**Hydrology and
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Interactive
Comment

Interactive comment on "Stochastic analysis of field-scale heat advection in heterogeneous aquifers" *by* C.-M. Chang and H.-D. Yeh

Anonymous Referee #2

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This paper uses the stochastic theory to analyse the advection-dispersion equation (ADE) written for temperature. The procedure is well established for solute transport and, as such, its application to heat transport is not novel considering the well-known analogy between the solute and thermal ADE.

What could make this paper interesting, but is not discussed, is a thorough evaluation of how the different transport rates for solutes and heat may affect macro-dispersion: Heat diffuses about 100 times faster than solutes while heat is advected, roughly speaking, at the Darcy velocity but solutes at the pore velocity (see, for example, the discussion of the thermal retardation factor in Bodvarson, 1972, Geothermics, Vol. 1). This behaviour affects macro-dispersion: For example, Geiger & Emmanuel (Water Resources

Research, 2010) showed that the concept of macro-dispersion can also break down for heat transport in heterogeneous fractured porous media, leading to "non-Fourier" transport (in analogy to non-Fickian transport) but this is less likely than for solute transport due to the different transport rates for heat and solute.

Finally, I am also missing a discussion of the range of validity of this analysis because, strictly speaking, heat transport is a non-linear problem as density and viscosity change with changing temperature, which again changes the advective velocity and dispersion tensor.

In summary, I am afraid that my recommendation is to reject the paper: it's content, while correct and well presented, is simply not novel enough to warrant publication.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 10311, 2011.

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