

## ***Interactive comment on “Bias correction schemes for CMORPH satellite rainfall estimates in the Zambezi River Basin” by W. Gumindoga et al.***

### **Anonymous Referee #1**

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The authors have included so many aspects in this paper and a reader tends to get lost in all the several techniques used and the results presented. May be, instead of including all possible methods for bias correction, they could have investigated those methods that remove the bias for specific uses of satellite derived rainfall. There are several instances when the reasons for undertaking some of the analysis is not clear, e.g. what were the reasons for plotting rainfall for a selected station against that of several other stations? The purpose of undertaking quality assessment is not clear, and how the outcomes are used in the paper. Some of the results presented in the form of a Table are best illustrated say using bar graphs, e.g. Table 4. The authors frequently present rainfall values without including the units of measurement. The authors tend to over-emphasize the influence of elevation on rainfall at a location, yet other important factors are not considered. For example orography or aspect has not been considered

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when this is very important in the Zambezi Basin. Distance to moisture sources such the equatorial regions, Indian Ocean has a major influence on rainfall in the Zambezi Basin. It is also difficult to ascertain how the conclusions are supported by the results obtained. This is mainly due to so many results having been presented, and the reader has difficulties linking these to conclusions.

Specific comments Line 48-51 and elsewhere, I suggest that you avoid using the abbreviation SREs for satellite-derived rainfall estimates. If you do an electronic search, SREs is commonly understood to represent Special Report on Emission Scenarios in the climate and hydrology community. Why do you not use RFE which is widely understood to represent satellite rainfall estimates? Line 65, replace “have challenges” by “has problems or has weaknesses”.

Line 160-161 rainfall is a flux and therefore the units must clearly show the period over which the measurement was made, “1400 mm/yr” not “1400 mm”. All major hydrology journals including HESS decided last year that they will insist that units of fluxes such as rainfall, evaporation, runoff should be clearly written. Lines 244 – 251 defining symbols used in Equation (2) should immediately follow this equation. Line 226, why did you decide to use a minimum of five rainy days? Line 227, why did you decide to use a ten-day window? Line 228, why did you decide to use a threshold of 5 mm? Line 238, letter “d” used in Equation (2) has not been defined what this represents. Line 249, simply state what “n” represents. By defining this as the number of gauges in the domain of the study, this may imply that this was changing depending on whether you were considering the upper, middle, and lower Zambezi Basin. Line 250, is T representing the number of years in the sample rather than duration of the study period. Do you mean the time it took you to do the study?, e.g. 6 months Line 255, justify the use of 3 elevation zones, and the elevations used to separate these zones. Line 256, how valid is the assumption that stations within the same elevation zone will have the same bias when it is a fact that within the Zambezi Basin, orography and distance from moisture sources are very important? Line 303, What do Gt and St represent in view of the

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fact that these letters had a different meaning in Equation (2)? Line 322, what is the meaning of CDF and ecdf? Line 328, you are now using P<sub>raw</sub> to represent CMORPH rainfall, but earlier on this was represented by S(l,t). Line 356 to 359, you are again using different symbols/letters to represent rain gauge and satellite derived rainfall. Line 364 no need to give a definition of the correlation coefficient. Trivial. Line 386, the sentence is not clear Line 405 – 422 is rather confusing. What were you attempting to achieve? How did you select stations that you considered to be the dependent which are plotted on the Y-axis, and those you considered to be the independent on the X-axis? It is not clear to the reader what you are trying to convey Line 427, what are you referring to as the “daily average time series (1998-2013) CMORPH? Do you mean average over the whole basin or for specific locations? Line 432 – 439, it seems in Line 432 to 436 you are describing the values of the standard deviation for rain gauge data. However, in subsequent sentences, it seems you are highlighting that there is no matching. I am not sure of what. Line 473 – 475, I do not think it is informative to compare absolute differences among stations receiving possibly very different amounts of rainfall. A 2 mm/day difference on a station receiving an average of 20 mm/day is considerable but not for a station receiving 200 mm/day. Line 520, what do you mean by “rainfall types”? Take note that in climatology, “rainfall type” has a specific meaning. Line 544, it seems information presented in Table 4 could have been simplified like in Figure 9. By the way, is Figure 9 not presenting information contained in Table 4? If that is the case, one of them has to be removed. Line 576, what do you mean by “bias correction schemes averaged”?

Line 583 not clear Line 607, how did you select the rainfall intensity classes? Line 625, how did you define a wet season and a dry season? Line 641 – 642, Mushumbi, Zumbo, and Kanyemba are not on the Zambezi Escarpment Line 643, Mvurwi, Guruve, Karoi do not have elevations below 400 m. See the elevation information you gave in Table 1. Line 648 – 656 are unclear and confusing because of the incorrect elevations you are assigned to the stations are stated in the previous sentence. Line 663, it is incorrect to refer to the Zambezi basin as being semi-arid. Yes some parts

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are semi-arid, but most of the Upper Zambezi, Upper Kafue, Upper Luangwa, parts of the Shire basin are sub-humid to humid. Line 674 – 675, did you prove this? Line 708, what are seasonality tendencies?

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-33/hess-2016-33-RC1-supplement.pdf>

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