Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-440-RC3, 2019

Hydrology and Earth System Sciences
Discussions

Interactive comment on "On the shape of forward transit time distributions in low-order catchments" *by* Ingo Heidbüchel et al.

Anonymous Referee #3

Received and published: 19 November 2019

This is an interesting paper that describes the relationships between transit time distributions and catchment characteristics. This manuscript is a modeling study for which the authors use a state-of-the-art 3 dimensional saturated unsaturated zone and surface water model. They vary several catchment characteristics and evaluate how this affects the transit time distribution. Moreover they characterize catchment behavior and transittimes using characteristic numbers such as the flowpath number F. The manuscript is well written and mostly easy to read, literature is extensively cited. Maybe the manuscript is long and could be shortened in some sections to gain more impact(17 figures and 9 tables are hard to take in). Having noted this, I must also admit that it is clear that a lot of time, effort and attention has been put into this manuscript. The many variables that have been tested make the results section a bit of a struggle to

read and fully digest. The discussion and conclusions do highlight the most important findings effectively. The conclusion could even be further shortened. I have no major objections to this manuscript and think it could be published with minor revisions. I do wonder why the authors decided to present all their analyses on the transient traveltime distributions instead of the cumulative outflow as mention in section 4.3, which in my opinion would give a results that is less dependent on the precise rainfall sequence? Most interestingly I found that an advection-diffusion based model (mostly darcain) does only under strict conditions yield TTD's that can be described accurately with advection-dispersion TTDs. Therefore a gamma-distribution is not only an effect of preferential flow paths and dual porosity, but also of flowpath-storage relationships as indicated with the flowpath number.

Minor comments Figure 11: why does panel D have curved lines while all the others are straight. Figure 6. I think the order of the legend does not correspond with the panels. But this figure is really hard to understand. For example the center front panel shows "no condition", but still it causes a decrease in traveltime. (y axis). So the decrease is relative to what? All the different colors and linetypes make it hard to understand. Figure 9 and 10: Fig 9 I don't understand why the alpha-plot has no dashed symbols and the D-plot has no solid symbols. This also doesn't seem to match with fig. 10 that has both dashed and solid symbols?

Line 685: not fully sure what you mean to say with "-but only taking". I suggest to replace it with "and use" Line 701. Available storage > storage change. Here I miss the timescale. Do you refer to yearly storage change? Line 701 more water than it can remove (yearly or daily or hourly?) I think you need some kind of characteristic timescale here to define these definition (probably closely related to flowpath number F?) similar in figure 9. Line 760 "where" or "when"?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-440, 2019.