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Hydrology and Earth System Sciences
Discussions

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.

Anonymous Referee #3

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The manuscript by Ma et al. presents a very interesting study on blending multiple satellite estimates to obtain a better precipitation estimates, especially over region with complex terrain. The analysis is systematic and results support the improvement in precipitation estimates due to two-stage blending approach. During my read, on several occasion I kept searching for necessary details. Unless those details are provided, it is hard to fully evaluate the merit of this work. Therefore I would suggest major revision of the current version of the manuscript. Authors may want to improve the manuscript along the following lines:

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[1] Please provide full details of bias adjustment and data merging stages. With the help of some example dataset, Authors need to describe how Equations [1], [2a] and [2b] adjust the bias. Similarly please demonstrate with some dataset how weight parameters were obtained from Equation [3].

[2] Please include plots justifying why Student's t distribution was selected. I am sure at different training sites, different distributions (Lognormal, Gamma, etc.) may show better performance.

[3] Please explain how the information from gridded data (Satellite estimates) was transferred to point locations (training and validation sites). Did Authors apply some downscaling approach? Bringing information from 25km grid to a point in a complex topographical region is challenging.

[4] In equation [1], normalized elevation is used as a covariate. If it is not included, how it will affect the result. Can you quantify it? Was that included just because you are dealing with TP? In the discussions (Section 5), Authors mention about the importance of including other covariates related to precipitation generation mechanism.

[5] As mentioned in Section 2, the data of only warm period from May to September 2014 has been used in this study. Since all the satellite data are available for several years, can Authors perform similar analysis for few years and validate their approach?

[6] Since similar approaches have been developed previously (as mentioned at the end of second paragraph of page 2, Authors should compare the results with the existing approach. The only unique feature of the current approach is that it provides predictive uncertainty.

[7] The results presented in Figures 3 and 4 homogenizes many things. In Figure 3, are you presenting the average value over all the validation sites? I am sure results will differ significantly if you look into individual sites. Also time series plots would show more features than the bar plot. The results from blended is similar to many adjusted

SPE, then can it be concluded that there is no need to blend. Simply apply the stage 1, bias adjustment, and select the best SPE.

[8] In Figure 4, Authors conclude that the blended data have been dropped towards the gauge references but please look at the precipitation with higher values. It appears that red dots have narrow spread for the lower values but SPE is over estimating the values.

[9] Authors claim that the two-stage approach has advantage of not getting impacted by the poor quality SPE. Based on Figure 4a, it can be argued that why to include those SPE which has very low weight. Please justify. Furthermore, Figure 6 shows improvement ratio, of course the SPE with very low weight will show high value here. Why not be careful at the first place in selecting a set of SPE?

[10] Authors talk about CC for a rainfall event (Sept 22, 2014)? Given that the analysis is performed on daily data, how do you obtain CC?

[11] Title says 'A flexible two-stage approach....' In the second paragraph of Section 6, Authors talk about what is the flexibility here. The statement is very general that it is capable of involving a group of multi-SPE. Is that so unique? Please look into it and accordingly modify the title.

[12] Figure 8a is quite different from Figures 7a to 7d. By blending. higher values disappeared from the map except in Southwest corner. Please explain.

[13] The blending product will be extremely beneficial for the areas where there is no or very few rain gauges (specially in mountainous area). However the study area was carefully selected in such a way that the rain gauge density is high. Can the results be extrapolated from the training and validation sites to get the improved blended gridded product, the way Authors have done in Figure 8? If yes, then there must be some guideline how many minimum training sites do I need to apply this two-stage approach in other complex regions.

[12] The manuscript should be thoroughly checked for grammar and usages.

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