**Response to Interactive comment by Anonymous Referee #3**

Comments from the referee are printed in black. Authors' responses are printed in red.

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).
Thank you for reading and evaluating our manuscript. We fully agree that it is long and that it would benefit from further condensing certain sections. We have already shortened it considerably in the past but we will make another effort to achieve this.

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.
Thank you also for acknowledging the effort we put into this research. It started small but grew into this large study comprising more and more of the relevant catchment and climate properties. Still, it is far from being complete (there are still more parameters to test and analyze). We will make another effort to streamline the results section better in the revised manuscript and to shorten the conclusion to the most important take-away messages (moving more of the less important findings to the supplement). This process of restructuring and reevaluating is always iterative.

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?
The decision to plot the TT probabilities against the actual transit time instead of the cumulative outflow is mainly based on the desire to work with TTDs that are 'real' in order to get an impression of how they would look like and change their shape in real-world catchments. Also, we could not have investigated the influence of precipitation frequency or the influence of different precipitation patterns/sequences with the cumulative outflow method.

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.

Thank you for pointing this out. Actually, based on another reviewers comment we additionally tested lognormal and truncated lognormal distributions to fit the modeled TTDs. We found that the lognormal distributions capture the TTD shapes in many cases better than the AD distributions.

Minor comments Figure 11: why does panel D have curved lines while all the others are straight.
If you look closely, you can see that the lines in panel A are also slightly curved. This is due to the fact that both $P_{sub}$ and $\theta_{ant}$ have three different modes (large, medium, small and wet, intermediate, dry) while $D_{soil}$ and $K_S$ have both only two modes.

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.
Agreed. This is a very complex figure that is hard to understand. We are going to try to make it clearer and simpler. We double-checked and all the different colors and line types are indeed correct (also the order in the legends). Still we can see that the figure is too complex.

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?
This correct observation is due to the fact that we recommend using gamma distributions for catchments with low hydraulic conductivity (solid) and AD distributions for catchments with high hydraulic conductivity (dashed). In figure 10 we show relationships for all (low and high $K_S$) scenarios.

Line 685: not fully sure what you mean to say with “-but only taking”. I suggest to replace it with “and use”
Good suggestion. However, we will modify this section anyways due to the new results we have from the fitting of the lognormal distributions.

Line 701. Available storage > storage change. Here I miss the timescale. Do you refer to yearly storage change?
The timescale is the combined average interevent and event duration (~5 days). A much shorter time scale – compared to the yearly storage change – that makes F more variable/responsive in time. We will add this information to the manuscript.

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.
Yes, we will add the characteristic time scale (combined average interevent and event duration) to the description.

Line 760 “where” or “when”?
When sounds indeed better. Thanks.