

Interactive comment on “Dual state/rainfall correction via soil moisture assimilation for improved streamflow simulation: Evaluation of a large-scale implementation with SMAP satellite data” by Yixin Mao et al.

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Received and published: 19 September 2019

We appreciate the comments from the reviewers. We respond to each reviewer comment below:

Major comments: 1) I have only one major comment which is related to the rainfall correction and its effect on the streamflow simulations which to me is a bit ambiguous and should be improved. In many parts of the manuscript it is said that the correction of the rainfall has a smaller effect since the rainfall

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forcing used (IMERG-ER) has a good quality (see lines 331 onward). However, this contradict with the results in Table 3 where the open loop simulations show in some cases of very poor performance of flood simulations (which are likely due the poor rainfall quality) and with other sentences stating that the IMERG-ER has large errors (line 448) in some basins. In fact, when forced by NLDAS2 there is a significant increase of the model performance up to 80

We have responded the reviewer's comment via the following points: 1) We agree with the reviewer that we overstated the “good quality” of IMERG, since it is clear from our streamflow results that IMERG rainfall quality is not good in some sub-basins. To address this, we have toned down the argument that IMERG has “good quality”, and instead emphasized that one reason of the smaller rainfall correction results than found by previous studies is because of the relatively better quality IMERG compared to older rainfall products (this discussion is now moved to Section 4.1 in the manuscript). In addition, the revised manuscript now clearly acknowledges (in Section 3.2.2) that in some sub-basins (the Bird, Spring, Illinois and Deep sub-basins in our experiment), SM-based rainfall correction scheme can potentially play an important role in improving VIC streamflow estimates because of relatively large IMERG error (with respect to the NLDAS-2 baseline). However, such potential improvement was not realized because these basins are densely vegetated with (subsequently) low SMAP quality. We believe that these revisions make our discussion more consistent, and balance and address the contradiction noted by the reviewer. 2) Regarding the addition of gauge-based rainfall dataset – the NLDAS-2 product used in the study is indeed already based on the gauge-based CPC rainfall (as well as ground radar), which is the reason that we used it as the reference precipitation in our study. Even if NLDAS-2 rainfall is not perfect especially when translating into streamflow results (as can be seen from our streamflow analysis), its reliance on gauge observations ensures that it is relatively more reliable than the other satellite-based rainfall products considered in this study. Therefore, it provides an adequate benchmark to evaluate the lower-quality satellite-based products. We have added a more detailed description of the NLDAS-2 rainfall

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product in Section 2.2.4 to highlight these points.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019-41>, 2019.