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

Anonymous Referee #1

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This paper attempts to use a flume setup to explore the utility of fiber-optic distributed temperature sensing (FO-DTS) for measuring surface water – groundwater interactions. Unfortunately, the experimental setup is fundamentally flawed and the results obtained have little resemblance to real world situations. There are two major problems in the setup –

1) Complete ignorance of thermal conduction of streambed (I am using stream-aquifer interactions as an example here). The setup does not consider the fact that as groundwater seeps into the stream, it will change its temperature dramatically along the flow path through thermal conduction, especially where it comes close to the top of the

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streambed. In other words, when groundwater finally exits the streambed to mix with stream water, its temperature will be very different from that of the source area. By "source area", I mean the region away from the streambed, where groundwater has a relatively constant temperature. So when the thermal conductivity of the streambed (i.e., the sediments between stream bottom and the "source area") is different, the temperature response of surface water – groundwater interactions will be different. In this paper, however, groundwater is directly injected into surface water without going through a streambed.

Yes, there was a special case where the authors put a layer of gravel on the bottom of flume, but that could not simulate the thermal conduction impacts of the streambed on seeping groundwater. The authors have to design the streambed in the injection section. They probably need to take into full account the different materials (silt, sand, gravel), and different depths (depth matters when thermal conduction is considered).

2) The use of the wrapped DTS cable on a PVC tube filled with gravel. In real world applications, people will typically lay straight DTS cable on the streambed, which has a very small thermal mass and does not affect the measured temperature of the water. In this paper, however, the wrapped DTS cable on a PVC tube filled with gravel adds a significant amount of thermal mass and this will inevitably have a major impact on the temperature measurement. It is thus questionable to directly relate the temperature measurement of this study to a typical DTS straight-cable deployment in the field. Another issue with the PVC tube is that it is a big continuous impermeable barrier and will probably affect the flow regime where the DTS temperature is measured, as compared to the case where you don't have such a barrier in the field.

The second comment can potentially be addressed by comparing the current results with a case you remove the PVC tube and deploy straight DTS cable and other miniature temperature probes.

I also have a comment about the authors' statement on the use of velocity ratio (lines

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5 to 9 on page 6). That statement is largely incorrect – for groundwater mixing with surface water, the total flow rate (i.e., Darcy's velocity) should be used, not the pore water velocity. So whether using a gravel layer or not (see the discussion on lines 1-5 on page 9) does not enhance "convection" – note that your probe is interacting with water coming out of the gravel layer (porosity does not really matter in this case).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 8167, 2014.