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Interactive comment on "Linking groundwater travel times to stream chemistry, isotopic composition and catchment characteristics" *by* Elin Jutebring Sterte et al.

Anonymous Referee #2

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In the manuscript "Linking groundwater travel times to stream chemistry, isotopic composition and catchment characteristics," Sterte et al. analyze the drivers of catchment travel times across catchments in norther Sweden. They use a physical hydrology model combined with particle tracking to to generate transit time distributions and compare this to isotopic and stream chemistry observations. Overall, I think that the study is well done and the manuscript is well written and easy to follow. However, I do have some significant concerns about the manuscript in its present form.

1. My most serious concern is that it's not clear what the novelty of this study is that would warrant publication in HESS. All of the methods used here are well established

C1

and the idea that catchment travel time distributions are driven by catchment characteristics is not new. The authors start from the hypothesis that catchment area is the main driver, however previous research has already indicated that many drivers will be important, so disproving this hypothesis does not seem to be the best angle to take here. I would suggest the authors consider what portions of their findings are the most novel addition to the body of literature in this area and organize the manuscript around this rather than the area hypothesis. Even if the area hypothesis is what guided the study in the first place, this does not need to be the storyline of the manuscript.

2. Along the same lines as my first comment I think the introduction could use significant revision. As it stands it is a very broad overview of the topic but I would like to see a more thorough review of previous finding directly relevant to this work that can clearly motivate the novelty of this study and the gap it is filling.

3. Similarly I think the discussion section would be more powerful if it provides a better evaluation of how and where results form this study add new information/disagree or provide additional corroboration to existing studies.

4. For the most part I think the paper is very clearly written, however the description of the modeling approach is a bit confusing and could use some more details. For example the term simulation is used to refer to both the hydrology model and the particle tracking portion which can be confusing. This section could be helped by a figure or a schematic to illustrate the approach I think.

Specific comments: 1. I think the catchment numbering could be done in a more intuitive way so its easier to separate unique outlets (i.e C12-15). I would suggest giving each of these outlets their own letter and then numbering points within them potentially by drainage area, that way it is easier to compare when points are within the same drainage or not.

2.Line 138-140: This is confusing are you trying to say that the hydrologic model is run first and then the particle tracking is applied to the outputs of that model?

C2

3. Section 2.3 – this is really more a description of scenario design than numerical methods. I would consider renaming.

4. Line 148: 'several years' is very vague can you be more precise.

5. Line 154: at what time frequency were particles injected into the model? Just at the start of each year?

6. Line 159: I think the more standard reference for this would be heavy tailed rather than long tailed.

7. The term simulation is used to refer to both the hydrology model and the particle tracking model and this can make the methods confusing when you are talking about run times for example.

8. At the beginning of section 2.3 you say that you used several years of simulation but actually it looks like you use only one year of the hydrologic simulation but repeated it 1000 times (i.e. more than several). This description is confusing.

9. I think some of the tables could be converted to figures to better present the information. For example Table 4 could be presented as a series of maps.