Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-355-AC2, 2020

Atmospheric Measurement Techniques Discussions

Interactive comment on "Performance evaluation of multiple satellite rainfall products for Dhidhessa River Basin (DRB), Ethiopia" *by* Gizachew Kabite Wedajo et al.

Gizachew Kabite Wedajo et al.

kabiteg@gmail.com

Received and published: 21 December 2020

Response to Reference 2 (RC2) 41: You forgot Commercial Microwave Links (CML). The following concepts of Commercial Microwave Links (CML) are included in the introduction part. "In addition, Communication Microwave Links (CML) is recently introduced as cheap and fast rainfall estimation method (Smiatek et al., 2017) but not fully tested methodology (Nebuloni et al., 2020)." 43: Radar is also an indirect measurement technique, which needs calibration like satellite. Corrected by removing "radar" and substituting it "using rain gauge is a direct. . ." 46/47: What do you mean with "incomplete measurements"? Please explain this. To avoid confusion, the sentence is

revised as follow: "provide point measurements and subject to missing data due to mainly measurement errors". 62: I assume there is a space missing in "overtime" (-> over time). Corrected as suggested. 211/212: What do you mean with "rain gauges ... were excludes for fair comparison"? Are those stations excluded, which were used to calibrate the satellite data? What is with these stations used in gridded sets, that are used to calibrate the satellite data? Rain gauge stations such as Jimma and Nekemte were used for the calibration of SREs and thus, excluded for this study. The lists of stations used for this study are shown in Figure 1 and Appendix Table 1. Accordingly, for clarity, I have updated the manuscript with this information. 225: Remove "and/or radar precipitation", as radar data were not used in this study. Corrected as recommended. 273: Do you mean "quantity fluxes" instead of "quality fluxes"? Yes, I mean "quantity fluxes" and I have corrected accordingly. 284: Introduce abbreviation "USDA". Corrected by introducing the abbreviation in the revised manuscript. "United States Department of Agriculture (USDA)". 338: Remove "numerical" as you have done a statistical analysis here. Accepted the comment and removed the word "numerical". 341/342: I miss an explanation, why the SREs correlate better at monthly time scales than on annual time scales. This is because of performance of SREs improved with increased time aggregation that peaks at monthly timescale. This could be due to the incapability of all the SREs to capture interannual rainfall variability. 347: I propose to use the same scaling of the axes for all four subfigures in figure 3 and add the 1:1 line. Done as recommended. 347: I propose to use the same scaling of the axes for all four subfigures in figure 3 and add the 1:1 line. Done as recommended. 353: Please explain the intention and what do you mean with "goodness-of-fit criteria". The term "goodness-of-fit criteria" is used here just to mean that the performance of the other three SREs varies with different statistical measurement indices. To avoid confusion, I replace it with "statistical indices used in this study". 356: As for figure 3, add also in figure 4 the 1:1 lines. Done as recommended. 358: I propose to rescale the y-axes to move the symbol a little bit from the x-axes. Done as recommended. 360: Which thresholds were used for figure 6? 1mm/day? Yes, the minimum rainfall thresholds for

preparing Figure 6 is 1 mm/day. 367: I propose to add a description of the seasonal cycle of the precipitation. Main rainy season in the DRB is from June to September while short rainy season ranges from March to May but the rest is dry season. 385-389: I cannot follow this argumentation. Of course, good precipitation measurements are needed for good hydrological modelling. But different parameters between the data sets shows that the model need different adjustments for the different data sets. This shows the sensitivity of hydrological model performance to different rainfall products, which shows the accurate characterization of rainfall variability is very critical for reliable hydrological predictions. 396-404: For me it seems the predictions underestimate the streamflow and do not overestimate it, as the blue line with the observations is especially in the peaks always higher than the orange line with the predictions. The result shows that streamflow is underestimated peak streamflow for all rainfall products, including the gauge rainfall but generally overestimated streamflow volume. Therefore, I have rewritten the sentence to avoid confusion. 401: I assume an "a" is missing in "stemflow" (-> streamflow). Corrected. 402-404: What are the criteria for satisfactory estimations of streamflow? According to Moriasi et al. (2017) performance evaluation, CHIRPS2 and IMERG6 performance is good (NSE > 0.65) while gauge rainfall data was satisfactorly performed. Accordingly, I have corrected some how the sentence. 404: Typo in guaged (-> gauged). Corrected 405: Is there a time shift between the TAMSAT3 time series and the gauge data in figure 8? It seems there is a constant phase displacement between observation and prediction. No time shift at all (see Figure 9). 407: What is the P-factor and R-factor in table 5? These were not introduced. The description of P-factor and R-factor were given in section 2.3.3. "The total uncertainty in the model prediction is commonly measured by P-factor and R-factor. P-factor represents the percentage of observed data enveloped by the 95 percent prediction uncertainty (95PPU) simulated by the model. The R-factor represents the ratio of the average width of the 95PPU band to the standard deviation of observed data. For realistic model prediction, P-factor $\geq$0.7 and R-factor $\leq$1.5 is desirable (Abbaspour et al., 2007, Arnold et al., 2012)." 423/424: Regarding the "interannual rainfall variability",

