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Discussions

Interactive comment on "Technical note: Calculation scripts for ensemble hydrograph separation" *by* James W. Kirchner and Julia L. A. Knapp

Anonymous Referee #1

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The authors have developed a MATLAB script and an R script that estimates new water fractions and transit time distributions (TTDs) based on Kirchner's 2019 method. The method has been extended in this manuscript to provide robust estimations when outliers are present. I believe that this manuscript can serve as a good manual for potential users of that script. They have also provided some thoughtful analyses that would help users understand the potential limitations of the method.

The manuscript is well-written and mostly ready for publication. I only have some minor comments to help increase readability. Also, as a potential user, I have a few questions for the authors on how to use the method correctly.

1. Required number of samples

Could you suggest, at least, a rule of thumb number for the minimum number of samples required to perform an analysis using this method? I do not think that there would be a definite answer, and I guess it would depend on which analysis a user wants to do (among many others). Still, any suggestion would help potential users design their sampling strategy for their analysis of interest.

2. New water fractions and TTDs estimations when the TTDs are humped

The authors showed that the method overestimates uncertainty associated with the estimated averaged TTD when TTDs are humped. They argued that nonstationarity (time variability) of the TTDs might have caused the overestimation problem. If that is the case, is it possible to get better uncertainty estimations when one estimates TTDs for each subset (assuming that the subsets are well constructed)?

The authors also showed that the method overestimates the new water fraction at the daily time scale when the TTDs are humped. While they have shown that the issue can be resolved at the weekly time scale, I think that there is a way to get a good estimation at the daily time scale. Some of their explanations about the overestimation of the new water fraction and the results that are shown in Figure 6 imply that the method could estimate F_{new} pretty well at the daily time scale if one estimates TTDs first (probably with m about 7 days in this case, and for each subset to alleviate the uncertainty overestimation issue) and then use β_0 for ${}^{Q}F_{new}$?

3. On the use of IRLS

The role of IRLS is a bit unclear. Their robust estimation method consists of two steps (the MAD-based filtering and the use of IRLS), but those steps' relative importance is not discussed. As the authors described in lines 173-178, IRLS could be an additional source of getting less accurate estimates. Would it be possible that, in some cases, the method estimates better TTDs and new water fractions when only the filtering is applied? Then, I think it would be great to provide an option to do the MAD-based filtering separately.

4. Clarifications

L9, L65: I am not sure if the method can “measure” TTDs and new water fractions.

L58: It is hard to understand why the strongly biased outliers are harder to detect and eliminate.

L61: “Large enough” – Wouldn’t it makes the outliers easy to detect?

L317: The authors have used the term “nonstationarity” frequently throughout the manuscript. If I understand correctly, I think it should be “time variability,” not non-stationarity.

L330: Perhaps better to provide the lag-1 serial correlation r_{sc} for the non-humped TTD cases.

Figure 2: C_P and C_Q notations here do not match with the notation used in the text. In the text, the double subscript notation is used.

Figure 2b: Coloring the corrupted data point (using different colors for the corrupted C_P and C_Q) would make the figure easier to understand.

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