**Climate
of the Past
Discussions**

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

C. Chouinard and J.-C. Mareschal

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Our responses to most of the reviewer's comments are given in the open discussion. We want to emphasize the main points.

The reviewer wondered why we investigate the boundary condition. As mentioned in the discussion, we think it is important to point out that results depend on the boundary conditions because some authors have used different boundary conditions. We do agree that a constant heat flux boundary conditions is difficult to justify but it has been used. We added a reference to a paper by Beltrami (2001) who used such a boundary condition.

The reviewer asked about the inversion with variable diffusivity. It does not lead to a

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non-linear inverse problem when the diffusivity is known. We now explain more clearly that a solution for horizontally layered half space could be used in the case where thermal diffusivity is known to vary with depth.

The reviewer raises the question of the selection of the damping parameter. There is no "objective way". The basic problem is that of the trade-off between resolution and stability. In linear inversion, it is possible to fit the data exactly, regardless of the level of noise. Of course, we do not want to do that and this is why we have to decide how large a misfit we can tolerate to keep the solution regular. This is where the damping parameter enters. Its selection is based on a-priori assumptions on the regularity of the solution. This is discussed at length in textbooks on inversion cited in reference (e.g. R.L. Parker, 1994). The practical way to deal with this problem for borehole temperature profiles has been discussed in the paper by Clauser and Mareschal (1994).

We appreciate these comments as well as the editorial suggestions made by the reviewer.

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

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