Solid Earth Discuss.,
https://doi.org/10.5194/se-2019-38-RC1, 2019
© Author(s) 2019. This work is distributed under
the Creative Commons Attribution 4.0 License.

Solid Earth Discussions
Open Access
EGU

Interactive comment on "Large-scale electrical resistivity tomography in the Cheb Basin (Eger Rift) at an ICDP monitoring drill site to image fluid-related structures" *by* Tobias Nickschick et al.

Anonymous Referee #1

Received and published: 19 March 2019

This is a review of "Large-scale electrical resistivity tomography in the Cheb Basin (Eger Rift) at an ICDP monitoring drill site to image fluid-related structures", by Nickschick et al. that aims to use geophysics to image fluid relevant structures in deep formations. This is an interesting application of a rarely-applied deep electrical imaging method and seems to be within the scope of the journal. The manuscript is written in acceptable English and the figures are well drafted, though several of the figures could be combined. The organization is adequate, but could be improved. Given that the claimed focus of the work is to elucidate fluid-related structures, I find that

Printer-friendly version

Discussion paper

CC BY

there is relatively little treatment of this subject in the interpretation and discussion. Specific comments related to each of these general observations may be found below. I recommend that the manuscript be returned to the authors for revisions.

General comments: 1) strengthen the interpretation and discussion of fluids, or recast the purpose of the work towards structures (or whatever else seems most appropriate). 2) combine figures as noted 3) reorganize the text as noted, specifically focus on making the introduction flow better, ensuring that all content is in the appropriate section, and shortening the background section 4) given my comments below related to the complexities of interpreting ERT data due to convolved signals from porosity, chemistry, saturation, and clay, I suggest adding a focused section to the discussion (or interpretation) section clearly explaining how you tease apart these elements in your data.

Specific comments:

Introduction: the structure of the introduction is awkward, particularly because it immediately jumps into site description, without giving any big-picture setup or explanation.

Page 1, L12: “series of open questions” Either state those questions here, or move this text to where the questions are stated.

Page 1, Line 20: Change “drills” to “drilling”

Page 2, Line 33-34 & Page 3, Line 1: While I certainly agree that ERT is sensitive to fluids as indicated here, this justification for the ERT method seems incomplete because the several earth properties that control resistivity can be difficult to tease apart to attribute. As indicated on P2L34, the measurement is sensitive to porosity, salinity, saturation, and clay content all at the same time, and therefore the only way to retrieve any one of these parameters is to know three others.

Section 2.1 is very long and covers a wide variety of topics. Readability would be improved if this section was shortened and focused specifically on the topics most

Printer-friendly version

Discussion paper

CC BY

related to the manuscript.

P6L32 – P7L1: Suggest breaking this into two sentences.

P7L3: Suggest to add a reference to support this statement on low resistivity areas.

P7L4&5: The topic of MT surveys was introduced back on Page 6: This text here seems repetitive, I suggest to reorganize or reword.

P8 L2: suggest to delete: “imaging a pathway from”

P8 L6-8: This text seems out of place. The authors have used this section to explain existing data, however this short paragraph indicates availability of data and explains their method for using it but does not explain the data. Could be rewritten to be more appropriate for this section, or moved to methods.

P8-L10-12: As indicated above, the nature of ERT interpretations is that these several properties all affect the measurement together, and therefore it is difficult to point to any one contributor as the primary control on electrical properties. Large porosity could have the same effect as high conductivity fluid in small pores. Low saturation could have a similar affect to small porosity. I think it is inaccurate of the authors to say “ERT is qualified for the detection of fluid signatures” without carefully explaining this statement in the context of how each material fraction contributes to the measured electrical signals.

P8 L20-21: “. . .for practical and theoretical reasons, most suitable for large-scale ERT experiments. . .” Please explain why, related to both practical and theoretical reasons. This seems like an important element of this manuscript given that such large scale measurements are so uncommon. It is also counterintuitive since Dipole Dipole configurations are well known to have poor signal to noise in comparison with nested arrays, for example.

Figure 2: I suggest either merging this with Figure 1 or Figure 3 to make a 2-panel figure, OR perhaps merging all three to make a single 3-panel figure.

CC BY

Page 9, L2: “greater distances” suggest to replace this with actual distance numbers.

Figure 4 seems unnecessary and could be deleted.

Page 11, Line 9: Please deleted “A number of”

Page 12, L22: “Figure 6” Which panel of Figure 6 is being described here?

Page 14, L2: “(White Columns)” what does this refer to? Which figure?

Page 14, L3-4: What figure does this refer to? I assume #6. “appears significantly smoother” Smoother than what? How do you know it is “significant”? If referring to Fig 6, left panel, then I disagree – if the authors intend to make this argument, then it should be supported by a quantified metric.

Figure 6: What is the right panel here? I do not see it explained in the text. I see that it is “Reciprocity”, but what do the percentages mean?

Page 15, Line 3-4: “sensitivity analysis with about 130 m, for the small profiles and 1300 m for the long one ” This is confusing – please reword and check to be sure punctuation and word usage is accurate.

Figure 8: This is unnecessary as a stand-alone figure. The information here should be combined with Figure 3.

Page 17, Line 5: “stadiums” this is unusual usage of the word. Suggest replacing with a more common word.

Page 17, Line 10: How is the depth of investigation calculated?

Figure 9 and Figure 10: It seems that some masking is missing from the panels of this figure. Surely the Depth of Investigation could not be equal along the entire line length of all lines?

Page 20, line 12: “an excellent permeable channel for deep fluids conduct” – this is confusing as written, please reword.

CC BY

Page 20, Line 12-14: This should be moved to the discussion.

Page 20, Line 24-27: References should be added to support this statement.

Page 21, Line 16-17: Please indicate on which ERT image this can be seen, and where on the image.

Page 21, Line 28: Is there any reference to support this supposed circulating mineral water?

Page 22, Line 3: “At at least one spot along our profile, the HMF, these fluids can propagate to the surface through the Tertiary sediments, but also at other sites expressions of fluid flow can be observed. ” Please explain how this can be observed in the data measured for this experiment.

Page 22, Line 15-17: Suggest to support this statement with a reference.

Figure 11 (and reference to Figure 10): It is well known that inversions can result in over- or under-estimations of physical properties across sharp boundaries. For example, on Figure 10, from 3000 – 5500m along the line, there is a change from resistive material to conductive z=0 to z = 200 m. Here in figure 11, this is interpreted as “lower clay and sand” in a distinct unit – but how do you know this is not just an inversion smoothing artifact?

Page 23, Line 3: Figure 11 should be explained in the discussion, not conclusion.

The conclusion section contains "summary" content and "discussion" - please rewrite this to focus on only concluding remarks.

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2019-38, 2019.

CC BY