Comment on hess-2021-563

Anonymous Referee #2

Referee comment on "High-resolution (1 km) satellite rainfall estimation from SM2RAIN applied to Sentinel-1: Po River basin as a case study" by Paolo Filippucci et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-563-RC2, 2022

The paper titled "High resolution (1 km) satellite rainfall estimation from SM2RAIN applied to Sentinel-1: Po River Basin as case study" explores how precipitation estimates can be retrieved by inverting the precipitation necessary to produce the soil moisture signal measured in both ASCAT and S1. They compare their results between the 12 km ASCAT product and the target 1 km product. The end result shows that the overall performance of the higher resolution soil moisture product is mostly similar to the coarser resolution ASCAT one. However, there are large difference in performance depending on the topographic/land cover domain. Overall, the study is well presented and relevant to the community. I recommend the paper be accepted after moderate revisions.

My main comment is that the paper would be well served by a large enhancement of the discussion. The paper shows how the finer detailed SM1-derived precipitation estimates are at best equal to the ASCAT product which at first glance is a discouraging result. However, the correlation maps tell us a much more interesting story. As is noted in the paper, valley vs peaks seems to be playing an important role in the retrieval accuracy. The authors then present arguments of why this might be the case but I believe these arguments could be further developed. Here are some relevant questions that could be discussed accordingly.

1. What could be done moving forward to address the weaknesses observed over these regions? What are the reasons for these weaknesses?

2. What other precipitation datasets could be used to evaluate the product? Since there are large errors over the high mountainous regions, this is most likely strongly driven by errors in the precipitation product. I believe that the use of an algorithm such as that used in PRISM over the US would be interesting to improve these estimates.

3. How much of the error is attributed to the SM2RAIN model parameters and how much to the noise of the retrieval?

I am not suggesting that the authors solve these issues in this paper, but I do think a comprehensive discussion around these ideas would be very useful. In many ways, the appendices already include many of these ideas; when creating a discussion section, I would suggest scavenging from these sections and then eliminating the appendices. The paper could handle more figures, so some in the appendices could be added in here.