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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Sampling frequency trade-offs in the assessment of mean transit times of tropical montane catchment waters under semi-steady-state conditions" *by* E. Timbe et al.

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1 General Comments:

The paper investigates the influence of sampling frequencies on the transit time estimates obtained by the lumped convolution modelling approach. For a tropical montane catchment in the Ecuadorian Andes, weekly stream water samples at eight locations, weekly soil water bulk samples and event based rain water samples were collected over a time span of two years and analysed for their stable water isotopes.

The isotope data was aggregated to weekly, biweekly, monthly and bimonthly temporal resolutions. The transit time distributions (TTDs) and mean transit times (MTTs) of soil and stream waters were estimated with a lumped convolution modelling aproach. Soil water TTDs were estimated with the Linear-Piston model (LPM) and the gamma distribution model (GM). Stream water TTDs were estimated with the Exponential-Piston model (EPM) and the GM. All models were optimised for different temporal resolutions of the input data in two different scenarios: in the first scenario the model was run with all input data time series aggregated to the same temporal resolutions between daily and bimonthly; in the second scenario the output time series (soil or stream water) were kept at their original weekly resolution, while the aggregation stages of rainfall data were varied between daily and bimonthly.

The results of this study demonstrate the significant influence of sampling frequencies on the obtained fitted parameter values and the implied TTDs and mean transit time (MTTs).

This well written paper is based on an impressive data set. By pointing out the importance of sampling frequency, its results are suited to enhance the design of future isotope studies. Furthermore, the demonstrated effects of varying sampling frequencies might help with the interpretation and comparison of different isotope studies, as it points out that different sampling frequencies may lead to systematic deviations of MTT estimates. The presentation is clear and concise. Except for a few required rephrasings and smaller technical corrections, the paper makes a pleasingly elaborate impression. I think the paper may be published after minor revision.

2 Specific Comments:

page 12461, lines 9 – 11: *"Keeping this finding in mind, a sensitivity analysis considering the effect of sampling frequency should be a common part of the workflow while*

applying lumped parameter models to estimate the TTD and MTT."
To my knowledge, most isotope studies simply lack the appropriate data (daily time series of precipitation data) to conduct the requested sensitivity analysis. In most cases the decision to use coarser temporal resolutions for bulk samples of precipitation will be caused by financial, logistical or (espcially in remote areas) practical reasons. Of course, a broader data base on the sensitivity of lumped convolution modelling to sampling frequencies might help to correct effects caused by coarser sampling frequencies. Whenever event based precipitation isotope sampling is feasible, the requested sensitivity analysis seems reasonable, but the statement *"should be a common part of the workflow while applying lumped parameter models"* is too general.

page 12462, line 3: The sentence *"These results show a distinct tendency than the one obtained by [. . .]"* has to be rephrased.

page 12463, lines 27 – 28: *"For soil waters LPM yielded similar τ predictions than GM"*
Might be rephrased to: "For soil waters LPM yielded τ predictions similar to those of GM"

page 12466, line 2: *"[. . .]seem to be related to the shape of the MTT distribution function, when[. . .]"*
I would suggest replacing "MTT distribution function" with either just "distribution function" or "TTD". Furthermore, the "when" after the comma should start a new sentence.

page 12667, lines 11 – 13: *"In particular, the performance of steady state modeling approaches can be considerably improved increasing the sampling frequency, offering an indirect way to account for the time-variable conditions."*
I agree that an increased sampling frequency might improve the performance of

steady state (or any other) modelling approaches, but I fail to see where the increased sampling frequency *"offers an indirect way to account for time-variable conditions"*, which were discussed nowhere in the paper. Consequently, the last statement is not adequate to conclude the paper.

3 Technical Corrections:

- page 12454, line 21 : "the lower limit was establishED at 5%"

- page 12465, line 29: "seems to oversymplifY"

- page 12466, line 27: Switch the positions of "increasing" and "considerably".

- page 12467, line 1: Change "to account the more reliable distribution function" into "to identify the most reliable distribution function".

- Table 4 and Table 6: while the table legends refer to S_f, the second columns of the first rows are S_r (Tab. 4) and T_r (Tab.5)

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