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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Analytical and Numerical Solutions of Radially Symmetric Aquifer Thermal Energy Storage Problems" *by* Zerihun K. Birhanu et al.

Anonymous Referee #1

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Review

General comment The authors proposed similarity solutions for equilibrium transport problems in 1-D and 2-D and numerical scheme for non-equilibrium transport problems. However, the model considered in the study is lack of innovation and too simple to represent the real problems. First, the exact analytical solutions for 1-D and 2-D (radial) problems are well known in many literatures. Actually, Yang et al. (2010) have already given a semi-analytical solution for the 3-D problem (radial and vertical directions) with the heat conduction to the overlying and underlying layers in consideration for ATES system. Second, since the exact solution exists, I do not see the necessity

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to propose the similarity solution that deviates too much from the exact solution as shown in Figure (1); Third, no field data support the findings of numerical experiments and the importance of non-equilibrium model solved numerically is not demonstrated. Therefore, I recommend to reject this manuscript.

Minor comment (1) For equation (28), the boundary condition at far side should be x->∞ instead of t-> ∞ (2) For equation (31), why propose a similarity solution that is inaccurate compared with the given exact solution? In addition, Figure (1) compares the exact solution with the similarity solution for 1-D problem. How about the accuracy of the similarity solution for 2-D problem? It's better to compare the similarity solution with the exact solution considering the obvious difference in 1-D case. (3) For figures with 2 or more subplots, it might be better to put letters (a,b,c. . .) or numbers (1,2,3..) in front of the subtitle of each subplot to help us understand the sequence of these plots. (4) On page 12 line 22, the meaning of the operation for each time interval is not clear. (5) On page 15 line 61, me->be. (6) On page 17 line 3, provide-> serve as

Reference: Yang, S.-Y., Yeh, H.-D. and Li, K.-Y. (2010), Modelling transient temperature distribution for injecting hot water through a well to an aquifer thermal energy storage system. Geophysical Journal International, 183: 237–251. doi:10.1111/j.1365-246X.2010.04733.x

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