

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

### **Anonymous Referee #3**

Received and published: 6 June 2019

This study provides the descriptions and validation results of the 11-year (2007-2018) SM2RAIN-ASCAT global rainfall dataset. Overall, the study fits the scope of ESSD, the paper is well written and the presentation quality is very good. I think that the dataset has great potentials for different applications, as also stated by the authors, especially in specific regions of the world where it seems to outperform other products based on different approaches (e.g., GPM IMERG Early Run). However, there are several aspects that need to be addressed before the paper can be published.

Line 34: What do the author mean by “operationally available in NRT”? This is not a crucial aspect for the dataset presented in this paper.

Line 36: It is important to note that it is not global as it does not provide rainfall over water bodies, and it is limited to the availability and quality of soil moisture data. This

should be clearly stated also in the conclusions.

Line 42: Please, specify “the IMERG Global Precipitation Measurement (GPM) mission product

Line 75: Rainfall is not “measured” from space. Precipitation retrieval based on “top-down” approaches is very complex due to interaction of the radiation emitted by the Earth’s surface with gases, and liquid and solid hydrometeors within the clouds. For example, passive microwave retrieval techniques need to account for variability of all these elements (e.g., surf. emissivity and temperature, water vapour content, cloud water content, sizes, shapes, density, 3-D distribution of liquid, solid and mixed-phase hydrometeors).

Line 76-78: Please, rephrase this sentence: “these methods are based on inversion techniques where the upwelling radiation (or backscattered signal for radars) is related to the surface precipitation rate”.

Line 133 (and Line 176, and Line 327): Please, clarify what you mean by “1009 points”. Are these 12.5km x1.2km grid boxes? What do you mean by “uniformly distributed”? How have they been selected? How many “points” are selected in each region? How are the raingauge measurements treated to be associated to each “point”?

Line 203-205: it is not clear how the 12 hour sampling of the ASCAT soil moisture product is used to obtain the daily (24 hour) SM2RAIN rainfall prouct.

Line 282-284: correction of the overall bias can be very effective for mitigating errors in all products. It should be pointed out by the authors if SM2RAIN-ASCAT dataset presented in this paper is the same product that would be obtained operationally in NRT (see also Line 34). If this is not the case, in my opinion, for a fair comparison, the IMERG GPM Final Run should be used instead of the Early Run in this study. Otherwise, the authors should explain clearly why the GPM Early Run is used in this study. Although I understand that IMERG Final Run can not be used for TC, I recommend to

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show the results of SM2RAIN-ASACT compared to IMERG Final Run.

Line 314: Optimal value for FAR is 0, not 1. Please, correct.

Line 316: Please, motivate the choice of 0.5 mm/day (and not a lower value > 0 mm/day) as rainfall/no rainfall threshold.

Line 379-380: How many points are used to compute these averages in each region? Are “problematic” areas for soil moisture retrieval (complex orography, highly vegetated, ecc.) included among the 1009 points used here?

Line 389: Why R and RMSE are considered “more important”? Please, justify this choice.

Line 400-401: It is not clear what periods is used for the calibration in the two separate time frames. I assume that the calibration is not carried out for the whole periods.

Line 404-408: it is not clear what the authors mean by distinguishing “in space” and “in time”.

Line 411-413: ERA-5 is used for calibration. It is not fair to use this dataset to create this map, and show R and RMSE.

Line 468: Please, specify what is the committed area for ASCAT products (not ASCAT).

Minor corrections: Line 46: correct: “provides better performance better” Line 100: correct “has the advantage of requiring” Line 138-139: please specify which datasets have been used for the TC, what for the regional assessment, and what for global assesment. Line 190: Please, correct: “spatially averaging” Line 392-393: please correct this sentence. Something is missing, or maybe remove “,” after “filtering”. Line 402-403: Please, correct this sentence.

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