Exploiting Sentinel-1 polarized data for the classification of areas and time intervals where coherently apply a change detection method for the retrieval of superficial soil moisture at the field scale

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Introduction

Objective: modelling the contribution of the vegetation to the SAR signal for retrieving soil moisture content at the field scale on a agricultural land use.

Classical approach: using optical indices whose availability is dependent on weather conditions.

Alternative: testing SAR based vegetation indices.

Method

Backscattering model: volumetric and attenuated superficial contributions were considered.

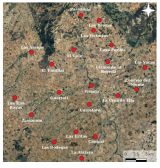
Change detection method:

- applied where the volumetric contribution is considered to be constant by means of veg. index;
- calculation of maximum differences of the SAR signal within the study period.

Soil moisture calculation: the maximum variation of signal is linked to the maximum variation of soil moisture.

Study case and dataset

Spain - Salamanca
1258 km^2
Agricultural land use
Low vegetated areas



Sentinel-1 SAR
Sentinel-2 MSI
18 measurements stations (REMEDHUS, ISMN)

Model set up

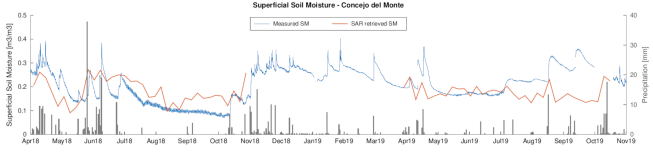
Study period: irrigation seasons of the years 2018, 2019.

Study area: 4 km^2, the retrieval is applied in the nearby of the measurements stations.

Tested vegetation indices: NDVI, NDWI, PR (Polarization Ratio), RVI (Kim et al., 2009).

Results and Discussion

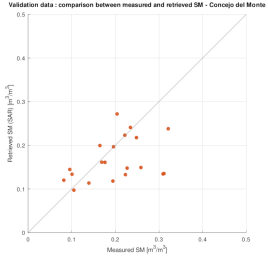
Soil moisture trend in one of the measurement sites



The solution of soil moisture obtained by using the PR SAR based vegetation index led to better performances compared to the other vegetation indices tested.

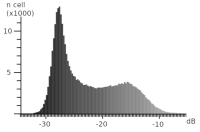
The trend of the soil moisture retrieved from SAR data follow the pattern of meteoric events within the study period in all the 18 areas where the estimation has been performed.

Best fit of the solution with the measured data in areas covered with low vegetation.

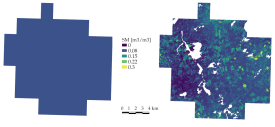


Ongoing works

Dynamic filtering of areas where the volumetric contribution is dominant using iterative Kittler-Illigworth (see Satalino et al., 2014)



SMOS downscaling with spatial patterns of our results



Roughness (Zribi, 2008)

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