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Discussions

Interactive comment on "How effective is river restoration in re-establishing groundwater – surface water interactions? – A case study" *by* A.-M. Kurth et al.

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Review Kurth et al., HESSD

The paper develops a novel and innovative approach for testing potential increase in groundwater-surface water exchange as result of successful river restoration programmes. This research is timely and falls well within the scope of the journal.

The paper is generally well structured and written, I made a couple of specific comments below. My main concern with the presentation of results is that they remain rather descriptive, identifying (temporal variability in) spatial patterns that are inter-

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preted to result from changes in groundwater-surface water interactions. I think this paper could be improved by a more detailed statistical analysis of the alterations in spatial patterns (see some suggestions and references to example literature below), resulting in the development of some clear metrics of exchange flow indicators. Although the discussion refers to variability in actual fluxes, they have not been independently confirmed. In summary – it remains very uncertain to what degree changes in T-patterns between days with very different meteorological conditions can be used to robustly infer groundwater-surface water exchange flow alterations. If not further elaborating on this, the paper should at least discuss these limitations in a more critical fashion. I am convinced this could be achieved relatively quickly and doesn't require a major revision.

Please see some more detailed, partly technical comments:

ABSTRACT: -Nicely written abstract! I suggest including $\frac{1}{2}$ sentence of what type of restoration has been considered – generation of bedforms? -1094-4: Rephrase start of sentence, mentioning of passive DTS is redundant, what does "well-tried" mean in this context? -1094-7: Specify what results were validated by Rn measurements – spatial patterns of exchange? Exchange rates?

INTRODUCTION: - check for commas - 1095-2: Re-establishing GW-SW interactions is surely not always an aim of river restoration. Firstly, under many conditions GW and SW are naturally disconnected and secondly, in many areas this would pose serious risks of re-connecting to 'de-activated' contamination, for instance in some floodplains heavy metals have been deposited after acid mine drainage and re-connection of GW-SW in such cases has heavily debated over the last decade - 1095-7: references to water quality could be more up to date and relevant; not sure how Bardini et al., 2012 refers to "health" either? - 1095-11: remove 'worldwide" - 1095-12: what do you mean by 'appearance'? do you mean that it needs to be aesthetically appealing? - 1095-24: I agree, there is not much published work but have at least a look at the works of Vaux et al., of Ward et al, and of Hesters et al., - i.e. Hesters and Doyle, 2008 is a classic!

- 1096-1: I would call this a "restored river section" or restored stream reach" - 1096-8-10: Sentence is muddled up – check phrasing - 1096-15: change to "improve" and describe what you are providing an outlook for

MATERIALS AND METHODS: -1097-2: was selected as reference for this study or is it something like a wider/national reference site? -1097-27: Careful calibration is PARAMOUNT -1098-10: by APPLYING an electric current -1098-10: The sentence "Passive measurements are standard temperature mea- surements along the glass fibre (Steele-Dunne et al., 2010)." is misleading, the paper referred to is a key reference for fibre-optic based soil moisture measurements – which are not part of this study. You need to update references for this statement or remove it. -1098-13-17: This needs to be further elaborated and I am not sure you can infer a temperature resolution from the range of heating achieved. How far beyond ambient temperature did you heat the cable? The resolution will be affected by a range of instrument/setup/calibration related parameters.

Is there no further information on the calibration procedures of the DTS? What type of setup has been applied? This is essential information to assess the accuracy of the presented measurement results. There is information required on the technical details of DTS survey, e.g. for A-DTS – how much heating was applied to the cable?

Section 2.3 is surprisingly short – please provide some relevant information on sampling procedures and analysis.

-1099_5ff: If a dynamic calibration based on calibration sections exposed to the atmosphere has been used then has direct exposure to sun light been avoided? What color did the cable have? Why did you use two instruments? The two instruments used are very different in their setup (to my knowledge the AP-Sensing Agilent doesn't provide any raw Stokes and Anti-Stokes data? Have they been calibrated in a similar fashion? -1099-15ff: What was the rationale for this different treatment of the sites? -1099-20: Spell out and explain the PAB approach -1099-28ff: Clearly, this will be a

mixture of water, not just groundwater but also collection of water percolating towards the water table? -1100-4: Define STS logger -1100-5: As mentioned further down for the figures – it would be helpful to have a sketch of the location of field infrastructure in relation to the investigated features -1100-11: I guess the piezometers were perched, not flushed? With regard to conducting your Rn sampling – how did you pump (what rate, what pump) in order to avoid de-gassing?

Interpretation of Chriesbach results: I think we see a clear down-stream warming of the river? How do you explain this if not by GW contributions, given the colder outside temperatures? An analysis of T-differences from a spatial mean (such as in Krause et al., 2012 or Krause and Blume 2013) would actually highlight this drift. Or is this the result of measurement drift? Hard to identify without more information on the calibration and accuracy.

-1104-4: You have not measured any quantities – what justifies this statement?!

Figure 1: I suggest removing most of the not required content from the smaller blow-ups, the majority of the information shown only distracts from the essential content

Figure 2: Is the air temperature measurement an average of the 200m of cable exposed to the atmosphere or is this an independent measurement? The Y-axis makes me think, over what time did you integrate per measurement? 30sec? Several minutes?

Figure 4: See also comment to figure 1 – hear a more detailed local map would help to see the location of the different sections

Figure6: Here (and possibly also in the previous plots) it appears that temperatures are not just plotted? Is the shown color map actually a spatial interpolation? If this is the case this should be explained in detail.

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