Hydrology and Earth System Sciences Discussions

Interactive comment on "A novel explicit approach to model bromide and pesticide transport in soils containing macropores" *by* J. Klaus and E. Zehe

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First we would like to thank Mr. Coppola for his detailed and helpful review and that he outlined some additional points for the discussion on solute transport.

We can not completely share the interpretation that the generally good agreement of simulated and observed bromide transport is ascribed by the relatively good description of the curve tails. It is one reason, but we want to underline that also the concentration peak at 200 min, that falls together with the main discharge peak is reproduce in a good way. Nevertheless, it is right that the good match in the tail of the solute concentrations may be attributed to the residual solute mass leaving the system with the declining hydrograph, and the convective water transport.

We appreciate that a more complex model structure would possible allow us to capture the first flush of Bromide, which is not captured with our approach. We will discuss this in the revised manuscript. However, a more complex model approach would mean to include more parameters that are possibly purely identifiable.

Mr. Coppola is right that the solute transport is mainly transported in terms of water convection, and other local factors are weakly represented. E.g. subsurface mobilisation of soil water is represented poor. He compared our results with results from outflow experiments of soil columns, where the characterisation of soil hydraulic conductivity can not only rely on the outflow information. He suggested including a discussion about the different solute transport mechanisms in the paper especially compared to the mechanisms represented by the model. We think this is a very good idea to provide additional reasons for the limitations in the transport modelling. In a revised version we will add such a discussion.

Mr. Coppola asked why we did not use the information about the 25 TDR probes to describe field heterogeneity of soil moisture. Please note that TDR observations here just yield a vertical average across the upper 30 cm and no information about the deeper subsurface. The main reason is the difficulty to use 25 point measurements on 30*30 m^2 the 2D moisture parallel to the hillslope slope line. We could of course characterise the data be means of geo statistics (mean, variance, variogram) generate initial soil moisture patterns by means of turning bands. The difficulty here is how to condition these simulations to the observed values at the measurement locations which are spread across the site (3d surface with a 2 d model). This could easily be achieved within a 3 D model, but is not straight forward with our 2D model. As the scope of our study was clearly on equifinality of the model structure, especially the flow path network (worm burrows and tile drain) and not so much on the effect of initial conditions we preferred a simple characterisation of the initial state. Nevertheless, as outline in the response on review#1 the 25TDR probes supply data on the initial conditions of the wet case of the hillslope soil moisture.

Further we change the notation of the n in the van Genuchten and Freundlich equation and describe the Freundlich parameter n now by the parameter β.

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