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Hydrology and Earth System Sciences Discussions

Interactive comment on "Transport at basin scales: 1. Theoretical framework" *by* A. Rinaldo et al.

A. Rinaldo et al.

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Reply to Referee #4

All authors feel they have to thank this reviewer for his thorough review work and the interest in the paper.

Detailed answers to the comments by Referee #4 are included below.

> *After eq. (1) it would be helpful to comment a bit on porosity changes along the flow paths.*

In order to obtain the result of eq. (2), we have assumed that the porosity does not change along the flow paths. The revised manuscript expands a little on the subject.

, noticing that current transport theories through heterogeneous formations assume constant porosity.

> *On p. 1617 it is said that dispersion terms are not space-dependent. Please indicate more clearly that this statement is most likely not intended to refer to the "classical" notation of dispersion tensors used in the Eulerian framework, which is mentioned just two lines before.*

In the revised version of the paper the statement: "Mathematically, dispersion terms are generally anisotropic and time-dependent but not space-dependent." has been removed for brevity and because is out of the scope of our discussion at this point of the paper. We fully realize that the space dependency is a can of worms, well outside the interest of basin-scale, nonpoint source transport.

> *After eq. (8) the two terms on the right-hand of this equation seem to be mixed up in the explanation.*

True. Eq. (8) and the following explanation have been rearranged in order to avoid confusion. We feel grateful to the reviewer for pointing this out.

> *4. From Figs. 1 and 2 and also from the notation used for paths on p. 1632 I got the impression that all rain water which is arriving in area A_i has to pass through the entire channel c_i according to the concept used. In reality, only part of the water will do so, while the rest will only pass through some downstream part of the channel. Please comment whether this effect could be significant or not..*

Thorough observation which refers to an issue which was neglected in the writing of the earlier version of the manuscript but is well known from the literature. We have

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used the convolution of an exponential (portraying residence time distributions) and an inverse gaussian distribution (portraying residence times within the entire length of the reach). This is known (Lindgren et al., WRR, 2004) to produce results practically equivalent, via a suitable calibration, to the randomization of the site where the i-th overland path reaches the channel in a general convolution scheme. We have suitably modified the text to acknowledge this fact but maintain our assumption.

All other technical correction proposed have been met in the revised version, and need no comment.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 1613, 2005.