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Comment on hess-2022-188

Francesc Gallart (Referee)

Referee comment on "Isotope-derived young water fractions in streamflow across the tropical Andes mountains and Amazon floodplain" by Emily I. Burt et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-188-RC1>, 2022

The manuscript "Hydroclimate and bedrock permeability determine young water fractions in streamflow across the tropical Andes mountains and Amazon floodplain" by E.I. Burt *et al.* proposes an analysis of the young water fractions in a set of small and mesoscale catchments in an area without or with scarce previous information.

The subject is timely and the area is poorly known, the paper is well structured and written and the figures and tables are adequate .

Nevertheless, the methods are rather outdated because the authors follow the approaches used in the early works when relevant aspects such as the importance of the sampling rate and the dependence of young water fraction on stream discharge were not yet sufficiently described. Some of the more significant papers in this aspect are cited by the authors in the discussion but not taken into account in the methods.

This means that the results obtained in this work are largely suspect to be dependent on the flow regime of the streams and on the moments when the samples were taken respect to the flow regime. The relationships obtained between the young water fractions and the characteristics of the catchments, stated from the title, may therefore be spurious.

In my opinion, the manuscript could be accepted for publication in HESS if the following recommendations are followed.

- 1) Given the scarce sampling rate and the lack of comparison with the flow regimes, the conclusions of the work should be removed from the title, which should be less conclusive.

2) The sampling scheme did not follow strict time intervals so the 'unweighted' young water fractions are not time-weighted but of uncertain significance. Therefore, I strongly recommend to use only the 'volume-weighted' (the usual term is flow-weighted) young water fractions in the text, discussion and conclusions while the unweighted water fractions can be shown in a table just for comparison.

3) The dependence of young water fraction on discharge (discharge sensitivity) should be analysed. This dependence has been scarcely investigated but may inform on the behaviour of the catchments and be more robust for catchment comparison, because it might be less dependent on the sampling scheme and more appropriate than the young water fraction in this work. This dependence may be stated for every catchment using the equation (6) in the Gallart et al (2020) paper already cited in the manuscript.

A more detailed explanation of the resampling approach used is recommended

Finally, the current knowledge shows that "it has been difficult to identify a simple topographic control on young water fractions at the global scale" because of the inadequate and variable sampling schemes and the lack of consideration of flow regimes. Different sampling schemes and periods can give different results (Stockinger *et al.* 2016 and 2019, Gallart *et al.*, 2020). The authors should propose a final conclusion more adequate to the limited sampling schemes used in their work.

Suggested paper not cited in the manuscript:

Stockinger *et al.* (2019). Time variability and uncertainty in the fraction of young water in a small headwater catchment. *Hydrol. Earth Syst. Sci.*, 23, 4333–4347