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# On the assesment of a new 4D soil moisture product over Basilicata Region

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Climate change is already causing suffering and damage, representing the greatest current challenge and threat to our planet. As global temperatures increase, widespread shifts in weather systems occur, making events such as droughts and floods more intense and unpredictable. Both have a direct connection to the variability of Soil Moisture (SM), which therefore needs to be provided at adequate spatiotemporal resolutions and with good accuracy along the soil profile. Currently, there are no satellite SM products that can offer information at high temporal and spatial resolutions, particularly when investigating root zone and large spatial scales. Blending satellite products with similar characteristics but different features in terms of resolution may allow us to face such a gap. In this light, the 25 km Metop ASCAT Surface Soil Moisture (SSM) product, with a sub-daily temporal resolution (2-6 measurements per day), and the weekly improved SSM S-1 data at 1 km spatial resolution are based on satellite acquisitions in the same microwave spectral region (i.e., the C-band) processed with the RT1 algorithm (Quast et al., 2023)

In this work, we fused, firstly, these products to obtain a daily 1 km soil moisture product, named SCAT- SAR SWI, following the method of Bauer-Marschallinger et al. (2018). As inputs, we used the ASCAT H119 - H120 (Climate Data Record v7 Extension 12.5 km sampling) and an optimized version of SENTINEL 1 SM products made available by the Technological University of Wien for the January 2017 - July 2022 period. Subsequently, we applied the Soil Moisture Analytical Relationship (SMAR) model (Manfreda et al., 2014) to the SCAT-SAR SWI surface product to obtain RZSM information. This made it possible to depict the Basilicata region (southern Italy) test case in four dimensions (time t plus x, y, and z) at high spatiotemporal resolutions. The performance of the developed SCAT- SAR SWI SMAR product, as well as that of the SCAT- SAR SWI, was evaluated for comparison with the 1 km ERA5-Land downscaled SM data (i.e., volumetric_soil_water_layer_1; volumetric_soil_water_layer_2).

The results are encouraging, demonstrating the capability of the product to discriminate the behaviour of areas characterized by different SM contents based on their orography and precipitation regimes. The western part of the region, more affected by precipitation and more mountainous than the other sections of the region, shows indeed a positive correlation (R□0.8)

with the ERA 5 LAND 1 km product, higher than that obtained for the flatter western subset (R□0.6-0.7). This is likely due to the more consistent precipitation patterns in the western part.

***Reference***


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