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Discussions

Interactive comment on "Storage dynamics, hydrological connectivity and flux ages in a karst catchment: conceptual modelling using stable isotopes" *by* Zhicai Zhang et al.

Anonymous Referee #1

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This paper presents some interesting simulations of a karst catchment in China. However, (at present) I cannot recommend publication, but after the following concerns are addressed

However, before I can recommend publication the following list of concerns need to be addressed.

Main comments

From reading this paper, it is unclear what the real novel contribution is. Surely interesting results are presented, but what do we really learn? I cannot derive this from the abstract, nor the conclusions. Please make this MUCH more explicit. The specific aims

tell you mostly "what" you do, instead of what you want to learn (and what is new about that). Only once I know what we aim to learn from this paper I can properly review the paper. Right now I mainly see a long list of results and statements. Sure I could comment on every detail of them, but that would not warrant a review which allows me to judge the scientific contribution of this paper well.

The writing of this paper needs significant improvement. In its current format, the paper contains very awkward and confusing use of the English language, which makes it at times hard to read and review. I suggest a native speaker takes a critical look at the whole paper. That makes more sense than that the reviewer does all this work for them. Nevertheless, I provide a long list of suggestions below, but addressing these will probably be not sufficient to tackle the language problems of this paper. Note that these problems with the writing do not only refer to grammar issues, but also to the plethora of statements, structure of reasoning, etc. that are unclear it the current format.

Detailed comments

Line 9: "unique" does not seems appropriate since other studies have similar or higher temporal resolution isotope and hydrometric data. For example,

Floury, P., Gaillardet, J., Gayer, E., Bouchez, J., Tallec, G., Ansart, P., Koch, F., Gorge, C., Blanchouin, A., and Roubaty, J.-L.: The potamochemical symphony: new progress in the high-frequency acquisition of stream chemical data, Hydrol. Earth Syst. Sci., 21, 6153-6165, https://doi.org/10.5194/hess-21-6153-2017, 2017.

von Freyberg, J., Studer, B., and Kirchner, J. W.: A lab in the field: high-frequency analysis of water quality and stable isotopes in stream water and precipitation, Hydrol. Earth Syst. Sci., 21, 1721-1739, https://doi.org/10.5194/hess-21-1721-2017, 2017.

Line 10: "flow-tracer model" is not really a clear term

Line 10: the model represents "the movement of water" using "two main landscape . . ..".

I suggest to add this, otherwise the sentence does not make much sense anymore.

Line 11: "cock-pit": I think you can remove the hyphen.

Line 12: "this inferred" is not logical. Something like "from these model results we inferred" would be much better

Line 13: or something like "had least water stored, whereas the slow reservoir has least water stored" (which makes the sentence more understandable, and it removes the redundant "intermediate" part.

Line 14: specify that you talk about mean ages OF WATER.

Line 14: "marked" seems unclear and redundant to me

Line 14-16: This statement is somewhat meaningless with its current explanation. "Connectivity can be defined in many ways" so I suggest that you describe what you physically found, rather than use an undefined buzzword. Actually, all the statements until sentence 18 are somewhat unclear. What do you mean by "reversible directionality"? I can guess, but please try to make the wording clearer to the reader.

Line 16-19: please revisit these sentences to make this an understandable abstract.

Line 32: "whole catchment" instead of "whole karst system" (the karst system may have a different scale).

Line 33: "However, semi-distributed lumped models need to have hydrogeological units adequately represented, in order to relate water flow in different landscape units and model parameters that have physically meaningful concepts." Is not logically connected to the previous statements. Where does the "however" come from?

Line 36: "Three main types of porosities – (a) micropores, (b) small fractures, and (c) large fractures and conduits – can be intuitively identified in karst systems." Do would it not help to start a new paragraph here?

Line 35: "can be intuitively identified" what do you mean here?

Line 42: (Rimmer and Hartmann, 2012; Hartmann et al, 2014; Zhang et al, 2017). Include and "e.g. since many more examples will exist).

Line 43-46: please rephrase "However, this kind of approach cannot disaggregate water storage and 45 flux dynamics within different landscape units, and may be inadequate for modelling when understanding known spatial differences in hydrogeological structure is important in terms of provisioning water supplies and understanding water quality issues (Fu et al, 2016; Zhang et al, 2013)"

Line 59: I think what Kirchner said is that these tracers help to 'highlight their differencs" rather than that they "resolve" anything really.

Line 71: "Hydrological connectivity, which has been simply defined as the transfer of water from one part of the landscape to another (McGuire and McDonnell, 2010; Golden et al, 2014; Soulsby et al., 2015)," this statement suggests that hydrologic connectivity is about the transport of water (e.g. velocity) rather than the "celerity effects" it is used for to describe. I think you need to be more accurate in its description.

Section 2.1. Did you take this information from other (peer reviewed) publications? If yes, please cite these.

Figure 1: please make it much more explicit in the caption what you display here.

Table 1: the range is a redundant variable.

Table 1: consider indicating how much of the time there is zero flow.

Table 1: why not provide a flow duration curve instead. That will we WAY more informative than what you currently present.

Line 159: CalculationS

Line 162: for each of the (not in each of the)

162-163: inconsistent with singular and plural. Check grammar.

Line 168: fix superscript "rainfall (m3 hour-1)"

Equations 8-11: I presume you talk about some mean age for the box, please specify this.

Equations 8-11 there equations are missing the "aging" term. (i.e. water gets older over time), please add this term and check if you calculations are correct. . .

Section 3.2 months spin up time may be sufficient spin up time for hydrometric fluxes, but will it be for modeling of ages?

Section 3.2: "First, different parameter combinations within the initial ranges in Table 3 were tested. And then, the parameter ranges were reduced according to the best models (KGE >0.3) for the second calibration. This resulted in a total of 10^5tested different parameter combinations. I do not understand how you arrive at the second 10^5.

Line 276: "rogue" ? what do you mean

Figure 10: these values cannot be correct since the areas under these curves do not add up to 1.

Line 420: cannot instead of can't.

Line 445-447 "Given the results on water storage dynamics and the relative contribution to the fast flow reservoir shown in Figures 7 and 8, it can be deduced that the storage change within each conceptual store is the main driver of hydrological connectivity between them." Is this not just how you defined that the catchments functions yourself? So what did we really learn in the end? (also remove the "s" in stores)