Evaluation of SMOS soil moisture level 2A products with modelled near-surface soil moisture patterns over Spain

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Introduction

Soil moisture is a key variable in the hydrological cycle. Soil moisture satellites like SMOS provide information about soil moisture with a high temporal spatial resolution and a global coverage. The quality of these satellite-based soil moisture products are often assessed by comparing them with in-situ data. Comparison is however hampered by the different spatial and temporal scales (support), because the spatial resolution of SMOS is rather low compared to in-situ field measurements. To overcome this problem, we use a stochastic, distributed unsaturated zone model (SWAP) that is upscaled to the support of SMOS data points.

Material and Methods

SMOS is compared with the mean of observations of the REMEDHUS site, which consist of 22 locations where soil moisture is measured at 5 cm depth. A comparison is made between the SMOS (level 2A product), the observations from REMEDHUS and SWAP (figure 1). ASCAT and AMSR-E are also included in the intercomparison.
The SWAP model has been used to model 79 locations in Spain (only one presented here) of which detailed precipitation and evapotranspiration data are available. The model (24 realizations) is upscaled to SMOS pixel size and compared with SMOS. One location in the northern part of Spain is shown.

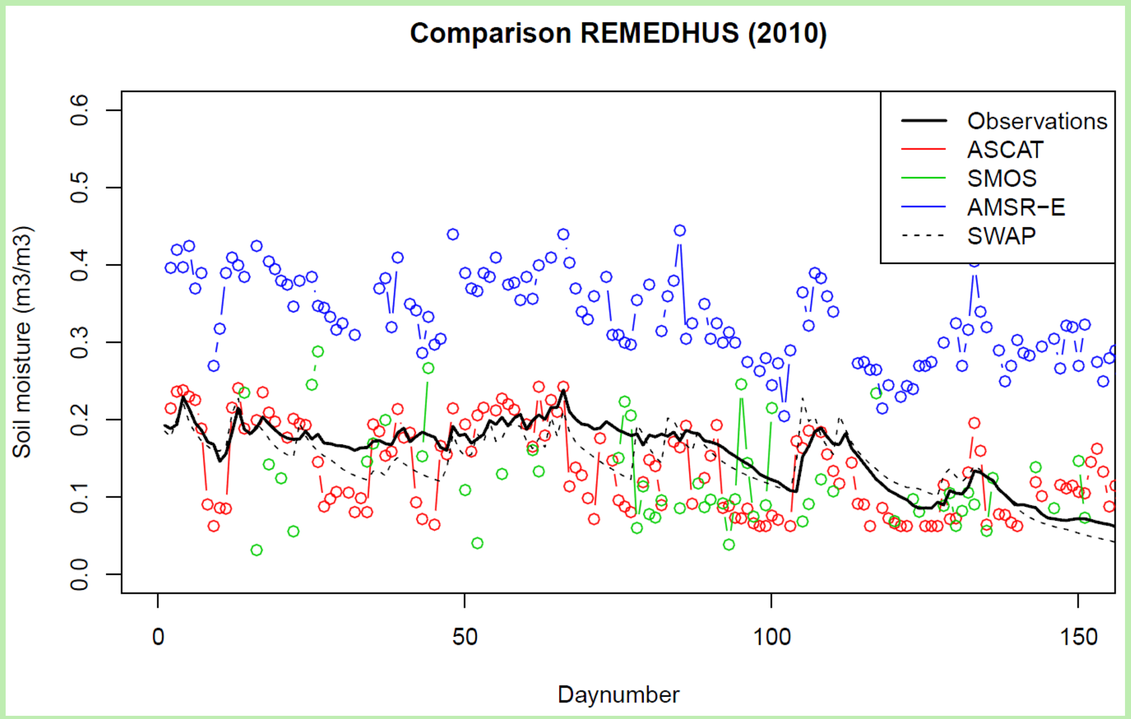

Figure 1: Comparison of satellite derived soil moisture and SWAP model for the REMEDHUS network

