

Interactive comment on “Flow regime change in an Endorheic basin in Southern Ethiopia” by F. F. Worku et al.

Anonymous Referee #1

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Flow regime change in an Endorheic basin in Southern Ethiopia

By Worku et al.

Review comments (submitted on March 21, 2014)

Worku et al. used 29 indicators of hydrologic alteration (IHA), climate and landcover change to study the changes in the natural flow regime in the Omo Gibe basin in the Southern Ethiopia. This is an interesting and much required study for this basin. Similar studies are also required for other basins where in situ data are scarce or unavailable. The research presented in this study is very relevant to this journal. This study is well structured and well presented. However, I have few concerns on how results are analyzed and conclusions are drawn. Below is the list of comments and concerns that

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have to be addressed.

1. The major conclusion for this study is that dry season flows are increasing in the Omo-Gibe basin. Authors have analyzed stream flow trends from 12 stations and the results indicated that only 2 station show significant increasing trend (Table 3). How can authors conclude that overall trend in dry season flows are increasing when 10 out of 12 stations does not show significant increase in trend?
2. It is hard to understand which stations are showing significant trend (by geographic location) and which stations are not. Can you identify stations with ids in Figure 1 and then discuss the results in trends so that readers can relate where significant trends are observed and how is the LCLU changing in those regions?
3. Authors indicate that they have used stream flow data from 32 gauging stations (shown in Figure 1) which have records ranging from 14 to 46 years. It is not clear, which station has how many years of data. It would benefit readers if you can show in Figure 1 by classifying gauging station in Figure 1 by different colors based on the number of years of data available.
4. Are the multi-year data (stream flow) from each station used in this study continuous without any data gaps? How did you handle if the data available was not continuous and has data gaps? How did you handle such situation while dealing trends?
5. Author indicated that... “from each region the stations with the best data in terms of quality and record length in excess of 20 years were selected for characterizing the natural flow regime and variability. For most stations the period of record available spanned from about 1982 to 2008, with the exception of the stations at Abelti and Asendabo, where data was available from 1963 and 1967 respectively.” The MK trends results would change based on the length of the data used. For example, MK trend result for a data (1982-2008) could show significant positive trend but may show a different trend when data with different time period/ length (1963-2008) is used. So, I am wondering if the time period for each station or length of the data is different, how

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we can inter compare trend results from one station to another.

6. Moreover, the time period of analysis or length is not same for all the variables in this study. For example, stream flow used is from 1982-2008; Rainfall from 1970-2008; Temp (1970-2008); ET (2000-2008); Water levels (1992-2008). How can we compare trends for these variables when the period of analysis is different? Authors should redo entire analysis by choosing a particular time period for all variables. Say 1982-2008. In case data is not available for at least 20 years, a different data set or variable should be used.

7. Page 1313, lines 27-29, authors indicate that P, PET, AET were analyzed for 70 spatially distributed points. However, previous research (Velpuri et al., 2013, Remote Sensing of Environment) indicates that point based estimates of P, PET, AET have more uncertainty than spatially averaged estimates. Moreover, daily point based estimates have lot more noise that can influence trends. Authors should use spatially averaged estimates instead of point based estimates.

8. It is hard to believe the results of land cover change analysis unless both the land cover data are thoroughly validated. Both the LULC datasets used in this study are generated using different input datasets and different classification algorithms. Most often comparisons of such datasets do not agree with each other. How much of change do you attribute to the difference in data sources? Don't you think, if 83% of increase in grassland and cropland due to conversion of FL, GL and WL is real, it should show significant increase in flows from majority of the stations?

9. In the current manuscript, the discussion on the trends in IHA parameters for the 12 stations is presented as a whole. Instead, the trends in IHA parameters for the stations falling within a region vs LCLU change happening in the region should be examined to see the cause and effect of LULC change on each parameter trends. What I mean is that table 3 should be separated by regions. Then comparison should be made with the parameter trends (significant or not) vs the amount of LCLU change. 10. In section 2.2,

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add discussion on Evapotranspiration (PET and AET) and land cover datasets used.

11. Page 1305, Line 1, use just 5% significance level instead of two significant levels.

12. Page 1307, selection of homogenous regions should be numbered as an individual section (2.3?)

13. Page 1309, Lines 24-25, MOD16 is actual ET dataset. Does it provide potential ET data? Provide the link from where you downloaded the data.

14. In table 3, can you classify all the indices into five categories as in Table 2. For easy comparison, please maintain the number for each indices same as in Table 2.

15. Can you provide p-value in tables 4, 5, and 6?

16. Why have the authors presented flow duration curves (Figure 4) for pre-1995 and post 1995? This type of classification is not performed for IHA parameter trend analysis or for climate variable analysis. Then, why here? Although probability of exceedance has increased for post-1995 data, it could be due to climatic variability. It is not correct to draw conclusion that this increase in the probability (for 8 years) is due to land cover change.

17. Figure 5 indicates that mean annual dry season rainfall for Omo-Ghibe is decreasing. This is in contrast with the conclusion of the study that dry season flows are increasing. How do you explain this?

18. Did you analyze the trends in the Lake Turkana inflows (Figure 6) obtained from Abera, 2012?

19. Several sentences in the manuscript are confusing mainly due to poor choice of words. I would recommend a thorough English review.

20. It is difficult to understand that temperature in the basin is showing significant increase whereas PET trend is not showing any increase. Can you explain why? Provide more information on how PET data was derived.

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