

Interactive comment on “An improved perspective in the representation of soil moisture: potential added value of SMOS disaggregated 1 km resolution product” by Samiro Khodayar et al.

Anonymous Referee #2

Received and published: 3 March 2018

OVERVIEW

The manuscript describes the potential added value of the “all weather” disaggregated 1-km SMOS L4 (v3.0) soil moisture product obtained by integrating SMOS, MODIS (optical) and Land Surface Temperature data by ERA-Interim. Indeed, by using ERA-Interim modelled data the problem of missing observations during cloudy conditions is overcome. The comparison with SMOS L2 and L3 (CATDS) soil moisture product over the Iberian Peninsula, and specifically over the VAS area, is carried out. Moreover,

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the initialization of the SURFEX-ISBA model with SMOS-derived soil moisture data to assess the impact of the model initialization on the simulations is investigated.

GENERAL COMMENTS

The manuscript investigates a relevant topic. The recent availability of 1-km soil moisture products from the disaggregation of coarse resolution retrievals, and from high-resolution microwave sensors (e.g., Sentinel-1), still need to be thoroughly assessed and, particularly, tested the potential added value in hydrological or climatic applications. By reading the title, I was really interested to the paper and I thought its content was different with respect to the current text. I expected a more general view in which the added value of the high resolution product in real-world application(s) was determined. Therefore, I firstly suggest changing the title that is misleading.

I have to admit that I couldn't resist to read the comments of reviewer 1 who made a very good review and I agree with most of her/his comments (that should be addressed). Additionally, I have three major comments:

1) The paper is too long, not well organized (e.g., several repetitions), and not focused to a clear message. The new SMOS L4 (v3.0) “all weather” product is introduced. However, a little description of the product is carried out, with a reference to a “Quality Report” not present in the reference list. As highlighted by reviewer 1, many details are missing (e.g., spatial resolution of ERA-Interim LST, its merging with MODIS-derived LST, ...). These points need to be clarified. The title should be changed to underline the presentation of the new product. The whole paper should be focused on this new product.

2) More important than point 1, the paper should be focused clearly on the more rel-

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evant aspects the authors want to convey to the readers. The disaggregated product has a spatial resolution of 1-km, the assessment should be carried out with observations and/or modelling at 1-km resolution. It is not done in the paper. As in most “soil moisture downscaling papers” the assessment of the disaggregated product is carried out in the *TEMPORAL DOMAIN*, usually concluding that as the disaggregated product shows similar performance than the coarse resolution product. Being at higher resolution, it is a better product. Unfortunately, for me it is wrong and misleading.

I expected that the new disaggregated product was compared with high resolution modelled data (constrained by in situ observations) in the *SPATIAL DOMAIN*. This comparison is needed to understand if the disaggregated product is able to reproduce the high resolution soil moisture variability (at 1-km scale). Of course, the model should be forced with high resolution meteorological forcing (e.g., radar rainfall), and it is hard to be done.

In my opinion, the comparison with SMOS L2 and L3 products should be strongly reduced and the authors should focus on the *SPATIAL* assessment of the SMOS L4 “all weather” product (likely compared with SMOS L4 v2 product not including ERA-Interim LST). If the new product is able to reproduce the spatial variability of high resolution modelled data, then the authors can say that “the SMOS L4 v3 product captures the 1-km soil moisture spatial variability”. Otherwise, all the sentences similar to this one should be removed by the paper.

3) The analysis for the initialization of modelled data is, at least for me, not clear and likely not appropriate. To assess the added value of the soil moisture product, the authors should introduce the product into the modelling (e.g., through data assimilation) and assess the model performance without and with the use of the product. Specifically, the authors should assimilate different SMOS products into the modelling and then assess the best product based on the simulation results after the assimilation. The authors only showed that if different initial soil moisture conditions are considered,

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different results are obtained. However, this is highly expected and largely shown in the scientific literature. An assimilation analysis I guess goes beyond the scope of the paper. Therefore, I am suggesting removing, or strongly reducing, this part.

Some specific comments and corrections should be also addressed. For instance, the introduction introduces ONLY SMOS among the satellite soil moisture products currently available. We have SMAP, ASCAT, AMSR2, ESA CCI and Sentinel-1 as operational products freely available. They should be at least mentioned.

Some of the comments are already reported by reviewer 1 and I believe the paper in the current form should be significantly modified. Hence, I have not included the specific corrections at this stage.

RECOMMENDATION

On this basis, I found the topic of the paper relevant, but the paper still needs substantial improvements. Therefore, I suggest a major revision before the possible publication in *Hydrology and Earth System Sciences*.

Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, <https://doi.org/10.5194/hess-2018-17>, 2018.

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