Review of the manuscript entitled: "Detecting ground ice in warm permafrost with the dielectric relaxation time from SIP observations"

I thoroughly enjoyed reading this article. It is written in a very clear and logical manner, presenting a good field application for SIP data and how it can be used to distinguish areas of the subsurface which contain ground ice.

Overall, I believe the article is in good shape but requires a bit more technical detail, particularly on error reporting, and is missing a couple of elements for a complete discussion. I have some suggestions and comments for the authors which I will enumerate below. The comments I found to require more attention and are critical for the narrative and consistency of this work are written in red.

Line 52: Real part is resistance, which is different from resistivity. It is important to have the right terminology, especially in this (theory) section. You may wish to explain the relationship between resistance and resistivity after.

Table 1: Is this produced with Eq. 7? If so, it is not very clear to the reader.

Line 189: Are the ground electrodes Ag/AgCl? This type of electrodes is used in SIP surveys to avoid polarization. Please specify.

Line 213: It looks like you have accurate GPS coordinates of the electrodes used. Are these being used in your inversions?

Figure 6: X and Y axis font is too small.

Methods and Results: There is not a great deal of detail about post-acquisition data processing. You also don't report any error metrics corresponding to inversion or ART results. I believe this needs to be addressed in order to contextualise the accuracy of the model results presented.

Consequently, the error corresponding to your results could have an impact on which areas you can confidently categorize as "containing ground ice".

Figure 11: Can you comment on the fact that relaxation time does not seem to change when ice content increases. It seems to be effective in picking up presence of ice but not disgusting between different levels of ice content.

Line 298: Remove "the"?

Line 300: I would probably introduce RFE earlier, alongside the other equations in your methodology, not in the discussion.

Figure 12: Please mention what yellow and black outlines mean in figure caption.

Figure 13: As for figure 12, please explain the black outlines in the figure caption.

Line 312: Degree symbol.

Line 330: How was the threshold for the imaginary part determined?

Section 6.2: I don't fully understand the logic behind figures 14 and 15. ART categorizes some datapoints as in the "contains ground ice region", Imaginary part does the same, and there is some overlap between the two. However, how do you know which one is correct? Is this based on the borehole data? Are you assuming everything below 0.6m depth (borehole log) has an above zero percentage of ground ice?

Line 367: I suggest you expand this is a short paragraph in your discussion. The section would be about the limitations of the SIP method, pathways for improvement and future research. I believe this would round up your narrative and provide prospects for future studies.