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Hydrology and Earth System Sciences Discussions

Interactive comment on "Investigating patterns and controls of groundwater up-welling in a lowland river by combining fibre-optic distributed temperature sensing with observations of vertical head gradients" *by* S. Krause et al.

Anonymous Referee #2

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General Comments

The manuscript presents an analysis of spatially variable groundwater contributions to a lowland river. By combining distributed temperature sensing of hyporheic zone water temperatures with local observations of vertical hydraulic gradients between groundwater and surface water the authors could distinguish vertical hydraulic gradients caused either by upwelling groundwater originating from regional groundwater gradients or by local heterogeneities of streambed conductivities.

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Interactive Discussion
Discussion Paper

The analysis presented in this paper is novel and will be a valuable contribution to the hydrological community. The manuscript is technically sound, the methods are fully described and the mathematical development is complete. Overall, the manuscript is well-written (reviewer 1 highlighted the importance of consistency already), but there are several points that require more clarification prior to publication.

As suggested by Reviewer 1 the authors should provide an analysis of losing stream conditions or at least discuss which phenomena they were able to observe in their data sets during the rainfall event at the end of July. How would you define the four CASES during losing conditions?

In Figure 1 the GW flow direction is indicated using gray arrows. When comparing the locations where upwelling groundwater was actually observed (CASES 1 and 4: P 1,2,3,4,8,12,25,26,27) with the groundwater flow direction in Figure 1, it seems, that groundwater is up-welling more or less perpendicular to the groundwater flow direction. The insertion of groundwater iso-lines in Figure 1 could help to highlight or to clarify this question. The relation between the spatial distribution of distinct areas, where the river is effectively gaining water and the orientation of groundwater table gradients should be analyzed in the discussion. In the Introduction (P.340 L. 14-20), the authors pointed out the importance of aquifer-river exchange in lowland rivers for nutrient export. I think, the discussion should be conveying the potential implications of the study findings to better quantify nutrient fluxes, in particular, in the context of the spatial variability of locations with groundwater up-welling and the spatial orientation of regional groundwater flux.

Specific comments:

- In the abstract I am missing a sentence regarding the implications of your findings

- P. 345 line 5 Where do you define PTFE piezometers. This is the only sentence where this abbreviation is mentioned.

- P.349, line 22 I guess you meant Figure 4 not Figure 2

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- P. 357 You Speak of . . .further insight into the nature and streambed controls...". Shouldn't it be ". . .nature of streambed controls. . ."

- P.357 Section 4.3.1 I would as well recommend inserting a table describing the four CASES/combinations of VHG and FO-DTS gradients, though the four CASES characterize your core findings.

- P. 358 L.15-21 This sentence needs to be shortened

- P. 358 L.23 change to . . . indicating upwelling locations. . .

Figures and Tables:

- Table 1: Is the meteorological station in Keele, where air-temperatures were observed, the same station where you measured precipitation?

- If you use colors in tab 2, I would use an additional color for CASE 1. Alternatively, add an additional column to the table which shows the four CASES.

- In Table 2 you compare the VHG differences to the spatial mean with the DTS- differences to the spatial mean (nearest) (shouldn't it be FO-DTS differences. . .). Comparing these results with the spatial extent of the FO-DTS cable loop (Fig 3B), the space between P1 (in table 2 it's T1,T2. . .needs to be adjusted) and the end of the cable loop seems to be too large to compare it directly (table 2), facing the spatial variability of VHG's (your findings!). I would leave this data point out.

- Due to the resolution of the x-axis in figures 4 and 5, the implementation of shaded columns or bars into the figures 4a/b and 5a/b indicating the time of your field campaigns (may be different bars for VHG and FO-DTS surveys), could help to better understand the data sets. When visually comparing the timing of all field campaigns the temporal variability of observed temperature and VHG anomalies are more intuitively recognizable.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 337, 2012.