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The influence short and long term climate changes on the temperature field at the Lake El'gygytgyn site: results from borehole data and modelling

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The crater lake El'gygytgyn Crater Lake in NE Russia was formed by an asteroid impact 3.6 Myr ago. Since 2008 and 2009, an interdisciplinary drilling campaign has been carried out that is part of the International Continental Drilling Program (ICDP). After successful core recovery, the aim is to interpret the longest time-continuous record of climate change in the terrestrial Arctic and to set it in context with data from other marine and terrestrial sites for a better understanding of Earth's varying climate. There are two wells from which temperature data are available. One lies beneath the lake, whereas the other one is drilled in the permafrost at the shoreline. In the latter one, a continuous temperature record over two years gives valuable information on the annual variation of ground surface temperatures, as well as indications of the deeper variation of temperatures down to a bottom depth of 140 m below surface.

Numerical studies regarding the show that long term past temperature changes have a significant impact on the temperature distribution at depth and thus permafrost thickness. Particularly, the amplitude of the last glacial maximum appears to be strongly evident even in the shallow borehole data.

Here, we follow up this work and focus on the thermal processes in the upper surface, studying the possible influence of changing lake levels and thus the spatial and temporal variation of the talik's dimension. Additionally, we perform sensitivity studies with regard to short and long term varying climate histories in order to quantify their influence on the subsurface temperature field. Statistical approaches help to determine uncertainty ranges within these simulations.