Soil moisture estimation using a multi-angular modified three component polarimetric decomposition

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Abstract

The main problem with modelling radar backscatter is the limited numbers of observables since a large number of parameters are required to describe the dominant scattering mechanisms. One approach to overcome this problem was first introduced by Freeman and Durden who used polarimetry to increase the observable space. However, using SAR polarimetry only the number of observables is still quite limited and several model simplifications must be made. As the intensity of the backscattered signal depends on the incidence angle, the observation space can be further increased by measuring the same area of interest at different incidence angles (multi-angular mode).

In this paper a three component bi- and tri-angular polarimetric decomposition is developed and applied on an airborne data set and makes use of the increased observation space. The modified three components are X-Bragg surface scattering, dihedral reflection with a roughness loss factor, and volume scattering from randomly and oriented dipoles.

The described model is applied on a dataset from the OPAQUE campaign in the Weisseritz catchment, Germany, performed by the German Aerospace Center (DLR) and the Geoforschungszentrum Potsdam. Full-polarimetric SAR data (L-band) were acquired by the E-SAR sensor of DLR. Results is shown for the overlapping area of three flight stripes. The inverted soil moisture is finally validated with ground measurements.