

Interactive comment on “Land use alters dominant water sources and flow paths in tropical montane catchments in East Africa” by Suzanne R. Jacobs et al.

Anonymous Referee #2

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This study presents an isotope driven investigation of water cycling in a catchment in Kenya. Travel times and source apportionment for various land covers are considered. The study targets a gap in understanding centering around tropical montane landscapes. The study is well written and an appropriate topic for HESS. I have two general concerns about how the data are being presented and general manuscript structuring.

(1) Data presentation and analysis

There is some concern with taking these isotopic data into the convolution modeling. Specifically, the length of observation record is not overly long which limits the ability to

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map out some realistic travel times here. The uncertainty gets very high in this regard. So, at best one could argue that the MTT estimations are just first-order assessments for comparing between the catchments. Further, taking on a classic time invariant MTT estimation is a bit troublesome with regard to the potential for comparisons. Namely, the travel times for each catchment likely shift with wetness (storage) condition and this dynamic shifting (mixing) likely represents itself differently throughout the one and a half year been considered here. As such, it is difficult to separate the impact of the land use on MTT from the variability of the flow on the MTT – more likely these aspects compound (and confound) the issue (see van der Velde et al., 2015, Consequences of mixing assumptions for time-variable travel time distributions, *Hydrological Processes*). Some consideration of these aspect must be taken up within the analysis – or at a minimum in the discussion with regards to impacts on the results and interpretations. As these estimates are currently presented they tend to over-sell the ability of such analysis and what we can truly learn from them. These MTT estimation techniques are far from perfect and difficult to connect with mechanisms. It would be unfortunately for the uncertainty inherent in them to conflate with our understanding of these sites.

Actually upon deeper reading, I am not sure the MTT analysis is truly justified or even needed in this study. The high uncertainty and extrapolation needed to make the convolution effort make sense and to interpret the results are not justified. This study would be more powerful to be a data presentation with an EMMA analysis constrained by the uncertainty inherent in these data which were hard to collect. The current MTT analysis is just too thinly supported by the minimal data and has no real consideration of variability versus uncertainty to allow for a rigorous interpretation. I would strongly recommend removing these parts of the study and focusing in on the other aspects to make for a sound and clear analysis. If the MTT estimates are to be kept, I think they need to be made much more robust through uncertainty analysis and/or mechanistic model explorations (the GLUE presented just gets at modeling fitting). Further, the role of variability versus errors given limited sampling in time and space must be extensively considered. Given the audience of HESS I feel this loose application of MTT

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convolution efforts weakens the case for this research and is not needed given there are several strong aspects already.

(2) Manuscript structuring

The introduction lacks any logical structure and must be improved. As currently presented, several topics are touch in an apparently random order. First montane landscapes then isotopes then MTT then tracers then EMMA and finally Kenya. The must be a general building of argument to highlight a knowledge gap that this study is trying to fill. The review of literature is rather surficial and must be improved to highlight better the current landscape surround this study to help the reader see where this study fits in with previous work.

In addition, there is some concern with regards to mixing results in with methods. The section 2.5.2 is a good example of this. To alleviate this, I would recommend adding a results section whereby you present the raw data collected (isotopic and chemistry) and characterize these data fully. That type of an overview and statistic presentation will then lay a groundwork for the more advance results. In practice, this means to expand sections 3.1 and 3.2 and allow the data to take center stage for this study – which is valid as these data are a significant contribution to the literature. As such, the data collected should be thoroughly reviewed and presented for the reader.

Last, the discussion section left a bit to be desired. I felt there was much text in this section that could find a better home in results as it just highlights the findings of this current study. There could be expansion on the limitations and implications of this study for the region or these types of regions. That shift in emphasis would likely resonate better with readers helping this study move from a place-based investigation to a more general research investigation.

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