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Soil moisture assessment based on Sentinel 1/2 and in-situ data: The vineyard case study

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Vineyards are crops whose production has a major economic impact in the Portuguese economy (~750 million euros) being exported worldwide. As the climate models project a larger variability in precipitation regime, the water requirements of vineyards can change and drip irrigation can be responsible for salt accumulation in the root zone, especially when late autumn and winter precipitation is not enough to leach salts from the soil upper horizons, turning the soil unsuitable for grape production.

The aim of this work is to present a methodology to map surface soil moisture content (SMC) in a vineyard, (40 hectares) based on the application of two classification algorithms to satellite imagery (Sentinel 1 and Sentinel 2). Two vineyard plots were considered and three field campaigns (December 2017, January 2018 and May 2018) were conducted to measure soil moisture contents (SMC). A geostatistical method was used to estimate the SM class probabilities according to a threshold value, enlarging the training set (i.e., SMC data of the two plots) for the classification algorithms. Sentinel-1 and Sentinel-2 images and terrain attributes fed the classification algorithms. Both methods, Random Forest and Logistic Regression, classified the highest SMC areas, with probabilities above 14%, located close to a stream at the lower altitudes.

RF performed very well in classifying the topsoil zones with lower SMC during the autumn-winter period (F-measure=0.82).

This delineation allows the prevention of the occurrence of areas affected by salinization, indicating which areas will need irrigation management strategies to control the salinity, especially under climate change, and the expected increase in droughts.