

Interactive comment on “Mass transfer effects in 2-D dual-permeability modeling of field preferential bromide leaching with drain effluent” by H. H. Gerke et al.

Anonymous Referee #3

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General comments: The objective of the paper is to review and to analyze the importance of mass transfer between the soil matrix and fracture volumes on total Br-leaching from a drained experimental field. The objective fits well within the scope of HESSD. Data of the Bokhorst experimental field and the dual-permeability model 2D-DPERM were used. The authors tried to accomplish the objective by comparing four values (called scenarios) of mass transfer rate coefficients. The remaining parametrization and data for validation were taken from previous work (Köhne and Gerke 2005, Gerke et al. 2007). My main critic is that a comparison of four values of transfer rate coefficients is far too less to assess the sensitivity and importance of one

parameter in a multi-parameter model. It is well known that parameter values interact in a multi-parameter model and that several parametrization can give equally good results (Beven, 2006). I suggest extending the study including a range and distribution of the transfer rate coefficients, bottom boundary conditions, initial relative volume of fracture and soil matrix pores and other transfer parameters the authors expect to be relevant, with limits of acceptance for the model simulations. Moreover, I find that it can not be excluded that the results are biased by the initialization assumption that all bromide infiltrated in the soil matrix. The authors state that they use ‘this somewhat hypothetical split in bromide influx’ P 5931 L26-29 to demonstrate more clearly the importance of transfer coefficients. I find this assumption might be misleading; some importance might be given to transfer, while in reality bromide was infiltrated both in the fracture and soil matrix volumes. The overall impression of the manuscript is rather weak. The title, objectives and conclusions need to be formulated more concise and precise. The conclusion section is rather more a summary. The structure of the text needs to be improved; results of previous work should be evaluated in introduction or discussion, not in materials and methods. A reader can’t get a sufficient overview of the work and conclusions by reading the abstract alone. The language is unnecessary complex with many long sentences in the introduction and many redundant words. The model and the dataset itself are both of the high quality the authors presented in earlier work. This work could be innovative and a major contribution towards understanding of the importance of transfer coefficients after a major revision and extension. I recommend a major revision including a large extension of the sensitivity analysis of the parameters of the mass transfer. It might be eligible to withdraw the manuscript and resubmit after the revision as the revision needed is so comprehensive. Beven, K.J., (2006). A manifesto for the equifinality thesis. *Journal of Hydrology* 320, p.18–36

Specific comments: Title: needs to be formulated more precisely in accordance with reformulation of objectives; f.i. A sensitivity analysis of mass transfer for bromide leaching from a drained field – a dual-permeability modeling approach or.. Two-dimensional modeling of preferential transport of bromide from a drained field
Abstract: The objec-

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tive given in abstract P5918 L6-8 is not the same as in Introduction P5922 L20-22. A review of mass transfer reductions is not given. The relation between soil-structure and transfer coefficients is in the manuscript poorly demonstrated. A reader would much easier distinguish between what is related to the presented study and what to previous published work, if the authors had used the past tense for the presented study. Please, use consistently past tense in the whole manuscript for all related to the presented study.

Introduction Discuss more specific transfer coefficients in relation to soil type and structural properties Subsurface drains -> drains from second time onwards. P 5919 L14-19 unnecessary complex. Furthermore, the quality of ground- and surface waters is significantly affected by preferential transport of nitrogen and phosphorous from drained agricultural fields (ref.). P 5919 L29- P5920 L5 and P5922 L2-L6. Reformulate and/or split in two sentences. P5922 L26 'stepwise model calibration' Do you mean 'stepwise aggregation of model estimates to field scale'. I got the impression that most of model calibration was done in previous work. It says so in the materials and methods P5927 L20 and in the result section P5934.

P5923 L16 the site ... before. When was that? Any risk for contamination? P5923 L16-27 and P5929 L9-18. I found it several times hard to grasp what is related to the present and what to previous studies. Move discussion of previous studies to introduction or discussion, and present in Materials and Methods only information used in presented study. Then, all redundant expressions like 'here' and 'in this study' can be skipped. P5924 L 9 then -> 25 March 1997? Not clear. L21 For the analysis, the soil is considered-> The soil was considered Use consistently '2D' like in in the model name 2D-DPERM., don't mix 2-D and 2D- P5929 Mass transfer: Introduce scenarios more properly. I got the impression that only one value was used reading it the first time. The transfer term parameters were adopted... -> the range/scenarios/distributions of transfer terms were adapted ... L9-18 see above. L10-L12 not useful 'for what'? Were the macropores not earlier emptied that the matrix pores after irrigation? Why should

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not ponded water infiltrate in the macropores?

P5933 L15-16 skip, belongs to M&M L 20 and onwards Use past tense P 5935 L11-12 reformulate P5936 L2 towards PF domain -> towards SM domain? P5940 L16-L21 belongs to M&M, relation to local scale soil structures not properly proved, just stated. P5941 L6-7 Which soil type and structure has the soil studied by Haws and Rao? und-> and P4942 L5-7 reformulate, something is missing P5944 The conclusions section is rather a summary than conclusions. The conclusions of the study need to be formulated more concise and precise. 5944 L11-21 Can be skipped, L21-27 Results might be biased by assumption that all bromide infiltrates in soil matrix.

Fig 4. Add PF – and SM- model simulations at field scale. Remove plot scale simulations. It is of importance to know whether the base flow is systematically overestimated or not. Fig 7. The simulated cumulative bromide leading for the different scenarios as presented in Fig 7. will probably look different when taking away the assumption of bromide infiltrating in SM pore systems only. Still, from the presented comparison between scenarios and measurements, it looks like the scenario highest fits best as long as the soil is wet and the scenarios lowest and low best for the drier soil. Is it worth to test a hypothesis in which α_{ss} is depending of h ? However, the assumption for infiltration needs first to be adjusted. Otherwise, the fit might improve for the wrong reason.

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