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Hydrology and Earth System Sciences Discussions

Interactive comment on "Influence of aquifer and streambed heterogeneity on the distribution of groundwater discharge" *by* E. Kalbus et al.

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General Comments: The paper represents an interesting approach to quantify the impact of streambed and aquifer heterogeneity on the pattern of groundwater fluxes. The temporal and spatial pattern of exchange fluxes and its controlling parameters/processes and scale dependencies are still poorly understood and usually not included in attempts of modelling coupled aquifer-stream systems. The content of this paper is of great interest to the scientific community as well as practitioners and regulators and well within the scope of this journal. The work presented in this paper is based on previous experimental and model based studies. It is generally well written in a rather brief but mostly concise style. I recommend to undertake a minor revision

of the manuscript in order to improve its structure and take care of some minor irregularities that are mentioned in more detail below.

The introduction gives and overview of previous and recent work in the field but doesn't really explain the necessity for the presented work. I suggest to work out the research gaps a bit clearer and how this work is meant to address them. Furthermore it appears to be not clear to me where the according to the definition of the authors the aquifer stops and the streambed starts in the conceptual model? What information, data are justifying the assumptions made in the conceptual model? The first two paragraphs of the Background section refer to old results from the study side - it is not always clear why this is needed in such detail. I would suggest to better set the scene here and to restructure and explain the field side, experimental methods and modelling approaches. The scenarios themselves are well explained, however, it is not explained why this particular specific scenarios have been chosen - can you please provide a bit more background information. The conclusions could be broadened up a bit, including one or two sentences about the wider implications of the findings for instance for pollutant transport and biogeochemical modelling.

Specific Remarks:

2200 4-8: Please reformulate or cut out this sentence - As it stands (results of a previous study) it doesn't belong into the abstract.

2200 8: It appears to be not clear how the scenarios are based on the model results? Please specify.

2200 9: To quantify the impact of aquifer and streambed heterogeneity?

2200 18-21: That sentence could do with a bit of rephrasing to make it easier to understand.

2200 21: I would suggest to formulate it as: The representation of heterogeneous distributions of aquifer and streambed properties in the model has been proven to be

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beneficial for the accuracy of xyz simulations

2201 23: spatial exchange pattern

2203 8: Please specify what the "flow and temperature boundary conditions" are. Furthermore, subsurface permeability is not necessarily constant in time - you may have temporally variable clogging effects and seasonal impact of vegetation - or can this be excluded for the investigated stream reach?

2203 16-22: Are these old data or new? More explanation needed here.

2203 23ff: What about colmation processes and siltation around emerging macrophytes?

2204 2: I would call it potential influence as it is a hypothetical scenario based investigation.

2204 25: What is the background for the representation / delineation of the streambed by a 60cm layer and not more or less? This sounds rather arbitrary?

2204: Model set-up etc: As this paper represents a hypothetical modelling experiment - why did you decide to use a real world case study?

2205 1ff: Lots of assumptions made on model parameterisation and boundaries - more information needed how these assumptions are justified.

2207 3: I would suggest to reformulate into something like: ....result in relatively uniform spatial pattern of fluxes ranging around average values

2207 6: suggest replacing "eliminate" by "reduce" as well as: "This case will never..." into "it is highly unlikely that...."

2207 15: One could argue that even for large-scale applications such simplified assumptions are resulting in low prediction accuracies and thus are not optimal

2207 28: Again - I would never say never....

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2208 2/3: At least not due to the considered ranges and patterns.

2209 24: I wouldn't formulate this as a recommendation but rather say that it might be appropriate for large scales (considering that also at that scale there are more advanced approaches based for instance on geo-statistical representations of spatial pattern etc)

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