Review Hess-2018-205 version 2

Storage dynamics, hydrological connectivity and flux ages in a karst catchment: conceptual modelling using stable isotopes

By Zhang et al.

The paper describes a detailed and data-rich study on applying conceptual tracer-aided modelling to understand the hydrological response of a karstic catchment. It does so by also considering hillslopes besides the more classical slow and fast subsurface reservoirs. It is well written, structured and presented. Although the presented methods are not novel, their application in karstic environments has novelty and value to the hydrological community. The work has been done, as far as I can tell, in great detail and profoundness.

I have not been involved in the first round of reviews. Reading the discussion, the authors improved their article (mainly clarification and some more detailed discussion) based on the reviews. One remark, however, I must admit I am quite disappointed by the data policy statement that the data are not made openly available. This hinders scientific progress for no obvious reason, it also obstructs verification of the data and modelling. I hope the authors can do another attempt freeing the data. Notwithstanding this annoying shortcoming, I think the article can be published after taking into consideration the minor questions and technical correction listed below.

One point of concern relates to the mean age distribution, as already pointed out in the first round of reviews. Can the authors discuss what is the value of a mean age of the discharged water if the reservoir storages are so small: hillslope unit has V=23 mm (while being 0.88 of the 1.25 km2 surface area) and the fast reservoir has a mean storage volume of 0.2 mm (with max of 6-7 mm).

My second point relates to the groundwater sampling. L135: How did you sample the GW? Did you remove some pore volumes before taking the sample? What is exactly an isotope value over 13 or 35 m filter length (as screening is over entire length)? How does that influence your modelling results of the slow reservoir? Would sampling over smaller filter screens not be more informative?

Technical and minor remarks:

The use of symbols in the article are not according to HESS standards. HESS promotes use of single symbol representation for parameters, variables etc. (please replace con-fei-KK-Age etc with single letter symbols

L248: the all > all the

Fig 4: lc-excess panel impossible to read. Maybe enlarge (or add enlarged version in supplement?)

Fig 4: panel a: typo in legend. Aimulations > simulations

L362: why can the storage volume of 0.2mm of the fast reservoir be explained with “because the underground river/conduit volume represents only a very small proportion of the porosity of the

entire aquifer". A huge conduit above the local groundwater level would have no storage in your model but take up quite some proportion of the subsurface, isn't it. Please explain

L391 (and on some more place). Why "unique". It is a situation we see more in e.g. large fissures/preferential flow paths in soil hydrology / subsurface hydrology, in urban area (mentioned later on in the article) etc. It is a normal situation that can be explained physically easily. Therefore, I do not see this as something "unique", but "distinct or characteristic"

Fig 9: negative sign missing in lower part plot

L459: is the low connectivity due to low storage or due to low hydraulic gradients (in unsaturated subsurface)?

L464: here I agree, the low storage is not the driver, the hydraulic gradients are the driver and storage can be a useful index for it in lumped conceptual modelling. I would suggest to say hydraulic gradients ((such as gradients in water levels are)

L468: also here: Unique? Replace by 'distinct/characteristic'

L472: Suggest to add preferential flow in large fissures, cracks in soil hydrology

L488: "release younger water"? The fast system cannot hold on to the water, so how does it release it?

L491: Typo Jasecho

Thom Bogaard

Delft University of Technology

The Netherlands