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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Electrical Resistivity Dynamics beneath a Fractured Sedimentary Bedrock Riverbed in Response to Temperature and Groundwater/Surface Water Exchange" *by* Colby Steelman et al.

Anonymous Referee #1

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Review Electrical Resistivity Dynamics beneath a Fractured Sedimentary Bedrock Riverbed in Response to Temperature and Groundwater/Surface Water Exchange

The study deals with fractured sedimentary bedrock riverbeds and its spatio-temporal groundwater surface water exchange of the Eramosa River within the Grand River Watershed, Ontario, Canada. Surface electrical methods (ERT and EMI) were used for a quasi non-invasive assessment of the scale and temporal variability of riverbed temperature and groundwater-surface water exchange beneath its sedimentary bedrock riverbed. Underpinned were the solid geophysical data sets by a network of boreholes

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and streambed piezometers, installed across the site. The study further contained highly relevant material for HESS, is well written, structured and citied and attested the authors' fundamental background and experiences with the selected topic. Fractured sedimentary bedrock systems and its interaction processes are very complex and difficult to descript. Hence the presented study provided a useful approach for cost-efficient investigation into the river flow regime. Still there are a few issues that needs to be addressed until the manuscript is ready for publication. Although the study impressed be the amount of high quality data and different applied methods, it lacks a little of a clear and comprehensive purpose. Studies of interaction flow processes at rivers are relatively common since about one decade, however the presented geophysical investigation at bedrock rivers combined with ground truths core data is unique. Moreover, the economic and ecological potential of global bedrock rivers are remarkable, hence the study can be considered as a pioneer study with portable conclusions. This seems the strengths of this study, however it needs to be emphasized. It would be helpful if the authors establish somehow a relation between their investigations and findings, and a direct affected related system, such as a water supply or ecosystem services. If not available for the selected test site then relevant literature can be used. In this respect the manuscript might be slightly rearranged. Introduction should contain a clear state of the art containing the situation, the problem, the challenge and the provided response (solution). Although I like the extra paragraph 2 'background', it's quite uncommon and could be incorporated into the introduction and the material and method part, respectably. It is always helpful to read what other studies have archived at similar test sites and / or with similar approaches and where they were limited. This should be highlighted in the introduction and in the conclusion (and in the abstract too). The conclusion should hence contain the extracted information given by the findings as kind of a 'take home message' for the scientific community rather than a second abstract. I recommend acceptance with minor revision. Below a few remarks: - Line 94 – 96 amount of references can be decreased by a related review - Line 126 please mention that the presented Archie's law is simplified are provide the whole equation - Line 144

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just mentioned the temperature correction was done by Arps (1953) might be sufficient - Line 224 indicate the approx. location of the EMI lines in Figure 2 - Line 270 use 'Fig' or Figure either but consisted - Line 291 matrix porosities from the corehole relatively low in respect to? A short reference value for the same rock material from the literature is useful or do you mean in comparison to the weathered or broken rubble zone? If so, please mention it - Line 321 see above - Line 328 it is hard to follow here or maybe I missed the point how you ended up with the 46%, according to Archie in Eq.1? How do you get the Sigma w values or am I totally off? If you re-arrange the equation it needs to be mentioned if not showed - Line 332 – 349 how could you be sure that the EMI data were not affected by outside conditions, do you temperature corrected the ECa as well? - Line 420 I prefer including of the discussion together with the presentation of the results. This helps to shorten the manuscript which is almost every time helpful - Line 857 since you presented the ERT results in Figure 11 by common scale, Figure 10 is kind redundant, mention in the text that the ERT data quality (RMSE, removed data points) were higher under frozen, partly frozen conditions

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