Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-404-RC2, 2017

Hydrology and Earth System Sciences
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Interactive comment on "A nonparametric approach toward upper bounds to transit time distribution functions" *by* Earl Bardsley et al.

Anonymous Referee #2

Received and published: 17 August 2017

The author develops a nonparametric method to determine upper bounds in catchment transit time distributions. Upper bounds are found through an optimization technique whose objective is to reproduce the output to a certain level of accuracy. I think that the article can be of interest to the readership of this journal, but a few points still need to be clarified to make it more accessible to the community. I therefore suggest "major revisions".

First of all, the method is very general and lacks of physical interpretation. I understand this is a technical note so I only suggest the authors to use a real hydrologic example as illustration (Section 4). My opinion is that the current illustration does not introduce anything new and an application to real tracer data would be more useful.

Second of all, assuming that "p" remains constant and neglecting the transit time dis-

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tributions of other forms of output (e.g., evapotranspiration) is problematic in real applications (see for example the papers by Botter, 2011, Harman, 2015 and by Calabrese, 2017). Can the method introduced in this manuscript be extended to introduce multiple outputs, each one with its own transit time distribution?

Lastly, how is this method better than the estimation of age thresholds discussed in Kirchner (2016a)? I ask the author to discuss this.

Minor comments:

-Page 3, line 1. X_τ should be placed after “magnitude”.

-Page 3, line 3. Shouldn’t “tracer flux” be “water flux”?

-Page 3. The paragraph which begins with ”A sequence of K different..” needs to be expanded. It is hard to follow the translation in time and the new notation. Why not introducing the notation with common origin at t=0 from the beginning?

-I think Figure 1 is not necessary.

References: -Botter, G., E. Bertuzzo, and A. Rinaldo (2011), Catchment residence and travel time distributions: The master equation, Geophys. Res. Lett., 38, L11403, doi:10.1029/2011GL047666. -Harman, C. J. (2015), Time-variable transit time distributions and transport: Theory and application to storage-dependent transport of chloride in a watershed, Water Resour. Res., 51, 1–30, doi:10.1002/2014WR015707. -Calabrese, S., and A. Porporato (2017), Multiple outflows, spatial components, and nonlinearities in age theory, Water Resour. Res., 53, 110–126, doi:10.1002/2016WR019227.

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