Hydrol. Earth Syst. Sci. Discuss., 5, S897–S900, 2008
www.hydrol-earth-syst-sci-discuss.net/5/S897/2008/

Hydrology and Earth System Sciences Discussions

HESSD

5, S897–S900, 2008

Interactive Comment

Interactive comment on "Lateral inflow into the hyporheic zone tested by a laboratory model" *by* P. Y. Chou and G. Wyseure

Anonymous Referee #1

Received and published: 8 August 2008

This paper presents a laboratory J-shaped column experiment to determine the transport parameters such as pore water velocity and dispersivity. HYDRUS 2D/3D is used as a numerical tool to analyze the experimental results. Although the outcomes of the paper are beneficial, I have a number of comments which need to be addressed and clarified which will improve the paper significantly.

1. The authors claim that the experiment discussed in the paper simulates lateral groundwater flow by means of taking into account the "hyporheic zone". The hyporheic zone is defined as a porous area which connects stream water and subsurface water. Water moves from the main channel, flows through the hyporheic zone and returns to the main channel. In the experiment, part of the J-column is referred as the hyporheic zone which in my opinion cannot be referred as a hyporheic zone according to this

definition. Furthermore, the classical advection dispersion equation (equation (1) in the paper) cannot simulate the observed concentrations in a stream-aquifer system which includes a hyporheic zone. Therefore, there exist a number of mathematical models in the literature which are developed to be able to represent the observed concentrations for such areas. One of the commonly used mathematical model is called the Transient Storage Model (TSM) developed by Bencala and Walters (1983). Both in TSM and in other models, the governing equation which gives the concentration, is different than the classical advection dispersion equation. Therefore, the classical advection dispersion equation should not be used to analyze the results of an experiment which includes the hyporheic zone. However, in this paper, the results of the experiment are analyzed by using the classical advection dispersion equation. Consequently, this J-column experiment and the outcomes of this paper cannot be valid for the hyporheic zone. The results rather indicate the relation among flux, dispersivity and pore water velocity in the saturated vs. unsaturated zone. The linkage between the hyporheic zone and this study might be that the outcomes of this paper should be taken into consideration when working on a hyporheic zone region.

2. Following the first comment, I would suggest to re-write some parts of the paper by carefully re-defining the objectives and discussing the outcomes accordingly. Also, the linkage between individual studies done in the literature is not discussed and explained. Thus, the literature review in the introduction section should be re-written so that it will lead the readers to an understanding of the aims of the manuscript.

3. For a better understanding of the hyporheic zone and transient storage models, I would suggest to go over the following references:

Bencala, K.E., Walters, R.A., 1983,"Simulation of solute transport in a mountain pool-and-riffle stream - a transient storage model", Water Resources Research, 19(3): 718-724.

Bencala, K.E., 1983, "Simulation of solute transport in a mountain pool-and-riffle stream with a kinetic mass-transfer model for sorption", Water Resources Research, 19(3): 732-738.

Packman, A.I., Bencala, K.E., 2000, "Modeling surface-subsurface hydrologic interactions", in Streams and Ground Waters, Jones, J.B., Mulholland, P.J., Published by Academic Press, San Diego, CA, pp. 45-80.

Winter, T.C., Harvey, J.W., Franke, O.L., Alley, W.M., 1998, "Ground water and surface water as a single resource", U.S. Geological Survey Circular 1139.

4. Page 1569, line 20: In the introduction section, it is stated that the exchange in the hyporheic zone is assumed to be governed by flow-induced pressure differences over the riverbed. This assumption is made in a study by Elliott and Brooks (1997). In order to give the complete picture about TSM to the reader, other assumptions made in other studies should also be included, i.e., the mass transport between the channel and the storage zone occurs due to the concentration gradient (Bencala and Walters 1983); mass transport between the channel and storage zone occurs due to the mass flux (Kazezyilmaz-Alhan and Medina, 2006).

Elliott, A.H., Brooks, N.H., Transfer of nonsorbing solutes to a streambed with bed forms: Theory, Water Resources Research, Vol.33, Is.1, 1997, pp. 123-136.

Elliott, A.H., Brooks, N.H., Transfer of nonsorbing solutes to a streambed with bed forms: Laboratory experiments, Water Resources Research, Vol. 33, Is.1, 1997, pp. 137-151.

5. Page 1573, equation (6)-(10): The equation (10) which is given as the solution of the advection-dispersion equation subject to initial and boundary conditions given in equation (6)-(8), has only time variable whereas the governing equation and initial and boundary conditions have also space variable which makes the solution inconsistent with the problem. Further, the response concentration Cr and Cr,est are not clearly explained. Please clarify this issue in the paper.

HESSD

5, S897–S900, 2008

Interactive Comment

6. Page 1573: The symbol Rf in equation (10) is not defined. In equation (9), the symbol inside the Laplace operator should be L[f(t)]. Line 17 reads "The impulse response in time domain becomes...". I think this should be the pulse response according to the boundary condition given in equation (7).

7. Page 1576, section 3.3: It is not clear to me the identification of the beginning and the end of the response: How do you define the minimum slope for the start or the maximum duration to determine the end of the response? Please clarify this part of the section.

8. Page 1576, line 17:" The equation (8) as described by Mojid et al...". I believe this should be equation (10).

9. Page 1578, line 13: "Figure 2 illustrates an example of an excellent...good fit". I would recommend weakening this statement (and the caption of Figure 2a) a little bit by replacing "excellent" with "good" as I do not see an excellent fit in Figure 2a especially in the tail portion of the curve.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 1567, 2008.