Review on “Comparison and validation of eight satellite rainfall products over the rugged topography of Tekeze-Atbara Basin at different spatial and temporal scales”

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General comments:

The manuscript focuses on evaluating of different satellite rainfall products in the Tekeze-Atbara Basn, Ethiopia. It is interesting to see a validation study of satellite data in the hydrologically remote part of the world where there is limited data for understanding the climate and hydrology. However the structure of the paper is not easy and clear and the results are not clearly discussed. There are also many type errors. I see many spacing errors between words. On the abstract section alone I have seen more than 10 errors. I have indicated those errors as minor comments. Those errors are too many to list them in my review; I hope the authors will spend some time to correct those errors. With this and other concerns I have indicated below I cannot recommend to accept the paper for publication.

Specific comments:

Abstract

1. The authors indicated that they have evaluated the performance of the products at various spatial and temporal scale. However, in the abstract Line 26 to 28, the spatial and temporal scale of the evaluation is not indicated.
2. The abstract should be rewritten to summarize the evaluation result at the multiple temporal and spatial scale. The authors indicated that they have done evaluated the 8 products at various temporal (daily, monthly, seasonal) and spatial (point, sub-basin, basin) scales. However, they did not indicated clearly which products worked at what scale.

Introduction

3. Page 2: The statement from 23 to 28 needs a reference.
4. The authors indicated that tomography as a key factor influencing microclimates in the basin (Page 3 line 32 -33). However, Figure 2b which indicate the relationship between elevation and annual average rainfall doesn't capture the effect of topography. That relationship between rainfall and topography as indicated in this figure is insignificant. What are the authors claming that the topography is a key factor?
5. Figure 2b disproves the stamen on page 4 line 18 and 19.
6. The rainfall products were not described very well. As the authors indicated satellite rainfall products quality can be affected by the algorithms used. The authors should discuss the different algorithms and platforms used by those products. What part of the electromagnetic spectrum was used? Are they polar orbiting, or sun synchronized satellites or a geostationary satellites are used? The description of the the different products on page 6 and 7 should address this.
7. Page 6 line 21: the autors describe CMORPH product as having a very high spatial and temporal resolution however in the summary table (Table 1) this product doesn't prove to be at a higher resolution compared to others such as CHIRP and ARC and others?
8. Page 7 line 4. TRMM 3B42V7 is not a latest version
9. Table 1 should indicate that the temporal reolution for TRMM3B42V7 should be 3hr. And the product TRMM3B42 should be referred as TMPA-3B42 (Huffman et al., 2010; Prakash et al., 2013; Vrieling et al., 2010).
10. Page 8 line 22 to 24: Why the inverse distance interpolation is selected? And what was the grid size used for interpolation this will matter since your rainfall products have a various spatial resolution? Inverse distance weighting (IDW) is a possible simple way to go but probably not the best one. There are interpolation algorithms that take into account secondary information (e.g. kriging with external drift).
11.
12. The performance indicators for satellite rainfall are too simplistic. The authors should consider a categorical statistics to evaluate the effectiveness of those satellite images. Refer Haile et al. (2010).

    Haile, A.T., Rientjes, T., Gieske, A., Gebremichael, M., 2010. Multispectral remote

sensing for rainfall detection and estimation at the source of the Blue Nile River. International Journal of Applied Earth Observation and Geoinformation, 12: S76-S82.

The authors should indicate the number of incorrect and correct rain detection by those satellite products.

Why the authors include RMSE and AME isnot RMSE better explanatory than AME since it gives higher weight for larger errors. Otherwise, they provide similar outputs.

13. The reference use on page 9 line 3 Moriasi et al., 2007 is actually for a performance evaluation of simulated flow, sediment and nutrient. My question is that if you accept a PBIAS of ± 25 and R of 0.5 (which will be 0.25 R-square) as input to your hydrological model; imagine the performance of your model. I really do not agree with the performance evaluation criteria.

