Observation uncertainty of satellite soil moisture products determined with physically-based modelling

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Introduction

Accurate estimates of soil moisture as initial conditions to hydrological models is expected to greatly increase the accuracy of flood and drought predictions. As insitu soil moisture observations are scarce, satellite-based estimates are a suitable alternative. The validation of remotely sensed soil moisture products is generally hampered by the different spatial support of in-situ observations and satellite footprints. Unsaturated zone modelling may serve as a valuable validation tool since it could bridge the gap of different spatial supports.

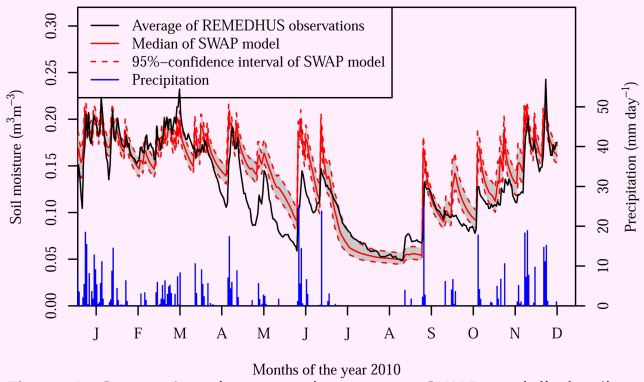

Figure 1: Comparison between the average SWAP modelled soil moisture at the REMEDHUS network and average of the in-situ observations of the REMEDHUS network for the year 2012in Spain

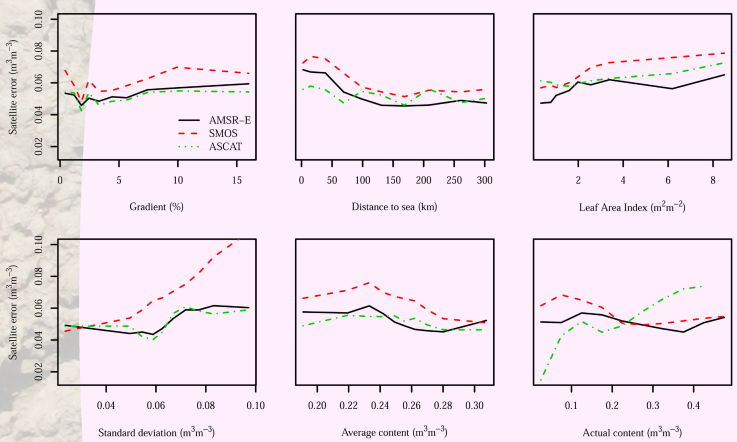

Figure 3: Satellite standard error of satellite soil moisture for different factors in comparison with SWAP model for the period January 2010 - June 2011 over Spain.

Material and methods

A stochastic, distributed unsaturated zone model (SWAP) was used for comparison with point observations at the REMEDHUS network to enhance understanding of the model and to assure that the SWAP model could be used with confidence for other locations in Spain (Figure 1). A timeseries analysis was performed to compare surface soil moisture from the SWAP model to surface soil moisture retrievals from three different microwave sensors, including AMSR-E, SMOS and ASCAT for Januari 2010 to July 2011 (Figures 2). A relation was found between the satellite errors and different external factors (Figure 3). It was also found that the satellite errors show a clear spatial correlations (Figure 4), which could be very important for applications (e.g data assimilation).

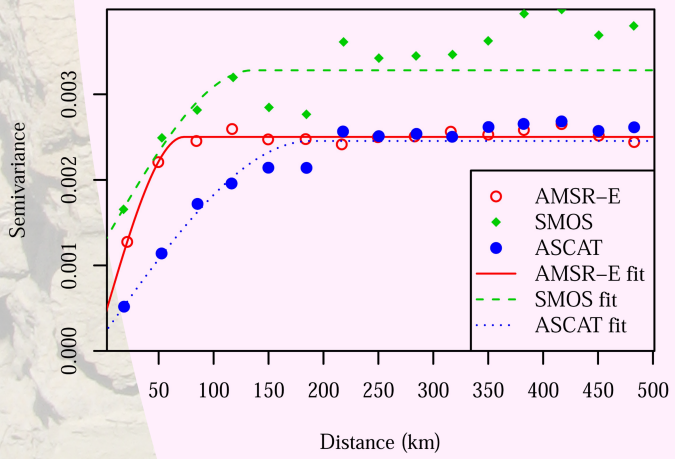

Figure 4: Semi-variograms of the time dependent satellite product error calculated for three soil moisutre products, for the period January 2010 - June 2011 over Spain.

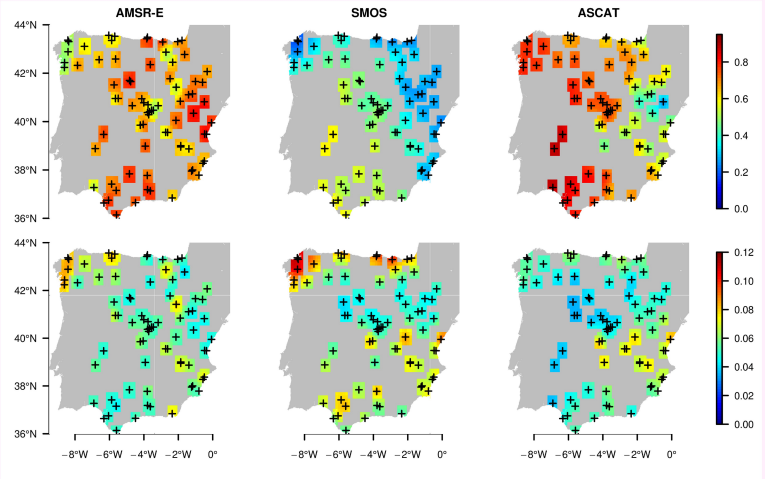

Figure 2: Correlation (top) and satellite standard error (bottom) for three satellite soil moisture products for the period January 2010 - June 2011 over Spain.

Conclusions

- Temporal dynamics are best captured by AMSR-E and ASCAT
- Satellite error for the three sensor were found to similar (0.05 m3m-3)
- The satellite uncertainty is spatially correlated and spatial patterns are found
- Important to include model error in satellite validation

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