Note on previous SC:

We would like to mention that the other Author comments are published as Short Comments due to a misunderstanding between the two authors. Please consider all short comments by Markus Weiler as Author Comments to the individual Referee Comments.

Responses to comments of Referee #5 to the paper "Integrated response and transit time distributions of watersheds by combining hydrograph separation and long-term transit time modeling"

Comment:
The manuscript is generally well written and clearly presented. I fully agree with other referees that rather limited data is shown/presented and think that the authors need to provide more, so that results can be reproduced.

Response:
As mentioned in previous responses to comments, the raw data will be provided in the final MS.

Also more info in figure captions would be good and some figures could be combined. As these points have been addressed by other referees and responded to by the authors, I focus here on two additional main comments.

Captions have been improved and some figures combined.

1. The authors should put some more effort to make the work more accessible to physical interpretation by the general hydrology community, by providing better symbol definitions and associated dimensions/units. Specifically, the manuscript introduces and discusses a number of quantities/variables, but notation is not always well defined, and dimensions/units are not given for any of the introduced quantities; dimensions/units for non-trivial quantities should be given when they first appear. Alternatively, a list of symbols with units would be helpful. The unit ambiguity and associated physical interpretation problems can be exemplified in connection with eq. (5). The statement on pg. 10 after eq. (5) states that "The denominator of Eq. (5) is equal to the event water runoff (Weiler et al., 2003) and the total event water fraction F can then be derived." But the denominator units appear to combine to (s-1), if the functions peff and he both represent pdfs, each with units (s-1), and f is unitless; if this is not the case, what are then the right units? If that is the case, what is the physical F interpretation with units (s-1)? And how does F, a "total event water fraction" with units (s-1), entering also in eq. (7), relate to f, a (unitless?) "fraction of e□ective precipitation that becomes event water" in eq. (5)?

We will include dimensions/units in the revised manuscript. In Equation 5, the units of the denominator are defined as: Precipitation (Volume/Time) and this is not a PDF, just precipitation varying with time, and f (-) is unitless and h_e (s_{-1}) which is multiplied in the convolution by dt (s). Therefore, the results of this convolution is event water runoff (Volume/Time), which can be divided by the total runoff (Eq.3) to calculate the event water fraction (-)

Other ambiguity examples regard the quantities C and Q efficiency in Tables 2-3; what are these quantities? Such physical interpretation and unit relation questions need to be clarified throughout the manuscript.

Efficiency is unitless, since it is a goodness of fit measure that is normalized with a maximum of 1 (similar to R2). We will clarify this in the Tables in the revised manuscript.

2. Quantifications that closely relate to those in this manuscript have been addressed in other publications, specifically regarding how different land cover/use, but also other landscape and soil elements and water subsystems (soil water, groundwater, lakes and streams, in addition to wetlands) in a catchment affect in particular the long-term TTD (e.g., Darracq et al., environmental Fluid Mechanics, 10, 103–120, 2010; Destouni et al., Environ. Sci. Technol., 44, 2048–2055, 2010). These publications relate transit (or travel) time distributions for non-reactive tracers to different elements/subsystems in the catchment, by gridding the catchment and the different flow and transport pathways through it and its different elements/subsystems, and explicitly and mechanistically calculating the water flow fractionation and the travel time addition of each pathway fraction (grid cell) in each element/subsystem for all different pathways through the catchment. The main contributions and implications of this manuscript would be better clarified if the authors discussed its complementary, overlapping and/or opposing aspects in relation to corresponding but different modeling approaches in other publications. Could such other approaches for instance be used to check the assumption stated in one of the authors' responses to reviewer #3 that the role of other factors than land use is small because "other factors, like soil and landscape, were very similar among the catchments"? What does such similarity mean in terms of the different flow and transport mechanisms, as well as transport pathway lengths through different water subsystems, which together determine TTD according to the other publications? Furthermore, what does such similarity mean in view of the spatial variability, shown and accounted for in the other publications, of different soil and landscape factors, in addition to land use/cover, within catchments? At least some discussion about these issues and questions would be good to introduce in this manuscript.

Yes, these are valid points. Other models could be used to complement this method and test if other factors assumed to be similar for this study, are playing an active role influencing response and transit time. In the same way, water isotope composition could be used to test the applicability of other models to predict catchment response to precipitation.

However, one of the purposes of this research was precisely to isolate land use as a factor that is determined by human activities and that is potentially having a significant influence on water availability. In consequence for the specific purpose of providing an understanding of the effect of land use on transit and response time, we believe that the method is self-sufficient. However, we will include some other modeling approaches in the revised manuscript into the discussion section to discuss its complimentary and to address what the similarity of TTD mean in view of spatial variability and land use and soils.