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Inversion of borehole temperature logs for nonsmooth ground surface temperature histories

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Ground surface temperature history inversion represents an intrinsically ill-posed problem due to to the highly diffusive character of the controlling partial differential equation. Up till now, most of the published inversions - based on Tikhonov regularization, truncated SVD, or following the Bayesian strategy - favor smooth solutions. In this contribution I present results from edge-preserving inverse techniques, which can be seen as complementary to the aforementioned methods.

Results on synthetic and field data are highly promising. As to be expected, when inverting temperatures from very deep boreholes a much steeper warming after the Last Glacial Maximum is obtained. However. there are many open questions related to this method. In contrast to some other methods, there is no obvious method to choose the required regularization parameter. Numerical experiments with different published strategies are presented. More important, the interpretation of results in terms of uniqueness, resolution, and uncertainty is far from clear, and a caveat concerning the very sharp glacial-interglacial transitions obtained in very deep boreholes is advisable.