

Interactive comment on “Analysis of streamflow response to land use land cover changes using satellite data and hydrological modelling: case study of Dinder and Rahad tributaries of the Blue Nile” by Khalid Hassaballah et al.

Anonymous Referee #2

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The paper shows the impact on streamflow due to land use and land cover changes in two tributaries of the Blue Nile River Basin. The tributaries - Dinder and Rahad - lie in Sudan where the hydrological data situation is sparse.

Therefore, satellite data are used for estimating precipitation and evapotranspiration. After calibration of the model at two discharge gauges, the hydrological model is applied for analyzing the impact of different land use changes on some streamflow indices. The topic is interesting and scientifically challenging.

However, the paper needs improvement before getting published. I will not correct

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some English grammar / expressions. A final proofreading from a native speaker is still recommended.

The comments are split into two parts:

1. Remote sensing:

Page 5 Line 9: The exact dates for these four years are needed. This is very important information for a land cover change detection analysis, also a brief information (e.g. coverage of cloud) about the quality of selected Landsat data is also necessary.

Page 5 Line 29. This description is not right. TMPA is just a product of TRMM. There are many TRMM products, here please specify which one you used. I think it should be TRMM 3B42V7.

Page 5 Line 34: here it was described as CHIRPS available from 1981, but in the Table 1 it was mistakenly written from 1983. Additionally, CHIRPS provides daily data for the globe, please correct "Pentads" in Table 1 accordingly.

Page 5 Line 36: The "TRMM" should be corrected to "CHIRPS"

Table 1: These products have different spatial resolutions, the authors should explain how they processed such data (how to deal with the difference in spatial resolution) and used them as input to the model.

Figure 3: In the caption, "19986" should be "1986". The legend is quite abnormal, in the remote sensing analysis, crop is more commonly assigned to yellow color, while natural vegetation to green. I advise to change legend. The four land cover maps in Figure 3 shows quite remarked differences, and it seems no regular pattern, which needs more discussion and analysis about the quality of classified map. Normally there should be a pattern, because human activities follow rivers to convert natural vegetation to crop lands. I advise to use one or more matchup Google Earth High Resolution Images to further prove/evaluate the reliability of classified map.

2. Hydrological Modelling:

Figure 1. I recommend to insert the Blue Nile River in the upper right map.

Page 5, line 15: Why did you reclassify the 44 soil mapping units into 8 dominant soil groups? Was this necessary for the hydrological modelling?

Figure 2: The WFlow_sbm model needs more explanation. How is runoff generation modelled? How is ETA calculated? Is there no interflow component?

Chapter 3.4: The IHA approach should be explained in more detail (add app. half page)

Table 2: Please explain the accuracy assessment. What means “producer” and “user”? Did you perform a cross validation analysis? The accuracy seems very high with little uncertainty for all classes. Can you prove this?

Chapter 4.1.1 / Figure 4 and Figure 5: A critical discussion about the calibration and its uncertainties is totally missing. Couldn't you assess the reliability of the RS data by ground truth measurements (rain gauges)? Please comment on that. Concerning the figures, there are great differences in the peak flows with reverse biases. For instance, at Al-Gewisi station, you get a large underestimation in the first validation period for CHIRPS, whereas you get a large underestimation for the same time period and RS method for the Al-Hawata station. There are many contrary results comparing the two figures. Please discuss this issue. Moreover, did you vary the plant parameters for different crops (Root depths, crop coefficient, LAI, etc.)? Please name and quantify the parameters.

Chapter 4.2: You should not only the resulting streamflow pattern (Figure 6) but also the different ETA – for same HRUs (Hydrological response units) and for the entire catchment. How was the water balance changed?

Page 17, line 22: “In the Dinder River the effect of LULCC on streamflow is not big as in Rahad River.” Please find reasons for this different behavior.

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Conclusions: Please analyze also the effect of different precipitation patterns and magnitudes on streamflow in different years (2001 until 2012). When do you see a larger effect of LULCC on streamflow alteration? Find explanations for that.

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