Anonymous Referee #2

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General comments:

The presented manuscript describe the use of Electrical Resistivity Imaging (ERI) for imaging seasonal resistivity changes for three profiles at the Arkansas river. Aim is to get insight into recharge and discharge mechanisms, a very interesting question for which ERI is an appropriate method to be used along with others to gain understanding. After describing the hydrological setting, they spend a few sentences on the ERI method, the used instruments and cables. In the result section they show for each profile some pictures along with an image of the absolute resistivity changed inferred from the inversion of the measurements. The conclusion consists of four already-known statements, four very general ERI interpretations and four outlooking sentences. I am not familiar with the rare manuscript type "Technical Note" and how the evaluation differs from a normal paper. The instructions describe it as "Technical notes report new developments, significant advances, and novel aspects of experimental and theoretical methods and techniques" I understand that for a Note a paper can (or must) be short but would expect some novel approach in either the measurement type, the data analysis or the understanding of processes. Neither of this seems to be the case. Additionally, more technical details are required, including the electrode spread, the used measuring protocol, and the inversion options (or approach) in order to understand the relevance of the results. The authors are apparently no experts in ERI. Apart from the vast literature in Applied Geophysics, there is a large number of ERI (particularly time-lapse) papers in hydrology journals (including HESS) that are widely ignored, some being very similar relevant. Specifically, there have been papers on monitoring river water – ground water interactions giving detailed background and conclusions. I see no lessons to be learned (significance), maybe only for the very specific site. But I see a lot of shortcomings in the description of the methodology that make it impossible to assess scientific quality. The organization is appropriate and the texts are well-written. To summarize, I cannot recommend publication of the manuscript in the high-standard journal HESS, mainly due to lack of novelty and significance. In case a resubmission is recommended, a (very major) revision should include i) necessary details, ii) absolute resistivity tomograms as well as relative differences, iii) a thorough literature review and iv) a critical discussion of the results that go beyond the findings specific for your study area. In this case I would offer my services as reviewer.

Author Response:

We thank you for your thorough review and constructive comments. Major revisions will be made to the manuscript, which will be resubmitted as a new submission. Specifically, a detailed discussion about the understanding developed from this research as it pertains to river-aquifer interactions will be added to the revised manuscript to better highlight the hydrologic importance of this work. Additionally, significant details about the geophysical instrumentation and inversion criteria will be added to the methodology section to provide evidence of scientific quality. An extensive review of studies addressing groundwater-surface water interactions will

be conducted to further examine the previous work conducted within this area, and to shed light on the novel aspects of this work.

Specific Comments:

RC1: A Profile layout is missing, you just said that one profile is parallel and one is perpendicular.

Author Response: A figure showing the location of the ERI profiles in relation to the Arkansas River will be added to the revised manuscript.

RC2: At least for the parallel it is questionable whether 2D conditions (constant conductivity perpendicular to the inversion plane, i.e. topography) are met and if not how this could affect your results.

Author Response: The initial goal was to conduct surveys both parallel and perpendicular to the river at the Hartland site however, no survey could be conducted perpendicular to the river due to heavy vegetation.

RC3: Details on the data analysis and results (data fit etc.) missing.

Author Response: A section regarding details about the inversion criteria will be added to the revised manuscript.

RC4: How did the river water conductivity change over time? This also includes temperature changes. Why did you not account for it in the interpretation or conclusions?

Author Response: The river water resistivity was measured at the time of each survey as used as an input parameter in the inversions. The revised manuscript will report the river water resistivity at the time of each survey.

RC5: How was the river body treated in the inversion routine?

Author Response: The river body was treated as a constant resistivity layer (measured resistivity of river water in the field using conductivity probe). The depth of the river was surveyed at each electrode. A section regarding the underwater inversion criteria will be added to the methodology section of the revised manuscript.

