

Review of: "Integrated response and transit time distributions of watersheds by combining hydrograph separation and long-term transit time modeling"

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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. 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.

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 p_{eff} and h_e 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 effective precipitation that becomes event water" in eq. (5)? 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.

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 modelling 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.