

Interactive comment on “Hydrological characterization of watersheds in the Blue Nile Basin” by S. G. Gebrehiwot et al.

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Dear Editor, We are grateful to the reviewers for their suggestions about how to improve our paper. Based on their comments, we have made corrections to the paper with a focus on clarifying the methodology and the main points of the paper. We have also redone the statistics with a transformation of the categorical variables for use in multivariate analyses along with continuous variables. The details of our responses to reviewer 2 comment are presented below.

Comments from Reviewer 2.

C3001

General Comment:

I suggest publication of this manuscript only if there is clarification of the relevance of the past-data study to the current-date water resources management policy decisions regarding water scarcity in this basin (that is so passionately expressed in the Introduction section). Also, I feel that in regions like the Nile and the Blue Nile basin, the extension of the manuscript's analysis to the prediction of seasonality that is essential for the more important securing of dry-period water resources (also mentioned at least twice in Introduction section), has not been given adequate focus.

Yes, the study is based on data from 1959-1963, and the other reviewer also saw a need to better justify these data for current conditions. As in our response to the concerns of the first reviewer, we have emphasized the value of examining these data since there is nothing since that gives comparable spatial resolution, and this resolution is the basis for catchment classification. And while we note that soil degradation and changed agricultural practices can influence the relation of these characteristics to the hydrological regime, there are other aspects, such as geology and topography that we expect to have remained consistent. And even if soils and land use have changed to some extent, there is still likely to be similarities in the response of specific soil and land use variables that are of value today (page 12, line 5-7). We also agree that seasonality is an essential feature of the hydrological regime. In the climate of the Blue Nile region we had seen the variables we considered, mean monthly flow during the driest month, and peak flows to be useful indicators of the seasonal extremes in the region where there have been and still are distinct wet and dry periods in the year. The length of these wet and dry periods is also of interest, and we are exploring this issue in another paper in preparation, but there we use daily flows over half a century to look at the length of the dry season, and how it is changing. That aspect of seasonality though, is not possible to pursue in the 1959-1963 data that is focused on spatial differences over the period of a few years, albeit on many catchments. In the Discussion part of the paper, though, we have made it clear that seasonal aspects of the dry season flow

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is a problem that is represented by the data we examine; page 12, lines 7-11 "...One potential problem with this study could be the non-stationarity of the climate, which particularly influences seasonal flow regimes. However, as the distinct wet/dry season regimes remains in the region, the focus on low flows and high flows was still valid for current climatic conditions, as peak and low flows remain the dominant seasonal aspect of the flow regime..."

Specific Comments:

In particular about the analysis time period relevance, even though the methodology is good, the conclusions are mainly relevant for the 1959-1963 data collection years as reviewer # 1 also points out. Considering that climate, land use etc. are likely to have changed with the prevailing hydrological non-stationarity in the climate system, how do you propose to [1] collect similar modern-day data, even in some basic form (manually? google earth? satellite remote sensors? others?) [2] build a companion methodology to adapt the results to have relevance on current-day management decisions? About the seasonality, which of all the data used have seasonality components that are useful towards seasonal predictions? Is there a seasonality in the correlation? Finally, sources of information are increasingly available that provide spatial variability information on some of the variables used. Is it possible to use such information to better explain the variation of hydrologic variables?

The basic problem a researcher will face in trying to characterize the current hydrological regime of catchments in the basin is the need for good flow data from over 30 basins in the region at the same time. As we pointed out in our response to a similar concern from Reviewer #1, we have taken advantage of the comprehensive spatial coverage in the USBR data set to make a characterization of the major factors influencing the flow regime. In the absence of comparably spatial contemporary data for comparison, the relevance to the findings for the current situation does need to be considered carefully, as we point out in the discussion. We hope that if and when contemporary data comparably good spatial resolution becomes available this study will be of use for a historical

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comparison of how the influence of the hydrological response to specific land use and soil types may have changed. We also believe this study can serve as an example of an approach to hydrological characterization in its own right. For more details as to how we have addressed the issue of contemporary relevance and seasonality, please see our earlier responses to Reviewer 1 and Reviewer 2-General Comments.

Technical comments:

Page4103,Lines 4-6: Please clarify this line; what covers the temporal variability and of what in the catchment: characteristics or hydrologic response?

We have corrected the technical error on page 4103 line 4-6, now page 12 line 26-28.

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/7/C3001/2010/hessd-7-C3001-2010-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 4089, 2010.

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