

Interactive comment on “Past climate changes and permafrost depth at the Lake El’gygytgyn site: implications from data and thermal modelling” by D. Mottaghy et al.

Anonymous Referee #1

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In this study, the authors try to assess permafrost distribution and its thickness at the Lake El’gygytgyn site. The manuscript is well-written and is easy to follow, however the abstract might need some work to highlight major findings and conclusions of this research.

General comments:

The authors try to estimate how an uncertainty in the thermal conductivity might effect the steady-state solution, see figure 5 in the presented study. At the same time, there is no mentioning of potential errors in the transient solution due to uncertainty in the thermal conductivity. Besides the thermal conductivity, the transient solution also depends

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on the porosity and unfrozen water content curves. It is suggested to conduct some appropriate sensitivity studies. It would be very interesting to see how the uncertainty in the porosity, thermal conductivity, heat capacity and unfrozen water content might influence the results on the presented Monte Carlo simulations.

Specific comments:

p 2610, line 24, "...the temperature distribution even in the upper surface." Probably you mean "in the upper layer of the ground material." How thick this layer would be?

p 2613, line 26, "... the freezing range can be adapted ..." Which unfrozen water content curves were used in the present modeling? A plot might be beneficial. Do you take into account salinity of the ground material? Do the modeling results depend on the assumed values?

p 2614, line 9, "... as well as literature data." Could you please provide some references?

p 2615, line 1-3. As I understand values of the thermal properties are estimated either from the laboratory experiments or literature. Here, you state that you adapt the values later in order to obtain a good fit. Do you simultaneously try to estimate the thermal properties and the temperature history (specifically during the LIA and later)? Please clarify.

p 2617, line 19. "... from the literature." The reference is missing.

p 2618, line 14. "... is estimated to be 14K, which is in agreement with the results of other studies." Could you please clarify how, the value of 14K is obtained? The references are missing. Is it agreement with Melles et al., (2012).

Figure 6, What type of the solution is shown? Is it the present day temperature distribution?