

## ***Interactive comment on “Developing an improved soil moisture dataset by blending passive and active microwave satellite-based retrievals” by Y. Y. Liu et al.***

### **Anonymous Referee #1**

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This paper proposes a method to combine active and passive microwave soil moisture products using a global land surface model climatology. Developing and improving global scale soil moisture data sets is of crucial interest in several areas including climatology and numerical weather prediction. The subject is relevant for HESS, however it does not investigate very deeply the approach and does not show much results of the new product. I recommend this paper to be published after major revisions as suggested below.

#### 1) General Comments

A general comment on this paper concerns the lack of clarity of the objective of the paper. Is the purpose of the paper to present a new method to blend passive and active and model soil moisture products ? Or is the objective to present the new blended product ? Or does the paper aim at presenting both methods and results, as suggested by the structure of the paper in Data/methods/results ? The content of the paper is clearly more focused on the presentation of the method. Most of the results shown should be actually part of the method section as detailed in the specific comments below. In contrast, some other crucial components of the method, such as the CDF-matching approach, are not detailed enough. Concerning results, validation conducted for three sites is very interesting. However the representativeness of these results should be addressed in the paper. And the only global result shown is about temporal coverage. The authors should show more results of the product, or, since the methods represents the most important part of the paper it should be acknowledged that the paper is a methodology paper.

## 2) Specific comments

P6700 line 16-17, P6702 lines 1-3, P6708 lines 3-7, P6710 lines 21-22: The transitional regions are defined as regions with high correlation between ASCAT and AMSR-E. They also delineate the boundary between sparsely and moderately vegetated areas. These two assessments are used several times in the paper. The paper cited in support of this rule is Dorigo et al. (HESSD) who show that AMSR-E has larger errors than ASCAT in region with 'moderate vegetation' and smaller errors in regions with 'sparse' vegetation. So, the transitional regions are just the common regions for which AMSR-E and ASCAT have  $\sim$ medium errors. Dorigo et al. is cited several times along the paper but no physical explanation is given. However the question remains for the reader: what is the relation between ASCAT/AMSR-E correlation and the transition between sparsely and moderately vegetated areas ? One would expect that regions of lowest vegetation coverage are the best for the two products. It would be useful (i) to provide a physical explanation of the reason why ASCAT soil moisture product has smaller

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errors in "moderately" vegetated area than in sparsely vegetated areas (ii) to define the transitional regions once and clearly in the method section, because it is used to define the areas where the two products are blended (instead of providing incomplete information all the paper along the paper). Actually Figure 5 which come late in the paper is useful to understand how the data sets are blended and it should be shown in the methods section.

P6702 line16: remove 'at the retrieval level'. Since the approach proposed in this paper consists in blending soil moisture products, it is not conducted at the retrieval level. Rather working at the retrieval level would consist in using brightness temperature and backscattering coefficients directly.

Introduction: A discussion concerning the interest of the proposed approach versus other approaches (e.g. data assimilation) would be useful.

P6703: Please introduce the content of the paper.

P6704 from line 18: Form here it seems that the description concerns both AMSR-E and ASCAT. It is the case at least for the re-sampling. Please clarify on line 25 if masking also applies to AMSR-e. If it is the case the authors should add a new subsection from line 18 (for example 'Data pre-processing').

P6706: line 11: replace 'absolute' by 'volumetric' everywhere in the paper.

P6707: The CDF-matching approach is an important component of the approach since it is used to rescale and correct bias of the two soil moisture products in terms of volumetric surface soil moisture. CDF matching needs to be described in more details in the paper. The authors use a pice-wise linear CDF-matching approach. It is important to discuss the choice of 8 intervals since usually only one interval that covers the entire range of soil moisture is used. The authors should tell how many parameters they use for each segment for each pixel. If they have 2 linear parameters per segment (which is most probably the case), then they have many 16 parameters per grid points.

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Again what is the interest of the segment approach compared to a second or third order CDF matching performed on the entire range of values? And the authors also have to explain how they compute the matching parameters: do they consider both mean and variance to compute the matching parameters? on which period do they calibrate the matching parameters? In addition global maps of ASCAT and/or AMSR-E products before and after CDF matching, together with global map of Noah surface soil moisture should be provided to illustrate the effect of the CDF matching on the product.

A more general comment is that using a CDF-matching approach to rescale products on the land surface model leads to have a strong contribution of the land surface model in the final product. While correlation with ground stations results from the satellite product, RMSE is strongly constrained by the Land Surface Model (LSM) volumetric soil moisture. The author should more clearly acknowledge that the proposed approach consists of blending microwave satellite products and model product of surface soil moisture. However to take advantage of satellite products and land surface model data assimilation approaches would be more relevant to reach an optimal combination. This should be discussed to clarify the interest of this approach compared to other methods. What is the benefit of developing a global volumetric soil moisture product in which satellite and model products are combined using non-optimal approaches? Shall the method use only ASCAT and AMSR-E (rescaled in terms of index) to provide a blended product expressed in soil moisture index?

P6708: From line 10 the authors should add a sub-section 3.3 on "validation method". Bullets 2 and 3 concern rescaling, already addressed in the previous sub-section 3.1, so they should be removed. Then remaining bullets 1, 2, 5 all focus on the validation of the products at different stages of the rescaling and merging approach which is more consistent with the text introducing the bullets.

P6710: Results are presented for three sites only. Are they representative of other sites? This needs to be discussed.

P6710, section 4.2: This section is supposed to show results. Figure 3 shows correlation between ASCAT and AMSR-E. This is part of the method and it is used to define the regions where the products are merged. So it should be moved to sub-section 3.2. Figure 4 shows a results from Parinussa et al, (submitted to an other journal). It should be discussed and not shown since it is not a result of this paper. In addition it is not a results, it is again part of the method. Figure 5 shows the contour of the regions for which the blended product uses only AMSR-E, only ASCAT and merged products. Again it is part of the method. The only results shown in the paper are the validation results (for three sites) and Figure 6 showing temporal coverage of the blended product.

It would be interesting to provide more results in this paper. A table summarizing the blended product characteristics would be useful. (period, mean resolution, mean temporal resolution). I would be also useful to discuss the interest of such a product for the users community. For what applications is this product expected to be beneficial ?

Figure 4 is from Parinussa et al. which is submitted to an other journal. It should be removed.

### 3) Technical comments

P6713: use the correct reference for SMAP (Entekhabi et al.: The Soil Moisture Active Passive (SMAP) Mission, Proceeding of the IEEE, vol98, N5, May 2010)

P6709-6710: It is useful to use numbering in the text to organize and make it clear the structure of the sentences. However it is used too often in these two pages. In section 4.1 four sentences are structured using numbering. Please use less often numbering in this section.

Figures 3 and 6: The quality of these figures is very poor and the colorbar scales are much too small. In figure 6 it is not possible at all to read the values.

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