Hydrol. Earth Syst. Sci. Discuss., 10, C4672–C4674, 2013
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Interactive Comment

Interactive comment on "Influence of aquifer heterogeneity on karst hydraulics and catchment delineation employing distributive modeling approaches" *by* S. Oehlmann et al.

J. West (Referee)

L.J.West@leeds.ac.uk

Received and published: 5 September 2013

The authors report numerical simulations of flow in a karst aquifer in order to investigate the influence of permeable faults and conduits on the flow pattern, and spring catchment delineation. The work demonstrates the importance of including information on conduit position and geometry – specifically the fact that conduits tend to increase in size and permeability moving down the flow direction – in order to correctly simulate hydraulic gradients and catchments in karst systems. The work is of good quality and the subject matter is suitable for publication in HESS. However, addressing the following points will improve the manuscript and clarify the contribution of the work reported:

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1. The simulations are steady-state, which means that they won't reproduce effects such as seasonal variations in catchment areas and flow pattern. The reader needs to know a little more about the extent of seasonal variations in the system to evaluate the work. To this end, authors should briefly describe the ranges of hydraulic head variation in their observation wells during the period over which averaging was undertaken as well as the typical seasonal variation in effective rainfall. They should then comment on the likely impact such of seasonal variation on the spring catchment areas identified in Fig 5 (d) and (e).

2. Authors should report a little more detail on the (hydro)geological characteristics of their aquifer, for example, matrix porosity and permeability measurements, and the pattern of discontinuities such as joints and bedding planes (e.g. spacing, orientation data, from boreholes or outcrop). The authors suggest matrix permeability values are low compared to those obtained from calibration (Km in Table 1), so the latter reflect the smaller scale discontinuity network. It would therefore be useful to know the observed characteristics of this network, if any are available.

3. The assumption of a single conduit depth corresponding to the modelled water table depth in scenario 1 seems odd, given the unrealistic nature of this homogeneous-permeability scenario (p 9036 line 6), and seems to create some problems. Why not use the actual (seasonal averaged) water table depths from Fig 5a instead?

4. As mentioned by the previous reviewer there is currently not sufficient information given about the goodness of the calibration, with only the overall RMSE reported. Ideally the head calibration targets (observation wells) should be shown on Fig 5, and calibration target errors specified and reported for both head and spring flow calibration targets. This will allow the reader to better evaluate the fits produced by the modelling scenarios.

Technical corrections: line 24 p9033 – theoretical distance of hydraulic head difference should be b' (b-prime) as in eqn (5) rather than L?

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Page 9037 line 2 and Table 1. Please explain how the calibration parameter recharge R = 1mm/d was derived (presumably this is a long-term seasonal average?)

Page 9043 line 6. The text 'In scenario 3. . .strange shape of the areas is caused by early filling of the conduits with water' makes no sense as this is a steady-state simulation? Please reword.

Page 9043 line 20 Text 'Gallusquelle Spring drains nearly all water from the springs at the river Fehla' – do you mean that it drains water from the conduits feeding into these smaller springs?

Fig 4 – please label the fault zones (as mentioned in the text p98035 line 15) on these cross sections. Also suggest that you show the seasonally averaged water table elevations. Fig 6 – add units for the 'y' axis

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 9027, 2013.

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