Result

14. The authors provided a single average statistics like average PBIAS, r, RMSE and MAE for different satellite products (Page 9 line 14 and 15). The authors should discuss the range of variability of those statistics and their relation to landscape position.
15. The discussion in line 16 page 9 is lamped. The authors should address the range of variation, standard deviation and their relation to landscape postion. Otherwise this doesn't make any sense "Similarly, r value of these products was≥ 0.5 in the majority of stations with an average value of 0.52, 0.50 and 0.50, respectively.."

What does the average line representing in Figure 3 a and b? what does that implies?

16. The autores indicated that RMSE and MAE has showed the same trend as PBIAS and r (page 9 line 18 and 19). How is this measured?

17. This doesn't make any sense, the study is about comparing of those products with gauged data, but here they averaged the performance statistics. I guess the authors should discuss the range of performance/variability in terms of spatial and temporal scale for each products since this was indicated on the abstract section as a method (page 1 line 23 and 24).

18.

Tables

19. Table 2: On Figure 3a I can see a PBIAS value of negative but under Table 2 the autors indicated rage of PBIAS from 0 to infinity. How do you council that?
20. Table 2: The authors should remember that R = 1 doesn’t mean perfect, it is obvious we have to check the slope and interest of the fitted line. Eg. Y = 5x + 8 has Pearson correlation coefficient (r) of 1 but Y and X are not similar.
21. Table 3 is duplicated on Table 4. Remove Table 3

Figures

22. Figure 1. Label the two figures. What does the dotted line over the DEM represent?
23. Figure 2. Label the two figures and describe them independently.
24. Figure 3. What does the average line representing?
25. Figure 4 where are those representative station located in the watershed?

General comments:

Abstract: the abstract full or problem

1. Line 21: space between rainfallproducts
2. Line 26 space between thatCHIRPS, Line 26 space between TRMM,and, Line 26 space between wereable
3. Line 27 space between BIASand
4. Line 28 space between >0.5over different
5. Line 35 space between respectively.CMORPH
6. Line 35 space between scale.Their
7. Line 39 space between lowlandswhereas
8. Line 40 space between athighland
9. Line 41 space between thepixel-to-pointcomparison
10. Line 42 space between showthat

11. Line 42 space between scalesin
12. Page 3 line 29 and 30 modify it as: with a significant elevation variation
13. Page 6 Line 17: sofar PM and IR are not defined. I see later in the paper they are defined.
14. Many many errors (dailyrainfall page 9 line 10, (r)of page 9 line 11, andTables page 9 line 14, double fullstops (page 9 line 17), MAE,which line 18,
15. Page 9: wasfurther (line 24), investigatedat, that the, correlationfor, reducedat, Forexample
16. Page 10: madefor, correlationcoefficients, of the, season.CHIRPS,
17. Page 11: many
18. Page 12: so many type errors
19. Page 14: ofTRMM, productshave, withsimilar, werefound, products.Bayissaet, (2017)revealed, (2007)showedthat CMORPH, etcccc

Reference

Haile, A.T., Rientjes, T., Gieske, A., Gebremichael, M., 2010. Multispectral remote sensing for rainfall detection and estimation at the source of the Blue Nile River. International Journal of Applied Earth Observation and Geoinformation, 12: S76-S82.

Huffman, G.J., Adler, R.F., Bolvin, D.T., Nelkin, E.J., 2010. The TRMM multi-satellite precipitation analysis (TMPA), Satellite rainfall applications for surface hydrology. Springer, pp. 3-22.

Prakash, S., Mahesh, C., Gairola, R., 2013. Comparison of TRMM Multi-satellite Precipitation Analysis (TMPA)-3B43 version 6 and 7 products with rain gauge data from ocean buoys. Remote sensing letters, 4(7): 677-685.

Vrieling, A., Sterk, G., de Jong, S.M., 2010. Satellite-based estimation of rainfall erosivity for Africa. Journal of hydrology, 395(3): 235-241.