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Using Sentinel-1 and Landsat 8 satellite images to estimate surface soil moisture content.

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Nowadays, the potential for more accurate assessment of Soil Moisture (SM) content exploiting Earth Observation (EO) technology, by exploring the use of synergistic approaches among a variety of EO instruments has emerged. This study is the first to investigate the potential of Synthetic Aperture Radar (SAR) (Sentinel-1) and optical (Landsat 8) images in combination with ground measurements to estimate volumetric SM content in support of water management and agricultural practices. SAR and optical data are downloaded and corrected in terms of atmospheric, geometric and radiometric corrections. SAR images are also corrected in terms of roughness and vegetation with the synergistic use of Oh and Topp models using a dataset consisting of backscattering coefficients and corresponding direct measurements of ground parameters (moisture, roughness). Following, various vegetation indices (NDVI, SAVI, MSAVI, EVI, etc.) are estimated to record diachronically the vegetation regime within the study area and as auxiliary data in the final modeling. Furthermore, thermal images from optical data are corrected and incorporated to the overall approach. The basic principle of Thermal InfraRed (TIR) method is that Land Surface Temperature (LST) is sensitive to surface SM content due to its impact on surface heating process (heat capacity and thermal conductivity) under bare soil or sparse vegetation cover conditions. Ground truth data are collected from a Time-domain reflectometer (TRD) gauge network established in western Crete, Greece, during 2015. Sophisticated algorithms based on Artificial Neural Networks (ANNs) and Multiple Linear Regression (MLR) approaches are used to explore the statistical relationship between backscattering measurements and SM content. Results highlight the potential of SAR and optical satellite images to contribute to effective SM content detection in support of water resources management and precision agriculture.

Keywords: Sentinel-1, Landsat 8, Soil moisture content, Artificial Neural Network, Multiple Linear Regression

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