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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.

Anonymous Referee #4

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General comments:

This paper belongs to a set of two, which are devoted to flow and solute transport modelling at the basin scale. The first paper provides the theoretical background and two examples, which are kept simple by intention, while the second presents a comprehensive application of the developed theory to a basin which discharges towards the Venice lagoon. This splitting in two parts is justified due to the large amount of material covered.

The "theoretical" paper to be discussed here contains a thorough presentation of the Lagrangian approach which can be favourably used in order to efficiently handle large-scale flow and transport problems. The corresponding travel-time based concept allows to straightforwardly employ contact times between mobile and immobile phases in order to quantify non-inert solute transport.

The paper is well written and the authors present the theory needed for their approach in a versatile manner. The topic is of high interest in the hydrosciences as catchment-scale and basin-scale problems receive increasing attention concerning water quantity and water quality issues. The paper represents an important fundamental contribution to these issues and, therefore, certainly deserves publication. I am recommending minor revision of the manuscript according to some suggestions / questions outlined below.

Specific comments:

1. After eq. (1) it would be helpful to comment a bit on porosity changes along the flow paths.
2. 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.
3. After eq. (8) the two terms on the right-hand of this equation seem to be mixed up in the explanation.
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.

Technical corrections:

1. p. 1615: l. 23: "use" instead of "uses"

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2. p. 1617, l. 5: “Fokker-Planck” instead of “Fokker-Planck’s”
3. p. 1617, l. 26: Please add subscript “w” to “Q”.
4. p. 1621, l. 4: “van Genuchten” instead of “Van Genuchten”
5. p. 1621, l. 16: “relation” instead of “position”?
6. p. 1622, l. 9/10: “According to” instead of “Accordingly with”
7. p. 1630, l. 10: skip “a”
8. p. 1633, l. 3: “a usual . . . ” instead of “an usual . . . ”

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