

Response to Referee Comment #2

Thank you for detailed comments. We have now revised the manuscript accordingly. Please find below our itemized responses.

Main Comments:

1. In the abstract, the authors mentioned that application of post-processing techniques involving near-real time satellite rainfall products could improve the accuracy of the GFS forecasts. However, no supporting analysis was presented in this manuscript for this statement. What is the basis of this statement? If it is based on some reference study, please provide details of those studies. If not, then please include appropriate analysis results in support.

Response: We agree that we have not provided supporting analysis, and therefore have replaced the statement *“The accuracy of GFS forecasts could be improved by applying post-processing techniques involving near-real time satellite rainfall products.”* with *“We recommend exploring appropriate post-processing calibration techniques, that use near-real time products, such as, IMERG Early, to improve the performance of GFS, particularly at shorter time scales.”*

The reason for our recommendation is that IMERG Early outperforms GFS in most cases, and therefore, it can be used to calibrate GFS. The IMERG Early outperform GFS in Wet Guinea and Savannah regions in terms of bias, and the spatial structure of IMERG Early is the same as IMERG Final – as the main difference between the two products in the inclusion or exclusion of rain gauge data which affects primarily the bias. However, it is not clear what kind of post-processing technique is more appropriate.

2. In section 3.5, the authors attempted to correct for biases in the IMERG Early precipitation products with climatological input and concluded that climatological bias correction is not effective for IMERG Early products. However, there was no significant relevance of this section to this manuscript. What was the purpose of presenting these analyses in this manuscript?

Response: We agree that it is not meaningful to present results that do not improve performance. Hence, we have removed the climatological bias correction from our evaluation. In the Conclusions section (see last paragraph), we have recommended the need for identifying appropriate bias calibration techniques, and suggested some potential methodologies that could be explored.

3. The authors stated in conclusion that the GFS forecasts are almost unbiased at low to medium rain rates. However, it is unclear which GFS forecast product they are referring to by this statement. It is my assumption that they are referring to the 15-day accumulated precipitation here which should be clearly stated to avoid confusion.

Response: Yes, we have now added the qualifier '15-day accumulated'.

4. The authors claimed in conclusion that the use of IMERG Early to calibrate GFS would improve GFS forecast quality, however, there was no evidence presented to support this statement. Did the authors performed any analysis that has not been included in this manuscript and reached to this conclusion? If so, they should include the results from that analysis to support their claim.

Response: We have now removed this statement, as we have not provided supporting evidence. In addition, we realized that a suitable post-processing technique needs to be developed to take advantage of the (relatively better) performance of IMERG Early. We added a recommendation that reads *"We recommend identifying suitable post-processing calibration techniques, through the use of near-real time products, such as, IMERG Early, that could improve the performance of GFS, particularly in the wet Guinea and Savannah regions. Possible calibration methods that could be explored include: simple bias (multiplicative) correction, multi-resolution bias correction through wavelet analysis or empirical mode decomposition method, and Artificial-based methods such as Feed Forward Neural Network (FFNN), Support Vector Machine (SVR), and Adaptive Neural Fuzzy Inference System (ANFIS)."*

5. Since the area studied involves multiple dams used for water supply, irrigation, hydropower, etc., I would have loved to see some event specific results to demonstrate GFS products' ability to forecast significantly dry and wet event which is very significant for reservoir management.

Response: We think this could be extracted from our figures. Figures 5 and 6 show the performance of GFS for each day, and each reservoir location. Figures 8 and 12 show the performance of GFS as a function of rain rate, for two time scales, and for each reservoir location.

Minor Comments:

1. Axes should be labelled appropriately to convey that these are 15-day accumulated precipitation amounts instead of "daily".

Response: We have removed 'Daily' from the labels. The timescale is shown in the figure caption.

2. Page 2, Line 13: "with annual rainfall of rainfall" should be rewritten as "with annual rainfall of".

Response: The text has been removed during abstract re-writing.

3. Page 3, Line 29: Please check the reference "Saha et al. 2011". Should this be "Saha et al. 2014"?

Response: We agree. It is fixed now.

4. Page 4, Lines 76-78: Please check this sentence and rewrite.
Response: It has been re-written now.
5. Page 5, Line 106: “Hybrid eddy-diffusivity mass-flux (EDMF)”.
Response: It is fixed now.
6. Page 6, Line 128: “The Climate Hazard’s group Infrared Precipitation (CHIRP) and with Stations (CHIRPS)” should be rewritten as “The Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS)”.
Response: We have fixed it now.
7. Page 7, Line 164: In terms of the size of the watershed, smallest among the study dams is the Bakolori Dam. However, the author said it is the Markala Dam on this line. The unit of the watershed area should also be changed to “km²” from “m²”.
Response: We have fixed this now.
8. Page 10, Line 209: “CV is the coefficient of variation” instead of “CV is the coefficient if variation”
Response: It is fixed now.
9. Page 23, Lines 393-394: Please rewrite this sentence.
Response: It has been re-written.
10. Page 26, Line 432: “some consistent features emerged” instead of “some consistent featured emerged”.
Response: It has been fixed now.