Hydrology and Earth System Sciences Discussions

Interactive comment on "Sand box experiments to evaluate the influence of subsurface temperature probe design on temperature based water flux calculation" *by* M. Munz et al.

Anonymous Referee #2

Received and published: 8 September 2011

The paper is generally well written. Authors start with precise questions to answer and prepare in a proper way the experiment devoted to the investigation of an interesting topic as the use of heat as natural tracer for water subsurface movements in sediment. Nevertheless, even if the set-up avoids one of the main source of error, the presence of non-vertical flows, the amount of problems to overcome in order to have reliable temperature data remains big, and I am personally a bit skeptical about the applicability of this technique in a river streambed. By the way the Authors carefully analyzed all the problems and tried to provide answers to all the unclear points in the data interpretation. The description of the experimental apparatus is detailed and direct to understand.

Concerning the results: - Are you sure about the variations of hydraulic conductivity with Temperature? Could you provide one reference showing this kind of effect? - You attribute the lack of significance of higher upward fluxes to the oscillating tap water temperature. Did You check this fact? And did You cross check with any probe the temperature of the sediment surrounding the bucket in order to exclude other kind of effects (what about rain)? You should say something more. - At Pag. 6171 You state the utility of some "preliminary calculations for selecting measurements depths and frequencies". Did you do them? How did you choose the depths for the probes? If possible, justify the choice of the depths. -You state that the MLTS seems to be the more accurate. But this installation would probably not be effective in presence of horizontal flows. What is then its practical use?

- I am pretty sure that it is possible to simulate your experiment with any numerical solver for the coupled equations of heat and liquid water propagation in porous media (e.g. Hydrus-1D). Did You try to do this? It could be helpful for You for data interpretation, since You would be able to match your results with an ideal (numerical) case.

- I think also that You can try to correct for the thermal insulation of the piezometer in a rigorous way, applying analytical solutions of the heat equation in presence of a composite medium, with different thermal properties. Look for example in the Carslaw and Jaeger. Since the position of the probes is fixed inside the pipe, the correction could be very effective.

Curiosity: what about using temperature from optical fiber? You could use the fiber as 3D MLTS, accounting for horizontal flows as well.

Technical Corrections:

Pag. 6167, Sec. 2.5 line 25: assu"e"med Pag. 6169, Sec. 3.2 lines 19-20: (Fig. 2b) is referred to (Fig.2c) and vice-versa