

This paper makes a useful contribution to comparing the performance of 3 satellite rainfall products over Ethiopia for the five year period 2003-2007. It is generally clear and well written, and the diagrams are relevant. A good overview is given on the topographical and landscape properties of the country. Unfortunately, this study seems to be the repetition of a previous study by Hirpa et al., 2009 with the only difference of extending the study area but not extending the reader's knowledge on important drivers and triggers that cause the herewith found results. Besides a stronger discussion of the results and extended interpretation, a clear recommendation in the end is missing, as to which product should be applied by the hydrological modeller (since this was apparently the motivation in the beginning according to Line 23 in the text), or even the development of a new -combined?- product. Also completely missing is a discussion of the in-situ measurements, especially of their performances and discrepancies. With a little effort for error detection and correction, a lot more use could be made from that data. Overall, I am a little concerned about the chosen time unit: the analysis of five years of data on a monthly basis, and excluding the months October- February might not give a strong statistical significance. In general, I am convinced of the relevance of this topic and applicability of results to further studies and therefore support the publication of this paper after major revision.

[Author's Response] The authors would like to thank the reviewer for taking the time to comment on the paper. We have provided our responses to the specific comments below.

Specific comments:

P7670 L2+L4 what is the difference between the basins and the regions / do they overlap / are they the same?

[Author's Response] We should have used the term "river basins" on line 4 instead of "regions" for better clarity. The term "regions" was intended to mean river basins. We have changed "regions" to "river basins".

P7670 L16 "...the performance of the three SREs were found to be season independent"- how can this be assessed if the 'Bega' season (October - February) was not considered?

[Author's Response] There are 2 rainy seasons in Ethiopia; the major rainy season (Kiremt) and the minor rainy season (Belg). The Bega is not considered a rainy season in Ethiopia because of the insignificant amount of rainfall. To avoid confusion we have changed the wording to read the following "When compared to ground based rain gauges throughout the six regions, and for the years of interest, the performance of the three SREs were found to be similar for both the Kiremt and the Belg."

P7670 L22: I find the first sentence too general with regards to SREs being an alternative source for hydrological modeling, because many hydrological applications require longterm time series (30-100 years or more), which are not available from satellites. SREs can at most be a complimentary source (very valuable, no question).

[Author's Response] There are cases where SREs can be the only source of rainfall data because of either the absence or sparsity of the rain gauges.

Hydrological models can be implemented with much shorter time series and a number of other inputs. There are applications that use only SRE data (flood forecasting, landslide, etc.). For an example, please see works by Bob Adler on real time flood and landslide forecasting across the globe, which only uses TRMM rainfall data.

P7672 L17 longterm is here misleading because I don't find 5 years to be longterm. At least the years 2003-2007 should then be stated in brackets.

[Author's Response] We have added [2003 – 2007] as requested.

P7673 L5 maybe a reference to section 2.3 could be included here

[Author's Response] We have made Reference to Section 2.3 following the mention of the rain gauges.

P7674 L 26 Fig 3 does not support the choice of the authors to exclude the Bega season in all catchments. This might have been a good choice in the Hirpa et al. 2009 study with the Awash basin, but the remaining basins show similar precipitation amounts as in the Belg or Kiremt season.

[Author's Response] Our intention was to focus on the major and minor rainy seasons within Ethiopia, those being the Kiremt and the Belg. The river basins that receive a majority of their annual precipitation during the Kiremt (Awash, Blue Nile and Baro Akobo) receive a smaller percentage during the Bega (6%, 19% and 9%). We do acknowledge that the remaining river basin, which are those that receive a majority of their annual precipitation during the Belg, have higher percentages of precipitation during the Bega by comparison to the Kiremt; however, these basins receive a very small percentage of the countries annual precipitation.

P7675 L 19 a stronger discussion of the rain gauge is necessary, e.g length of series for the different stations, performance, diagrams, trend-detection, ... Why was there no effort made to fill gaps in the data? Especially since the 5 years x 12 months = 60 months do not give many samples for a statistical analysis. Maybe an overview on discarded months could be given – do they cluster around specific dates?

[Author's Response] We chose not to fill in the gaps to avoid the introduction of any error. The discarded months were not found to be clustered around specific dates.

P7676 L3 using a 5-year average seems to reduce the available data unnecessarily. Time lags in measured and satellite data could be discovered by other methods. Also the study of Hirpa et al, 2009, which is cited here does not give a reason for this methodology.

P7676 L21 how does time averaging minimize spatial errors?

[Author's Response] Rainfall is a random process both in space and time and, like other random processes, its spatial variability decreases with time averaging. The spatial variability of 1 minute of rainfall is much higher than the spatial variability of daily rainfall, which is higher than the spatial variability of annual – and so on. This means that a point measurement of rain fall (i.e., rain gauge) may be a poor estimate of a pixel's 1 minute rainfall, where as the 5 year average provides a more reliable estimate of the pixel rainfall. By taking the 5 year average we are maximizing the benefit of the data by reducing the point-pixel discrepancy.

P7677 L 6 "... when available, ground based data to update the ANNs" - was ground based data available? Was the rain gauge data set used here possibly part of it? Or was none available and is this one of the reasons for the relatively bad performance of PERSIANN over Ethiopia?

[Author's Response] No rain gauge data was used to update the ANNs over Ethiopia. The performance differences are attributed to the different algorithms.

P7677 L16 especially for hydrological modeling, the annual cycle is very important. Why is this completely neglected here?

[Author's Response] The focus of our study has been on the 5 year average because of the point-pixel discrepancy issue.

P7679 L2 please give the formula for the bias ratio, or at least explain how this metric is to be read.

[Author's Response] The definition of the bias ratio was provided in Section 3.4 "...the seasonal mean rainfall of SRE divided by the corresponding seasonal mean rainfall of rain gauge data." The interpretation was provided as "A bias ratio greater than one indicates overestimation by the SRE, a bias ratio less than one indicates underestimation by the SRE, and a bias ratio of one indicates no bias in the SRE (all with respect to the rain gauge data)."

P7680 L9 does the bias ratio as a function of elevation also have an indication on the rain gauge data? Especially since in river basins with less complex topography, this impact decreases? Does it rather explain biases in measurements than in satellite data?

[Author's Response] The conclusions are based on several rain gauges, and all rain gauges indicate the same result meaning that it is not measurement error. If it was due to a point error, the results might have been random, with some overestimating and some underestimating.

P7681 extend conclusions.

[Author's Response] We have modified the conclusions and added discussion on the physical mechanisms that could possibly cause the relationship between bias and elevation.