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Hydrology and Earth System Sciences
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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Dear Dr Krause

Thank you for your detailed comments.

I will reply to your remarks in the following:

ABSTRACT:

- The restoration measures implemented will be added to the abstract. - The sentence will be rephrased to "Standard Distributed Temperature Sensing (DTS) measurements

and novel active and passive DTS approaches were employed to study groundwater-surface water interactions in two reference streams and an experimental reach of an urban stream before and after its restoration." - "Radon-222 analyses were utilised to validate the losing stream conditions of the urban stream in the experimental reach."

INTRODUCTION:

- We will have a native speaker specifically check the commas in the manuscript. - You're absolutely right, of course. Re-establishing GW-SW interactions is not a general aim and bears risks. This part of the sentence should either be rephrased to "maintaining groundwater-surface water interactions" or left out. We will decide upon that. - More recent references will be included. - Bardini et al. (2012) conclude that the exchange of water, amongst others, in the hyporheic zone is fundamental for microbiota and invertebrates. Positive effects specifically on ecosystem health are not given. Hence, the reference will be removed. - "Worldwide" will be removed. - Unfortunately, river restorations (at least in Switzerland) tend to focus on recreating a more natural appearance rather than removing the causes for the degradation, which, admittedly, would be more time- and cost-consuming and significantly more challenging. - The references mentioned are very interesting indeed. However, they do not refer to evaluations of the success of river restoration projects in re-establishing hyporheic exchange. - We will rephrase "restored site of the stream" to "restored stream reach". - Sentence will be changed to: "Additionally, hydrogeological conditions were investigated in the vicinity of the restored stream reach and losing stream conditions verified with Radon-222 analyses." - "Improve" - "an outlook on the application of the described DTS measurement approach and ..."

MATERIAL AND METHODS

- these sites were selected by us as reference sites; they are no national reference sites - Of course. - "by applying an electrical current" - Susan Steele-Dunne described very well the passive (soil) DTS application. However, independent of whether the cable is

buried in soil or in sediment or is fixed on the streambed, the measurement technique is the same. Hence, the reference was used to refer to the passive, as opposed to the active, DTS approach. - The temperature resolution was not inferred from the heating of the cable – they are two independent parameters. The heating of the cable depends on the power applied and the temperature of the cable (as it could be seen that warmer sections of the cable heat up more strongly (specific heat capacity)). The temperature change of the cable in water was 1.3 K to 1.6 K. In dry sections of the cable the temperature change was around 20 K. - The DTS instrument was calibrated with two water baths (ice, hot water; constantly stirred) with dispersion, slope and offset corrections. - The cable was heated with 10 A at 48 V, i.e. 2.48 W/m.

Section 2.3 - Information on sampling procedure and analysis will be added to the manuscript.

- The cable was not exposed to sunlight during calibration. - The cable is red. - Our research group has two DTS instrument – an older AP Sensing for passive DTS measurements and a newer Oryx DTS for measurements with the PAB approach. As the latter instrument is installed in an autonomous DTS system and was purchased at a later time, the experiments had to be performed with two different instruments. All passive DTS measurements were performed exclusively with the AP Sensing instrument, while all PAB measurements were performed with the Oryx DTS. - The same calibration setup was used for both DTS instruments. - The field sites were treated the same (for passive DTS). PAB measurements could not be performed in the reference streams as it was technically impossible to install a cable there and installation in all three streams would have been too costly. - The PAB approach will be described in more detail. - Yes. “Solely groundwater-fed” should be “mainly groundwater-fed”. - “... were measured every 15 minutes with a temperature logger (®STS Switzerland) situated...” - A sketch of the field site will be included. - The groundwater from the piezometers was pumped for 15 minutes, i.e. the piezometers were “flushed”. We’ll ask a native speaker for a more appropriate word. - Pump: jet pump (®Gardena Ger-

many), pump rate 0.9 l/s - Samples were taken early in the morning to prevent warming of the water in the tubing; the tubing was checked for formation of gas bubbles before sampling commenced. - The warming of the water temperature towards the end of the cable is not due to instrument drift, as the apparent “drift” varies significantly throughout the day. The temperature difference is thereby about 0.2 K, which happens to occur at a colour step in the plot – i.e. it appears to be higher. - (1) The groundwater inflow could be seen. (2) A constant water temperature close to the local groundwater temperature measured throughout the experiment (46 hours) is a strong indicator of groundwater infiltration into the stream. - Figure 1: The intention of the maps is to not only show the position of the stream, but also the land use – natural, rural or urban. By removing these sections of the map this information would be lost. - Figure 2: The air temperature measurement is an independent measurement with Onset Hobo TidbiTs (®). Measurement interval was 3 minutes. - Figure 4: We will include a sketch of the site. - Figure 6: Temperatures are “just plotted”, not interpolated.

I hope to have answered all your questions. Thank you for taking the time to review our manuscript.

Best regards

Anne-Marie Kurth

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 1093, 2015.