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Comment on hess-2021-540

Craig William Christensen (Referee)

Referee 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-RC1, 2022

Dear Maurya et al.,

I commend you on this great paper about the FloatTEM system. As a practitioner of EM geophysics in the geotechnical engineering sector, these case studies and synthetic modelling studies are very helpful illustrations about the capabilities of your new system. I particularly like the very clear and straightforward formulation of the result of that synthetic modelling study: 25 siemens is the limiting conductance on the SW-FloatTEM.

I could only find a few minor points where I could think of improvements to your paper, mostly in the Discussion section of your paper and about the limitations of your system beyond DOI.

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-FloatTEM? Do you lose lateral resolution? Are there operational challenges in getting equally good data?

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?

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

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)?

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.

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