

Review of: "Precipitation and Temperature Trends over the Lake Tana Basin, Ethiopia"

Jouni Räisänen¹

¹ University of Helsinki

Potential competing interests: No potential competing interests to declare.

GENERAL COMMENTS

The paper represents a literature review on observed and projected temperature and precipitation trends in the Lake Tana basin in Ethiopia. A widespread warming trend in temperatures is found, whereas the trends in precipitation are more diffuse, differing in sign between different areas and different studies.

The main strength of this paper is that it draws together a large body of earlier research, making a collection of literature references easily available to other researchers. In addition, the main conclusions are robust. However, for a reader desiring any deeper insight on how climate has changed in the research area and how it is likely to change in the future, an approach based on literature review alone is not very informative.

The main problem is that a large number of disparate studies are mentioned, with little if any attempt to understand the reasons for their different results or to judge which studies deserve more and which less attention. For example, observed trends in climate may depend strongly on the period for which the trends are calculated, whereas projected future changes depend on both the forcing scenario, model(s) used and the time horizon of the projection. Also, there is an important difference between projections based on a single climate model simulation (which might be heavily affected by internal variability in the simulated climate as well as by model-specific errors) and those that make use of a larger ensemble of model simulations. Obviously, the latter should be given much more weight.

Another issue that is relevant to both observed and projected trends is that, as a rule, more recent studies should be preferred over older ones. As for the observations, newer studies can include more recent data, which should make the effects of the ongoing global warming better discernible. For the model projections as well, the gradual increase in computing power and the resulting increase in the number, resolution and (presumably) quality of model simulations makes newer studies generally preferable over older ones.

At least as regards the future projections, the value of the paper could be substantially increased by an own analysis of recent climate model simulations. Specifically, the Cordex Africa data base (<https://esgf-data.dkrz.de/search/cordex-dkrz/>)

includes Regional Climate Model simulations for 9 models at 25 km horizontal resolution, which should already be fine enough for your research, for both the RCP2.6 and RCP8.5 scenarios. Calculation of temperature and precipitation changes in these models as a function of time, model and RCP scenario would only require a moderate effort, but it would give the readers a much more coherent idea of the expected future direction, magnitude and uncertainty of climate change than the listing of many but disparate and occasionally outdated studies.

In any case, when reviewing the results of the earlier studies on observed trends, it would be important to systematically report the periods over which the trends were calculated. This is at least partly done in Table 2, but it would be useful to also mention the periods when reporting the trends in the text. Similarly, for the future projections, the forcing scenario, the time frame of the projection, and the type and number of models should be given, particularly when quantitative numeric values are reported. An effort to this direction has been made in Table 3 but this could be expanded.

Still one general point. At many places, the paper refers to extremes. However, to the extent that I see, only changes in average daily maximum and minimum temperatures and precipitation have been calculated in the reviewed studies. Therefore, the repeated references to extremes seem like a void selling argument that should be avoided.

SPECIFIC COMMENTS

1. Abstract, L2: is to critically evaluate
2. abstract, L7-8: consistent pattern of change?
3. Abstract L10-11. This sentence is unclear. Do you mean that "... temperatures have increased significantly at most of the stations and are projected to further increase under ..."?
4. Abstract, L11-12: temperature increase is more pronounced than precipitation changes?
5. Introduction, L1. Omit "changes".
6. P2, paragraph 3, line 4. What do you mean by "influenced by differences in variability"? Is it just "influenced by natural variability" or "influenced by the different characteristics of variability in temperature and precipitation"?
7. P2, paragraph 3, L8. which are expected?
8. Section 2, line 5: it is approximately ...
9. Section 3, line 3. and they provide
10. P5, paragraph 2, line 2. precipitation, not perception
11. Section 4, lines 3-4. and trend analysis of precipitation and temperature at different timescales
12. P6, L3-5 from the bottom (and later). When citing studies on observed trends: it would be useful to always indicate the period for which the trends were calculated, because this may affect both the sign and magnitude of the trends.
13. P7L4-5. The terms Kiremt, Bega and Belg are not widely known outside of Ethiopia. Therefore, it would be useful to mention the months that they correspond to.
14. P7, paragraph 2, L1. rainfall has / had
15. P7, paragraph 2, L3-4. rainfall had increased by 35 mm per decade, but the trend was statistically insignificant

16. P7, paragraph 2, line 7. minimum temperatures
17. Table 2, row 4, column 4. Rainfall trend is not significant?
18. Table 2, row 6, column 4. no significant trend in rainfall
19. Last line of P7 - L1-2 in P8. Please compare apples with apples. If you give the minimum temperature increase as the range for the RCP 4.5 scenario and the maximum temperature increase as an upper bound for RCP 8.5, it is impossible to figure out whether minimum temperatures are expected to increase more or less than the maximum temperatures.
20. P8L3-4. Under which scenario?
21. P8L5. all models projected?
22. P8L6. "precipitation either increased or decreased, depending on the season" or "the seasonal mean precipitation either increased and decreased"?
23. P8L7-8. What is the time period represented by the projection?
24. P8L9-11. The study of Dile et al. (2013) was based on only one climate model simulation. Therefore, the huge contrast between the first and the next 30 years most likely reflects the large natural (internally generated) variability of precipitation in the study area. However, this result has no predictive value, because there is no reason to expect that internally generated natural variations in the real climate system would follow those in this particular model simulation.
25. P8, L1 of paragraph 2. Omit this sentence (this was already said).
26. P8, paragraph 2, L2-5. The findings of Abdo et al. (2009) for downscaled precipitation showed neither a systematic increase or decrease, in contrast to increasing minimum and maximum temperatures.
27. P8, paragraph 2, L6-7. Does this refer to the projected or observed (as "station" suggests) trends? If this is about observed trends, it should have been discussed in Section 4 rather than Section 5.
28. P8, paragraph 3, L6-8. What was the forecasting period? How do these values differ from the currently observed values?
29. Table 3, row 3, column 4. Precipitation change is not significant?
30. Table 3, row 4, column 4. No trend in precipitation
31. Table 3, row 6, column 4. Both increases and decreases in precipitation?
32. Section 6, L2. As far as I understood, you have analysed the changes in the mean values of daily maximum and minimum temperature and precipitation, but not their extremes.
33. Section 6, paragraph 2, L3. Replace "tend to increase" by "have increased". Past changes may or may not have predictive value for the future.
34. Section 6, paragraph 2, L3. minimum temperatures
35. Section 6, paragraph 2, L4-5. The temperature trends have been statistically significant ... (statistically significant variabilities does not make sense)
36. Section 6, paragraph 2, L8-10. Please see my earlier comment about apple-to-apple comparison. Furthermore, this sentence should be moved to the next paragraph about projected temperature changes.
37. P9, second last line. near and long-term periods?
38. P9, last line. By which period of time?

39. P10, L2. the trend of precipitation has been? Or do you specifically mean that the variation of precipitation has been out of phase between different areas over shorter periods of time?
40. P10L5. In contrast
41. P10L8. Please add the months when the Bega and Belg seasons occur.
42. Figure 3 should be Figure 1 (because this is the only figure in the manuscript). In addition, you should refer to the figure in the text. If there is no need to refer to a figure, then, by definition, the figure is redundant.
43. Caption of Figure 3. The trends of annual average minimum and maximum temperatures and precipitation
44. P12, paragraph 3, line 4. increases in temperature are more pronounced than changes in precipitation