

## ***Interactive comment on “Time-variability of the fraction of young water in a small headwater catchment” by Michael P. Stockinger et al.***

### **Anonymous Referee #1**

Received and published: 28 January 2019

This paper presents a numerical experiment to estimate the relative influence of the different sampling periods in the estimate of the fraction of young water (fyw). The authors used 1-year long subsets of precipitation and stream tracer data sampled sequentially over a 4.5-year long record. This resulted in 189 different to estimate fyw based on sine function fits. I find the paper interesting as this approach to estimate the event water fraction is becoming popular among hydrologist. However I dough this paper provides information useful outside the catchment where the data was collected. The authors made no case on how these findings would be relevant to other locations. As such, it reads like a case study. Therefore, I suggest this paper not be consider for publication in HESS in its present form. In addition, I found the study lacks proper justification for the used of 2% difference in fyw as indicative of a significant difference.

C1

The statistical approach is also somehow vague. For example, it would be important to know how does the  $r^2$  fits of the input compare to the  $r^2$  fits of the output. This would allow understanding what is driving to low mean  $r^2$  values that were observed for some of the results. Other specific comments:

Line 21 (P1): Sentence in poorly worded.

Line 23 (P1): The abstract indicates that they recommend an  $r^2$  threshold for future studies. However nowhere in the text, the authors offer any justification for the limit.

Line 6 (P2), Line 15 (P13) and elsewhere: Better to refer "water stable isotopes" rather than "stable isotopes of water"

Line 16 (P3): Indicates that the hypotheses were tested against rules of acceptance that were based on whether differences in Fyw exceeded a threshold value of  $\pm 2\%$ . A more comprehensive justification for the 2% threshold should be included.

Line 17-18 (P4): Please explain how this precision was estimated. Did you collect duplicate samples?

Line 21 (P4): Did you consider using deuterium instead of  $^{18}\text{O}$ ?

Line 14-16 (P5): It would be interesting to see the distributions or  $R^2$  of both fits independently.

Line 1-5 (P6): Since the 2% threshold is mentioned in the introduction this explanation belongs there.

Line 22 (P7): These values are very low. An  $r^2 = -.08$  would indicate that a sine wave function is weak to describe the variability of the data.

Line 24-25 (P7): Can you provide information about the range of the  $r^2$  of these fits

Line 4-9 (P8): Would this indicate that the sine fit method is not appropriate for much of 2014? How confident can one be of the Fyw estimates when the  $r^2$  are below 0.2?

C2

Line 12-14 (P8): It is not clear what is the significance of this clustering of points .

Line 19 (P8): Considering how skewed the data is would it be better to use the median? Also I suggest some standard deviation or standard error .

Line 20 (P8) Please consider some measure of error or uncertainty in the flow estimates.

Line 23-345 (P8): Please elaborate, that is indicate how many of the 189 were between these ranges.

Line 29 (P8): Please provide some statistical information about the strength of the correlation.

Line 10 (P9): This is confusing about figure 9. Are these the 189 fits? That is, are these fits over a one-year duration time series?

Line 17 (P9): Where is the value of  $\delta^{18}\text{O}$  for ground water coming from?

Line 19-20 (P9): please elaborate some more in the parallel to the Weigand et al. [2017] study

Line 18-19 (P13): How do we know this conclusion is relevant to other catchments?

Line 24-25 (P 13): This sentence is vague. Please explain.

Line 26-28 (P13) It would be important to understand if the variability observed here would be relevant to understand difference across catchments.

Figure 1: The markers for the precipitation and runoff gauges are too similar. Add latitude and longitude grids to the map. The contour should be in the legend indicating the units. In addition, the font next to the contours is difficult to read.

Figure 4: In the legend, please clarify that "mean" refers to

Figure 7: Please add a legend. Figure 8: The caption should include an explanation of what is hypothesis 2

C3

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C4