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Soil moisture estimation over cereals fields using l-band alos2 data (merguellil case – KAIROUAN)

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Soil moisture is a key component for water resources management especially for irrigation needs estimation. We analyze in the present study, the potential of L-band data, acquired by (Advanced Land Observing Satellite-2) ALOS-2, to retrieve soil moisture over bare soils and cereal fields located in semi-arid area in the Kairouan plain.

In this context, we evaluate radar signal sensitivity to roughness, soil moisture and vegetation biophysical parameters. Based on multi-incidence radar data (28°, 32.5° and 36°), high correlations characterize relationships between backscattering coefficients in dual-polarization (HH and HV) and root mean square of heights (Hrms) and Zs, parameters, Sensitivity of radar data to soil moisture was discussed for three classes of NDVI (less than 0.25 for bare soils and dispersed vegetation, between 0.25 and 0.5 for medium vegetation and greater than 0.5 for dense cereals). With vegetation development, where NDVI values are higher than 0.25, SAR signal remains sensitive to soil moisture in HH pol. This sensitivity to moisture disappears, in HV pol for dense vegetation. For covered fields, L-band signal is very sensitive to Vegetation Water Content (VWC), with R^2 values ranging between 0.76 and 0.61 in HH and HV polarization respectively.

Simulating signal behavior is carried out through various models over bare soils and covered cereal fields. Over bare soils, proposed empirical expressions, modified versions of Integral Equation Model (IEM-B) and Dubois models (Dubois-B) are evaluated, generally for HH and HV polarizations. Best consistency is observed between real data and IEM-B backscattering simulations in HH polarization. More discrepancies between real and modelled data are observed in HV polarization.

Furthermore, to simulate L-band signal behavior over covered fields, the inversion of Water Cloud Model (WCM) coupled to different bare soil models is realized through direct equations and Look-up tables. Two options of WCM, are tested (with and without soil-vegetation interaction scattering term). For the first option, results highlight the good performance of IEM-B coupled to WCM in HH polarization with RMSE value between estimated and in situ moisture measurements equal to 4.87 vol.%. By adding soil – cereal interaction term in the second option of WCM, results reveal a stable accuracy in HH polarization and an important improvement of soil moisture estimations in HV

polarization, with RMSE values are ranging between 6 and 7 vol.%.