

## ***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 #4**

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This manuscript develops a physically based model for a large karst catchment and calibrates the model to observed discharges, head values, and tracer transport times. I think this is the first time that such a model has been published, and it represents an ambitious attempt to approach the difficult problem of calibrating karst flow models to real work aquifers. However, I also think that the manuscript is often overreaching in its general conclusions. In addition, the physical explanations of the model or results often are confusing or seem to be in error (see example cases below). Additionally, the literature review seems quite focused on results from this particular research group and could benefit from more broad citation and discussion of the work of others (some

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suggestions given below).

Major points:

1. Many of the general conclusions about the properties of the aquifer overreach what can realistically be determined by such a small set of simulations. As an example, the authors conclude that the volume of the conduits must be within a certain range. However, the parameter space for conduit properties is very large, because their position, size, and connectivity must be determined. The simulation sets presented only sample this space very sparsely. Therefore, it is not clear to me that such general conclusions can be made. Similarly, conclusions about karst model calibration, such as the statement that “this study demonstrates that for a steady-state  $\dot{C}_w$  the hydraulic conductivities of the  $\dot{A}_s$  matrix can practically be calibrated independently of the conduit parameters,” also seem suspect given how little of the parameter space has been explored.
2. In a number of places in the manuscript physical explanations are confusing or in error. For example, on page 9289 they state that the transport equation is multiplied conduit cross-section, but multiplying the equation by a constant factor would have no effect. What is meant here? The authors also describe on page 9295 that, “While the  $\dot{C}_w$  cross-section gradually grows with time, the surface-volume ratio increases as well leading to a higher roughness, further enhanced by exchange processes between the individual conduits.” Surface-volume ratio should decrease with increasing cross-section. It is completely unclear to me why higher roughness would be expected for larger cross-sections. The reasoning here is at least confusing and possibly incorrect. On page 9298 the discussion of dissolution under turbulent flow is incorrect. The diffusion boundary layer is not only present under turbulent conditions, but is also actually what would produce differences in dissolution rate due to differences in flow velocity.
3. The introduction and discussion are lacking in their discussion of relevant literature and how this work relates to the work of others. For example, similar work on identifying

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conduit properties from flow and transport has been conducted by Saller et al. 2013, Hartmann et al. 2013, and Luhmann et al. 2012, just to name a few. A more thorough literature search and discussion is required.

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