Interactive comment on "SM2RAIN-ASCAT (2007–2018): global daily satellite rainfall from ASCAT soil moisture" *by* Luca Brocca et al.

Anonymous Referee #1

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This study provides detailed descriptions of the SM2Rain product and several evaluation results. Overall, the study would be useful for current and future SM2Rain users, and fits the scope of ESSD. However, I do find that the manuscript misses several key information in SM2Rain production and evaluation.

1. Line 24 – 29: The statement here is too strong. I agree that SM2Rain is a useful product in some aspects. However, I have not seen strong evidences that SM2Rain substantially outperforms other merged products, e.g., MSWEP v2.0. Additionally, soil moisture retrievals prior 2002 have very low data quality. I personally doubt if good precipitation can be derived from these soil moisture data sets. Hence, I also suspect whether SM2Rain "is suited to build long-term consistent rainfall".

2. Line 147: A global map of ASCAT temporal sampling frequency would be helpful.

3. Line 201 – 203: I'm wondering if there are any risks of increasing false rainfall events by linear interpolation?

4. Line 242: The authors state that runoff at 20km grid is negligible. Can you provide some rainfall-runoff simulation works to support this hypothesis?

5. Line 249: I'm a little bit confused by equation 2. First, the authored stated that ET is negligible. Then, why it is still considered in equation 2? Second, it seems g(t) and e(t) should be plus in sign, according to equation (1)?

6. Line 261: e(t) is calculated using ERA5 ET. The ERA5 ET is expected to depend on ERA5 precipitation. For instance, a dry period seen by ERA5 (precipitation deficiency) will lead to low ET. Therefore, the authors should discuss the dependency of ERA5 and SM2Rain rainfall product, particularly when TC is considered in the later part of the paper.

7. Line 281: What is the reference rainfall?

8. Section 3.4: Please also specify the error model used in this TC analysis.

9. Section 3.5: Equations of these scores will be helpful here.

10. Line 367: I'm still not clear which product is used as a reference to correct SM2Rain.

11. Section 4.1 and Line 385: It's un clear how SM2Rain parameters were calibrated (determined) and extended to the global scale.

12. Figure 5: SM2Rain is calibrated against ERA5. Therefore, the consistency of ERA5 and SM2Rain only suggests how well ASCAT was fitted to ERA5. The authors should be clear that this is not suggesting the accuracy or the performance of SM2Rain (Line 414 – 415).

13. Line 431 – 433: SM2Rain show better performances relative to which product? It seems that SM2Rain's R is much lower than the other three in Figure 6 a and b.

14. Following the comment above, SM2Rain was derived by calibrations against ERA5. However, its performances are consistently lower than ERA5. Then, what's the contribution/value of SM2Rain?

15. Line 446: What products are used for TC analysis? Massari used ERA. However, I don't think this is appropriate for this study. SM2Rain here is calibrated against ERA, and they may have cross-correlated errors.

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