

## ***Interactive comment on “Selection of borehole temperature depth profiles for regional climate reconstructions” by C. Chouinard and J.-C. Mareschal***

### **Anonymous Referee #1**

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The paper by Chouinard and Mareschal discusses the impact of the selection of borehole temperature profiles on the result of inversions for ground surface temperature histories (GSTH). In particular they study a data set from Canada and compare inversion results for all boreholes and a subset that has been screened for non-climatic artifacts. I believe this is an important contribution that can help to improve the quality of paleoclimate reconstructions.

I find it particularly noteworthy that, for instance from the Manitoba-Saskatchewan dataset, only 13 of 73 boreholes are considered usable. Maybe the authors should include some of these numbers in the abstract to highlight that only a tiny fraction of

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well logs are really suitable for analysis.

### Specific comments:

Figure 2, and the discussion of boundary conditions, p 127 l. 18 - p128 l.14, should be removed altogether. I do not see the physical meaning of a constant heat flow b.c. in this context. And whether a temperature increase is step-wise or linear, well that's what the inversion is trying to resolve. A change in b.c. is just one particular disturbance of many possible disturbances and I don't see the necessity of this discussion.

Paragraph "The inverse problem discretized". Using JOINT, I believe thermal diffusivity must be assumed constant, instead of "is usually assumed constant". Otherwise it's no longer a linear inverse problem. Also, using the thermal resistance approach plus a constant diffusivity is technically possible, but leads to an inconsistency in the differential equation. I agree it's probably a valid assumption, but the assumptions implicit to the model should be made more clear.

I do not agree with the handling of the damping parameter by the authors. They do not show how they arrived at the damping parameter, yet they draw conclusions about the resolution of inversion results from different datasets using different inputs. Since the damping parameter affects this, an objective method should be used, such as L-curve or GCV. Otherwise it will not be possible if a loss or increase in resolution is driven by data quality or poor choice of the damping parameter.

P 134, l. 20 to 29. This synthetic experiment is only valid if the data was noisy.

In general the manuscript is very readable. However, at some points the authors make very general and imprecise statements, for instance:

P 133, l. 1. "For borehole temperature data, the value of  $\epsilon$  ranges between 0.01 and 0.1." This is not true. In fact, the authors use later a value of 0.3. The value of  $\epsilon$  is dependent on many factors including the number of data points and the level of noise.

p. 123, l. 14: "Many other papers deal "empirically" with practical considerations." What

does that mean? And why the quotes?

p. 124, l 4+5: Again quotes. Either it is noise, then remove the quotes or it is not, then use the correct term, or please explain.

p. 124, l.15: “for instance, boreholes located on the shore of a lake can be (and are) logged, but boreholes in the middle of a lake never are.” Although I assume I know what the authors mean, I am pretty sure boreholes in lakes exist and are being logged.

There are probably more of such phrases and I would urge the authors to work on this to improve the readability.

Figures:

Fig 1: Please label the regions. Fig 2: As said before, Figure 2 seems unnecessary to me.

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Interactive comment on Clim. Past Discuss., 3, 121, 2007.

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