

## Soil moisture retrieval from Sentinel-1 acquisitions in an arid environment in Tunisia : application of Artificial Neural Networks techniques

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### ABSTRACT

In this paper, an approach for estimating the soil moisture content (SMC) in arid environment in Tunisia is presented. In countries characterized by arid and semi-arid climate, it is very important to obtain reliable estimates of soil moisture evolution for water management purposes, in order to reduce water wastes and properly schedule agricultural practices. On the other hand, the retrieval of SMC is often hampered by the small humidity range (below 10%).

A retrieval algorithm aiming at estimating the soil moisture and based on artificial neural networks (ANN) has therefore been implemented, using the data collected by the Synthetic Aperture Radar (SAR) sensor of Sentinel-1. By taking advantage of the fast computation and high retrieval accuracy, ANN are able to generate reliable output maps of SMC starting from the complex SAR images and using little auxiliary information, as Digital Elevation Models, Local Incidence angle, Normalized Difference Vegetation Index (NDVI), and so on. The peculiar strategy adopted for the training, which has been obtained by combining satellite measurements with data simulated by electromagnetic model (based on the Integral Equation Model, IEM), made this algorithm robust and almost site independent. The obtained results demonstrated that ANN represent a powerful tool for estimating SMC, provided that they have been trained with consistent datasets, made up by both experimental and theoretical data. The relationship of the algorithm validation between the estimated and measured SMC showed Pearson's correlation coefficient,  $r = 0.77$ , and RMSE = 1.84%, in spite of the very low SMC values found on the area.