To exploit the advantages of frequency diversity, this study investigates a potential combination of dual-frequency polarimetric SAR data for soil moisture retrieval over vegetated agricultural fields. First, the behaviors of scattering mechanisms at different frequencies were analyzed using the L-band Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR), C-band RADARSAT-2 data and the ground measurements collected during the Soil Moisture Active Passive Validation Experiment in 2012 (SMAPVEX12). The first results indicated that, for narrow leaf crops as canola, corn and wheat, the volume scattering component at C-band was more sensitive to the ground measured biomass than that at L-band. In contrast, for the broad leaf crops as soybean, the L-band volume scattering component is slightly better correlated to the biomass.

According to the first results, we assume that C-band signal is generally more sensitive to vegetation characteristics than L-band. Thus, we shall estimate the volume scattering by using C-band signal. Then, a volume transformation from C-band to L-band is supposed to lead to a better surface scattering component for soil moisture retrieval. These results will be presented in the conference.