June 5th, 2023

Dear Dr. Hrachowitz,

Thank you for your time during the final stages of manuscript revision. We are pleased to report that we have taken care of the three minor revisions suggested by Referee #1. The final comments added clarity regarding the overlapping influence of hydroclimate and lithology on stream young water fractions. We also corrected a mislabeled axis. We feel that our manuscript is strong and are pleased to present a final version for publication.

Thank you again.

All the best,

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1. *Stream discharge chronicles have usually log-normal distributions. In these distributions, the mode is smaller than de median and the median is smaller than the mean and these differences increase with the variance of the distribution. This means that any discrete samples will be closer to the mode than to the mean, and when averaged will give negatively biased discharge values. The larger the variance of the discharge and the smaller the number of samples, the more negative bias the sample average. If Fyw increases with discharge, this bias in discharge sampling propagates to Fyw sampling.*

Along the bootstrap resampling method used to analyse the uncertainty of the Fyw estimates, an analysis of the likely role of infrequent sampling on Fyw biases should be applied to the two catchments with continuous discharge records shown in Figure 3b. The mean discharges of the 609-SC and 3077-S catchments should be calculated with all the available data and compared with those calculated with only discharges synchronous with sampling times. As these hydrographs suggest a large difference in discharge variance, this will provide with an idea of the representativeness of the samples taken respect to the real stream flow volumes, and the dependence of the likely bias on the discharge variance.

I do not expect the results of this exercise to contribute to any relevant modification of the results of the manuscript, but I do hope that the authors can discuss these results in a way to value the limitations of the sampling design, and to warn the readers about the likely errors that can be made when flashy streams are insufficiently sampled.

We agree that this is an interesting exercise to determine potential biases in sampling. We completed this exercise and found that the mean discharge during sampling was very similar to the mean discharge of the continuous hydrograph. One potential explanation for this is that the overall variability in the hydrograph in these tropical watersheds is smaller than that observed in some Mediterranean and temperate watersheds. We added the following text to the manuscript (lines 285–295) to highlight the importance (and difficulty) of sampling across the stream hydrograph:

The discrete nature of the stream sampling and limited time resolution of our sample collection could introduce bias in estimation of F_{yw} (Gallart et al., 2020b). As one check on how representative our sampling was of flow conditions, we compared mean stream runoff corresponding to times of sample collection with mean stream runoff from the continuous runoff records for sites 609-SC and 3077-SC. For site 609-SC the mean discharge during sample collection was 8.8 mm/d while the mean discharge of the continuous record was 8.0 mm/d. For site 3077-SC the mean discharge during sample collection was 11.6 mm/d while the mean discharge of the continuous record was 11.0 mm/d. The similarity in the mean values may reflect the low discharge variability at our tropical study sites compared to catchments in temperate and Mediterranean climates, yet even in this setting, incomplete sampling across the flashy hydrograph is expected to introduce uncertainty in calculated F_{yw} values.

2. The sentence "We interpret the first-order shift in Fyw values from the high Andes (where baseflow indices are high) to the mid-elevations (where baseflow indices are lower) as being related to this change towards a wetter, stormier climate, suggesting a primary role for hydroclimate forcing in determining transit times in these mountainous catchments" is in some contradiction with the preceding sentence "We attribute the low Fyw observed in the high mountain sites in our study at least in part to high permeability of the fractured shale bedrock".

In my opinion, the former is more consistent, given the wide range of precipitation, than those that attribute the observed differences in Fyw to lithological aspects. I suggest a rewrite of the text in order to indicate the difficulty of testing both hypotheses simultaneously and to avoid showing any preference on one of the two without adequate evidences.

We agree with the reviewer that determining if hydroclimate or lithology exerts a stronger control on young water fraction is very difficult. We have added the following text to line 510 of the manuscript:

Thus site 1540-SC highlights overlapping impacts of hydroclimate and lithology on F_{yw} in this setting: this catchment has the highest F_{yw}, and a combination of high total precipitation and low permeability granite bedrock. Yet with our present data, it is not possible to distinguish which variable (hydroclimate or lithology) exerts a stronger control on F_{yw}.

3. The axes in Figure 9f should be interchanged.

We have corrected the axes in Figure 9F.