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Hydrology and Earth System Sciences
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 #2

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In the submitted manuscript, Zhang et al present a modelling studies that deal with water dynamics, water isotope ratios and water ages in a small karst system in South West China. The authors use a lumped modelling approach that is able to simulate ïĄd'^{2}H ratios using mixing and partial mixing assumptions. Using the same approach, the authors also calculate water ages for the three main storages of the model, which are a hillslope storage, a fast karst groundwater reservoir and a slow karst groundwater reservoir. Using a Monte Carlo approach, the authors provide simulations discharge and ïĄd'^{2}H of their model including uncertainty ranges. Using regional sensitivity analysis, they show that 5 of their 12 model parameters are sensitive. In the following, the authors analyse the model internal dynamics to better understand landscape connec-

tivity and age distributions in the system's subunits.

1. The study is well-written and concise. The model calibration and sensitivity analysis are detailed and well described However, there are some remaining concerns that the authors may account for before their manuscript can be considered for publication:

2. For the reader, who is not familiar with the author's preceding work, it is not clear how the model works. The schematic description in Fig 2 indicates that ET is taking place from the slow and fast karst groundwater storages, which would be quite unusual. To avoid misconception, please provide a complete model description in appendix (the table A1 is hardly understandable).

3. Some clarification on where the novelties of this work start is necessary. The authors inform the reader that in Zhang et al. (2017), the model was developed in previous work that used tracer data in addition to stream discharge to constrain the model structure, improve parameterization, and aid calibration. If this was done before, and the methods only describe how the isotope enabled model was parametrized and evaluated, what is the novelty of this particular study?

4. Figure 4 shows that only 5 of 12 parameters are sensitive, which is quite a low number. Usually, discharge contains enough information to identify 4-6 parameters (Jakeman & Hornberger, 1993). Adding of additional information like isotopes should increase this number, if the model structure is well-chosen. To check the contribution of discharge data and isotopes, could the authors show the parameter sensitivities using discharge or water isotopes only?

5. With a large fraction of the model parameters insensitive, how conclusive are the interpretations on the model internal dynamics that the authors use to explain connectivity and water age distribution in the system? In some of the figures, uncertainty ranges are provided and they are quite wide. In other figures (e.g., Fig. 5), only the mean is provided although the parameters controlling the observed processes ("w" in case of Fig. 5) are insensitive.

I am confident that the authors are able to address these moderate remarks and I am looking forward to reading a revised version of the manuscript. Some more technical and specific comments can be found in the attached pdf.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2018-205/hess-2018-205-RC2-supplement.pdf

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