Table 1: Statistics of the comparison with observations

	R^2	RMSE
ASCAT	0.446	0.0423
SMOS	0.106	0.0807
AMSR-E (VUA)	0.623	0.1608
SWAP (model)	0.731	0.0331

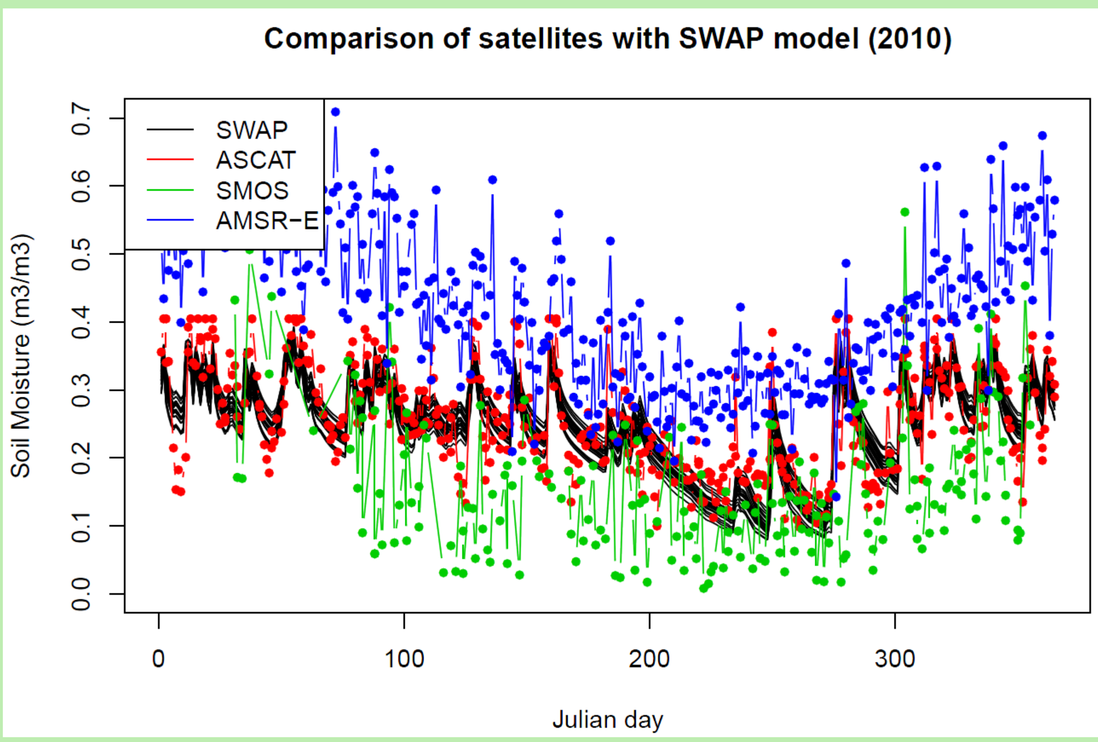

Figure 2: Comparison of soil moisture satellites with the SWAP model for a location in North Spain

Table 2: Statistics of the intercomparison of figure 2. R^2 is given in the green boxes and RMSE in the purple boxes

	SWAP	ASCAT	SMOS	AMSR-E
SWAP		0.620	0.153	0.347
ASCAT	0.0492		0.118	0.232
SMOS	0.1299	0.1375		0.159
AMSR-E	0.2002	0.1995	0.2717	

Conclusions:

In general SMOS seems to underestimate the modelled near surface soil moisture content. The SMOS timeseries also shows a quite noisy signal. The general trend of soil moisture is captured well by SMOS. This noisy signal could be caused by RFI still present in Europe. Further research in other areas in Spain is needed to determine the overall quality of the SMOS Level 2A product.
ASCAT has a fairly good agreement with both the modelled and observed soil moisture.
AMSR-E overestimates the amount of soil moisture, however correlations with the observations are high.
RMSE of all satellites exceed the 0.04 m3/m3 and the correlation between different satellites is rather low.

NWO
Netherlands Organisation for Scientific Research

SMOS Science Workshop
27-29 September 2011 – Arles – France

Universiteit Utrecht