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Discussions

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Interactive comment on "A flexible two-stage approach for blending multiple satellite precipitation estimates and rain gauge observations: an experiment in the northeastern Tibetan Plateau" *by* Yingzhao Ma et al.

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Anonymous Referee #2: This manuscript describes a two-step methodology to combine multiple satellite precipitation products to produce a blended daily precipitation estimate. The process involves first bias correcting the individual satellite QPE products relative surface rain gauges. Then, a Bayesian weighting is applied to blend the various QPE datasets into a single product. The approach is demonstrated on a small area in the northeastern part of the Tibetan Plateau over the 2014 warm season, as well as an individual heavy rain case. Overall the manuscript needs to be checked for

correct grammar and usage, and the data and methods sections could be lengthened a bit to make things clearer and therefore reproducible (some specific suggestions for this below). Generally, with a few tweaks to the writing I feel this is publishable with minor revisions.

Response: We thank this reviewer for the great comments. The manuscript will be carefully checked to avoid grammar and usage typos. The data and methods sections will be lengthened in the revised manuscript as required by this reviewer.

Specific Comments: The manuscript would be much easier to follow if consistent terminology were used to refer to original SPE, bias corrected SPE, and blended SPE throughout.

Response: Revise as suggested!

Lines 75-80: Additional information about the data used is needed: Please specify the versions of IMERG and CMORPH you are using, and whether the IMERG is the near real time early, near real time late, or research/final runs. It is also interesting that you chose to use TMPA, which is no longer being produced and is generally very similar to IMERG. Additionally, IMERG, CMORPH, and TRMM-3B42 all have daily products available - why did you choose to use the 3-h products and (presumably) accumulate to daily? Finally, what method did you use to resample the IMERG?

Response: The CMORPH V1.0 research products and the Level 3 IMERG V03 final run products are used in this study. We agree that TMPA is similar to IMERG, but the satellite retrieval algorithm between the two products are different. Considered that TMPA 3B42V7 shows a good performance in the TP, it is selected as an individual in this blending process. It is known that the daily scale of SPE is accumulated from the 3-h (TMPA, CMORPH) or 30-min (IMERG), we admit that we can directly use the daily scale instead of accumulation again from the 3-h products as suggested. The nearest neighbor interpolation is used to resampling the IMERG data. We will also rephrase these issues in the revised manuscript as pointed out by this reviewer.

Line 85: If you are using CMORPH V1.0, it also corrects using GPCP.

Response: Corrected as suggested.

Line 116: This equation would be easier to read if separated into 3 lines.

Response: Separated as suggested.

Line 162-170: Some discussion of the effects of comparing point data to somewhat low resolution gridded data is needed.

Response: We will rephrase this statement as suggested by this reviewer.

Line 182-183: It seems that the scatter is reduced for the blended product, but it has induced a high bias for low rain days and a low bias on heavy rain days. It's difficult to see if the bias is improved compared to the original SPE products.

Response: We thank this reviewer for the comment. Yes, the scatter is reduced for the blended SPE. We perform an additional comparison at the validated locations based on various rainfall intensities in Fig. 1. Based on the two-stage blending (TSB) method, the blended SPE have been effectively dropped towards GR at the validation sites (Figure 1b), especially for the rain intensity values less than 15 mm/d (Figure 1c). Also, there is an overestimation for the original SPE but an underestimation for the blended SPE as the daily rainfall is more than 15 mm, partly because the Bayesian correction (BC) process might over-correct the original SPE on the heavy rainfall in this case. Overall, this TSB method has its ability to exert benefits from SPE in terms of higher performance and mitigate poor impacts from the ones with lower quality.

Line 213: I disagree with this statement. PRECDR is clearly very different from the others, and to this point in the manuscript has shown very litter value to be kept in consideration, and I think it is worth acknowledging this, then using the case study to point out that PRECDR can in fact be informative and on a case by case basis.

Response: We fully agree with this reviewer for the comments. We will add the state-

ments in the revised manuscript as pointed by this reviewer.

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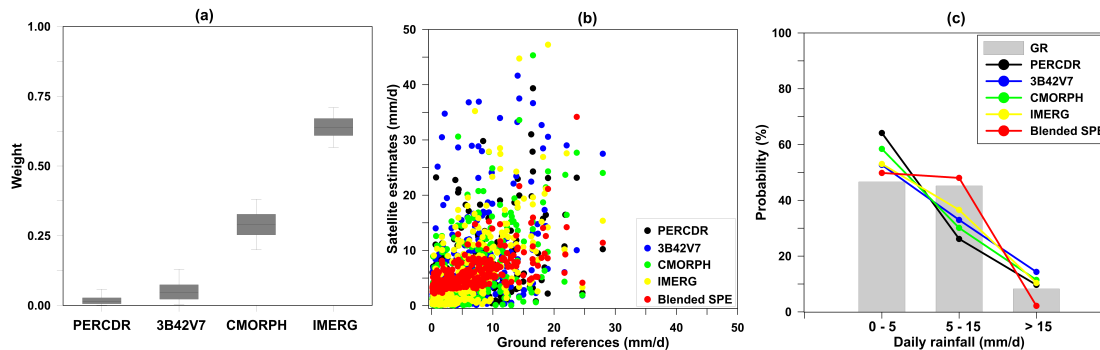
Discussion paper

Fig. 1. (a) The Box-Whisker plots of relative weights of SPE; (b) Scatter plots between GR and various SPE; (c) The PDF of the GR, original and blended SPE with various intensities