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Thermal modeling of the temperature field at the Lake El'gygytgyn site

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The crater lake El'gygytgyn in NE Russia was formed by an Asteroid impact 3.6 Myr ago. Since 2008, an interdisciplinary drilling campaign is carried out that is part of the International Continental Drilling Program (ICDP). The aim is to obtain 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 drill site locations, one near the deepest part of the lake and one on land close to the shoreline. Altogether, 315 m of sediments plus 200 m of underlying volcanic bedrock were cored. Here, we focus on the thermal properties and the temperature field beneath and near the lake. Temperature measurements were performed near the shoreline along a 168 m deep water column. First data from the land-based borehole indicate mean annual soil temperatures of the permafrost. Thermal properties of the subsurface are theoretically deduced from the available cores at this stage.

We present results of numerical simulations of the temperature field with the focus on studying the transition between talik and permafrost regions. An undisturbed temperature log in the permafrost borehole will be measured in the near future. Modeling results are used to predict this temperature profile.

Transient simulations of the temperature field are applied to investigate the impact of varying mean annual ground surface temperatures due to climate changes in the past.