

Hydrol. Earth Syst. Sci. Discuss., author comment AC1
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Reply on RC1

Pradip Kumar Maurya et al.

Author comment on "Technical note: Efficient imaging of hydrological units below lakes and fjords with a floating, transient electromagnetic (FtoaTEM) system" by Pradip Kumar Maurya et al., Hydrol. Earth Syst. Sci. Discuss.,
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Dear Craig,

Thank you for taking time and giving feedback on the paper. Please see below the response of your comments/suggestions.

First, your synthetic modelling studies show that the freshwater system lacks the same DOI as your saltwater system. Given that, why not just deploy the saltwater system in all cases? Are there disadvantages in using the SW-FtoaTEM? Do you lose lateral resolution? Are there operational challenges in getting equally good data?

Response: We cannot deploy the SW-FtoaTEM system in all cases. Because SW-FtoaTEM have longer turnoff time because of bigger loop and more turns, therefore doesn't provide unbiased early time signal usually before 10 us, which in freshwater case results in loss of resolution in first 10-20 m.

Second, I have one concern that you rely heavily on a priori knowledge of water resistivity and depth when making models. As a practitioner, I can imagine bathymetry or conductivity meters failing. Does your synthetic study offer any insights into how this might affect results? Are there certain environments, like rivers entering the sea, where spatial variation in electrical resistivity is very high and extra considerations are needed?

Response: I agree, in this paper we have included priori knowledge of water resistivity and depth assuming that all functionally of the system is operational. However, depending on the environments, local geological conditions, system would still perform well and provide you satisfactory and useful inversion model in absence of water resistivity and depth information. This two information's are additional but not mandatory for inversion and provide better resolution. In case of lateral resistivity variation, you can let the resistivity of the water column be free in inversion and only constraint the water depth. This will allow the inversion to adapt the lateral resistivity variations.

Similarly, on Line 132, how did you come up with the 10 % and 30 % uncertainty for water depth and resistivity, respectively? Do you have a source to back up these choices? Are these the realistic uncertainties in real-world instruments

Response:

We normally know the water depth from the echo-sounder or similar and the water conductivity by measure with the conductivity probe, and we use this info as prior in the inversion of real data. Therefore, we also add prior on water depth and resistivity for the synthetic stuff. The 10% and 30% (0.1, 0.3) prior constraints are more conservative estimates to be on the safe side. A single water depth/conductive measurement are less uncertain than 10/30%, but there are point measurements while TEM has a footprint). However, for field cases as in this paper, we used 5 -10%, In synthetic cases we tried to be conservative , so that we don't over-estimate the model resolution.

Lastly, you haven't commented on the thin conductor between lakewater and sand in your Lake Ravn case study (Figure 7). Do you believe this is sand or something else (like lakebed, organic sediments)?

Response: Thanks for pointing out, we will include this in the revision. Yes, this thin layer we believe is fine sediments like clay/silt.

My strength is more on the interpretation of geophysical models to EM theory, so I would have to rely on other reviewers to give more detailed comments about the setup of your system. But, to my knowledge, I don't see any obvious shortcomings.

Otherwise, I only have minor comments:

- Line 81: I would revise to "in the following subsections"
- I am rather picky about hyphenation of multi-word adjectives. Here's a helpful source on the matter: https://owl.purdue.edu/owl/general_writing/punctuation/hyphen_use.html . Some instances in your paper where I would revise:
 - Line 76: real-time
 - Line 202: 70-year-old (note singular use of "year")
- Line 80: "freshwater" should be a single word
- Capitalize proper names of bodies of water. For example, Line 261: "Horsens Valley"
- There was an issue with the cross-reference pointing to other figures with maps at Lines 449-450 and 458-459
- Table 1: Incorrect unit for RX coil area for SW-FloatTEM
- Line 229: I was going to suggest a less whimsical-sounding word than "wigglier" to use, but I can't think of a more formal word to use in its place. So I suppose this fun word can stay.

Response: Thanks for these minor suggestion, we will modify them in the revised manuscripts.

Thank you again and I look forward to seeing your final version being officially published.

