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Hydrology and Earth System Sciences Discussions

Interactive comment on "Cross-evaluation of modelled and remotely sensed surface soil moisture with in situ data in Southwestern France" *by* C. Albergel et al.

Anonymous Referee #2

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Overview

The study investigates the reliability of four Surface Soil Moisture (SSM) products obtained from: 1) the ASCAT satellite sensor, 2) the SIM hydrometeorological model of Météo France, 3) the ALADIN numerical weather prediction (NWP) model of Météo France, and 4) the integrated Forecasting System (IFS) of ECMWF (NWP model). In-situ soil moisture measurements collected at 13 stations (12 from the SMOSMANIA network and the SMOSREX site) in Southwestern France were used as benchmark. Results are promising and they show that both the ASCAT satellite sensor and the sim-

ulation models operating at the national and/or global scale provide a good agreement with in-situ observations notwithstanding the very different spatial support between the data sets.

General Comments

The paper is well written and structured and the topic is very relevant. The evaluation of the different SSM products derived from satellite sensors or from hydrometeorological and NWP models through reliable and long term in-situ observations represents an important issue also to employ these SSM products for other applications (flood forecasting, climatic studies, agriculture, ...). However, in my opinion, several aspects should be enhanced before its publication.

The first aspect is related to the organization of the paper. In the manuscript a total of six soil moisture products were evaluated and compared (for ASCAT sensor and IFS model two products for each were considered), i.e. a large number of data. In my opinion, it should be clear to the reader the purpose of the paper, i.e. the evaluation of different products against in-situ observations. In-situ data are assumed as benchmark ("truth"), notwithstanding the well-known problem related to their representativeness at the coarse spatial scale. Therefore, the comparison between ASCAT and SIM model might be removed. Otherwise, a more complete inter-comparison should be carried out (i.e. by comparing all the products among themselves). In this case it would be interesting to try to understand which product provides the more reliable soil moisture pattern (or, alternatively, the accuracy of each product) by using, for instance, the triple-collocation error method (e.g. *Scipal et al., 2008; Dorigo et al., 2010*). In this study, more than three soil moisture estimates are available for each point and, hence, also the reliability of the triple-collocation error method could be assessed.

Moreover, a table where all the soil moisture products are reported should be needed. This table should include the type of the product (in-situ, hydrometeorological model, NWP model), the investigated layer depth, the period for which data are available, the

spatial and temporal resolution, ... In fact, this table helps the reader to have a clear idea of the different data sets and models used in the study and of their differences. For instance, which are the main differences between the different models used? If I am not mistaken, the main differences between SIM model and the NWP models are not only related to the land surface scheme. In fact, for SIM model no data assimilation was performed but it uses also rainfall information from raingauges data across France (rainfall is the main driver of the soil moisture temporal pattern). The NWP models, usually, do not assimilate rainfall data and, hence, it is nice to see that these models provide a good agreement with in-situ observations; very few paper comparing NWP model output with soil moisture observations were published indeed (e.g. *Balsamo et al., 2009*).

These aspects should be better specified in the revised manuscript.

Moreover, three technical aspects can be improved:

1) The ASCAT SSM product used in the study does not represent the latest version of this data set. As reported in very recent studies (*Brocca et al., 2010a; 2010b; 2010c*), the new version of the ASCAT SSM product provides more consistent soil moisture estimates. I suggest to use this new data set and to discuss the results considering the above mentioned studies which proved the good behaviour of the new ASCAT SSM product against in-situ and modeled soil moisture data for different sites across Europe.

2) The analysis of the downscaled ASCAT SSM product has to be revised. I agree with Referee 1 that the significance of the correlation values computed with only 10 data points should be very low. Which are the average R values for the two data sets? I suggest, alternatively, to compare monthly or seasonal averaged values (that should be more robust) with in-situ observations taking the "original" and the downscaled ASCAT products into account. This analysis is easier to understand and clearer for the reader. However, the new ASCAT SSM product is already very good and I can't find an obvious added-value in the 1km product at this status. Basically, for hydrological applications,

the 1km product is totally the same of the 25km one (only a linear rescaling).

3) The analysis of the two products of the IFS of ECMWF is not complete. As stated by the authors in the Conclusion section the contribution of the new data assimilation algorithm (SEKF against OI) should be separated from the contribution of ASCAT. As far as I know, the effect of the SEKF versus the OI method is much stronger than that related to the assimilation of the ASCAT SSM product (*de Rosnay et al., 2010*). Reading the paper, I could think that the improved performance of the IFS_F6ui SSM product against the operational one can be related to the assimilation of ASCAT. I well understand that these results are very recent and it is not easy to include all of them in the manuscript. However, in my opinion, the analysis should be as much complete as possible and, hence, these very recent results on ECMWF product (and also those relative to ASCAT) should be added and discussed.

Below, in the specific comments, I report a small number of changes and clarifications that may be required.

On these bases, in my opinion, I find that the paper may become worthy of publication on HESS Journal after a moderate revision.

Specific Comments/ Technical Corrections (P: page, L: line or lines)

P4299, L9-20: This short discussion that proves the feasibility to compare in-situ local observations with coarse resolution satellite (or model derived) data is quite interesting. We found the same identical results in previous studies.

P4302, L24: Why only the descending passes are used? With the new version of the ASCAT SSM product both passes provide nearly the same results (*Brocca et al., 2010a*).

P4304, L20: What does this sentence mean: "because of the lack of usable satellite measurements"? Please specify better.

P4305, L4: I suggest to display all the performance indices (BIAS, RMSE) in a consis-

tent way, i.e. considering either in relative term (between 0 and 1, as the saturation degree) or in volumetric terms (m^3m^{-3}). Moreover, concerning the evaluation of the SSM ASCAT products against in-situ data, the latter should have been rescaled between 0 and 1. How was the normalization performed? Are the maximum and minimum values of in-situ observations or the residual and saturation soil moisture values considered? Please specify.

P4306, L8-10: Figure 5 should be more commented or removed.

Figure 2: I suggest to change this figure with a more detailed framework of the study area including, for instance, the digital elevation model or the land use/soil types map (along with the location of the SMOSMANIA and SMOSREX stations).

Figure 3-4: These two figures are very hard to read. Likely, only an example for two or three representative stations should be better (as in Figure 7).

Additional References

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