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Reply on RC2

Pradip Kumar Maurya et al.

Author comment on "Technical note: Efficient imaging of hydrological units below lakes and fjords with a floating, transient electromagnetic (FloaTEM) system" by Pradip Kumar Maurya et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-540-AC4, 2022

Dear all,

This paper introduces a new towed floating TEM instrument through model studies and several case studies. The structure is very clear of this paper and straightforward. I think the authors have taken good studies to illustrate the capabilities of the new system.

I read the comments from the first referee Craig and the authors' responses. Some of my questions have been answered. Thus, here I only list the comments which I still hold.

Response: Dear Shuangmin Duan, thank you for taking time and review the paper. Please see below the response to your comments.

Except for the application results of the instrument, I also expect more figures about the technical parts. Beyond table 1, I would prefer to see a figure of the waveform of the transmitted current and in Appendix-A I have expected to see your processing result of the transients, the error bars and the data fitting of your inversion, which can also provide a lot of information about how your instrument performs.

Response: in Appendix A, we have added a figure of waveform and a figure showing processed data with error bars and data fitting of the inversion.

When designing the instrument, you considered the water resistivity, depth, the TX current moment and so on to get a higher DOI. But what is the influence of the RX-TX offset on DOI. Why is a 9 m offset? How do you estimate DOI for these inversion examples?

Response: The Rx-TX offset is chosen as small as possible to make the system compact. RX is place 9m offset from the TX to minimizes the interference from TX to the RX-coil. We have not investigated RX-TX offset influence on the DOI, but the primary control of the DOI is late time gates, water resistivity, depth, the TX current moment. DOI is calculated following the Christiansen et.al., (2012), we included the refence in the revised manuscripts

In the instruction part, the author should also include the surface towed and deep dragged EM setups for hydrologic applications, such as groundwater explorations in shallow sea

areas presented by Micallef et al., (2020) and Gustafson et al., (2019). Maybe you could find more.

Response: the above refences and possibly more would be included in revised manuscripts.

Line 107 and 109: spelling 40m2->40m2

Response: will be changed in revised manuscripts

Line 117: "The model resolution study was also used in the design of the **SW-FloaTEM** system", I guess here you want to say, "The model resolution study was also used in the design of the **FW-FloaTEM** system"?

Response: We want to emphasize that the design of the SW-Floatem system was based on the model resolution study. For Comparison purpose we also included the model resolution study of FW-FloaTEM system. We clarify this in the revised manuscripts.

Line 133-135: I am confused with this expression "For the inversion, no lateral constraints were applied. However, for the model parameter analysis lateral constraints were assumed between 5 similar neighboring models (based on the true model) to simulate the improved resolution capabilities from information sharing when working with field data." Since this is a 1D inversion, how do you use lateral constraints? And what do you mean here on "model parameter analysis"?

Response: we follow the spatially constrain inversion algorithm by Viezzoli et al., (2009). All 1D inversion models are inverted by minimizing one objective function which includes lateral constraints between neighboring model parameters. Model parameter analyses shows how well a model parameter (resistivity or depth) likely to be resolved by inversion. See Auken et, al. (2015) for the detailed explanation.

Figure 5: The y-axis is confusing. What does positive and negative elevation mean? Where is the water depth? Below profile A-A', you make some legend as water, Gyttja, Sand and Clay. This makes me confused at the beginning since in the figure you use purple as the sand layer but in the legend you use yellow. But later I realized the legend only serves for the drilling B1 and B2. Maybe you could find a better way to display them.

Response: Elevations above sea level are positive and elevations below sea level are negative. The revised manuscripts will have changed borehole legend to avoid the confusion with inversion color scales.

Figure 5: Do you use interpolation to display profile A-A', since it is laterally smooth. If yes, what kind of interpolation do you use and what side effect this will bring? Why between 600-800 m, the DOI is so shallow, limited only to the upper 20 m?

Response: There is no interpolation along the profile A-A'. The reason why it looks smooth because it is drawn along a survey line, following approximately ~10 m spaced models, therefore, models are placed very closed, giving a smooth nature.

References:

Auken, E., Christiansen, A. V., Westergaard, J. A., Kirkegaard, C., Foged, N., and Viezzoli, A.: An integrated processing scheme for high-resolution airborne electromagnetic surveys, the SkyTEM system, Exploration Geophysics, 40, 184-192, 2009.

Viezzoli, A., Auken, E., and Munday, T.: Spatially constrained inversion for quasi 3D modelling of airborne electromagnetic data - an application for environmental assessment in the Lower Murray Region of South Australia, Exploration Geophysics, 40, 173-183, 2009.

Christiansen A. V, Auken E. A global measure for depth of investigation. Geophysics. 2012 Jul 1;77(4):WB171-7.