Hydrol. Earth Syst. Sci. Discuss., 11, C3840–C3842, 2014
www.hydrol-earth-syst-sci-discuss.net/11/C3840/2014/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Limitations of fibre optic distributed temperature sensing for quantifying surface water groundwater interactions" *by* H. Roshan et al.

Anonymous Referee #2

Received and published: 17 September 2014

In this manuscript the authors aim to test the limitations of FO-DTS for quantifying surface water groundwater interactions. They do this with a flume experiment in which the cable lies on the bottom while groundwater with a known temperature is injected through small holes in the bottom of the flume. They test different flow ratios, different temperature differences between surface water and groundwater, differences between injecting hot or cold water and the effect a thin gravel layer has on the temperature response.

However, the authors show only measurements and add little analyses to them. For

example, the apparent temperature response depends of course on the temperature difference and flow rate ratio (NOT velocity ratio! (I agree with reviewer 1 on this point)), but also on the fact if the water is well mixed and, if that takes a while, the heat exchange with the surroundings. Suppose the water is well mixed and heat exchange with its surroundings in negligible, (and the surface water reaches a steady state temperature!) the limits of detection depends on the accuracy and noise of the measurements. With the 'propagation of errors' method (see e.g. Genereux, 1998) this can be easily calculated, but is missing in the manuscript.

Other uncertainties, besides these theoretical ones, come then from the circumstances of the experiment: mixing conditions, heat exchange with surrounding, is steady state reached or not, etc. To me it seems that steady state temperatures are barely reached (due to the large thermal mass of the pvc tube this may take some time) and, especially, the complete mixing assumption is not met. The latter can be easily seen from the dye tracer tests: the dye does not reach the top of pvc tube (if the tube is indeed the red coloured bar on the pictures). These are two important flaws of the experiment and should either be fixed or qualitatively(!) be analysed.

Another issue deals with how the results are presented. In many studies, the heat balance equation is used to determine the inflow of groundwater. It would therefore be useful if this theoretical groundwater flow would be compared with the actually injected groundwater flow. This would shed more light on the errors made with the heat balance equation.

Reference:
Genereux, D., 1998. Quantifying uncertainty in tracer-based hydrograph separations. Water Resour. Res. 34 (4), 915–919.