Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Comment on hess-2022-188

Anonymous Referee #2

Referee comment on "Hydroclimate and bedrock permeability determine young water fractions in streamflow across the tropical Andes mountains and Amazon floodplain" by Emily Burt et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-188-RC2, 2022

The paper uses a unique isotope dataset for seven tropical catchments, spanning a range in elevation and particularly slope characteristics to determine the effects of topography and geology on the young water fraction. Although the analyses are relatively straightforward (and perhaps somewhat limited), the study contributes to the still limited literature on the effects of topography, geology, and catchment wetness on transit times or young water fractions and the results are certainly of interest to the readers of HESS. Furthermore, it provides important information on a poorly studied region. The manuscript is well written and nicely illustrated (although the color scheme is not immediately clear and not explained).

However, I also have several concerns. One major comment is that the most interesting parts of the results are given in the discussion section. These should be part of the results section. The other main comment is that the methods for the derivation of the topographic indices are not explained (what data source and algorithm were used?). In particular, I wonder if in this terrain a 30 m DEM is sufficient to calculate hillslope lengths or average flow path length to the stream. Finally, the introduction and the discussion sections could be strengthened by comparing the results more to the existing literature. I therefore recommend major revisions.

In addition to the main comments stated above and the more detailed list given below, I have also added some minor comments to the annotated pdf. Note that the editorial suggestions included in the annotated pdf are just suggestions.

- The introduction is relatively general and could be stronger. One way to do this is to provide a bit more information on what the papers mentioned on L90-93 say about the effects of topography and geology (or soil type) on transit times or young water

fractions.

- Provide more details on the Clark (2014) study, so that it is clearer how this study differs from that study.
- L134: Do you mean total area instead of mean area? Also, provide information on what algorithm and what data set were used to determine the topographic characteristics. I assume that you used a 30 m DEM. How dissected is the landscape and what are typical hillslope lengths? Can a 30 m DEM represent the hillslopes well or is it too coarse to calculate the distance to the nearest streams, i.e., are the hilslloпes and small streams smoothed out too much in this DEM? How was the location of the streams determined? What accumulated area threshold did you use for this? This affects all the distance to stream calculations – and probably also the hillslope length calculations. The stream network dataset shown in Figure 1 c-d seems to be insufficient for this job. I would also recommend to calculate a few other characteristics (e.g., those used by McGuire et al., Lutz et al., or McHale et al.,) and to show the relation (or lack thereof) with the young water fractions.
- L144-147: What method did you use to get a catchment-average rainfall rate?
- Section 2.1: Provide some information on the vegetation and soil type as well. I see that the vegetation in included in Table 1 but the difference between UPRF and TRF is not clear enough for a reader who is unfamiliar with this region.
- L191-194: I would recommend to rewrite the equations and to use symbols with super- or subscripts in the equation, rather than words. Also is the double sin or cos in equation 1 is a typo.
- L197: For the resampling, what fraction of the data was excluded? Just one data point or more, like 20%?
- L198-201: This part is not very clear. It would be good to rewrite it so that someone can repeat exactly what you did.
- L213: How much is slightly greater and is this a statistically significant difference?
- Figure 2: The figures in the manuscript are all very nice but perhaps you can explain the color-scale in the caption or add a legend to this figure.
- L231-233: Describe the amplitudes and whether or not these are different for the different streams. It would make sense to describe Figure 5 here and to give some information on the goodness of fits here. Are the fitted curves reasonable representations of the data? They are not great but look reasonable – but the goodness of fit is not quantified here. This makes it difficult to compare this with the fits in other studies on the young water fractions.
- Table 2: Are the amplitudes mentioned here the difference between the min and max values or the amplitudes of the fitted curves? Add some goodness of fit measure (see comment above).
- Section 3.2: Discuss figures 7 and 8 here.
- Discussion section 4.1: This section contains too many new results. Move these results into the results section (3.2). Move the rainfall and streamflow data (Figure 6) to either the study site description or create a new first results section for this. Then focus the discussion section more on the results. This includes more comparisons with other studies who have shown the relations between topographic characteristics and transit times or young water fractions (e.g., Lutz et al., McGuire et al., von Freyberg et al., etc.). Similarly add more discussion on papers that have looked at the effects of geology or soil types on mean transit times or young water fractions (e.g., Hale et al.; Soulsby and Tetzlaff, 2008).
- L307: How wide is this range compared to those found in other studies? Add some comparison.
- L307-308: This fits much better in the results section. It would strengthen the paper if this section was expanded.
- L312-314: How do these young water fractions compare to those in other studies or the global study by Jascheko? Add some comparison to the existing literature here.
- L336-341: The flashier hydrographs and differences in rainfall characteristics should already have been mentioned in the site description, but at the latest as the first

section of the results section.

- Figure 6b: It is clear that these streams are very flashy. It is not clear over what range of the observed streamflow, you took the samples. Can you give some statistics for this, e.g., what part of the flow-duration curve cover your samples cover? Or split the figure so that it is possible to plot the d18O in this figure as well to see when samples were taken?
- L386: Add some comparisons to the existing literature here. Suggested refs are provided in the annotated pdf.
- Figures 7 and 8 should be part of the results section, not the discussion section
- L469: It is unclear from the discussion section (nor the study site description!) that the lowland sites have clay soils as well. Shouldn't this mean that the flow is fast as well? This should be discussed more clearly on L 357 where you discuss the fast flow and therefore higher young water fraction for the mid-elevation sites. Following the same logic, shouldn't the low elevation sites then not have higher young water fractions as well? This could use some discussion.

Please also note the supplement to this comment:
https://hess.copernicus.org/preprints/hess-2022-188/hess-2022-188-RC2-supplement.pdf