Geophysical Research Abstracts, Vol. 8, 06487, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06487

Optimal Regularization for Smoothing Paleoclimate Inversions

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When inverting borehole temperatures for ground surface temperature histories (GSTH) using Tikhonov or related methods, a choice of the regularization parameter is necessary. This parameter controls the trade-off between the data fitting error and and the model seminorm applied for inversion. In particular when comparing different data sets and results, it is important to give a repeatable and objective way of choosing its value. We compare common methods for the choice of this parameter (e.g., L-curve, GCV). Most methods require the repeated evaluation of residual and model norms for different values of the regularization parameter. The computational effort can be considerably reduced using a CGLS solution for shifted systems. We will demonstrate the proposed methods in the context of multi-site GSTH inversions.