Clim. Past Discuss., 3, S139–S141, 2007
www.clim-past-discuss.net/3/S139/2007/

Climate of the Past Discussions

Interactive comment on "Thermal log analysis for recognition of ground surface temperature change and water movements" *by* M. Verdoya et al.

M. Verdoya et al.

Received and published: 4 April 2007

Answer to Referee #2

General comments - The referee questions the adequacy of the analyzed dataset to provide GST histories back to the Little Ice Age (LIA). We agree that the boreholes used for inversion (GH9, GH11, GH13) are a bit shallow to give a robust climatic reconstruction prior to 200-250 years ago, but at least the thermal signal of the final part of the LIA can be still present in the thermal logs. Their inversion gave GST histories prior to 1800-1900 in good agreement with other deeper (200-350 m) boreholes, investigated in previous studies (GH1, GH3 and GH4; Bodri et al., 2003; Pasquale et al., 2005a). Anyway, the GST histories obtained in this paper argue for the absence of the LIA in the investigated area, thus strengthening the results from the deeper boreholes previously analyzed. On the other hand, this is confirmed by independent proxies

(tree rings, glacial fronts, etc.). However, in section “Discussion and conclusions” some modifications were made and references added to clarify this point.

Specific points. All the suggestions were carefully evaluated and incorporated in the revised version of the manuscript, as it follows.

- We used the Darcy velocity. In the new manuscript this was better specified when necessary to avoid confusion.

- “Heat-flow density” and “groundwater flow” were used throughout the text to avoid confusion.

- Page 99, rows 27-28. It is well known that most of the thermal profiles logged in Italy are affected by transient perturbations due to recent tectono-thermal events. I guess that the referee is concerned with this problem. In principle, the climatic signal superimposes the thermal effect of tectonic processes. The latter thermal perturbation acts on the long (geological) time scale, whereas the climatic signal has a relatively short wavelength. The high-frequency climatic signal smoothes rapidly at shallow depth while, in the same depth range, the low-frequency tectonic signal can be considered as a uniform background signal. This means that the deeper part (the last tens of metres) of a borehole can be considered “quasi-stationary” to the short wavelength climatic perturbations and, in practice, unaffected by long-wavelength tectonic effects. In other words, tectono-thermal events act on large time (million years) and depth (crustal-lithospheric levels) scale, whereas climatic change has to do with shorter periods (10-1000 years) and shallower depths. However, concerning this point, the text was slightly modified in order to clarify the assumptions.

- Page 104. There was a mistake, and it was corrected.

- Page 109, discussion on borehole GH13. We agree that the conclusions for this borehole should be more prudent. Actually, there is little information about the changes in local conditions in the borehole surroundings, except for the last twenty years. The

CPD

3, S139–S141, 2007

same applies also to the other investigated boreholes in central Italy. Thus the final remarks about this borehole were slightly modified and turned in a more cautious form. However, we do not believe that the boreholes construction could have changed by itself the local conditions, because inversion results of both the 1982 and 2002 thermal logs give the same GST history.

Technical comments - Language was revised, and typing errors corrected as the referee suggested.

Interactive comment on Clim. Past Discuss., 3, 95, 2007.