

## ***Interactive comment on “Correction of real-time satellite precipitation with satellite soil moisture observations” by W. Zhan et al.***

### **Anonymous Referee #1**

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### **Overview**

The study investigates the use of satellite soil moisture observations for correcting real-time satellite precipitation over CONUS area. Specifically, satellite soil moisture observations from AMSR-E (LSMEM algorithm) are assimilated into VIC model through particle filter technique. The model is forced with real-time TMPA precipitation estimates. Results show that updated precipitation (after the assimilation of satellite soil moisture data) better agrees with NLDAS observation with respect to original TMPA data, even though some issues due to the noise of satellite soil moisture retrieval are to be investigated.

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## General Comments

I found the paper well written, quite well-structured and clear. The topic is surely of interest for the readers of HESS as the use of satellite soil moisture data for correcting/estimating rainfall has become a promising research activity in the very recent years. Indeed, satellite soil moisture data seem to provide a useful, and independent, source of information that can be conveniently used for improving the estimation of rainfall from remote sensing.

However, I found a major issue for which I believe the paper cannot be published in the present form. Indeed, in *Wanders et al. (2015, doi:10.1016/j.rse.2015.01.016)*, basically the same analysis is carried out. The only new aspect that I found relies in the pre-processing of AMSR-E soil moisture data that strongly improves the agreement between VIC and AMSR-E changes as shown in Figure 4 (much better than Figure 9 in *Wanders et al. (2015)*). This was due to the different soil layer depth of VIC and AMSR-E data and, by reducing this issue, the overall results seem to improve significantly with respect to *Wanders et al. (2015)*. However, a comparison between the results of these two studies is not given in the paper.

Moreover, *Wanders et al. (2015)* performed a more comprehensive study by using different satellite soil moisture products (also from ASCAT and SMOS) and also Land Surface Temperature (LST) data. Therefore, this study might be seen as only a small, even though likely significant, improvement of *Wanders et al. (2015)* and, likely, it should be published as Technical Note. Otherwise, the authors should extend the work in space and/or in time, and surely a detailed comparison with previous studies (*Crow et al., Pellarin et al., Brocca et al.*) is also required.

Moreover, I found the overall presentation of the results not satisfactory. In my opinion, the interpretation of Figures 14-16 is not easy and quite confusing. In the comparisons, some statistics for summarizing the results should be given. Usually, the assessment of rainfall product is carried out by using also categorical statistics (POD, FAR, ...) that

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are not used in the paper. The reference in the text to the figures is sometimes wrong (see Specific Comments). The paper seems to be quickly drafted without putting due attention. I also believe that too many figures are reported. In synthesis, I suggest improving the results description, with clear reference to previous studies and focusing only on the most important findings.

In the Specific Comments I reported a number of corrections/explanations that are required.

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

P5756, L2-3: NLDAS data are used here for the generation of the particles. It means that the particle filter is not independent from NLDAS observations that, later, are used for validating the results. This step should be removed.

P5757, L1-2: It is not clear which orbit (ascending or descending or both) is used in the study. Please clarify.

P5758, L7: Actually, the independence of grid cells in VIC model, and usually in all land surface model, represents for me (as hydrologist) a significant limitation for this studies carried out over large areas. It is well known that lateral fluxes are important component of the water cycle and their neglecting might represent an important issue. I suggest, at least, to underline this point.

P5758, L22-25: The method used for upscaling, in space and time, of NLDAS hourly observations should be specified.

P5759, L11: Change “idealize” with “idealized”.

P5759, L17-19: The problem of saturation was already shown in all previous studies using soil moisture observations for rainfall correction/retrieval. This should be acknowledged.

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P5760, L16: Change “Figure 8” with “Figure 9”.

P5761, L11-13: The sentence “To further avoid . . . isn’t available” is not clear to me and it should be revised.

P5761, L17: Section 3.3 is not present. Please check.

P5761, L18: Figure 12 should be moved before Figure 11. The reference to Figure 12c should be 12b.

P5761, L23: The correlation of 0.52 is between NLDAS and ? Please specify.

P5762, L3: TMPA (3B42RT) can be simplified in 3B42RT. Similarly for TMPA (3B42RT\_ADJ). Moreover, several times TPMA is written instead of TMPA. Please correct.

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