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Long-term tracking of climate change by underground temperatures

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Underground temperatures contain a record of past changes in the energy balance at the Earth's surface, such that borehole temperature data can be used to reconstruct long-term trends of ground surface temperature (GST) changes. In addition to surface air temperature, however, GST is the response of the ground to other near surface processes that govern the surface energy balance. In order to compare GST histories constructed from geothermal data with surface air temperature (SAT) data, it is necessary to ascertain the relationship between these quantities. We jointly interpreted four borehole temperature logs within a small area and SAT records from a nearby station. We find that the subsurface temperature anomalies are consistent with the SAT data even in the presence of a variable snow regime, and different surface conditions. Our results indicate that borehole records are robust long-term paleoclimatological indicators.