please add a figure with climatological monthly mean precipitation totals for all data sets. Done accordingly. 512: Replace "Dhidhessa River basin" with DRB. Corrected

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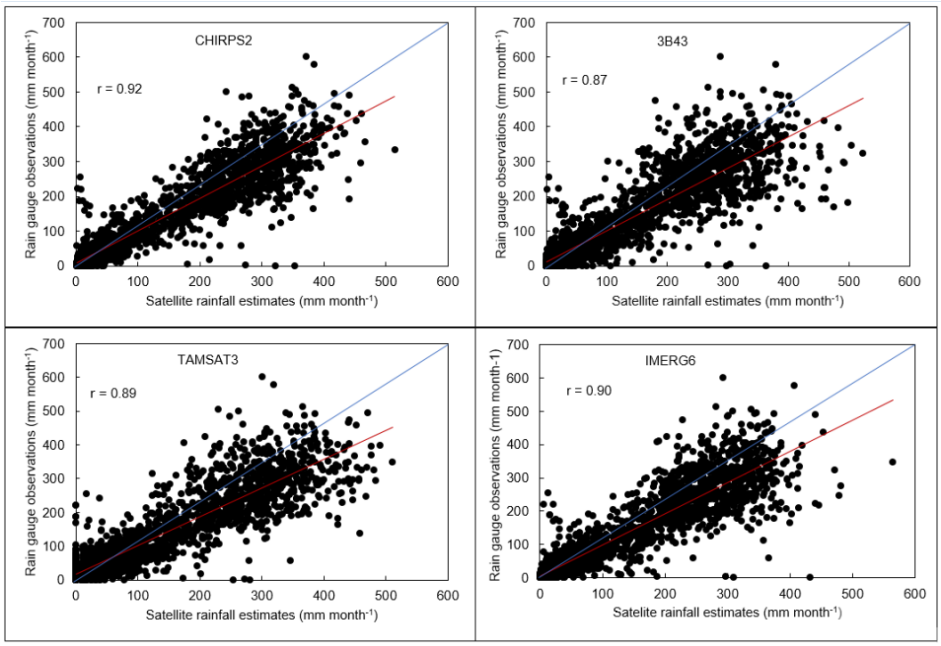

Fig. 1. Correlation coefficient of the four SREs at annual timescale over DRB.

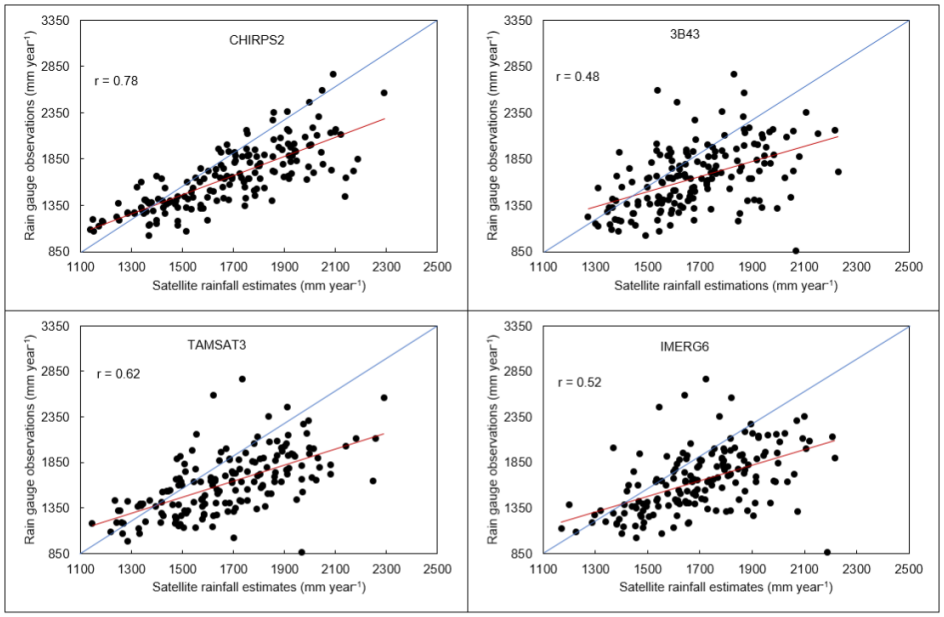

Fig. 2. Monthly correlation coefficient of the four SREs for the DRB.

