

Interactive comment on “Geophysical mapping of palsa peatland permafrost” by Y. Sjöberg et al.

Anonymous Referee #2

Received and published: 26 November 2014

This is a manuscript describing measurement of permafrost and talik using ground penetrating radar and electrical resistivity tomography geophysics. The methods applied here are well-tested and largely appear to have been deployed in an acceptable manner. I think the manuscript is a bit light on substantial results and interpretations, but it is nice to see new applications of geophysics to image permafrost. This manuscript is clearly within the scope of The Cryosphere and should be suitable for publication after moderate revisions.

Page 4, Line 20: I am not convinced that vulnerability was thoroughly estimated in this study. Based on the results presented, on case of warming was tested in a back-of-the-envelope model using one example permafrost thickness based on one measurement from an ERT line. This resulted in an estimate of 175 years to thaw under the warmer climate scenario (along with hand-waving order of magnitude uncertainty), but I do not believe this is comprehensive enough to be considered a vulnerability estimate.

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Page 8, Lines 11-20: I have some concerns with this application of CMP geometry for estimating velocity. Since CMP data is not displayed in a figure it is difficult to assess the quality of the dataset and effectiveness of this application. My first concern is that relatively low frequency 100 MHz and 200MHz antennas were used in a case where the reflector may have been as little as 50cm from the surface (in the case of the active layer). This could have resulted in waveguide behavior or refractions that would have made traditional CMP analysis unreliable. I suggest that a CMP dataset and associated semblance plot is provided by the authors.

Page 12, Line 17: “. . .thought experiment. . .” This seems to be a ‘back of the envelope’ calculation, not a thought experiment. I suggest reconsidering use of the term “thought experiment” throughout the manuscript.

Page 13, Line 8: The lack of reflections is surprising (particularly from taliks that should have had clear contrasts in physical properties throughout the winter). I suggest that either winter data is included or all mention of the winter data is removed from the manuscript.

Page 15, Line 6: How is the 15.3 m average thickness calculated? Based on previous remarks in the manuscript, the ERT imaged 15.8 m to more than 25 m.

Page 15, Line 22-25: The estimated ice fraction calculation should be presented earlier in the manuscript and in more detail to help the reader understand what goes into the calculation and what it means.

Page 16, Line 10-12: Another reason for this could be that the authors did not calculate the uncertainty in this estimate. I suggest a sensitivity analysis and uncertainty quantification to help place these thaw advance estimates better into context.

Page 18, Line 10. “. . .provide orthogonal views. . .” Perhaps I just don’t understand what the authors intend the word “orthogonal” to mean in this case, however looking at Figure 1, no geometrically orthogonal lines we measured so I don’t know what this is

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referring to. I suggest rewording for clarity.

Figure 3: Depth axes should be carefully calculated and displayed on this figure.

Figure 5: Where does the GPR uncertainty estimate come from? Just the potential variability in velocity?

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