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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.

Anonymous Referee #2

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GENERAL COMMENT

The paper presents results from a joint analysis of transient borehole temperature data (down to 150 m depth) combined with surface air temperature data, to estimate POM temperatures and possible vertical fluid flow components, in an area located on the Ligurian-Tyrrhenian side of the Apennines, in central-northern Italy. This area is very complex and challenging for climatic studies, being characterized by active geology, significant topography and narrow climatic divisions. The SAT data presented show distinct and diverse signals with strong changes over relatively small distances; on the other hand reduced borehole temperature profiles exhibit contrasting behaviours, suggesting local climatic differences, often coupled with non-climatic effects, such as groundwater flow, terrain and vegetation effects.

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Interactive Discussion
Discussion Paper

The results are encouraging and provide new information on the complex and highly variable climatic conditions in the area (with respect to warming and cooling events occurred in the last couple of centuries or so), but the data quality and density (such as the maximum depth of the borehole temperature data, the length and coherency of the SAT time series, the number of boreholes) are not yet adequate to provide a robust climatic reconstruction of the area. In particular, the potential of these datasets to assess the presence/absence of the widely discussed Little Ice Age is arguable; in fact, because of the noise in the data and the depth range of the borehole temperatures, the timing of this event seems below the temporal resolution of the presented solutions.

The paper is sufficiently well organized, figures and references are adequate.

Specific comments are given below.

SPECIFIC COMMENTS

“Darcy’s velocity” is an apparent velocity (volumetric specific discharge), whereas the average fluid velocity is a real mean velocity. It seems that these two different hydraulic parameters are sometimes used throughout the text with no clear distinction between them. Compare for example rows 26-27, page 105, with row 1, on page 106.

“Heat flow” and “groundwater flow”: I would suggest to use “heat flow density” or “heat flux” for the former, to distinguish between energy flow and mass flow.

Page 99, rows 27-28: “These departures decrease with depth, being the lowermost section assumed to be in thermal equilibrium.” This very restrictive and unrealistic assumption (for the studied area) would need to be evaluated with a sensitivity analysis.

Page 104, rows 3-4: “Noticeable downward flow was inferred in GH10 and GH12.” GH12 shows instead, upward flow.

Page 109, rows 15-22: The discussion about the discrepancy between GST histories and SAT series, with respect to the different evolution of the local climate around GH13 borehole temperature data is not convincing. The temperature perturbation on the

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borehole data is clearly a local recent event, that could be related to a variety of local factors; one interesting coincidence could be that it seems to have approximately the same age as the borehole. Could it be related to the borehole construction itself? In any case, GH13 would require further experimental validation to be used for GST history reconstructions.

THECNICAL COMMENTS

English needs improvement.

There are several typing errors (e.g. page 101, row 11), grammar (e.g. page 109, rows 18-19: The borehole GH13 is located), please check carefully the manuscript.

Page 104, rows 3-4: “Noticeable downward flow was inferred in GH10 and GH12.” GH12 shows instead, upward flow.

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