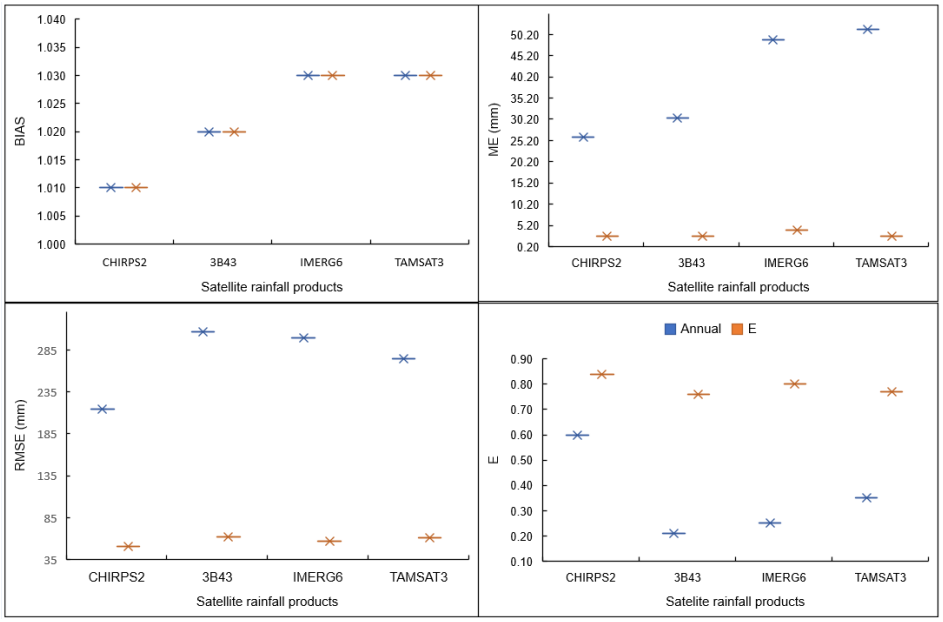

Fig. 3. Statistical indices of the four SREs for DRB at annual and monthly time scales.

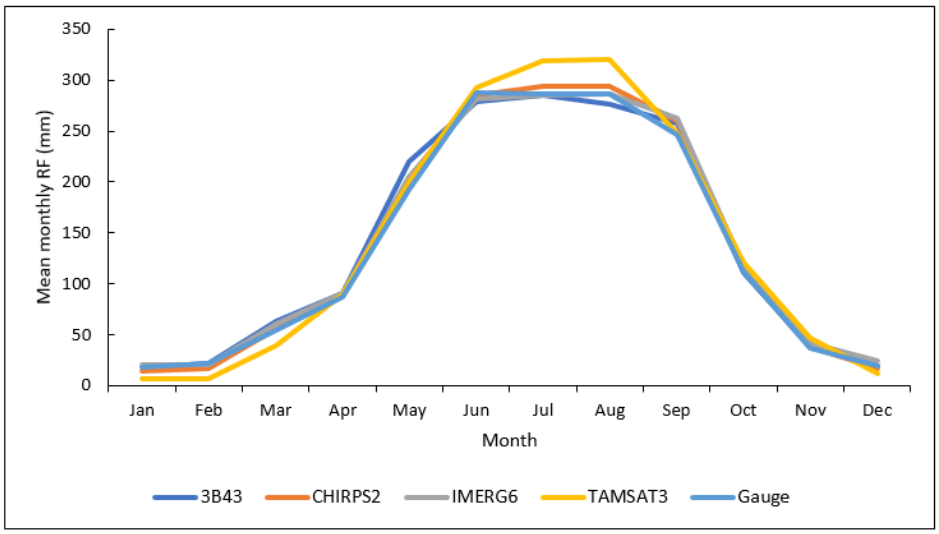

Fig. 4. Mean monthly rainfall (2001 to 2014).