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Discussions

Interactive comment on "Reducing the ambiguity of karst aquifer models by pattern matching of flow and transport on catchment scale" *by* S. Oehlmann et al.

Anonymous Referee #3

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In their submitted manuscript Oehlmann et al. apply a steady state groundwater model on the well-studied karst spring "Gallusquelle" in Southwest Germany. Adding solute transport equations they enable their model to simulate the breakthrough curves of two tracer experiments that were performed during recession conditions. They select 5 model setup scenarios each of them representing a different parameterization of the model. By varying the most relevant parameters for each scenario they show that considering separately hydraulic head, spring discharge and tracer breakthrough observations allows for reducing model parameter ambiguity. They finally show that 3 of the 5 scenarios can be discarded while 2 of them can be regarded as best representation of

the simulated karst system.

In general, this paper is worth to be published in HESS. It is written in a clear way, its analysis is well explained, and its results are plausible. But there are some important flaws that have to be taken care of before:

1. The introduction lacks a proper overview about (karst) simulation approaches, most importantly missing recent karst studies that already used transport equations and multi-objective calibration to reduce model equifinality/ambiguity (which should be picked up in the discussion again).

2. The assumption of steady flow in a karst system is only valid for lowflow/recession periods consequently making this analysis and its conclusion only valid for such conditions. During rainfall events, when concentrated infiltration and recharge initiate the optimum parameters may change completely. This should be pointed out more clearly in the discussion.

3. The analysis of parameter values and the influence of their variation on the multi-objective model performance do not take in account parameter interactions. However, parameter interactions of hydrological models, even with much lower numbers of parameters, have shown to be highly important. Varying only 1 or 2 parameters of a model as presented here could be completely be compensated by varying other model parameters simultaneously. The local type of sensitivity analysis presented her cannot consider this effect.

4. Pointing out the realism of the parameters in subsection 5.1 makes this study still strong but I recommend either to perform a regional or global sensitivity analysis (e.g. Sobol's method) or to relax the conclusions drawn from subsection 5.2 and the respective analysis significantly.

For more detailed elaboration please refer to the attached commented pdf of the manuscript.

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Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/11/C3552/2014/hessd-11-C3552-2014-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 9281, 2014.