RC6: Particularly for the Lakin Site, the geometry did change as both the water level and the width of the river changed. How did you compare Figures 4+5: You show absolute resistivity changes, which is is not really meaningful and therefore not used in literature. Please use relative change (in percent or as a ratio) that can be transferred directly into relative saturation (Brunet et al.).

Author Response: The revised manuscript will present all time-lapse profiles using a ratio of relative change. Because we do not know the spatial continuity of pore-fluid resistivity, it is not possible to directly infer relative saturation from these ERI surveys.

RC7: Figure 1: denotation of subfigures is wrong: (B) streambed and saturated zone may be partially connected ==> (C) (C) streambed and saturated zone and are disconnected by a vadose zone => (D) Text uses Figure 1a etc., please be consistent.

Author Response: The changes will be made within the revised manuscript.

RC8: Figure 5: very slight decreases are interpreted as huge recharge zones. However, I doubt that the typical resolution measures allow for such an interpretation. At least a critical discussion is missing.

Author Response: A detailed discussion about the interpretation of changes in resistivity as they relate to hydrologic processes will be added to the revised manuscript.

RC9: Except the very recent paper of Watlet, papers on ERI in hydrology are extremely rare and rather old (>10 years). In the recent years there have been a number of papers, particularly in the HESS journal:

Author Response: An extensive review of studies addressing groundwater-surface water interactions (as will the suggested references) will be conducted to further examine the impact of previous work conducted within this area, and to shed light on the novel aspects of this work.

Suggested References:

- Quantifying shallow subsurface water and heat dynamics using coupled hydrologicalthermal-geophysical inversion, Anh Phuong Tran, Baptiste Dafflon, Susan S. Hubbard, Michael B. Kowalsky, Philip Long, Tetsu K. Tokunaga, and Kenneth H. Williams, Hydrol. Earth Syst. Sci., 20, 3477-3491, https://doi.org/10.5194/hess-20-3477-2016, 2016

Monitoring hillslope moisture dynamics with surface ERT for enhancing spatial signifC3 icance of hydrometric point measurements, R. Hübner, K. Heller, T. Günther, and A. Kleber, Hydrol. Earth Syst. Sci., 19, 225-240, https://doi.org/10.5194/hess-19-225-2015, 2015

Three-dimensional monitoring of soil water content in a maize field using Electrical Resistivity Tomography L. Beff, T. Günther, B. Vandoorne, V. Couvreur, and M. Javaux, Hydrol. Earth Syst. Sci., 17, 595-609, https://doi.org/10.5194/hess-17-595-2013, 2013

A geophysical analysis of hydro-geomorphic controls within a headwater wetland in a granitic landscape, through ERI and IP, E. S. Riddell, S. A. Lorentz, and D. C. Kotze, Hydrol. Earth Syst. Sci., 14, 1697-1713, https://doi.org/10.5194/hess-14- 1697-2010, 2010

Other hydrology journals –

Robinson, D. A., A. Binley, N. Crook, F. D. Day-Lewis, T. P. A. Ferre 0, V. J. S. Grauch, R. Knight, M. Knoll, V. Lakshmi, R. Miller, J. - Nyquist, L. Pellerin, K. Singha, and L. Slater, 2008, Advancing process-based watershed hydrological research using near-surface geophysics: A vision for, and review of, electrical and magnetic geophysical methods: Hydrological Processes, 22, 3604–3635, doi:10.1002/hyp.6963.

Ward, A. S., M. N. Gooseff, and K. Singha, 2010, Imaging hyporheic zone solute transport using electrical resistivity: Hydrological Processes, 24, 948–953, doi: 10.1002/hyp.7672.

Outside of Hydrology:

Coscia, I., Greenhalgh, S., Linde, N., Doetsch, J. A., Marescot, L., Günther, T., Vogt, T. & Green, A. (2011): 3D crosshole ERT for aquifer characterization and monitoring of infiltrating river water. Geophysics 76(2), G49-G59, doi:10.1190/1.3553003.

There are also a couple of papers in HESS on groundwater/river water interaction without ERI being involved.