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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Process-based karst modelling to relate hydrodynamic and hydrochemical characteristics to system properties" *by* A. Hartmann et al.

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We thank anonymous referee #2 for the valuable review. According to her/his general comments, we will improve the terminology to make the manuscript more accessible for readers with a hydrogeological background. This will also include the consistent usage of the same terminology throughout all the sections. Indeed, the attempt to regionalize the system signatures failed with the climatic and topographic descriptors that we used, and there is not much knowledge to be drawn from this part of the study (which was also criticized by referee #1). We will therefore remove this part from the study and expand the discussion with an elaboration of possibilities to transfer the system signatures and

of the minimum number of karst systems that should be available. Furthermore, figure 6 will be removed from the text and added as supplemental material. Finally, the text will be proof-read by a native speaker to check its correctness of language.

In the following we will provide our suggested modifications according to the specific review comments:

1. We want to thank referee #2 for the literature suggestions that are indeed more appropriate to elaborate applications of distributed karst models. The reference Geyer et al. (2007) will be replace by Hill et al. (2010) and Birk et al. (2005).

2. Adding a full model description to the manuscript will obviously make it more stand-alone. If referee #2 agrees, the appendix will be extended to include a full description of the model. This will also include a clarification that the model is a special type of lumped model that considers spatial variability not directly, but through distribution functions of the model parameters. Furthermore the way to refer to the "compartment" structure of the model will clearly be defined at the beginning and used consistently throughout the remaining text.

3. We will add more information about the calculation of the first and total order sensitivities, including some of the most important equations of the method.

4. The word "detected" is admittedly chosen inappropriately. It will be exchanged by "explored".

5. Commonly, sensitivity analysis is used to explore the sensitiveness of the parameters on a certain measure of simulation performance, i.e. in our case X=parameter and Y=signature. This was expressed wrongly at some parts at the manuscript as correctly pointed out by referee #2. We will correct all those misleading expressions. In addition, the manuscript will be modified in a way that the possible sensitiveness of a parameter on a certain signature is only appearing in the discussion, while the results will only refer to the values of the sensitivity indices.

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6. We will update the whole subsection 5.2 to be more precise in terms of the description of the processes and hydrogeological expressions.

7. The equations for the groundwater in the model are not based on Darcy's equation but rather on a simple assumption of linearity, which is expressed by the storage constants. The parameter aGW represents the distribution of the storage constants (which will be elaborated in the appendix according to comment 2). SHF and SMF can be used to approximate this distribution. If assuming that the storage constant represents all geometric, topographic and hydraulic characteristics of the aquifer, then aGW expresses also their variability. But referee #2 is right: with the currently available information, it is not possible to extract only the hydraulic conductivities from the storage constants and we will correct this part of the discussion accordingly.

8. Please see our general reply at the top.

References

Birk, S., Geyer, T., Liedl, R., Sauter, M., 2005. Process-Based Interpretation of Tracer Tests in Carbonate Aquifers. Ground Water, 43: 381-388. Geyer, T., Birk, S., Licha, T., Liedl, R., Sauter, M., 2007. Multitracer Test Approach to Characterize Reactive Transport in Karst Aquifers. Ground Water, 45(1): 36-45. Hill, M.E., Stewart, M.T., Martin, A., 2010. Evaluation of the MODFLOW-2005 Conduit Flow Process. Ground Water, 48(4): 549-559.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 2835, 2013.