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Soil moisture retrieval from Sentinel-1 data using multiple linear regression approach

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Soil moisture (SM) is one of the key factors in the water cycle, that rules partitioning of the rainfall to surface runoff and infiltration. Despite its importance and detailed SM research in the last decade retrieval of the high resolution global SM data is still a significant scientific challenge.

Launched in 2014, Sentinel-1 mission, opens new possibilities of receiving high resolution spatial (up to 4x4 meters) and temporal (in most cases revisit time is less than 3 days) data products that might be useful for SM retrieval. Sentinel-1 uses C-band active microwave sensing device. It was proved that the best way to retrieve SM content remotely is to collect data using passive L-band sensor. However, C-band sensors are also sensitive to SM changes and due to that fact they are used to retrieve SM data from previous C-band missions (for example ASAR or RADARSAT). Besides SM changes, Sentinel-1 data are also strongly influenced by the surface roughness and more importantly by the vegetation. Analyzing data from different polarisations allows vegetation biomass description which also suggest that it should be possible to find relation between SM and Sentinel-1 backscatter measurements.

The aim of this study was to investigate the potential of near surface SM retrieval from Sentinel-1 data using multiple linear regression approach. In order to do so the in-situ measurements, using a time-domain reflectometer (TDR), were elaborated within the Kampinos National Park in Poland. Both low and high vegetation areas were investigated. In total 488 SM in-situ measurements were correlated with backscatter [dB] from Sentinel-1 in VH and VV polarisations. Comparison of the SM in-situ values against SM retrieved from Sentinel-1 shows a significant potential for high resolution SM observation using Sentinel-1 particularly over low vegetation areas.

Further research will be done on coping the high resolution Sentinel-1 data with low resolution missions (ex. SMOS) and afterwards using the disaggregated data to Sentinel-1 SM validation.