Interactive comment on "Characterization of precipitation product errors across the US using multiplicative Triple Collocation" *by* S. H. Alemohammad et al.

S. H. Alemohammad et al.

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We thank referee #1 for their positive and insightful comments. Here, we respond to the general and specific comments included in their review:

General Comments:

- The authors provide a creative and original study of the errors of several "standard" precipitation data sets using the Triple Collocation approach. Critically, this allows them to use the radar analyses without having to assume that they are exact. It also raises the interesting question of what the result would be if the

gauges used in Section 5 were entered as yet another dataset in the Triple Collocation study (obviously, only for the subset of boxes that have gauge data). How close would they turn out to be to the unknown true precipitation?

Response/Action: *We evaluated all possible triplets of gauge with two other products among the four products we have in this study. The results show that the gauge is in most of the cases the product with lowest RMSE, and in some others the second one with RMSEs close to the first product. This result is from the six pixels that we have dense gauge measurements; therefore, it should be interpreted carefully and may not be transferable to the whole domain. This is addressed in the supplementary material, Figures S3-S5, which was submitted together with the initial submission.*

- The fundamental assumption is that the errors are multiplicative. The background literature tends to advocate this approach for short-interval data – daily or sub-daily. By the time you get to monthly averages the precipitation itself (not the logarithm) tends to be settling toward Gaussian, indicating additive error, although this depends on how frequent the precipitation is. The biweekly interval is in between; is there any way to assess how correct a multiplicative model is?

Response/Action: *Here, we distinguish between the distribution of the precipitation data and the additive/multiplicative error model. In our study, we do not assume any distribution for either the data or the errors. We only make the assumption that the error model be multiplicative. This can be evaluated using the joint PDFs of each pair of the products. If the joint PDFs have a constant spread across different values of precipitation; then, the error model is an appropriate one. We made this evaluation, and the PDFs resulting from the multiplicative model have better spread compared to the additive model. So, we concluded that for biweekly data it is better to assume the multiplicative model. We added this discussion on the model selection to the final submission to better justify the choice of multiplicative model.*

- Finally, the English is extremely clean; if there were an annual award for such excellence, you would deserve it. Overall, a very strong manuscript that just needs some tune-up on the way to acceptance.

Specific Comments:

1. Abstract: It would strengthen the Abstract to be more specific about the details of the comparison: $2° \times 2°$ grid boxes for a specific part of CONUS (not just "across the U.S."), using biweekly accumulations for the period January 2002 through April 2014.

   Response/Action: *We incorporated this in the final submission and revise the abstract accordingly.*

2. Dataset citation: The various datasets used are not cited and acknowledged in a consistent fashion, but should be. However, I would suggest that one of the newly emerging best practices in publication is to provide a reference-list citation for the data sets used, just as is done for journal articles. See the AMS policy http://www2.ametsoc.org/ams/index.cfm/publications/authors/journal-and-bamsauthors/journal-and-bams-authors-guide/data-archiving-and-citation/ for a discussion and examples. I would urge the authors to adopt this approach to give proper credit and guide the interested reader to the appropriate archives.

   Response/Action: *We thank the reviewer for the informative reference on data citation. We list appropriate citation to the datasets in the final version.*

3. Dataset names: Shortening "TRMM 3B42" to "TRMM" is ambiguous, since there are many TRMM products, while "3B42" is specific. The same comment applies to the GPCP 1DD, for which "GPCP" is ambiguous, while "1DD" is not.

   Response/Action: *We replaced the appropriate abbreviations in the final version.*

4. P.14,L.2-3: It would seem that the insightful statement is that the cloud systems are driven by frontal systems. GPI reacts to clouds, and fronts generate clouds that are not necessarily well-correlated to precipitation.

   Response/Action: *We acknowledge the revised statement, and corrected it in the final version.*

   Technical Corrections

5. P.8,L.22: The IR in 3B42 is calibrated by microwave before use in the product.

   Response/Action: *We point out this calibration in the revised manuscript.*

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