

Interactive comment on “Performance of bias correction schemes for CMORPH rainfall estimates in the Zambezi River Basin” by Webster Gumindoga et al.

Anonymous Referee #2

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This paper investigates the use of bias correction schemes to correct satellite rainfall estimates in the Zambezi basin, a region in the world where data gauged rainfall is limited. With 50 million people dependent on water from this basin, having an accurate spatial and temporal representation of rainfall can help with modelling the water balance accurately which in turn can be used in studies on for example drought mitigation and risk reduction. Lacking accurate data, understanding the uncertainty within the products that are available is essential. This work applies existing methodologies to a new location. I believe this work should be published because it applies sound scientific methods and theories in a region where despite the high risk of hydrological disasters there are little models and data available. I suggest minor changes to strengthen the

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hydrological aspects of this paper.

(1) Does the paper address relevant scientific questions within the scope of HESS? I believe the hydrological application of this paper is currently limited and the paper could be strengthened in this aspect. (2) Does the paper present novel concepts, ideas, tools, or data? This paper applies existing concepts to a new (very relevant) location. (3) Are substantial conclusions reached? This is not possible with the results, but this does not affect the quality of the conclusion. (4) Are the scientific methods and assumptions valid and clearly outlined? Yes, although some clarification with regards to the gauged rainfall should be supplied. (5) Are the results sufficient to support the interpretations and conclusions? Generally yes, although conclusion should be caveated with regards to the limited gauged rainfall data and the expected misrepresentation spatially due to this. (6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes, with exception of how the gauged rainfall was constructed. (7) Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes (8) Does the title clearly reflect the contents of the paper? Yes (9) Does the abstract provide a concise and complete summary? Yes (10) Is the overall presentation well structured and clear? Yes (11) Is the language fluent and precise? Yes (12) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes (13) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes, please see comments below. (14) Are the number and quality of references appropriate? Yes (15) Is the amount and quality of supplementary material appropriate? Not applicable.

General comments: Topographical relationship and distance to lake relationship to bias not found. More details are required with regards to the used gauged data and in which category the gauges are locations e.g. are there an equal amount of gauges in all of the categories? Also the sensitivity of the method to the amount of gauged data should be discussed, perhaps if there were a few more gauges a relationship could be found. This

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should be named as a caveat. Especially as the Elevation zone bias correction method performs well this conclusion requires more justification to be convincing or it needs to be changed/'mellowed'. Taylor diagrams, I have not come across these before and find them difficult to understand. I understand the benefit of showing 3 performance scores on one plot, perhaps when you introduce them you can try and clarify by using a simple diagram, showing where the perfect model would sit and what it means when the results are located up/down/sideways from this perfect point. Strengthen link to hydrology by doing for example comparing cumulative rainfall volumes over the time period of a drought (or take the dry seasons) of the different methods. This quick analysis would give an indication of the uncertainty of the methods and the impact this would have for the volumes of water in any type of water balance analysis, which is essential for hydrological applications. A comparison to spatial rainfall derived from gauges isn't necessarily required to get an indication of the range of uncertainty of the methods. Discussion is missing. This is another opportunity to link to hydrology and perhaps list your next steps. Is there any gauged flow data? Especially in regions where gauge rainfall in scarce, gauged flow can really help with verifying rainfall data. Will you next test the performance of these methods using a hydrological model? Etc.

Specific comments: Figure 1, use differences in colours and symbols for the gauges to indicate in which height and distance category they fall. Section 3.1.2, expand on which stations were omitted and add how many station per height and distance category were used. Include length of available times series. Consider using a table. Also, if spatial (gauged) rainfall was derived explain how, if it wasn't it might be helpful to state this too (if you have chosen not to, I'm assuming this is because generation spatial rainfall from point observations is riddled with uncertainties itself. You might want to add this is, because it gives insight in your understanding of the uncertainties related to your observations). Section 4.1 please expand on how the spatial interpolation of the biases was done in aid of reproducibility of your work. (Adding a reference would be sufficient). Figure 2, analysis would be more valuable if split into two figures of wet and dry season. The author indicates that the biases are different for these two so this

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would be insightful and helpful when assessing this rainfall product for application into a hydrological model. Figure 4, I find this figure confusing. I don't understand where the gauged, uncorrected and bias corrected are. Also, what was used to construct the mean and the max is unclear to me. This means I don't understand how you come to the conclusion about effectiveness of the schemes in section 4.3.1. Maybe this can be solved simply by having a clearer legend and adding a sentence to section 4.3.1. Figures 7, I find the greys difficult to distinguish. If a black and white figure is required please consider using fills/hatching. Otherwise the colours used in Figure 8 are excellent, so perhaps reuse these.

Thank you for your contribution to our understanding of rainfall products available for Africa.

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